Available online at www.elixirpublishers.com (Elixir International Journal)

Engineering Thermo Physics

Elixir Engg. Thermo Physics 114 (2018) 49455-49471

ISSN: 2229-712X

Hydrogen Economy in Pakistan and China; A Meta-Analysis

Usman Shehzad and Qadeer Abdul

aXi'an Jiaotong University, Xi'an Shaanxi China.

ARTICLE INFO

Article history:

Received: 27 November 2017;

Received in revised form: 24 December 2017;

Accepted: 5 January 2018;

Keywords

Hydrogen Economy in China,

Hydrogen Economy in Pakistan,

Current Energy Situation in Pakistan,

CPEC and Its Importance.

ABSTRACT

We have conducted a meta-analysis, a detailed literature review has been studied on hydrogen economy and it's important in both regions. We have also seen that how useful a hydrogen can be and how it can affect the overall economy of both regions (China and Pakistan). The reason for conducting meta-analysis is to compare the hydrogen economy performance in both countries. This analysis would also give a wider perspective that how hydrogen economy with its different functions, especially hydrogen in the energy sector can enhance the overall growth of the economy. In our analysis, we have compared the different statistics of hydrogen with different factors of economy and tried to assess the impact of hydrogen in those sectors. Our findings indicate that large-scale use of hydrogen is not a significant environmental hazard. If appropriate technical standards and safety standards are used, hydrogen is no longer hazardous to conventional fuels. The hydrogen economy has the potential to provide many benefits for the country, including reduced dependence on imported oil, environmental sustainability, and economic competitiveness. But without serious effort, there is no serious difficulty. Recommendations are made to guide Pakistan towards the path to the hydrogen economy. It must be a clear political support for the development of hydrogen. We need to establish a partnership with countries related to hydrogen technology. In order to overcome the technical obstacles, investment in the research and development of hydrogen and fuel cells is necessary. Current study is not only beneficial for policy makers but also for scholars.

Introduction

Throughout the world, hydrogen is regarded as the promising energy carrier for the mitigation of harmful gases, decarbonizing the smoke from vehicles, and enhancement of energy supply. Developing countries have launched technology roadmaps for the hydrogen economy, with the help of which the engineers and scientists are able to monitor the scheduled processes of hydrogen technology with the positive advancement. Hydrogen economy stands for the proposed system where hydrogen can be produced with the help of sources that are carbon-dioxide free and is utilized as an alternative transport fuel. Therefore, it can be inferred that hydrogen has the highest position on the basis of its highest energy provision, storage ease, and the environmental compatibility. However, hydrogen cannot be directly regarded as a source of energy, yet the chemical energy source (Mirza, et al., 2009). For the longer term, hydrogen can be used to reduce the harmful Carbon-dioxide emissions and is required to replace the gaseous and liquid fossil fuels for the transport of preferred fuel around the country. Hydrogen is seen as a perfect fuel. The key question is from which source hydrogen can be obtained in an economical way in vast amounts and at satisfactory cost. A vital perspective is to maintain a strategic distance from which hydrogen turns out to be only a more costly method for tackling fossil power problems.

Certain hydrogen generation methods have achieved development for business abuse: (a) steam reforming of natural gas; (b) splitting of natural gas; (c) partial oxidation of substantial oils; (d) gasification of coal and other overwhelming hydrocarbons and (e) steam–iron coal gasification. It has been demonstrated that albeit renewable vitality assets can't totally fulfill the vitality request, however, electrolysis connected with solar energy, wind, hydropower, and biomass can be of valuable hydrogen generation (Shahbaz, Lean & Farooq, 2013).

In an examination, hydrogen and methane were generated from wastewater slop. The outcomes propose that generation of hydrogen and methane from wastewater slime through a progression of two reactors is achievable. Hydrogen era from water utilizing atomic vitality has been investigated in Japan. It is found that the high-temperature gas cooled reactor (HTGR) has a plausibility to produce hydrogen financially contrasted and different sorts of nuclear reactors. With respect to seemingly perpetual radioactive waste to be produced by nuclear reactors, it is required to fundamentally decrease its weight to the human environment by applying transmutation advancements.

The main problem of modern society is the lack of fossil fuel's life through fuel combustion for daily use (Planton, et al., 2008). It is, therefore, necessary to develop alternative fuels instead of non-renewable fossil fuels {Midilli, & Dincer, (2008): Cormos, (2011)}. The hydrogen exchange from fossil fuels in the final energy consumption can be compliant, important environmental well-being technically an ecological and economic problem, e.g. production, storage, and transport are used to overcome the difficulties, (Koroneos, 2005).

Tele: 008613659269187

E-mail address: qadeerakli@gmail.com

Hydrogen is not only a fuel, but the only hydrogen is a process for transport and storage of energy, as future clean fuels. In the calculation, since it has been shown to have the energy of about 33 kWh in 1 kg hydrogen storage capacity is better (Nojoumi, Dincer, & Naterer, 2009). Hydrogen can become energy, such as heat or electricity for combustion or electrochemical reaction, the secondary energy source, that is, can be considered as an energy carrier (Secondary sources of energy are energy carriers.)

Because of the weakness of the gravitational field, no pure hydrogen gas is currently available. Therefore, hydrogen fuel should be produced from different sources. Water and natural gas have plenty of hydrogen in the room, so their range is reasonable. However, the simultaneous production of unwanted oxygen from hydrogen is to limit the production area of large hydrogen for the electrolysis of water (Teichmann, Arlt, & Wasserscheid, 2012). The economic way to produce hydrogen is the hot white cabbage steam spray to produce toxic carbon monoxide in large quantities, reducing the demand for this method (Cho, Marlow, & Niksa, 1995). Therefore, suitable substitutes for the production of high hydrogen content must be developed. In 1870, Jules Verne commented that hydrogen is a carbon-neutral alternative. Coal gas is another source of hydrogen. Coal combustion gas, to produce a water gas, a mixture of CO and hydrogen, gas and water, strongly converted into CO and hydrogen in gasoline and synthetic alcohols, so-called Fischer - recommended for Tropsch (Tsakoumis et al., 2010). In 1920 huge underground (natural gas) reserves were found, a cheap replacement of Coal gas is expected (Muller, 2003). In the modern world, methane can be regarded as the least expensive source of hydrogen. In producing hydrogen from natural gas, a few carbon oxides is produced for carbon gas. In the field of reducing the percentage of various production and CO 2 hydrogen gas emissions, a variety of ongoing studies. Many Asian countries, the use of natural gas and other natural gas as a source of renewable hydrogen in the industrial production of reforming hydrogen or steam from the partial oxidation of hydrocarbons (Adhikari, & Fernando, 2006).

The main disadvantage of other hydrocarbons are the emissions of airborne pollutants and greenhouse gases (Sarmiento et al., 2007). In general, hydrogen, methane, is produced from petroleum and hydrocarbons such as steam reforming processes (SR). However, the industrial production of hydrogen, conventionally fixed bed reactor, is a laboratory scale application that is capable of producing more than 85% of the reformed steam of partial natural oxidation gas and autothermal reaction. While the above-described reaction is performed in the same reactor, the efficiency of hydrogen production is different / lower than the efficiency of the steam reforming process (Welaya, El Gohary, & Ammar, 2012).

However, an impure hydrogen gas was obtained in high yield from the conventional reforming steam reaction. Among the various techniques for separating and purifying H2, membrane reactors play a very good role compared to conventional systems, it is possible to avoid the thermodynamic constraints of the obsolete reactor (Gallucci, 2013). It was reported by Professor Gryaznov in 1960. Membrane reactors in later years attracted more attention to efficient hydrogen production.

The transfer of global energy systems to a viable path is gradually becoming a major concern and strategic goal of the modern world (Dunn, 2002): Riahi et al., (2001).

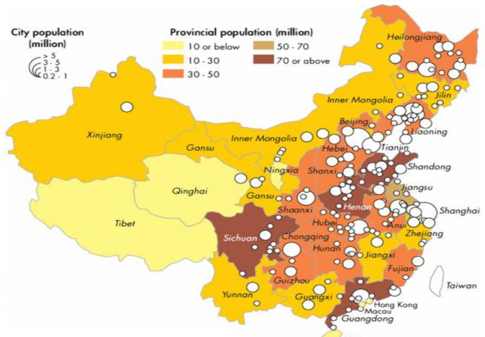
The concept of transition to hydrogen fuel has been proposed by scientists for more than 50 years (Schmidtchen et al., 1997). However, there are concerns that hydrogen is a dangerous explosive fuel, but the reverse is in many ways not true. Although hydrogen can explode under treatment, even gasoline and natural gas can explode. In 1981, Hoffman reported that using hydrogen more carefully or adequately, hydrogen consumption is safer than the conventional use of conventional fuels (Lenssen, & Flavin, 1996). Midilli et al. (2005) examined fundamental and fundamental knowledge that everyone should know about the importance of hydrogen as a fuel for sustainable development in the future. Hydrogen fuel cells and hydrogen-using technologies have reported the cleaner process and a more efficient process to transfer significant energy to a wide range of transformations in different energy systems. This fundamental change in the global energy system will lead to a significant strengthening of the energy system and the decarbonization of the energy mix to promote cost reduction. These climate protection criteria can be met with hydrogen-based technology and hydrogen-based technology. A wide range of studies has studied prospects and possible transition strategies towards a hydrogen-based energy system "Hydrogen Economy" (Barreto, Makihira, & Riahi, 2003: McDowall, & Eames, 2006). It takes time to change the basic structure of the energy system, but the transition to a perfect "hydrogen economy" will take decades. Consequently, structural changes in hydrogen technology and the permissible quantification of long-term trends are essential for proper implementation. Hydrogen production and use must be updated to stimulate the hydrogen economy, which must exceed initial applications (Veziroglu, 2002: Goltsov, & Veziroglu, 2002).

Renewable hydrogen can boost the world's energy confidence and can support the foundation of global property and harmony. Pudukudy et al., (2014) suggested that several factors need to be taken into account in order to win the victory for renewable hydrogen. These factors mainly concern the use of these resources for the production of hydrogen and electricity in a favorable and economically advantageous renewable energy source (Stambouli et al., 2012). Other factors include the social and environmental benefits of using renewable energy, providing internal policies that make renewable hydrogen more convenient. Extensive public and private support, excellent international cooperation in hydrogen research for development in other countries (Orhan et al., 2012).

Hydrogen Economy in China

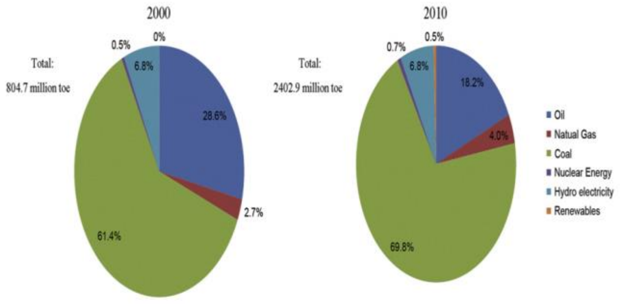
China is the second largest country with a territory of 9.6 million square kilometers. It has the most populous, more than 1.3 billion citizens (CIA, 2016). However, the distribution of the Chinese population is not large in the area. The majority of the population is concentrated in eastern China, especially in coastal areas. These areas also tend to be industrialized. In turn, the western and northern part of the country has the little population and it is not developed. Figure 1 shows the population of China and the distribution of large cities [2]. Since the start of the economic reform in 1978, over the past 30 years, China has developed into one of the fastest growing countries in the world with an average annual growth rate of 10%. China is the second largest economy in the world after the United States in 2010 (NBSC, 2016). The National Bureau of Statistics reported that China's GDP reached $ 7.26 trillion in 2011.

