

Challenges and Opportunities Regarding Adoption of Clean Energy Technology in Developing Countries, in Case of Iran

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Abstract

Nowadays, according to energy crisis, the use of renewable energies has brought tremendous interest in all over the world. One particular reason that has a great effect in consuming fossil energy is residential buildings, which in some countries like Iran has a usage equal to 40 percent of total energy usage of the country. In this paper, comparative statistics and information about the necessity of the use of clean energy instead of fossil fuel has been discussed. The results of the paper show that in Iran, there are some considerable challenges and opportunities regarding adoption of clean energy technology.

Keywords: Renewable energy, energy crisis, clean energy technologies.

1. Introduction

Twentieth century was a century of evolution regarding to our perspective toward energy and energy consumption. Energy crisis and air pollution and other new-happened problems shift progressive paradigms to moderate and more eco-friendly approaches especially in architecture and planning.

New horizons such as smart grid and clean energy technologies are a limited range of human being's activities to achieve sustainable design and architecture. This paper focus on the most important challenges and opportunities regarding adoption of clean energy technology in developing countries, and in this part, has adopted case of Iran for its inquiries. It is to emphasis on the importance of adoption of clean energy technologies and is to clarify that it is inevitable to persist on eco-friendly development plans especially developing countries such as Iran.

1.1. Research questions

A. What are the most important challenges regarding to the usage on clean energy technologies in the developing countries especially in case of Iran?

B. What are the most important opportunities regarding to the usage on clean energy technologies in the developing countries especially in case of Iran?

1.2. Methodology

The research is done based on analytical – interpretive approach. Logical Argumentation has been adopted as research method. Comparative study as well as descriptive-analytic techniques has been adopted as well. Data gathering steps are based on reviewing credible documents essay scientific paper and archival studies. A research and the case study based on Iran as a developing country. [1]

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2. Literature Review

One of the biggest environmental issues consequently in Iran currently faces are air pollution and carbon emissions. Iran's energy-related carbon emission has been on a steady increase as 240% was added over the past 18 years. The International Energy Agency (IEA) projects world energy demand the average world growth of CO₂ emissions between 2000 and 2020 is about 2.2% per year [2], Fig. 1 shows the CO₂ emission in Iran from 2002 to 2010, Unless new policies are put in place to curb energy use and greenhouse gas emission. Today, the problems of energy are considered as topic discussions around the world and a brief look at energy consumption shows that the progress of a country is directly related to it. Nowadays, most of the world's energy is provided by fossil sources, but some problems such as limitations on fossil sources and environmental effects made by using fossil energies has attracted some attention , Fig. 2 shows the world energy consumption by fuel from 1990 to 2035.

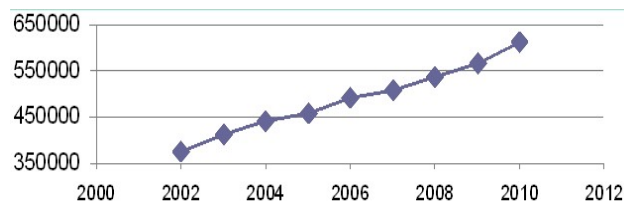


Fig.1. CO₂ emissions in Iran (KT) [3]

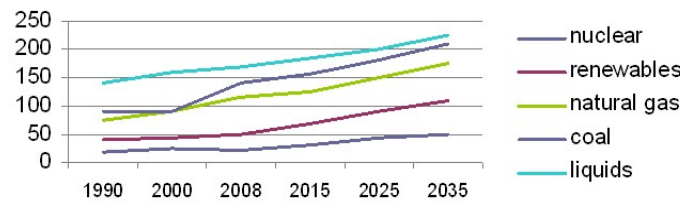


Fig. 2. World energy consumption by fuel, 1990-2035[4]

In addition, the harmful effects of fossil fuels such as air pollution, changes in rainfall and climate, force the government to think about the need for renewable energy [5]. According to the discussed issues in Iran contemporary architecture, energy has a great value of intention and day by day we can see more hoes important it is [6]. Energy has a high place in architectural theories, whether in designing or in construction [7]. Important role of architecture in designing is one of the subjects that needs study in families and in industry and in professional society and therefore we can reach developed context of sustainable architecture science [8], [9], [10]. Nowadays, energy is one of the main challenges in developing countries contemporary architecture and prior observation shows that these countries do not have acceptable qualification in clean energies consumption. With great intention of using green technologies, Regarding to clean energies is a part of movement, clean and healthy model in humans' life [11]. The literature review of the research shows that challenges and opportunities regarding adoption of clean energy technology in developing countries are of the most important issues, especially Middle East countries such as Iran though they enjoy prosperou1s oil wells.

