

Environmental Pollution Caused by the use of Fossil Fuels in Architecture and the Need for Renewable Energy

Allahbakhsh Kavooosi ¹

1. Associate Professor in Faculty of Architecture from Razi University, Kermanshsh, Iran

Email Address: kavooosi_a@yahoo.com

Received: (30-06 -2021)

Accepted: (24-08 -2021)

Abstract

The increasing demand for energy in the world and its increasing use, especially in the architectural sector, and the increasing environmental threats caused by the increase in fossil fuels and the scarcity of its resources have provided a suitable platform for the use of renewable energy. All government officials and experts around the world, realizing the necessity of this issue, are seeking to increase the share of this type of energy and to benefit from it in their energy portfolio program. The purpose of this paper is to describe the status of energy production from different sources and its consumption, the consequences of current consumption trends, and to identify the effective factors. Not only they are not a threat to environmental pollution, but also they are a capability for development and exploitation in this sector. The results show that with increasing fossil energy consumption in the building sector, environmental pollution has increased and this has provided a vital threat to the health of living organisms.

Keywords

Energy Consumption, Renewable Energy, Greenhouse Gas, Architecture.

1- Introduction

Statistics in the energy sector indicate a significant share of energy consumption in the construction sector, which is mostly used for cooling, heating and ventilation. Human concern today is due to environmental threats, in large part due to the use of fossil fuels to supply the energy needed in today's industrialized world. The solution to the problem is using new technologies to convert renewable energy to usable energy, which is an important infrastructure development requirement for clean energy utilization. This paper first deals with the perspective of energy production and consumption statistics and greenhouse gas emissions and then addresses the construction sector's share of energy consumption and greenhouse gas emissions.

2- Global status of energy resources and forecast of future demand

Forecasts from the Global Energy Outlook at different time horizons (2035, 2040 and 2050) indicate that primary energy demand will increase, and fossil fuels, including oil, natural gas and coal, will continue to have the dominant share of primary energy demand, despite their declining share in the global mix. According to some forecasts, energy consumption will increase by more than 50% over the next 30 years, much of it attributable to non-OECD countries. In the supply sector,

the fastest growth will be related to natural gas and renewable energies (Manzoor et al., 2014). The growth and development of today's world countries is undoubtedly influenced by the impact of energy on accelerating and increasing production. The industrial revolution without energy could not have the meaning of realization and emergence in global development. New technologies and enormous industrial developments have increased in comparison to the past and increased demand for production and development. In today's world, human beings have realized the need to improve current trend to increase production and reduce energy consumption. Another issue related to development and population growth is the increasing trend of urbanization. By definition, urbanization is an economic and social process that results in the transfer of labor from the agrarian economy to the industrial and service sectors of the city (Zhang &, 2015).

Global statistics show an increase in the world's population and an economic boom, resulting in energy demand and consumption globally. This is while energy production compared to its consumption is inadequate due to the limited underground resources available, which ultimately results in a crisis of energy supply. (Figure 1) Shows statistics on energy status, global demand growth, and projected demand growth by 2050 (million tons of crude oil equivalent).

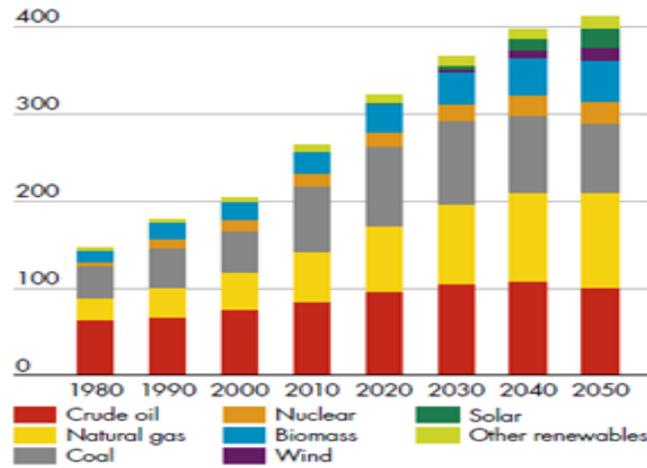


Figure 1. Global Energy Demand Forecast by 2050 (million tons of crude oil equivalent) (Source: (Alayi et al., 2020))