On the other hand, China is the world's largest exporter and the second importer. According to the general customs authorities, China's total foreign trade in 2011 was $ 3.64 trillion.



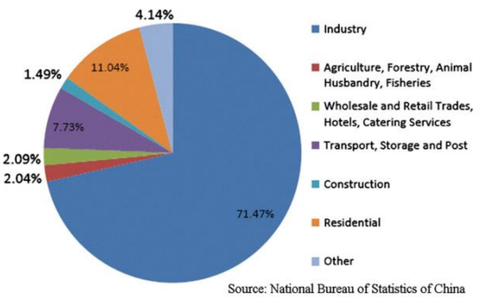
Source: National Bureau of Statistics of China

Due to the rapid expansion of the economy, the energy consumption of China is increasing. China exceeded the United States and became the world's largest energy consumption country in 2010 (Geng et al., 2017). At present, China accounts for 21.3% of global energy supplies, but its consumption rate has increased more than four times the world [7].



Source: BP statistical review of world energy 2002 and 2012

Figure 2 shows fuel consumption in China in 2000 and 2010. As you can see, coal is the backbone of the national energy system. It attracts more than half of the large energy needs that provide most of the fuel used in the power stations and most of the energy consumption in commercial and residential areas. Indeed, the importance of the total energy of coal in recent years has increased with the increase in electricity demand, which accounts for about 80% of the carbon. Oil demand grew rapidly, and oil consumption in 2010 rose from 231.1 million tonnes to 23 million -437.7 million tonnes. However, the share of core demand fell from 28 to 6% to 18.2%, which is attributable to a significant increase in the total energy consumption during this period. China aims to diversify its energy supply, but renewable energy such as hydropower, natural gas, nuclear power and so on occupies relatively little energy in this country (Day, 2016).



Source: National Bureau of Statistics of China

Figure 3 illustrates the energy consumption by sectors in China in 2009 [8]. In 2009, industries such as production, utilities, and mining are the largest domestic consumers, accounting for 72% of energy consumption. The housing sector accounts for about 11%, transportation, storage and postal services account for 8%. Agriculture, forestry, cattle farming, fishing and water quality are only 2%, reflecting the low level of agricultural mechanization in China

Hydrogen is by all accounts a promising possibility for unraveling the vitality worries of China. Hydrogen can be obtained from an assortment of sources, both fossil powers (coal, oil, natural gas) and renewable assets (hydro, wind, sun-powered, and biomass). Then again, China has inexhaustible coal holds and renewable vitality assets while oil and regular gas stores are restricted. This gives a chance to China to broaden its vitality supplies from a hydrogen economy. Hydrogen can then be used in high-effectiveness control era frameworks, including power modules, for both vehicular transportation and circulated power era. Generally speaking, emanations in a hydrogen vitality cycle are relied upon to be lower than today's carbon vitality cycle, however, the brought together a generation of hydrogen offers the additional favorable position of empowering huge scale catch and sequestration of CO2 outflows. Sequestration, alongside the proficiency change because of energy component innovation, could have a noteworthy effect in discharges from a hydrogen economy.

Literature Review

The numerous literature available on the importance of hydrogen in the energy sector. In our study, we have divided the literature review according to its nature, theoretical, empirical etc.

Fossil fuels contain very valuable properties not shared by advance energy sources which also made them prevalent in the last century, but the problem is these advanced resources are not renewable. The shifting of our world towards the fossil fuels is because of 1973 oil crisis, which forced them to search for alternatives. Hydrogen, as compared to other elements, contains a high amount of energy, environmental compatibility, and ease of distribution and storage. Mirza et al (2009), in their paper, assessed the vision of hydrogen economy in Pakistan. For this purpose, they evaluate the possible advantages and disadvantages of a hydrogen economy. Furthermore, the challenges and barriers towards hydrogen economy also discussed in the paper. They presented efficiently the current energy situation of Pakistan and also suggested that how government can transform from a conventional economy to hydrogen economy. The results of their study show that by combining hydrogen and fuel cells will give a way forward to oppose the long run challenges of energy security and climate change in Pakistan. The hydrogen economy will offer a range of benefits for the country. However, there are severe challenges existed and in order to overcome those challenges, a serious policy is needed. Other researchers have also identified the barriers to a hydrogen economy. A hydrogen-based society will require crucial leaps forward in both fundamental science and innovation (Kleijn & Van der Voet, 2010).

The energy crisis is defined as the increase in the prices of energy resources and the lack of energy resources. In general, it is called the shortage of electricity, oil, natural gas and other natural resources. As the world is completely changed by globalization, many emerging questions emerge from the attention of researchers. In terms of supply, energy supply continues to grow in this globalized world. The result was an energy crisis. Lack of energy as opposed to most countries and therefore has a serious impact on economic growth and social change. There are many opinions and ideas that can combine energy and economic growth. Energy is the backbone of any economy and plays an important role in the social and economic development of the country. Without enough energy, industrialization does not occur, but also in the areas of industry and manufacturing, waste and trade and transportation. Expansion of energy must also lead to high growth so that its scarcity is a process of growth. In short, energy is important for all resources, the energy crisis is the agricultural sector, industry, unemployment, poverty, GDP reduction, such as rising inflation, a direct impact on all sectors of the economy. Unfortunately, Pakistan faces the worst energy crisis in history. Pakistan, as in other developing countries, is one of the most energy-efficient economic growth, and energy demand is met by a lot of oil imports like most other non-oil producing countries. It is said that Pakistan's energy infrastructure has not been fully developed and poorly managed. Despite population growth, economic growth and demand growth in recent decades, there has been no serious effort to create energy. In addition, the electrical leakage and the loss of transmission through obsolete infrastructure aggravate the situation.

Hydropower, oil and natural gas are the three most important energy resources in Pakistan and are used to meet energy demand. According to MAE 2013, the share of energy production in Pakistan, 36% hydroelectricity and nuclear power plant, 35% through heating plants, 29% through gas plants, 0.1% through coal-fired power plants. Due to limited oil resources and political systems, Pakistan imports large quantities of petroleum products from the Middle East, especially Saudi Arabia. Pakistan's production, business, industry, and trade are heavily influenced by industries, financial crises and energy crises. As the industry continues to close, workers will be unemployed and on the way. In other countries around the world, the government will stimulate entry, business productivity, exports, improve competitiveness, and ultimately help the industry improve the economy. However, in Pakistan, most of the industry cannot be alone, they are impoverished suffering from confusion in the progress for heavy and costly energy bottlenecks, as a result, to limit exports to very low level. This is a transition to a neighboring country. In the short term, Pakistan, debt payment of circulation, Pakistan 10,000 solar park support, Chinese support, fully energetic crisis, we have established a number of long-term investment strategies, such as imports of electricity of Iran. After all, we must concentrate immediately.

Global Viewpoint Analysis

Peidong, et al. (2009) investigated in their paper that transporting hydrogen is an extremely critical part of the cost of the conveyed item. The outline of the framework, including gas pipelines and rail lines for conveying contributions for hydrogen production, will be an indispensable part of the hydrogen distribution infrastructure. The difficulties in accomplishing the best conveyance framework incorporate a choice of the site for hydrogen production and setting up a suitable transportation organization. Government arrangements must assume a part in changing the vitality framework to a hydrogen economy. Half and half vehicles, which share numerous regular advances, are turning out to be more vitality proficient and savvy, similar to the energy unit vehicles.

Contrary, Lu et al (2013) evaluated the possible characteristics in establishing a hydrogen economy in China. Since China is considered to be a unique in terms of its fast economic growth and population. With the increasing production of China, the environmental pollution is increasing with the passage of time. It is important to use such resources which are on one side increase the productive competency of China and on the other hand reduce environmental pollution. In addition to all this, the China's coal-based energy system results in omitting high CO2 emissions. For this reason, hydrogen is considered to be the best source for producing renewable energy and also protecting the atmosphere from extreme environmental pollution. The authors suggested that the advancement of power devices and a hydrogen economy will give new market openings and new occupations. Show learning demonstrates that hydrogen as a vitality transporter will include minimal natural hazard.

In the short term, there is a two-way causal relationship between energy and income for one-way Congressional Relationship for India and Indonesia for Philippines and Thailand. In Thailand and the Philippines, energy, rents, and prices were accompanying each other (Adjaye, 2000).

Article 2: For developing countries in Asia, electricity consumption has a positive influence on economic growth, and there is a bi-directional causal relationship between electricity consumption and economic growth. This shows that increased power consumption promotes economic growth and similar economic growth increases power consumption (Bayar, 2014).

Article 3: The demonstration result shows that in Pakistan case, the causal relationship between coal and GDP, unilateral Granger between GDP and total energy consumption, GDP is compared with electricity consumption. In Bangladesh and Sri Lanka, the causal relationship in one direction is not within the range of energy consumption from GDP, but the causal direction of oil is India in GDP in Nepal (Asgar, 2008).

Article 4: Integration testing of panel data of 10 countries in Latin America has shown that there is a bi-directional causal relationship between energy consumption and GDP in all sample countries. For further research, human capital, physical capital, and labor are also important factors and can be included in variables (Campo and Sarmiento, 2013).

Article 5: Long-term c states: "While there is a negative relationship between these two, the application of different tests on panel data from Pakistan, India, Sri Lanka, Bangladesh, Nepal is dependent on per capita energy consumption

Article 6: The causal relationship between energy consumption and GDP and GDP in terms of energy consumption, but widely non-OECD development (Nord & Siddiqi, 2010) It is used in advanced OECD countries more than in developing countries (Chontanawat, Hunt & Pierse, 2006), the impact on electricity consumption on GDP is higher in developed countries

Article 7: Energy consumption and GDP Analysis that being integrated between them is a major obstacle to growth of the economy, but with sufficient energy, the impact on the economy will diminish (Stern DI, 20

Article 8: For South Asian countries, Energy consumption and GDP, energy consumption and export are integrated in a short period of time It is pointed out that the energy crisis leads to a decrease in trade, which affects GDP growth (Shakeel, Iqbal & Majeed, 2013).

Article 9: Although it ranges from long-term energy consumption to high-income group, low-income group, Granger causes the cause-and-effect relationship between GDP and energy consumption of the upper and middle group. In sample countries (Farhani & Rejeb, over 90 countries, 2012 There is a strong relationship between energy consumption and economic growth among the link between economic growth and energy consumption of the year)

Article 10: Using sample and dynamic Podeldaten, GMM-system, 23 For sample preparation, there is a one-way causal relationship between per capita GDP range (Nayan, Kadir, Ahmad and Abdullah 2013) due to energy consumption

Article 11: Co-integration of actual products, energy, capital, and work can be found inappropriate tests.The results show the causal relationship of energy consumption to GDP of South Asian countries in short-term and long-term This means that the economies of any country depend on energy, the energy crisis certainly leads to a decline in economic growth (South Asia, 2007 Khan & Qayyum, dynamic energy modeling, and growth)

Overview

The analysis shows that there is a relationship between energy consumption and economic growth from the global perspective of panel data analysis in each country. There is a positive relationship with developing Asian countries. Several studies have found that it is a method, but other studies have found an interactive relationship. The Latin countries' results show a two-way causal relationship between energy consumption and economic growth. We compared OECD countries with non-OECD countries, countries, it was clear that the impact of electricity consumption on GDP is higher than in developed countries. Research in the South Asian countries shows a consistent form between energy consumption and GDP, energy consumption, and trade. The analysis of data from 90 countries divided into different income groups (Farhani and Rejeb, 2012) has brought strong relations between all countries within the sample between energy consumption and economic growth. Dynamic Panel Data (GMM system) also demonstrates a one-way, one-way, and per capita energy efficiency ratio for sample consumption in 23 countries. Mr. Bound also found the co-integration of real production, energy, capital and labor in Bangladesh, India, Sri Lanka, and Pakistan.