3. Usage of the Fossil Energy in Iran

Iran with area equivalent to 1648195 square meters has 60 million populations. Consumption of 9.63 million tones energy is about 9.1% of the total world energy consumption in 1996. It should be noted Petroleum and liquid gas, gas and electricity has a 54 percent, 43 percent and 2 percent share in a basket of initial energy usage [12]. It is explicit to see that Fig. 3. (a) . Process chart of GDP capitation and energy offer; (b) capitation of GDP production growth and use of energy capitation in Iran [13] [14] Fig. 3(a) shows the process of growing the usage of energy and getting increased compared to the growing process of Gross Domestic Product (GDP). Fig. 3(b) we compared the GDP against the state of increasing

energy capitation usage in Iran. It is very determining to clarify that the usage of the fossil energy in Iran such as other developing countries has considerable amount of environmental effects such as global warming, air pollution etc.

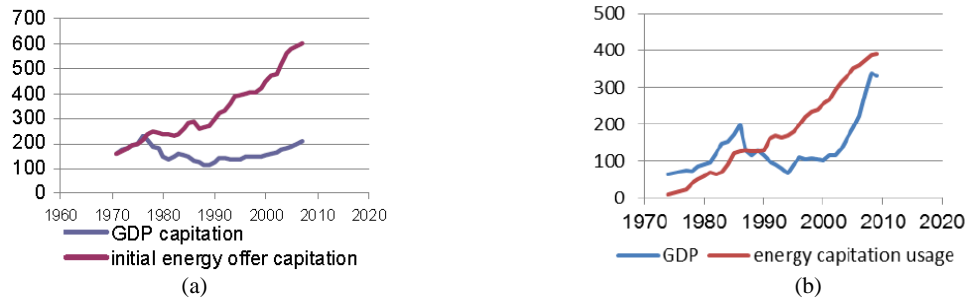


Fig. 3. (a) Process chart of GDP capitation and energy offer; (b) capitation of GDP production growth and use of energy capitation in Iran [13] [14]

4. Comparative Analysis

Energy usage in different countries around the world is various; Fig. 4 shows the growth in energy consumption and energy consumption per capita in World from 1990 to 2008. Industrial countries with 1.2 billion populations have 180 GJ (Giga Jules) annual initial energy usages for every country; Fig. 5 shows the growth in energy consumption and energy consumption per capita in Developed countries from 1990 to 2008. But developing countries with 2.2 billion populations have 10 GJ annual initial energy usages for every country; Fig. 6 shows the growth in energy consumption and energy consumption per capita in Developing countries from 1990 to 2008.



Fig. 4.(a) Growth in World energy consumption; (b) Growth in World energy consumption per capita[16]

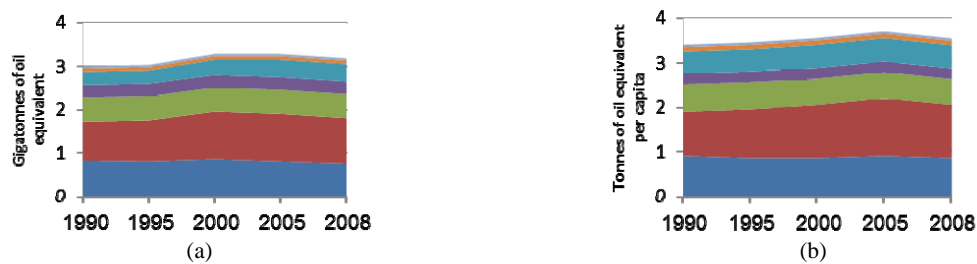


Fig.5.(a)Growth in Developed countries energy consumption;(b)Growth in Developed countries energy consumption per capita [16]