According to World Energy Organization statistics, the total amount of remaining non-renewable energy sources is 2.5×10^{24} joules, of which a high percentage is fossil and nuclear sources, but for renewable energy sources, it is equivalent to 3.8 quadrillion joules per year, or 580 times the Earth's total annual energy needs (Seif, 2010). Economists believe that the production and consumption of non-renewable resources should be as low as possible at present. But if there is no energy production and consumption in the world, the world economy will not move. For this reason, there must be an attempt to look for models for optimal production from one source (Hotelling, 2018). Fossil energy resources are scarce in the world, and their excessive consumption has reduced their reserves on the ground and created environmental crises, such as polar ice melts, tornadoes, severe storms, increased global temperatures, and impacts on the ozone layer. On the other hand, renewable

energy and new energy sources are very large compared to fossil fuels and do not pose a threat to the environment.

3- Prospects for energy consumption and greenhouse gas emissions

Energy consumption accounts for the largest share of greenhouse gas emissions in the world. Although economic growth and development require energy consumption, this type of consumption needs to be revised, redirected, and managed. Increased fossil fuel consumption due to energy demands increases greenhouse gas emissions. Reference Scenario (Uniform Trend in World Economic Growth) in (Figure 2) shows International Energy Outlook Report in 2016 that predicts significant growth in energy demand from 2012 to 2040. Emission of CO₂ pollution due to fossil fuels combustion over a 28-year period is also drawn.

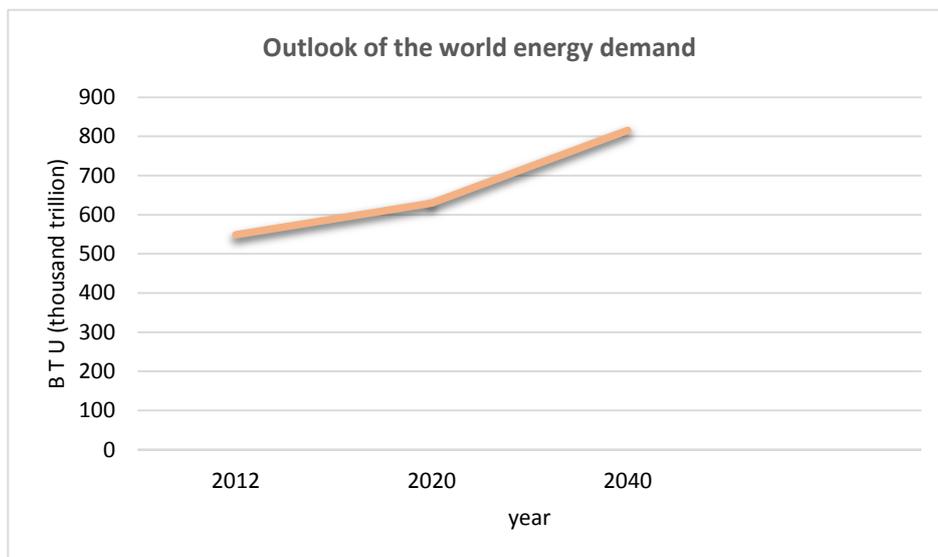


Figure 2. The Outlook of Energy Demand in the World (Source: author with the help of (Alizadeh et al., 2020))

Since the beginning of human history, human beings have realized the importance of energy for survival and have always attempted to supply the energy they need. Energy, as one of the factors of production today, plays a major role in the growth and development of different countries and has played a major role in the development of recent human civilization. The relationship between energy and economic growth is one of the issues that

has received much attention (Ebrahimi et al., 2011). According to the 2016 International Energy Outlook report, (Figure 3) shows that carbon dioxide gas emissions from the energy sector are projected to rise from 32.3 billion metric tons in 2012 to 35.6 billion metric tons in 2020 and 43.2 billion metric tons in 2040. Much of this carbon footprint is related to fossil fuels and developing countries outside the OECD.