From the Perspective of Developed Countries

Article 12: Granger's causation test and cointegration analysis show that energy consumption is strongly linked to economic activity and economic growth in the United States. The high-quality energy transition can reduce the energy required to produce the BSP unit (Stern D.I., 2004).

Article 13: As a variable for GDP and energy consumption in France, there is also a geographic statistical method for the application of VEC, economic growth (Amiri & Zibaei, 2012) according to long-term energy consumption term one direction.

Article 14: From 1960 to 2008, Turkey has found a positive relationship between energy consumption and economic growth. This relationship has intensified in recent years, which means that economic dependence on energy (especially oil) is increasing (Saatci & Dumrul, 2013).

Article 15: Turkey has a two-way causal relationship between energy production and economic growth. In other words, the increase in energy production will increase as economic growth increases.

By increasing the amount of energy, which means we import, bidirectional relationship between imports and non-economic growth of energy, increase economic growth and activity is the (Ozkan, Ozkan and Kuyuk, 2012).

Article 16: The result of the Johansen-Juselius cointegration method and the vector error correction model shows a unidirectional causal relationship between energy consumption and GDP. Therefore, any potential energy shortage can affect Turkey's economic growth process (Soyas, Sari, & Ozdemir, 2001).

Overview

In the synthesis of developed countries, energy production and economic growth, a unidirectional relationship between energy consumption and economic growth excluding Turkey two-way between imports of growth and economic energy are shown. This report has been strengthened for Turkey in recent years. In the United States, energy consumption is significantly affected by economic activity, changing the quality of high energy to reduce the influence on energy demand and the environment, it is possible to reduce the energy needed to produce the BSP. VEC alone and VEC by the geographic statistical method of France give a one-way relationship from energy consumption to long-term economic growth.

From the Perspective of Developing Countries

Article 17: The dependent variable and GDP as an independent variable, financial development, energy consumption, as population, show for Malaysia, the result is, energy consumption affects the development of economic growth and finance, both short-term as long-term. After developing the country perspective in energy consumption is influenced by the population in the long-term (Islamic, Shahbaz Ahmed, and Alam, 2013). Historical Series of Taiwan Article 18 of 1954-1997, a two-way causal relationship between total energy consumption (coal, oil, natural gas, and electricity) and economic growth (YangU, 2000).

Article 19: In China, cointegration between Johansen's cointegration test energy consumption cannot be found using the cause-effect relationship of Granger, Xiao, energy consumption and economic growth (Hou, 2009) and C ' is a two-way causal relationship between.

Article 20: 2007 from the study in 1971 on the relationship between energy consumption and Tunisian economic growth during the year, a causal sense with the economic growth of energy consumption of the structure of two autoregressive vector variables (Chouaibi and Abdasalem, 2009) shows the existence of the report.

Article 21: During the VECM- and Johansen Kointegrationsschatzung test, there is a long-term feedback between them, the results show a causal relationship between unidirectional traffic in GDP energy consumption. Therefore, for Tunisia, energy limits economic growth. Consequently, all impacts on energy supply have a strong influence on economic growth (Belloumi, 2009).

Article 22: Sri Lanka's analysis shows that real GDP is significantly affected by the change in current. Each time the power increases by 1 MWh, the additional power is 0.88.000 - 137.000 lumens (Morimoto & Hope, 2001).

Overview

The unidirectional relationship between economic growth and energy consumption is observed in Tunisia and Sri Lanka. In Malaysia, financial development affects both short- and long-term energy consumption, while population also affects long-term energy consumption. For China, but there is no cointegration between GDP and consumption by Johansen's co-integration test, while Hsiao Granger's causation has a bi-directional relationship. Another study for Tunisia has a bi-directional relationship between energy consumption and long-term economic growth. There is also a bi-directional relationship between energy consumption and economic growth

From the perspective of developing countries

Article 23 Nigeria's economy has a positive correlation between national income and energy expenditure. There was a bidirectional relationship between the use of production capacity and energy consumption (Kabir, Zaku, A. A. Tukur & J.g, 2013) and the causal relationship of Granger.

Article 24 During the IP, Vietnam's economic growth is supported by the fact that it is not limited to energy consumption. Demand for energy consumption will increase as economic growth advances, but vice versa (Binh, 2011). The synthesis of Nigeria is the relationship between energy consumption and national income since Vietnam's economic growth is not caused by energy consumption, but the demand for energy consumption and economic growth is growing.

Article 25: From the perspective of Pakistan: In Pakistan, increasing energy supply will boost economic growth, but a crisis in energy supply will create a barrier to economic growth. The impact of petroleum products and electricity is large (Siddiqui, 2004).

Article 26: but in the time series data from 1956 to 1996, there is no feedback report of the Xiao version of the Causal Reasoning Report and Granger, the results have shown that a high current consumption to boost economic growth I will do. Economic growth does not affect economic growth, but the increase or decrease in oil consumption causes the use of oil. There is no cointegration of gas consumption and economic growth (Aqeel & Butt, 2001).

Article 27: In industrial sectors, production costs can increase energy supply, but capital investment does not affect this energy shock (Mahmoud, 2000).

Article 28: The model of non-linear relations is influenced by fluctuations in the price of crude, which is lower or higher than the significant price of crude oil, regardless of the actual product that is no longer the case. Electricity must be provided by the government (Kiani, 2011).

Article 29: ARDL Test Limit Approach as indicated (Shahbaz & Feridun, 2011) and Granger's Causal Tests, the long-term equilibrium of electricity consumption and economic growth in energy consumption is bound to lead to economic growth. there is economic growth, this leads to energy consumption.

Article 30: There is a unidirectional relationship between GDP and consumption of oil, electricity, and GDP, while in the case of gas and neutral GDP coefficients. Demand for oil consumption for future agricultural growth (Mash Tak Abbas, Abdullah & Ghafoor, 2007).

Article 31: In the same period, while sugar and chemical industries to maintain consistency, (after the energy crisis), 2009 to 2007, power will be rejected by fiber, cement, and engineering. To save the industry, the Pakistani government must focus on the energy sector (Khurshid & Anwar, 2013).

Article 32: Indirect consumption and GDP have a long-term relationship. There is a one-way causal relationship between the use of power and economic growth. This means that any energy crisis delayed Pakistan's economic growth process. The government must invest in energy infrastructure to support economic growth (Yasmin, Javid, and Ashraf, 2013).

Article 33: Analysis of the Main Horizontal Report of the Textile Industry, the Performance of the Textile Industry (Shah, Essrani, Shah & Rahatto, 2013), seriously affected by the polarization power crisis.

Article 34: Analysis of independent variables by linear multiple regression analysis. Electricity consumption and interest rates have a negative relationship between the production of the textile industry and energy consumption and also indicate that there is a negative relationship between the textile industry and interest rates. The government must take severe measures to survive in the industry (Afzal, 2012).

Article 35: The positive relationship tested by the ordinary minimum square method for the energy consumption of GDP, the causal relationship between what exists between them, is a result of the Granger Causal Test Method. As energy consumption increases by 1%, GDP grows by 1.23% (Ahmad, Hayat, Hamad & Luqman, energy consumption and economic growth: evidence from Pakistan in 2012).

Article 36:Energy consumption and industrial production for consumption of unidirectional causal relationships using Johannsen co-tests and electricity for the industrial production of VECM oil, industrial production and coal consumption, bi-directional Confirm that there is a positive correlation between causal relationships. There is a causal relationship (Qazi, Ahmed, & Mudassar, 2012).

Article 37: To use such tools as Granger causality test, statistical analysis, etc. Correlation analysis indicates that Pakistan's GDP, including electricity, oil, is dependent on power consumption, in all its forms Gas and coal. One-way causal GDP to trade, GDP growth rate is trade liberalization, meaning to promote trade liberalization (Choudary, Safdar, and Farooq, 2012).

Article 38: Rising energy prices will affect economic growth. As prices rise, producers will be able to improve their quality standards or reduce their work to survive in the market (Rashed Azam & Ramzan, 2012).

Article 39: Economic growth flowing from there through to long-term consequences of the causal relationship between co-integration and economic growth and energy consumption Granger causality test flowing from there It is focused on being. Frequent changes in energy prices also affect economic growth (Adnan & Riaz, 2008).

Article 40: After applying SVAR, the results show that economic growth is increasing demand for labor, capital, and energy consumption. The Pakistan government must provide affordable energy to promote economic growth (Zeshan & Vaqar, 2013).

Overview

For Pakistan, conducted in various patterns such as Granger causality, binding assay, multiple regression analysis, etc. Some studies, Johannsen cointegration test, analysis and VECM correlation, energy consumption and economy check the relationship with growth. The impact of oil and electric products is remarkably high. Due to energy shock, production costs may decline, which may affect economic growth. Future growth in the agricultural sector will increase oil demand. Fibers, cement and engineering activities also declined during the crisis of 2007-2009. This shows that the industry is strongly influenced by the energy and the government has to concentrate on the energy field.

Production in the textile industry is also affected by the use of interest rates and energy. Pakistan's GDP depends on all forms of energy consumption such as oil, electricity, coal, and gas. As energy consumption increased by 1%, GDP increased by 1.23%. Economic growth is increasing demand for labor, capital, and energy consumption. The Pakistan government must provide necessary and affordable energy for economic growth.

Methodology and Analysis

Theoretical Framework

Ren et al. (2015a) described certain salient features of a hydrogen economy. It has been inferred that a hydrogen-based sustainable framework will expand the chance to utilize renewable energy in the vehicle segment. This will build the assorted qualities of energy sources and diminish general natural gas emanations. Hydrogen in the vehicle division can lessen nearby contamination, which is a high need in numerous vast urban communities. The power and adaptability of the energy framework will be expanded by the presence of hydrogen as a solid new energy transporter that can interconnect distinctive parts of the energy framework. The objectives for lessening vehicle commotion might be met by supplanting routine motors with hydrogen-controlled power modules. Energy components for battery substitution and reinforcement control frameworks are specialty advertises in which cost and proficiency are generally insignificant. Deals in this market will drive the innovation forward towards the time when power modules will get to be distinctly monetary for the presentation into the vitality part. Hydrogen electrolyzers/energy units associated straightforwardly to wind turbines are a helpful approach to offset neighborhood vacillations in the accessibility of wind power (Furuoka, 2016). The advancement of power devices and a hydrogen economy will give new market openings and new occupations. Show learning demonstrates that hydrogen as a vitality transporter will include minimal natural hazard.

Other researchers have also identified the barriers to a hydrogen economy. A hydrogen-based society will require crucial leaps forward in both fundamental science and innovation (Kleijn & Van der Voet, 2010). There is a gigantic execution crevice between what today's innovations can convey and what a market-driven hydrogen economy will require. Most reviews concur that key hydrogen innovations are still excessively wasteful and excessively costly, making it impossible to meet our vitality requests sooner rather than later. Generally imperatively, more effective and less expensive approaches to produce hydrogen must be practically available. Better stockpiling frameworks for hydrogen in the vehicle section are fundamentally essential. Energy component costs must fall, and their working lifetime must be expanded. An essential for the presentation of power module vehicles is a satisfactory hydrogen appropriation foundation.