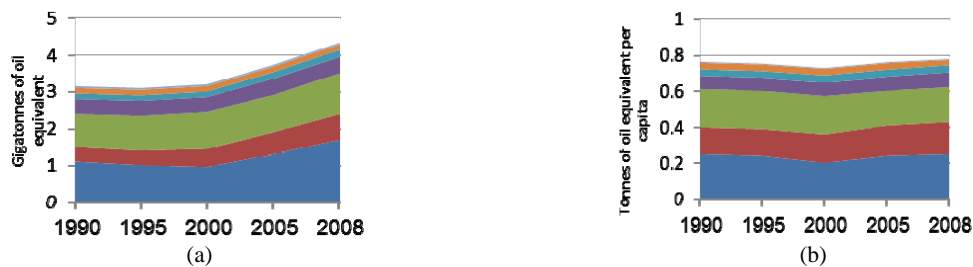


Fig. 6.(a) Growth in Developing countries energy consumption; (b) Growth in Developing countries energy consumption [16]

So today's, industrial countries are the biggest energy consumers and all of them consume 50 GJ annual, nonetheless the thing that causes the stability of economic systems and energies in countries is GDP. GDP was able to cover the priceless cost of energy resources of the development countries and regain the cost within widespread portioning using its modern and practical science and put them in practice inside enormous spectrum of applicable industries that has an upgrade equivalent intention value indeed [15]. Whereas Iran has an annual normal raining less than 30 % of the global average raining, the consumption of water is about twice than the advanced industrial countries. The rate of using electricity in Iran is approximately 0.33 of Europe industrial countries, whereas the produced electricity in Iran is about 3 to 4 times lesser than the normal electricity production rate [15].

5. Usage of Clean Energy

In spite of the vast oil and gas reserves, Iran has been paying attention to its RE resources, Solar and wind energy may have the best long-term prospects in Iran. As most areas in Iran are dry with low cloudiness, solar irradiation is quite high. The estimated potential is 2000kWh/m² with an average of 2800 useful hours per year. A 250kW solar generator has been installed in Shiraz. In spite of the high potential, but due to present high costs when compared with other energy options, it does not seem a very attractive option for the time being [17]. The usage of renewable energy consumption in the world compared to other consumption is shown in Fig. 7.

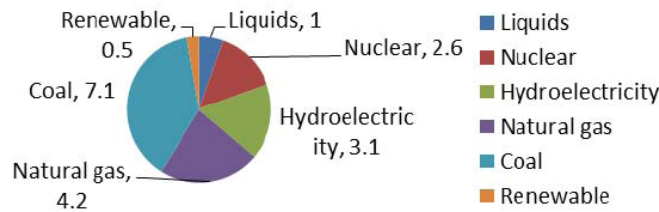


Fig.7. The role of renewable energy consumption in the world, 2008 [4]

Table 1. Electricity production and consumption in Iran, 2008[18]

Production of electricity	(GWh) from	Electricity consumption	
Coal	0	Industry	43697
Oil	28461	Transport	0
Gas	125393	Residential	40564
Biomass	0	Commercial and public services	23125
Waste	0	Agriculture / Forestry	15504
Nuclear	0	Fishing	0
Hydro	10627	Others	5188
Geothermal	0		
Solar PV	0		
Solar thermal	0	Total final consumption	128078
Other sources	0		
Total production	164481		

Nevertheless, it can be a good possibility for island solutions, i.e. for the supply of electricity to isolated areas with a small population where connection to a grid is economically not feasible, and where there is no potential for small hydropower development. Iran plans to produce 1% of total electricity from RE in the next 25 years [19]. Table 1 shows Electricity production and consumption in Iran. Though it is not as fast as estimated, and it means fossil resources will play their roles in near future; Fig. 8 shows the combustible renewables and waste comprise solid biomass, liquid biomass, biogas, industrial waste, and municipal waste , measured as a percentage of total energy use from 2002 to 2010.