Likewise, bringing down hydrogen fuel cost requires enhancements all through the whole hydrogen economy, from production, purification, transportation, and storage, to utilization. The change in power device vehicle innovations requires progressive leaps forward in energy unit advances and developing enhancements. The advancement of vehicle innovations and hydrogen production advances must continue simultaneously to break the egg and chicken issue (Ren et al., 2015b). Furthermore, Agnolucci and McDowall (2013) described that shifting to a hydrogen economy needs planning and actualizing a financial motivator plan to empower the working of hydrogen foundations and market advancement of power module vehicles. At first, specialty markets must be distinguished where hydrogen advancements can infiltrate the market with restricted monetary impetuses. As innovation learning and economy of scale drive down innovation and fuel costs, hydrogen advancements will extend.

While Peidong, et al. (2009) articulated that transporting hydrogen is an extremely critical part of the cost of the conveyed item. The outline of the framework, including gas pipelines and rail lines for conveying contributions for hydrogen production, will be an indispensable part of the hydrogen distribution infrastructure. The difficulties in accomplishing the best conveyance framework incorporate a choice of the site for hydrogen production and setting up a suitable transportation organization. Government arrangements must assume a part in changing the vitality framework to a hydrogen economy. Half and half vehicles, which share numerous regular advances, are turning out to be more vitality proficient and savvy, similar to the energy unit vehicles. Be that as it may, as hydrogen innovations enter the market, gas costs will decrease and crossover vehicles could be more focused than the energy unit vehicles, hosing the entrance of hydrogen advancements.

One of a component of the hydrogen vitality framework is that in every part of the framework there are a few contending advancements, with the more manageable choice seeming further away monetarily. The test is to explore a course that creates adequate appropriation of hydrogen advances to empower the hydrogen economy, without permitting the less feasible innovations to wind up distinctly so predominant that others are stifled. Cases incorporate, generation of hydrogen from non-renewable characteristic gas as opposed to renewables; large-scale production requiring long-distance transport instead of neighborhood generation; burning of hydrogen in nitrogen oxide-delivering interior ignition motors as opposed to power devices (Shahbaz, Arouri & Teulon, 2014).

Initially, China did not understand the criticalness and significance of energy security until the 1990s because of the frail monetary advancement and moderately bring down interest for vitality assets before 1990s. For a long time, China could meet its energy needs completely from household assets. In this way, energy security was not the nation's need for its reliance on worldwide markets was negligible. In any case, the circumstance has changed significantly in the most recent decade and worries about vitality security have developed in parallel. The vitality utilization of China has been taking off because of the fast monetary development, growing white collar class populace and the biggest size of urbanization. China was compelled to end its independent oil approach and import oil from abroad in 1993. In 2009, China turned into the world's second-biggest customer of oil behind the United States and the world's second-biggest net shipper of oil. In under an era, China has moved from being a minor and to a great extent independent vitality buyer to one of the world's fastest-growing vitality customers and biggest vitality shippers (Yuan, & Lin, 2010).

Vitality security contemplations of China today concentrate to a great extent on ensuring a constant and adequate supply of oil from abroad. Presently, China relies upon imported products for more than half of the oil it devours, and half of this foreign-made oil is from the Middle East.

China has many motivations to stress over its oil supply: little oil holds, high reliance on oil imports, the sensational variance of oil costs in the universal market, and political hazard in oil-providing nations.

Then again, China has plenteous and generally appropriated renewable vitality assets that can possibly bit by bit uproot fossil fuel in the nation's vitality blend. It is more alluring for China to attract its vitality to a substantial degree from nearby and indigenous renewable vitality assets, with a great deal less reliance on vitality imports from abroad. The utilization of hydrogen can encourage the abuse of the renewable vitality assets. Hydrogen can be obtained from various sources, both renewable (sunlight based, wind, hydro, biomass) and non-renewable (coal, oil), common anxiety that, dissimilar to coal, oil or natural gas, hydrogen is not an essential vitality source. It's part more intently mirrors that of power as a "vitality transporter", which is produced utilizing energy from another source and afterward transported for future utilization, where its put away synthetic vitality can be used. It is the key component of the vitality stockpiling limit that gives an answer for one of the significant issues of renewable energy sources, to be specific the vexing issue of discontinuity of supply. For example, many individuals have anticipated the development of a sun-oriented/wind hydrogen economy later on. Photovoltaic panels or wind turbines would change over daylight or be converted into electricity. The electricity would be utilized to split water (electrolysis) into hydrogen and oxygen in order to store hydrogen fuel. Energy units then devour the hydrogen to produce stable electrical power.

In entirety, hydrogen opens up the likelihood of (decentralized) production and consumption on the premise of an assortment of energy sources, in this way enhancing vitality supply. This may incredibly add to diminish the reliance on imported oil.

Methodology

We have conducted a meta-analysis, a detailed literature review has been studied on hydrogen economy and it's important in both regions. We have also seen that how useful a hydrogen can be and how it can affect the overall economy of both regions (China and Pakistan). The reason for conducting meta-analysis is to compare the hydrogen economy performance in both countries. This analysis would also give a wider perspective that how hydrogen economy with its different functions, especially hydrogen in the energy sector can enhance the overall growth of the economy. In our analysis, we have compared the different statistics of hydrogen with different factors of economy and tried to assess the impact of hydrogen in those sectors.

Hydrogen Economy in Pakistan

The hydrogen energy of fossil fuels is a very practical feature that is not shared by unconventional energy sources that became popular in the last century. Unfortunately, fossil fuels are not renewed. In addition, (CO, CO2, CnHm, NOx, radioactivity, heavy metals, ash, etc.), a contaminated fossil energy system must be emitted; Large renewable energy is harmful. Since the oil crisis in 1973, considerable progress has been made in the exploration of alternative sources of energy. Among the candidates, hydrogen is an exceptional actor for high energy content, environmental compatibility and easy storage and distribution. Hydrogen is not a source of energy, it is a chemical fuel. Hydrogen consumption is a long-term option to reduce CO2 emissions. Hydrogen, as a preferred fuel for transport towards the end of the century, must be replaced by liquid fuels and fossil fuels (Midilli, Dincer, & Rosen, 2005).

Hydrogen production is recognized as a clean fuel. The central issue is that hydrogen sources can be produced in large quantities at a reasonable cost. An important aspect is to avoid hydrogen being a more expensive method of using fossil fuels (Mulder, Hetland, & Lenaers, 2007). At present, 50 billion m 3 of hydrogen are produced annually, equivalent to 6.5 EJ of energy. About 99% is produced from fossil fuels through the reform of natural gas mainly consisting of methane. Hydrogen can be produced with other manufacturing techniques and different sources of energy. Electrolysis of water is one of the most widely used industrial processes for the production of hydrogen. About 108.7 kg of hydrogen by electrolysis can be prepared from one cubic meter of water and corresponds to the energy of the amount of hydrogen for these 422 liters of gasoline. The electrolysis current may come from a fossil or renewable source of energy. Photosynthetic bacteria are methods with considerable efficiency in generating hydrogen using solar energy.

Some of the hydrogen production processes are commercially mature: (a) natural gas vapor reformer; (b) catalytic decomposition of natural gas; c) partial oxidation of the heavy oil; d) gas vaporization and other heavy vapor and e) vapor (Momirlan, & Veziroglu, 2002). Renewable energy sources do not fully meet energy requirements, but it has been demonstrated that electrolytic solar energy combined with the significant production of hydrogen, wind, and hydro. This result suggests that the production of hydrogen and methane from sewage sludge can be carried out through a series of two reactors (Ting, & Lee, 2007). Some of the major benefits of hydrogen are listed below.

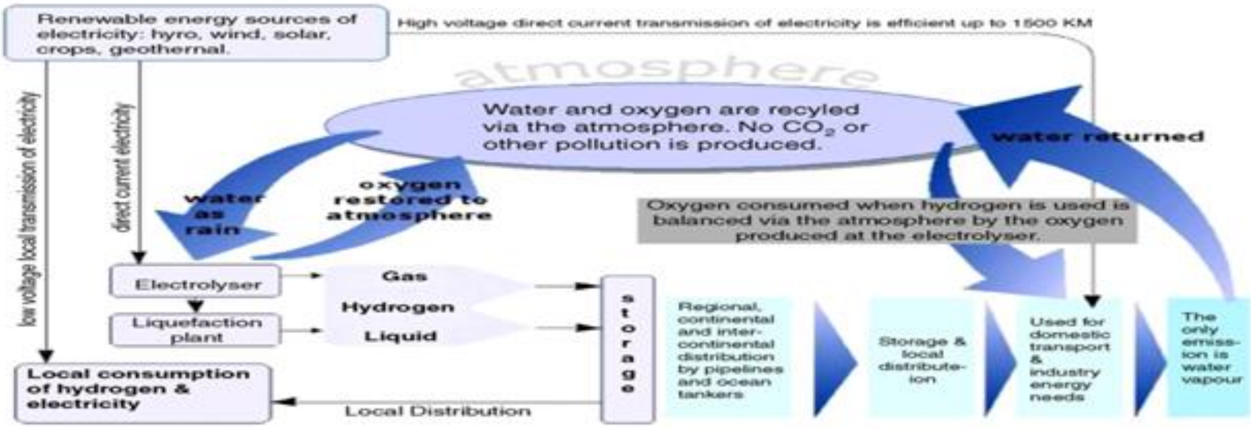
- Hydrogen is a pure non-toxic energy carrier with a high specific mass energy (for example, the energy content of 9.5 kg of hydrogen corresponds to the energy content of 25 kilograms of gas).
- Hydrogen can be transported safely with pipes.
- Hydrogen can be used as an energy carrier in a clean and sustainable energy system.
- During combustion, hydrogen generates non-toxic exhaust gases, but with the exception of some equivalence ratios (high flame temperature can lead to a significant NOx content in the exhaust gas)
- Compared to electricity, hydrogen can be stored for a relatively long time.
- Hydrogen can be used in any part of the economy (eg Automotive Power Generation, Fuel Cells).

There are several disadvantages of hydrogen.

- When blended with air, hydrogen burns at low concentrations and can lead to safety problems.
- The storage of liquid form is difficult because a very low temperature for hydrogen liquefaction is required.

Hydrogen Economy

The transition to a hydrogen-based energy economy, where the main carrier of chemical energy is hydrogen and the main form of non-chemical energy, progresses gradually after the end of the third century. The optimal endpoint of hydrogen conversion is to replace clean hydrogen with current fossil fuel. It is important for a better transition to hydrogen production. The economy of hydrogen from non-fossil fuels such as solar power, hydroelectric power, wind and nuclear power. 1 Figure 2 shows a sustainable hydrogen-based energy system.



Source: http://www.hydrogen.co.uk

1. Characteristics of Hydrogen Economy

The main characteristics of the hydrogen economy are the following

- Hydrogen-based energy systems increase the possibility of using renewable energy in the transport sector. This will increase the variety of energy sources and reduce global greenhouse gas emissions.
- Hydrogen in the transport sector can reduce local pollution. This is the absolute priority in many big cities.
- The introduction of hydrogen as a powerful new energy carrier, which can connect different parts of the energy system, improves the robustness and flexibility of the energy system.
- By replacing the conventional engine with a hydrogen fuel cell, you can achieve the vehicle's noise reduction target.
- Replacing the Battery and Backup System Fuel Cells are a market with a relatively low price and efficiency. Sales in this market will promote technology as long as the fuel cell becomes economical for the introduction of the energy field.
- A hydrogen/fuel cell electrolyzer directly connected to a wind turbine is a convenient way to offset the local variation in wind energy availability.
- The development of fuel cells and the hydrogen economy will bring new market opportunities and new jobs.
- Current knowledge shows that hydrogen as a fuel does not cause environmental hazards.

2. Disabilities and Challenges of the Hydrogen Economy

Hydrogen-based society needs fundamental advances in the foundations of science and technology. There is a big difference between the performance of what technology today can offer and what the hydrogen economy needs in the market. In most studies, important hydrogen technology has become too inefficient and expensive in the near future to meet our energy needs. Even more important,

- We need to develop resources to produce hydrogen more efficiently and cost-effectively.
- The best hydrogen storage system in the transport sector is very important.
- The price of the fuel cell will decrease and life expectancy will be longer.
- The premise for the introduction of fuel cell vehicles is a suitable supply of hydrogen.
- The major challenges of transition to the hydrogen economy are described in detail.

3. Competitiveness of Technology (R & D)

To reduce the price of fuel to hydrogen, it is necessary to improve the global hydrogen economy of production, processing, transportation, distribution, and distribution. Improving fuel technology is a turning point in fuel cell technology and the need to develop the transmission system. In order to solve the problems of chicken and eggs, the development of vehicle technology and hydrogen production technology must parallel.

4. Market Development

The transition to the hydrogen economy requires the design and implementation of a system of economic incentives to promote the construction of hydrogen infrastructure and the development of the market for economic vehicles. First, we need to identify the niche markets where hydrogen technology can enter the market with limited economic incentives. Hydrogen technology will continue to evolve as technological learning and scalability will reduce technology and fuel costs.

5. Construction of Infrastructure

Hydrogen transportation is a very important part of the cost of transported products. The design of infrastructure, including pipelines and railway lines, to contribute to hydrogen production is an integral part of the delivery system. The challenges for the optimal procurement system are the selection of sites for hydrogen production and the creation of a major transportation network.

6. Competitive Market - Hybrid Car

Government policies must play a role in transforming energy systems into a hydrogen economy. Hybrid vehicles that share many common technologies such as fuel cell vehicles are more energy efficient and energy efficient. However, as hydrogen technology enters the market, fuel prices have declined, hybrid vehicles are more competitive than fuels and weaken the penetration of hydrogen technology.

A unique feature of a hydrogen feed system is that there are several competing technologies in all aspects of the system and more durable alternatives seem to eliminate commercially. The challenge is to navigate the path that uses hydrogen technology properly to allow the economy of hydrogen without operating technologies that are less durable than others. For example, non-renewable, non-renewable, large-scale production and processing of natural gas requires long-distance transport and not a local production. Combustion of hydrogen in a combustion engine that produces nitrogen oxides instead of fuel cells.

Current Energy Situation in Pakistan

Pakistan's future energy system seems rather opaque. In recent years, oil imports from the Middle East have increased due to increased oil consumption and crude oil production in Pakistan. Natural gas accounts for about 50% of total energy consumption in Pakistan. Pakistan currently consumes all domestic natural gas production, but Pakistan must become a natural gas importer without increasing its production. As a result, Pakistan is considering gas and LNG import options to anticipate growth in natural gas demand. At present, coal plays a small part of Pakistan's energy composition, but the estimated reserves are estimated at 333 million tons. Demand for electricity in Pakistan is increasing rapidly. According to the government's estimates to meet the expected demand, it is necessary to increase the production capacity by 50% by 2010.

Pakistan has a proactive strategy to increase the share of renewable energies by 10% by 2015. Pakistan's geography and climate offer great potential for hydroelectric power, sun and wind power.

3. Pakistan's Economic Hydrogen Plan. Pakistan lacks vision and hydrogen strategy to prepare for business opportunities in the hydrogen economy and potential market niches. There have been several studies on the subject [12, 13], but a detailed analysis of the factors, barriers, keywords and actors and the steps needed to close the gap between the current and future vision is necessary. Pakistan Road Economy Roadmap Foundation

The transition to a hydrogen-based energy economy should progress step by step. Around the middle of this century, Pakistan was able to move into a clean, renewable and safe energy system.

i. Short term

The application of hydrogen can begin with a niche application distributed nationwide. These include, for example, city buses in areas with atmospheric problems [14]. First, hydrogen can be used for transport by mixing with natural gas of the internal combustion engine, which improves engine performance and reduces pollution. Vehicles equipped with a fuel cell with hydrogen as a fuel can be gradually introduced. These are zero-emission vehicles that only release steam into the exhaust gas.

On the other hand, the steam reforming of natural gas is due to the lack of infrastructure for the transport and distribution of hydrogen and the existence of a well-developed gas transfer infrastructure. After this early stage, the local hydrogen and gas station will lead to a larger hydrogen transport and distribution infrastructure that complements local production and replaces it with large production facilities to use carbon sequestration and isolation. [14]

ii. Interim Report

The restructuring of the electricity industry can provide opportunities for distributed power generation where hydrogen fuel cells provide electricity on-site. In addition, these fuel cells can also generate heat energy for hot water and industrial processes. The large-scale production of hydrogen is likely to increase as the gasification of the coal increases. Biomass in the form of agricultural residues and municipal solid waste can also be used to produce hydrogen by gasification or pyrolysis. CO2 capture technology and insulation technology are involved in mass production. In the medium term, we expect an increase in emission-free vehicles with hydrogen as fuel, thanks to the improvement in the installed storage technology. This can promote the construction of a hydrogen infrastructure in dedicated transport corridors or user groups.

iii. Long-term

An increase in the solid hydrogen market and the hydrogen infrastructure can extend the possibilities of a renewable hydrogen system.

Renewable electrical interruption can produce a market for hydrogen produced by electrolysis, which is used for advanced leveling, the full use of available renewable energy resources, power requirements little from the experience of current wind technology has been shown that hydrogen is a very necessary solution to address the intermittent Nature of the wind energy [8]. Fuel cells can use hydrogen to deliver electricity as demand increases or compensate for intermittent energy sources.

In this era, you can demonstrate the emergence and growth of advanced technology to produce hydrogen from water and sunlight and store hydrogen in high-energy systems. The fact that advanced technology to produce, store and use hydrogen penetrates the market shows the institutionalization of hydrogen economy

CPEC and Its Importance

The China Pack Economical Corridor is a mix of various developments in global, regional, bilateral and domestic situations. The ultimate goal is the peace, prosperity, and happiness of the peoples of both countries, regions and the world. The global picture has changed dramatically. The main drivers of this trend are technology, trade liberalization, free movement of capital, progress in telecommunications and transport infrastructures and the creation of cross-border supply chains. The focus of the global economy has moved eastward, as emerging markets are expanding at a much higher rate in developed countries. Its share of GDP has doubled over the past 50 years. Over the last decade, 70% of global growth has been allocated to emerging markets. These changes reflect changes in global governance. The integration of the world economy includes all the spheres of commerce, services, and capital flows. Regional cooperation agreements have risen and strengthened rapidly in recent years to capture this change, especially in the global economic climate. The prosperity of Pakistan is not a long way because we are very committed to projects that will lead the current leadership in a short time.

Recently, Pakistan and the Chinese government intentionally pursue the same strategic and political cooperation between the two countries, focusing on expanding the economic aspects of the relationship. As China and Pakistan leaders have changed almost at the same time, this driving force is strengthened to strengthen economic and trade cooperation. The new governments of the two countries are committed to strengthening relations between Pakistan and China at the beginning of their mandates. The Economic Corridor of China and Pakistan (CPEC) Pakistan's vision of 2025 aims to settle in low to middle-income countries, reaching a target of $ 4,200 per capita.

Due to the experience of improving project design, regional economy and security situation, CPEC not only benefits Pakistan but also contributes to peace, stability, and security. Prosperity. About 3 billion people in China, such as South Asia, Central Asia, etc., will benefit from the economic corridor. Through the development of special trade routes between China and Pakistan, you can train half of the world's population living in Asia. The economic corridor is the most important agreement between Pakistan and China. Both governments are committed to planning and improving the environment, but the real success of this corridor will be when the Chinese people and Pakistan have the development process in the corridor and will open up the cooperative cooperation area. I am very grateful to Chinese investors and other interested parties, including the private sector in

Pakistan. We have a very active role in the development of our leader's vision and our common goal is to realize this dream, which I am very confident.

i. Projects under CPEC

The current production capacity of energy in Pakistan now cuts the routine up to 5 hours a day where the country now has a power shortage of more than 4,500 MW but spreads 2-2 with electricity and 24830 MW It is estimated that the annual GDP- Production of 5% is the focus of the CPEC project and about 33 billion US dollars are invested in this sector. As part of the CPEC "Early Harvest" project, an estimated 10,400 MW of electricity will be produced in March 2018 under the CPEC project "Early Harvest".

CPEC-based energy projects are built by independent power generators independent of the governments of China and Pakistan. While the Pakistani government is bound by a contract to buy electricity at a negotiated fee in advance, China's export banks are financing these private investments at interest rates of 5 to 6%.

ii. Renewable energy project

Quaid-Azam Electronic solar park near the town of Bahawalpur has expected 60000 acres, estimated capacity of 1 million kW expected to be completed in December: Zonergy Chinese company to build the world's largest photovoltaic power plant The first phase of this project was from Xinjiang Sun Oasis and the power generation capacity is 100 MW. The remaining 900 MW will be installed under CPEC from Zonergy.

Under the CPEC, an additional 250 MW of electricity is produced by the consortium of China and Pakistan, but the Jhimpir wind turbine, built by the Turkish company, has already paid Zorlu Enerji 56.4 MW of electricity to the government of Pakistan an amount of $ 659 million. Another wind power generation wind turbine project is being developed by Hydro-China at a price of 1.15 million dollars and will generate 50 megawatts of power by August 2016. The prey of US $ 1.6 billion carrot is under construction, although construction is part of the CPEC plan, funds must be delivered separately from the root fund silk China.

Pakistan and China also looked at the demon-Bhasha dam in the framework of the CPEC project in December 2015 at 4.5 billion dollars, but while the Pakistani authorities still have the opportunity to involve optimism, no decision is made. Project funds are now proposed by the bottom of the CPEC, but before the announcement of CPEC, the three Sanxia Company proposed $ 2.4 billion 1100 MW Kohala water power.

iii. Coal

Potential coal projects of $ 580 million will have to be completed in 2019, and despite some renewable energy projects, most of the new production capacities under the CPEC program are based on the CPEC project "Early Harvest" Shanghai Electricity Company Shanghai China is building two 660 MW power plants under the "Tar-I" project with tar coal in the province of Sindh. The plant is driven by the hard coal and is to be used commercially until 2018.

Near the Thar-I project, China Mechanical Engineering Co., Ltd. (Initially proposed to build two 660 MW plants at the same time) Pakistan Engro Corporation Two 330 MW power plants in cooperation with the development of the two coal mines built Built up 3.8, in the first phase of the "Thar-ll Project", can produce 1 million tons of coal per year. The first phase is expected to be completed at a price of $ 1.95 billion by early 2019. In the next phases, we plan to produce an additional 3,960 MW of electricity for 10 years.

As part of this initiative, under the tar, infrastructure, CPEC project, the Lahore transmission line, built on the Faisalabad and Matiari transmission line for $ 1.5 million, Matiari is required for the distribution of $ 2.1 billion to Matiari. The Matiari-Lahore transmission line will be built "in case of emergency" by the Chinese Electric Technology and Equipment Company.