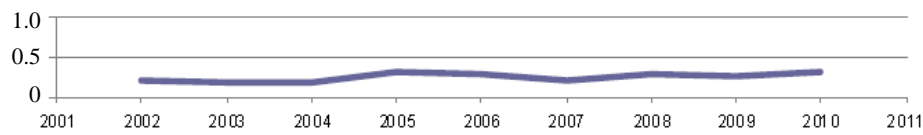


Fig.8. Combustible renewables and waste (% of total energy) [14]

6. Conclusion

The Islamic Republic of Iran lacks policy frameworks that stipulate provision of energy for sustainable development. This poses a great challenge to promote renewable energy in the country. Appropriate policies are required to successfully implement renewable energy Technologies. Although policy directives have been issued in Iran, stakeholders have not been advised on how to implement them as strategies and long-term policies, i. e. implementation guidelines are lacking. The contribution of renewable energy to the total energy mix is still small, due to lack of knowledge about their potential and insufficient social and environmental policies and programs to encourage their use / implementation. Iran has found it difficult to implement the existing policies and enforce the laws due to lack of infrastructure. The diffusion of renewable energy Technologies has been hampered by lack of training, maintenance and capacity to purchase the technology.

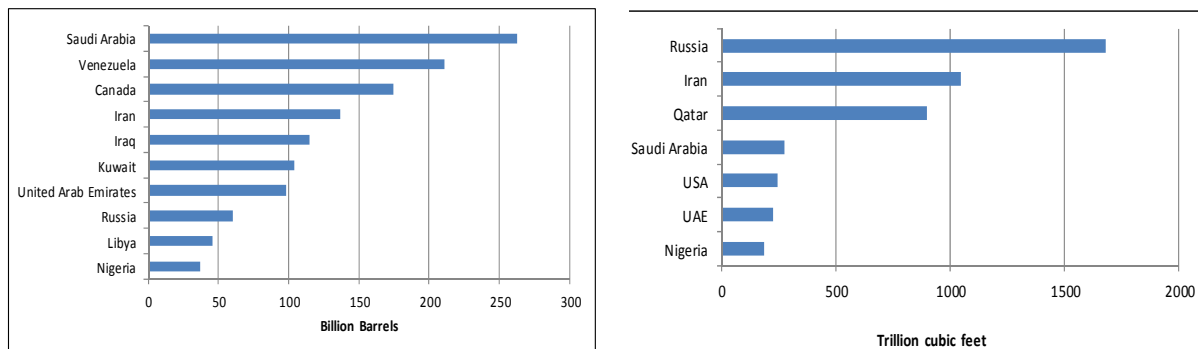


Fig.9. (a) Top proven oil reserves as of January 1 , 2011; (b) Top proven natural gas reserves as of January 1 , 2011[4]

The present policies in Iran have serious shortcomings as they lack provisions on standards to ensure quality in the provision of energy. The techno-economic boundary conditions, lack of infrastructure, capital and the tradition of technical standards, represent severe restrictions to rapid expansion of renewable energy technologies. There has been a tendency by policy makers to compare renewable energy with conventional sources of energy in terms of amount of energy generated. These collective conditions and restraints have made the Islamic Republic of Iran unable to implement the renewable energy technologies, as previously stated in [17]. There are three dominant challenges as follows:

- **Economical discussion:** A considerable number of developing countries have oil reserves and using clean energy isn't inadvisable, such as Iran With 9% of the world's oil reserves, and 17% of its natural gas reserves, Fig. 9 (a) shows Top oil reserves as of January 1, 2011; and, Fig. 9(b) shows Top proven natural gas reserves as of January 1, 2011. Iran has an abundant supply of fossil fuel resources, which tends to discourage the pursuit of alternative renewable energy sources.
- **Technical problem:** Technical and executive knowledge for using renewable sources needs utilizing of equipment that doesn't exist in developing countries because of newly arrived this subjects in expertise discussion, the required technical knowledge for make and maintenance equipment doesn't exist and existent technicians and workers haven't the required skills for using the new equipment and this needs a codified schedule for training expert forces in this path.
- **Building codes and design guidelines:** Because of government nonexistent codified schematization in this base, there isn't any codified laws and criteria and there isn't any regulations like design guideline and building codes and etc. in building construction sector according to the significant energy consumption part in building construction.

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