It is also a joint venture with Al-Mirqab Capital, in Singh province, in the port of Kashim, about 1,320 MW, or 2,080 million dollars. Pakistan Kashim Port Power Project Qatar and China Power Construction Company - a subsidiary of Sinohydro Resources Limited.

iv. Liquefied Natural Gas

The LNG liquefied natural gas project is also considered important for CPEC. Under CPEC, the Chinese government announced its intention to build a 711-kilometer gas pipeline from Gwadar to Nawabshah from the state. The pipeline will be connected to an 80-kilometer section between Gwadar and the Iranian border, easing sanctions against Tehran and forming part of the Iran-Pakistan pipeline of 2.775 km long. Iran has already completed a 900-kilometer pipeline at the border.

Part of Pakistan's pipeline will be built by the National Petroleum Authority. It will also have the capacity to transport liquefied natural gas to 1,000 million cubic feet per day, with an additional capacity of 500 million cubic feet if the proposed offshore LNG terminal is also completed. This project not only allows gas exporters to enter the Pakistani market but also allows China to secure its import route.

This project should not be confused with the expected completion of the 2-mile and long North-South pipeline of $ 2 billion 1100 km of liquefaction built with the Russian aid between Karachi and Lahore should not be confused with the $ 7.5 billion TAPI pipeline project, which is a planning project with Turkmenistan, Afghanistan, Pakistan, and India.

Other LNG projects are currently expanding the scope of CPEC, but under CPEC loans and officially under construction with the support and funding of China. 1,223 MW The Balloki Power Plant is currently located near Kasur and is being built by the Harbin Electric Company in China with loans from the Export-Import Bank of China. In October 2015, Prime Minister Sharif also opened construction of a 1,180-MW Bhikki power plant near Sheikhupura, jointly built by Harbin Electric of China and General Electric in the United States. It is the most efficient power station in Pakistan and should provide enough electricity to about 6 million households.

In Punjab province, the $ 1.8 billion project will have a capacity of 1,320 MW, which is under construction in the central province of Punjab. We operate and operate the plant as a whole, and is made up of joint ventures of two Chinese companies: Huaqin Shandong Company and Shandong Ruiyun Technology Group.

Other Punjab coal projects include a proposal of 5.89 billion to 300 MW for the creation of coal mines, a coal plant to be built in Pind Dadan Khan, Engineering Co. China Machinery, Punjab Salinity. Built by the joint venture of China Power Investment Corporation and the Pakistan Social Hub Power Company under the State Balochistan Capacity Plant, with a capacity of 660 MW, 970 million hubs in the area, a project of over $ 20 million is 1,320 mW Produces coal. In the city of Gwadar, but also has a 300 MW coal-fired power plant, financed with a 0% loan interest rate.

v. Spring Energy Project

Some early harvest projects are not complete until 2020, but the CPEC's "Early Harvest Capability", over 10,000 megawatts generated by 2018-2020, the Pakistan government will provide power generation capabilities of Pakistan's power grid within the 2018 about 10,000 MW, as the project to integrate the CPEC will have to be completed. It is not officially pretending to be CPEC, but the 1,243 MW power plant Balloki nuclear power plant at 1180 MW Bhakki is also connected to the Neelum-Jhelum 969 MW hydraulic power plant the Tarbela IV 1410 MW expansion project was built in 2013, Pakistan's power grid in 2018 added along with the CPEC project and the non-CPEC project. Another 1,000 MW of electricity will be in Pakistan from the CASA-1000 project, the lowest is Tajikistan, Kyrgyzstan, imported, which should be completed in 2018 in the second half of the year.

Business Benefits

China has exported more than 2.8 trillion dollars and imports most 1.88 trillion of imports that surpass natural resources by 2015. It is highly possible that the CPEC plays an important role in transporting goods from the Middle East and Africa plays in China, resources are rich and Pakistan must exploit the potential power of proprietary industrial natural resources.

China imported 300,000 million mineral products to about 30% of GCC member states in 2015 in the Middle East and Africa, the region is likely to be linked to China by Gwadar's bias. China also imports more than 12 billion organic chemicals such as acyclic alcohols and cyclic and plastic hydrocarbons and CCG countries imported more than 20 billion iron ore, copper minerals (manganese, chrome), natural pearls, and copper from Africa and so on.

Chinese Products

Once the transportation is complete with CPEC, this will help the entry of Chinese products into Pakistan. More than 42% of China's export price to China in 2015 was the base metal of 12% for textile products, followed by 8%, 5% Machinery and Industrial Machinery and Equipment for Chemicals and Products. It was also a mineral product with about 18% of Pakistan's total imports of machinery and equipment in the world, 13% in chemical or related products in the industry and 9% in basic metals.

Energy Resources for Hydrogen Production in China

China's fossil fuel reserves are asymmetric. China has the third largest coal reserves in the world, but oil and natural gas reserves are relatively limited in terms of consumption. As a result, China is a net importer of oil and natural gas. In addition, the distribution of these resources hides regional variability. The majority of the coal and oil reserves are in the north and the majority of the natural gas reserves in the western and central parts are located in the north. This means that there is no adequate correspondence between the location of most public services and the majority of energy-consuming cities, most of which are in eastern China, particularly in the coastal. On the other hand, renewable energy resources (water, wind energy, sunlight, biomass) are abundant and widely distributed throughout the country. However, most renewable energy resources are not developed. China is the world's largest hydrogen consumer, accounting for 22% of global hydrogen consumption [23]. The most popular demand in China comes from ammonia manufacturers. Fossil fuels, on the other hand, play a major role in the production of hydrogen in the country, accounting for 97% of total hydrogen production. Electrolysis of water accounts for only 3% of total hydrogen production [24]. Since unused renewable energy resources are important, China is ready to produce hydrogen in the future.

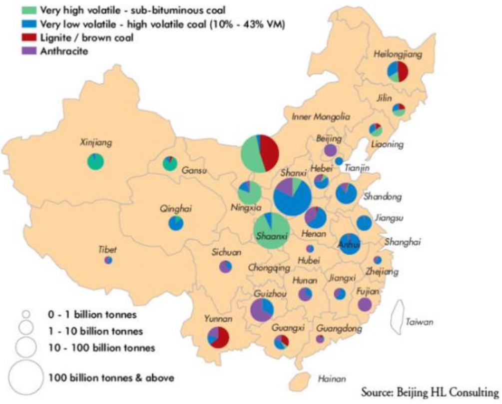
Table 1. Pollutant emission factor of total fuel cycle ratio.

Sources	SOx (gSOx/kWh)	NOx (NOx/ kWh)	C in CO2 (gC/kWh)	C in Co (gC/kWh)	Particles
Coal	3.400	1.8	33.8	40.0	0.00020
Oil	1.700	0.88	258.5	40.0	0.00015
Natural gas	0.001	0.9	178.0	20.0	0.00002
Nuclear	0.030	0.003	7.8	7.8	0.00005
Photovoltaic	0.020	0.007	5.3	1.3	0
Fuel cells	0	0	1.3	0.3	0

i. Coal

China had the third largest coal reserves in the world after the United States and Russia [10]. In 2003, the Ministry of Land Resources of China, prepared according to the international standard for reporting on coal, the country's total coal reserves is 1021 tons, it is "basic reserves" 334 tons, 687 Gt "prognostic reserve". According to the United Nations, "Basic Reserve" is a resource potentially used in current technical and economic conditions.

The "provisional reserve" includes amounts that cannot be recovered economically or uncertain amounts of economic importance. The "reserve" is an economically feasible part of the basic reserves. The distribution of Kohler's resources shows an imbalance, as shown in Figure 6 [26]. Most of the resources are in the western and northern regions of the country. Shanxi Province, Shaanxi Province, Inner Mongolia Autonomous Region together account for 65% of the country's coal reserves, but only 13% in the southern region, especially in Guizhou Province and Yunnan Province.



Location of major coal resources in China

More than 90% of the identified carbon stocks are in less developed and less developed arid zones. China is also the largest producer and consumer of coal in the world [10]. As coal production increased to about 3.1 Gb in 2009, China has surpassed the United States to become the world's largest producer of coal. In 2009, China also consumed about 3.2 g of coal, accounting for more than 46% of the world. Coal consumption has increased in China over the last decade due to an increase in demand for electricity of about 80% compared to coal. Gasification is the main method of converting coal into hydrogen [27]. It is also the nucleus of the energy generation of combined cycle gasification technology (IGCC). In a conventional gasification process, the coal is first pulverized into fine powder and mixed with water prior to high-pressure gasification with pure oxygen.

The starting material is heated to a high temperature (about 1400 ° C.) and decomposed to produce a mixture of hydrogen, carbon monoxide and certain residues. The resulting synthesis gas stream is removed and washed. The synthesis gas is then passed through a CO-layer reactor and the CO 2 is removed with a physical solvent. The acid gas contained in this solvent is desorbed by decompression. Hydrogen can still be purified to remove residual impurities. In China, about 50 million tons of coal are used annually for gasification.

ii. Oil

As per the Oil & Gas Journal (OGJ), China's oil reserves as of January 2011 are 20 billion barrels. [10] Figure 7 shows some of the major oil fields in China. As you can see, the country's most important oilfield is in the northern part of the country. In particular, the Xinjiang Ministry in the northwest has attracted particular attention. Recently, China has announced that Xinjiang will make the largest oil production and storage base in the country. It should also be noted that about 15% of total oil production from China offshore reserves comes and comes from the most probable growth in offshore oil production. China is the second largest oil consumer in the world and the second largest oil importer in the world. In 2010, China produced about 4.8 million net imports of oil, producing about 43,000 barrels of oil per day and about 92,000 barrels of oil per barrel per day. Poor fuels such as petroleum, particularly petroleum coke or waste can be used as a fuel for gasification, such as coal, for the supply of hydrogen. Combined with desulfurization and seizure of hydrogen-produced oil could be produced almost zero emissions. In addition, light petroleum fractions can be converted to hydrogen in the same way as natural gas. The limit of this method is that it is generally effective less hydrogen is generated because the molar content of hydrogen in the oil is lower. About 0.766 million tonnes of hydrogen are produced annually in China.

iii. Natural Gas

Estimates of natural gas reserves in China vary considerably from sources to sources. In the second half of 2008, China's Natural Oil Petroleum Group (CNPC) announced that the total reserves were technically and economically funded reserves of 5.94 billion cubic meters, 3.99 billion cubic meters. However, other estimates are available. The International Energy Agency (IEA) estimates that the 5-fold reimbursable reserves found in the identified region, and confirmed in 2007 Cedigaz We believe the reserves to 370 million cubic meters, supporting billions of cubic meters. In terms of coal resources, the distribution of natural gas is heterogeneous. The main gas fields of the country are in the state, western and central. Figure 8 shows the most important areas of natural gas and infrastructure in China. Natural gas consumption has been limited to China until recently. This is mainly due to the lack of infrastructures, in particular, long-distance gas pipelines connecting the main cities of consumption and gas fields, especially in coastal areas of China. Since 1990, the government has promoted the construction of natural gas transport infrastructure and the improvement of interregional links between regional networks. The total extension of the gas pipeline in the country reached 36,000 km, in the end, the ambitious triple the China record at the end of 2015 to meet demand.

Although the use of natural gas in China is on the rise, fuel is only a small part of national energy consumption.

In 2007, natural gas production reached 69.2 billion cubic meters, consumption reached 69.5 billion cubic meters and was almost two decades, the first natural gas imports to China. [28]. In 2007 China also developed into one of the ten best countries in the world in terms of natural gas consumption. Hydrogen can be prepared directly from natural gas by various methods, including steam reforming, partial oxidation, autothermal reformation and pyrolysis, and indirectly by electrolysis using electrical synthesis and/or gas recycling processes [27]. Approximately 60% of the world's hydrogen production is generated by natural gas. Ammonia hydrogen and natural gas from the oil industry make up most of the world's production today. However, in China, natural gas is mainly used as a raw material for chemicals because it is expensive.

iv. Renewable Energy Resources

China has a rich source of energy. These renewable energy resources offer the possibility of a zero emission of fuel for the production of hydrogen for electrolysis. According to the medium and long-term development plan for renewable energies China 2020, and aims to generate at least 15% of the total energy production of renewable energies. In recent years, China has been improved, the Air Pollution Control Act 2000 in 2007, has its own law to promote renewable energies, such as the Renewable Energy Act and the Law on the Conservation of Meanwhile, China is the world's largest investor in renewable energy projects investing between $ 120 billion and $ 160 billion between 2007 and 2010.

a) Hydraulic Power

Hydroelectricity is the main source of renewable energy in China. According to the results of the 2003 hydroelectric resources assessment of the state, hydroelectric power of 542 GW technically recoverable countries, which could generate 247 billion kWh of energy per year. Economically viable hydroelectric resources, particularly in the south-west, small-scale 125 GW hydroelectric power stations distributed throughout the country, the annual production potential of 175 billion kWh is estimated at 400 GW. [32] China became the world's largest producer of hydroelectricity in 2010, generating about 72% of the world's domestic energy consumption, generating 721 billion kWh of electricity from hydroelectric power. In addition, by the end of 2010, 213 GW is equivalent to one-fifth of the world's hydroponics. Small-scale hydropower plays an important role in electrification in China, particularly in rural areas. Small hydropower generation generally refers to plants of less than 50 MW. About one-third of remote cities rely on small water resources as their main source of water. At the end of 2010, China is implementing hydro projects of more than 55 GW and has support and incentive policies at about 160 TWh.

b) Wind

Wind is the second most important source of renewable energy in China. The terrestrial wind resource restored in the country is 253 GW, the first in the world with another offshore potential of 750 GW. In addition, China has many wind energy resources based on wind energy. With current technology, wind turbines can be installed in the ocean up to 10 km from the coast and at 20 m depth. Today, wind energy is the most economical renewable energy. According to data published by the Renewable Energy Industries Association and Greenpeace of China, China has a wind capacity of 16 GW, making it the largest wind power plant in the country, 41.8 GW Capacity increase despite rapid growth, and wind power in the country is only a small part of potential wind energy. One of the main obstacles to development is the lack of transport infrastructure.

c) Solar

In China, solar resources are attracting attention. The annual solar energy absorption is estimated at about 1.3 billion equivalent of standard CO2 (TCE). As you can see, two-thirds of China's territory is rich in solar power, particularly in Northwest Tibet and Yunnan is the annual average radiation level of more than 6,000 MJ / m 2. In China, generation of solar energy is growing rapidly. The annual production of solar cells in 2010 was 8.7 GW, about half of the world. In addition, in 2010, China will install 500 MW of new photovoltaic energy production plants and adjust the installed capacity up to 800 MW. In the past, about half of installed capacity was used for remote residents, special applications such as communications and navigation. Currently, solar-powered power plants are funded by the Chinese government. Xuzhou Xiexin, the largest solar power plant in China and a 20 MW solar power plant, was able to work together with the East China Power Grid at the end of 2009.

d)Biomass

China's biomass energy resources include rice and rice cultivation, forestry and animal fertilizer forest product transformation, energy crops and orchards, organic waste, municipal sanitation and local urban waste. Between the 600 Mt cane produced annually, 300 Mt (about 150 million tonnes) can be used as a fuel. About 900 Mt of waste from forestry and forestry products are available every year and about 300 Mt (200 Mtce) can be used for energy production. Currently, the potential for convertible biomass energy resources is around 500 million tonnes per year, which is less than 20% of total primary energy consumption. Biomass is mainly used by direct combustion of heating and cooking in China. In addition, biomass is used for biogas production and ensures the cleaning of baking energy for large rural areas. By the end of 2005, the total number of domestic digestion plants at biogas reached 18 million, annual output is estimated at 7 billion cubic meters. About 1500 large biogas plants for livestock and industrial wastewater produced billions of cubic meters. Biogas is now largely integrated into livestock stocks and is an important means of waste disposal in the agricultural sector. Conversely, a small fraction of biomass is used to produce electricity. At the end of 2005, the installed biomass power capacity in China reached 2 GW. Although the plant was littered (sugar cane residue) was 1.7 GW, the MSW incinerator and landfill gas were another 200 MW. The rest was gasification of agricultural and forest residues.

Conclusions and Policy Recommendation

Of the four identified factors, energy security seems to be the most important for China. The need for alternative fuels is particularly urgent in the transport sector. Public interest in renewable energy vehicles is on the rise due to the sharp rise in China's oil price and the intensification of fiscal tensions caused by the economic crisis. In 2010, the Chinese government set up a Renewable Energy Automotive Association, consisting of 16 strong public companies. The aim of the union is to promote research and commercialization of renewable energies. Due to strong state incentives, renewable energy vehicles are likely to expand their market share in the near future. Consequently, dependence on oil imports can increase significantly.

A simple energy supply analysis shows that China is currently facing a dilemma over hydrogen production. The country's coal-based energy system is beneficial and detrimental to the transition to a hydrogen-based economy. In favor of the hydrogen economy established dependence on the coal stream, the low price of "dirty" energy in establishing that such is the potential availability of hydrogen infrastructure of the coal industry is difficult to give an economic boost to the economy “Hydrogen". On the other hand, oil and natural gas are not the ideal sources for hydrogen production because they are expensive and limited in inventory. Long-term renewable energy resources are abundant in China It is likely to play a major role in hydrogen production, the biggest obstacle to the practical implementation of renewable energy is the high cost of infrastructure leading to costly electricity and low market acceptance In this situation, state incentives are an effective way to promote the production of renewable energy, the Chinese government has developed ambitious policies and is strongly concerned about the development of hydrogen and related technologies We provide financial support . We are studying hydrogen and fuel cell in all colleges and universities in China. In several fuel cell types, SOFC and the temperature variation of the MCFC variant is a source of hydrocarbon Hydrogen generated from hydrogen is more suitable. In contrast to low-temperature cells like PEMFC, both SOFC and MCFC allow carbon oxidation in the fuel and it is possible to oxidize CO. The study shows that the carbon fuel vaporizer can be used for SOFC and MCFC. Taking into account the national coal-based energy system, this may be an important field of application in the future.

A combination of fuel cells and hydrogen infrastructure is one way of addressing the long-term challenges of climate change and energy security for Pakistan. Current findings indicate that large-scale use of hydrogen is not a significant environmental hazard. If appropriate technical standards and safety standards are used, hydrogen is no longer hazardous to conventional fuels. The hydrogen economy has the potential to provide many benefits for the country, including reduced dependence on imported oil, environmental sustainability, and economic competitiveness. But without serious effort, there is no serious difficulty. The following recommendations are made to guide Pakistan towards the path to the hydrogen economy.

- It must be a clear political support for the development of hydrogen.
- We need to establish a partnership with countries related to hydrogen technology.
- In order to overcome the technical obstacles, investment in the research and development of hydrogen and fuel cells is necessary.

References

[1] Adhikari, S., & Fernando, S. (2006). Hydrogen membrane separation techniques. Industrial & Engineering Chemistry Research, 45(3), 875-881.

[2] Adjaye, J. (2000). The relationship between energy consumption, energy prices, and economic growth: time series evidence from Asian developing countries. Energy Economics 22, 615-625.

[3] Adnan, Q. M., & Riaz, S. (2008). Causality between Energy Consumption and Economic Growth: The Case of Pakistan. The Lahore Journal of Economics Vol. 13, No.2, 45-58.

[4] Afzal, H. M. (2012). Impact of Electricity Crisis and Interest Rate on Textile Industry of Pakistan. Academy of Contemporary Research Journal Volume 1, Issue 1, 32-35.
[5] Ahmad, N., Hayat, M. F., Hamad, N., & Luqman, M. (2012). Energy consumption and economic growth: Evidence from Pakistan. Australian Journal of Business and Management Research Vol.2 No.06, 09-14.
[6] Amiri, A., & Zibaei, M. (2012). Granger causality between energy use and economic growth in France with using geostatistical models. Munich Personal RePEc Archive (MPRA) Paper-36357.
[7] Aqeel, A., & butt, M. S. (2001). The relationship between energy consumption and economic growth in Pakistan. Asia-Pacific Development Journal Vol. 8, No. 2, 101-110.
[8] Asghar, Z. (2008). Energy-GDP relationship: A causal analysis for the five countries of South Asia. Applied Econometrics and International Development Vol. 8-1.
[9] Barreto, L., Makihira, A., & Riahi, K. (2003). The hydrogen economy in the 21st century: a sustainable development scenario. International Journal of Hydrogen Energy, 28(3), 267-284.
[10] Bayar, Y. (2014). Electricity Consumption and Economic Growth in Emerging Economies. Journal of Knowledge Management, Economics and Information Technology Vol. IV, Issue 2.
[11] Belloumi, M. (2009). Energy consumption and GDP in Tunisia: Cointegration and causality analysis. Energy Policy 37, 2745–2753.
[12] Binh, P. T. (2011). Energy Consumption and Economic Growth in Vietnam: Threshold Cointegration and Causality Analysis. International Journal of Energy Economics and Policy Vol. 1, No. 1, 1-17.
[13] Campo, J., & Sarmiento, V. (2013). The relationship between energy consumption and GDP: Evidence from a panel of 10 Latin American countries. Latin American journal of Economics Vol. 50 No. 2, 233–255.
[14] Chaudhry, I. S., Safdar, N., & Farooq, F. (2012). Energy Consumption and Economic Growth: Empirical Evidence from Pakistan. Pakistan Journal of Social Sciences (PJSS) Vol. 32, No. 2, 371-382.
[15] Cho, S., Marlow, D., & Niksa, S. (1995). Burning velocities of multicomponent organic fuel mixtures derived from various coals. Combustion and flame, 101(4), 399-410.
[16] Chontanawat, J., Hunt, L. C., & Pierse, R. (2006). Causality between energy consumption and GDP: Evidence from 30 OECD and 78 Non-OECD countries. Surrey Energy Economics Discussion Paper Series 113.
[17] Chouaibi, N., & Abdasalem, T. (2009). Causality between electricity consumption and economic growth in Tunisia: Policy implications. International Journal of Economic Policy in Emerging Economies, Vol.4, No.3, 2011, 211-230.
[18] CIA, U. (2016). Central Intelligence Agency-The World Factbook. New Zealand.
[19] Cormos, C. C. (2011). Hydrogen production from fossil fuels with carbon capture and storage based on chemical looping systems. international journal of hydrogen energy, 36(10), 5960-5971.
[20] Day, K. A. (2016). China's environment and the challenge of sustainable development. Routledge.
[21] Dunn, S. (2002). Hydrogen futures: toward a sustainable energy system. International journal of hydrogen energy, 27(3), 235-264.
[22] Farhani, S., & Rejeb, J. B. (2012). The link between economic growth and energy consumption in over 90 countries. Interdisciplinary Journal of Contemporary Research in Business Vol 3, No 11, 282-297.
[23] Gallucci, F., Fernandez, E., Corengia, P., & van Sint Annaland, M. (2013). Recent advances on membranes and membrane reactors for hydrogen production. Chemical Engineering Science, 92, 40-66.
[24] Geng, Y., Tian, X., Sarkis, J., & Ulgiati, S. (2017). China-USA Trade: Indicators for Equitable and Environmentally Balanced Resource Exchange. Ecological Economics, 132, 245-254.
[25] Goltsov, V. A., & Veziroglu, T. N. (2002). A step on the road to hydrogen civilization. International Journal of Hydrogen Energy, 27(7), 719-723.
[26] Gryaznov, V. M., Polyakova, V. P., Savitskii, E. M., Frades, L., Khrapova, E. V., Khuares, E., & Shkola, G. V. (1970). Influence of the nature and amount of the second component of binary-palladium alloys on their catalytic activity with respect to the dehydrogenation of cyclohexane. Russian Chemical Bulletin, 19(11), 2368-2371.
[27] Hou, Q. (2009). The relationship between energy consumption growths and economic growth in China. International Journal of Economics and Finance Vol.1, No.2 , 232-237.
[28] Islam, F., Shahbaz, M., Ahmed, A. U., & Alam, M. M. (2013). Financial development and energy consumption nexus in Malaysia: A multivariate time series analysis. Economic Modelling 30, 435-441.
[29] Kabir, A., Zaku, S. G., A.A.Tukur, & J.G, A. (2013). The relationship between energy consumption and national income of Nigeria. Journal of Economics and International Finance Vol. 5(2), 53-57.
[30] Khan, M. A., & Qayyum, A. (2007). Dynamic modeling of energy and growth in South Asia. The Pakistan Development Review Vol: 46-4, 481-498.
[31] Khurshid, M., & Anwar, W. (2013). Energy Crisis and Performance of Industry of Pakistan: An Empirical Study of KSE Listed Companies. International Journal of African and Asian Studies - An Open Access International Journal Vol. 2, 50-55.
[32] Kiani, A. (2011). Impact of high oil prices on Pakistan's economic growth. International Journal of Business and Social Science Vol. 2 No. 17, 209-216.
[33] Koroneos, C., Dompros, A., Roumbas, G., & Moussiopoulos, N. (2005). Advantages of the use of hydrogen fuel as compared to kerosene. Resources, Conservation and Recycling, 44(2), 99-113.
[34] Lenssen, N., & Flavin, C. (1996). Sustainable energy for tomorrow's world: The case for an optimistic view of the future. Energy policy, 24(9), 769-781.
[35] Mahmud, S. F. (2000). The energy demand in the manufacturing sector of Pakistan: some further results. Energy Economics 22, 641]648.
[36] McDowall, W., & Eames, M. (2006). Forecasts, scenarios, visions, backcasts and roadmaps to the hydrogen economy: A review of the hydrogen futures literature. Energy Policy, 34(11), 1236-1250.
[37] Midilli, A., & Dincer, I. (2008). Hydrogen as a renewable and sustainable solution in reducing global fossil fuel consumption. International Journal of Hydrogen Energy, 33(16), 4209-4222.
[38] Midilli, A., Ay, M., Dincer, I., & Rosen, M. A. (2005). On hydrogen and hydrogen energy strategies: I: current status

and needs. Renewable and sustainable energy reviews, 9(3), 255-271.
[39] Midilli, A., Ay, M., Dincer, I., & Rosen, M. A. (2005). On hydrogen and hydrogen energy strategies: I: current status and needs. Renewable and sustainable energy reviews, 9(3), 255-271.
[40] Mirza, U. K., Ahmad, N., Harijan, K., & Majeed, T. (2009). A vision for hydrogen economy in Pakistan. Renewable and Sustainable Energy Reviews, 13(5), 1111-1115.
[41] Momirlan, M., & Veziroglu, T. N. (2002). Current status of hydrogen energy. Renewable and sustainable energy reviews, 6(1), 141-179.
[42] Morimoto, R., & Hope, C. (2001). The impact of electricity supply on economic growth in Sri Lanka. Taiwan Energy Economics 22 , 309-317.
[43] Mulder, G., Hetland, J., & Lenaers, G. (2007). Towards a sustainable hydrogen economy: hydrogen pathways and infrastructure. International journal of hydrogen energy, 32(10), 1324-1331.
[44] Muller, R. A. (2003). A pollution-free hydrogen economy? Not so soon. Technology Review Online. Technology for Presidents.
[45] Mushtaq, K., Abbas, F., Abedullah, & Ghafoor, A. (2007). Energy Use for Economic Growth: Cointegration and Causality Analysis from the Agriculture Sector of Pakistan. The Pakistan Development Review 46: 4 Part II (Winter 2007), 1065–1073.
[46] Nayan, S., Kadir, N., Ahmad, M., & Abdullah, M. S. (2013). Revisiting energy consumption and GDP: Evidence from Dynamic Panel Data Analysis. Munich Personal RePEc Archive (MPRA) No. 48714.
[47] NBSC, (2016). National Bureau of statistics of China. China Statistical Yearbook.
[48] Nojoumi, H., Dincer, I., & Naterer, G. F. (2009). Greenhouse gas emissions assessment of hydrogen and kerosene-fueled aircraft propulsion. International journal of hydrogen energy, 34(3), 1363-1369.
[49] Noor, S., & Siddiqi, M. W. (2010). Energy consumption and economic growth in South Asian countries: A cointegrated panel analysis. World Academy of Science, Engineering and Technology Vol: 4 , 07-25.
[50] Orhan, M. F., Dincer, I., Rosen, M. A., & Kanoglu, M. (2012). Integrated hydrogen production options based on renewable and nuclear energy sources. Renewable and Sustainable Energy Reviews, 16(8), 6059-6082.
[51] Ozkan, D. F., Ömer, D., & Kuyuk, D. H. (2012). Energy production and economic growth: Empirical evidence from Turkey. Applied Econometrics and International Development Vol. 12-2, 79-88.
[52] Planton, S., Déqué, M., Chauvin, F., & Terray, L. (2008). Expected impacts of climate change on extreme climate events. Comptes Rendus Geoscience, 340(9), 564-574.
[53] Pudukudy, M., Yaakob, Z., Mohammad, M., Narayanan, B., & Sopian, K. (2014). Renewable hydrogen economy in Asia–Opportunities and challenges: An overview. Renewable and Sustainable Energy Reviews, 30, 743-757.
[54] Qazi, A. Q., Ahmed, K., & Mudassar, M. (2012). Disaggregate Energy Consumption and Industrial Output in Pakistan: An Empirical Analysis. Economics Discussion Paper No. 2012-29 .
[55] Rashid, M., Azeem, M., & Ramzan, D. (2012). Impact of Energy Consumption on Pakistan's Economic Growth. International Journal of Humanities and Social Science Invention Volume 2 Issue 6 , 51-60.
[56] Riahi, K., Roehrl, R. A., Schrattenholzer, L., & Miketa, A. (2001). Technology clusters in sustainable development scenarios. Progr Rep of Environ Issue Groups, 112-120.
[57] Saatci, M., & Dumrul, Y. (2013). The Relationship Between Energy Consumption And Economic Growth: Evidence From A Structural Break Analysis For Turkey. International Journal of Energy Economics and Policy Vol. 3, No. 1 , 20-29.
[58] Sarmiento, B., Brey, J. J., Viera, I. G., González-Elipe, A. R., Cotrino, J., & Rico, V. J. (2007). Hydrogen production by reforming of hydrocarbons and alcohols in a dielectric barrier discharge. Journal of Power sources, 169(1), 140-143.
[59] Schmidtchen, U., Behrend, E., Pohl, H. W., & Rostek, N. (1997). Hydrogen aircraft and airport safety. Renewable and sustainable energy reviews, 1(4), 239-269.
[60] Shah, B., Essrani, S. D., Shah, N., & Rahat, N. (2013). The Impact of Energy Crises on the Textile Sector of. Journal of Emerging Issues in Economics, Finance and Banking Volume:1 No.5 , 401-413.
[61] Shahbaz, M., & Feridun, M. (2011). Electricity consumption and economic growth empirical evidence from Pakistan. Springer Science+Business Media B.V. 2011 .
[62] Shahbaz, M., Lean, H. H., & Farooq, A. (2013). Natural gas consumption and economic growth in Pakistan. Renewable and Sustainable Energy Reviews, 18, 87-94.
[63] Shakeel, M., Iqbal, D. M., & Majeed, D. M. (2013). Energy consumption, trade and GDP: A case study of South Asian countries. Munich Personal RePEc Archive (MPRA), Paper No. 57677 .
[64] Siddiqui, R. (2004). Energy and Economic Growth in Pakistan. The Pakistan Development Review 43 : 2 (Summer 2004) , 175–200.
[65] Soytas, U., Sari, R., & Ozdemir, O. (2001). Energy consumption and GDP relation in Turkey: A cointegration and vector error correction analysis. Economies and Business in Transition: Facilitating Competitiveness and Change in the Global Environment Proceedings , 838-844.
[66] Stambouli, A. B., Khiat, Z., Flazi, S., & Kitamura, Y. (2012). A review on the renewable energy development in Algeria: Current perspective, energy scenario and sustainability issues. Renewable and sustainable energy reviews, 16(7), 4445-4460.
[67] Stern, D. I. (2004). Energy and Economic Growth. Encyclopedia of Energy, Volume 2 , 35-51.
[68] Stern, D. I. (2010). The role of energy in economic growth. CCEP working paper 3.10 .
[69] Teichmann, D., Arlt, W., & Wasserscheid, P. (2012). Liquid organic hydrogen carriers as an efficient vector for the transport and storage of renewable energy. international journal of hydrogen energy, 37(23), 18118-18132.
[70] Ting, C. H., & Lee, D. J. (2007). Production of hydrogen and methane from wastewater sludge using anaerobic fermentation. International Journal of Hydrogen Energy, 32(6), 677-682.
[71] Tsakoumis, N. E., Rønning, M., Borg, Ø., Rytter, E., & Holmen, A. (2010). Deactivation of cobalt based Fischer–Tropsch catalysts: a review. Catalysis Today, 154(3), 162-182.
[72] Veziroglu, T. N. (2002). Importance of HTM conferences for future of hydrogen economy.
[73] Welaya, Y. M., El Gohary, M. M., & Ammar, N. R. (2012). Steam and partial oxidation reforming options for

hydrogen production from fossil fuels for PEM fuel cells. Alexandria Engineering Journal, 51(2), 69-75.
[74] YangU, H.-Y. (2000). A note on the causal relationship between energy and GDP in Taiwan. Energy Economics 22 , 309-317.
[75] Yasmin, A., Javid, M., & Ashraf, Z. (2013). Electricity consumption and economic growth: evidence from Pakistan. Economics and Business Letters 2(1) , 21-32.
[76] Zeshan, M., & Vaqar. (2013). Energy Consumption and Economic Growth in Pakistan. Bulletin of Energy Economics, 1(2), 8-20.

USMAN SHEHZAD Master of Management Sciene Business Administration and Master Engineering Power Engineering and Engineering Thermophysics(Xi”an Jiaotong University).Awarded Shaanxi Provisional Government scholarship.Ambassdor of Pakistani Students Community in Xian Jiaotong University.

QADEER ABDUL Ph.D student of Business Administration (Xi”an Jiaotong University). Two times Awarded Shaanxi Provisional Government scholarship.

Acknowlegment
We thank Elixir International Journal, three anonymous referees, for helpful comments and suggestions.

Dedication
Children are building blocks for any society and country. The above work is dedicated to innocent souls of APS Peshawar who went to school on 16, December, 2014, to pursue education and never come back.