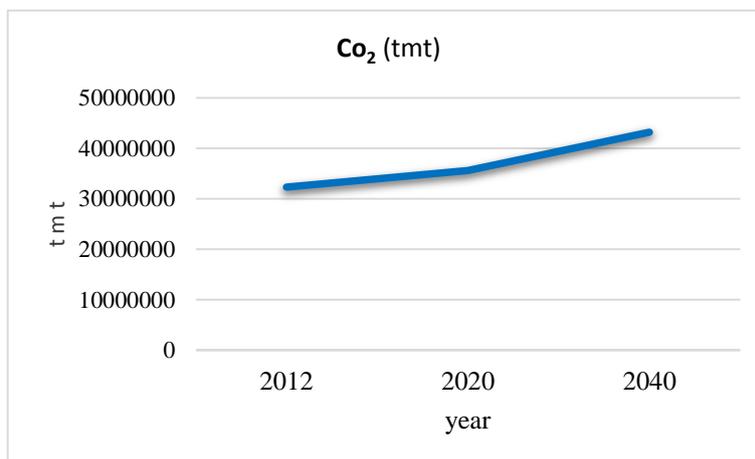


Figure 3. Carbon dioxide levels and projections to rise by 2040 (Source: Author with the help of (McKeown, 2017)).

Currently, industrialized countries are taking renewable energies more seriously due to the adoption of stringent environmental laws and also due to energy crises (Bahrami et al., 2013). From consumers' perspective, energy security means, first of all, easy and risk-free access to world oil and gas resources. Second, these resources are logically diversified in terms of geographical area of resources as well as transmission routes. Third, oil and gas flows are generally provided by points whose governments may be stable for a long period (Scheepers, 2007). The IAEA considers the carbon capture and storage mechanism as an important part of global efforts to limit global warming by reducing greenhouse gas emissions. According to the agency's estimates, CO₂ emissions could be reduced to levels that limit long-term global warming to below 2°C. This will be achieved through the extensive deployment of low-carbon technologies (Vijayalakshmi et al., 2006).

4- Energy and architecture

The amount of energy consumed in architecture includes the amount of energy consumed in heating and cooling systems and the provision of hot water and lighting systems and electrical appliances in the kitchen. Global statistics show the architectural sector's high

share of energy consumption. In order to reduce and conserve energy in architecture, the adoption of new technologies is of particular importance. The regulations for building residential and commercial units in most cities are designed to prevent unnecessary energy consumption in buildings. In some countries, purchases of energy carriers, such as electricity, fuel, and water are also subject to preferential pricing, again to encourage people to consume less. The standardization of the consumption of each energy device is another way of regulating the energy market in countries that goes back to macro energy policy in that country. It should be said that the mechanisms for implementing the rules and the goals set for them must be in full agreement (Gann David et al., 1998).

4-1- Energy demand perspective in architecture

Buildings, as one of the most energy-consuming sectors in the city, account for approximately 40% of the world's annual energy consumption. In different countries, due to their different characteristics, this sector accounts for a different share in energy consumption. In the UK, for example, buildings account for more than half of all energy consumed. The share of energy

consumption in buildings in the other EU countries and the US is 41% and 36%, respectively (Steamers, 2003). According to the latest International Energy Outlook up to the horizon of 2040 by the US Energy Information Bureau in July 2013, worldwide home energy consumption is growing at 1.5 percent annually, from 52 quadrillion BTU in 2010 to 82 quadrillion BTU in 2040.

Global reserves at the end of 2008 were about 1258 billion barrels. Worldwide crude oil consumption was about 84.5 million barrels

per day on average in 2008, and so it would have to end the world's crude oil reserves by another 42 years. (Figure 4) illustrates the energy consumption and primary energy demand in terms of final consumption segments (billion tons) for comparison, in which the significant share of energy consumption is in the construction sector, indicating the need for attention to this sector and the replacement of clean energy sources in this sector.

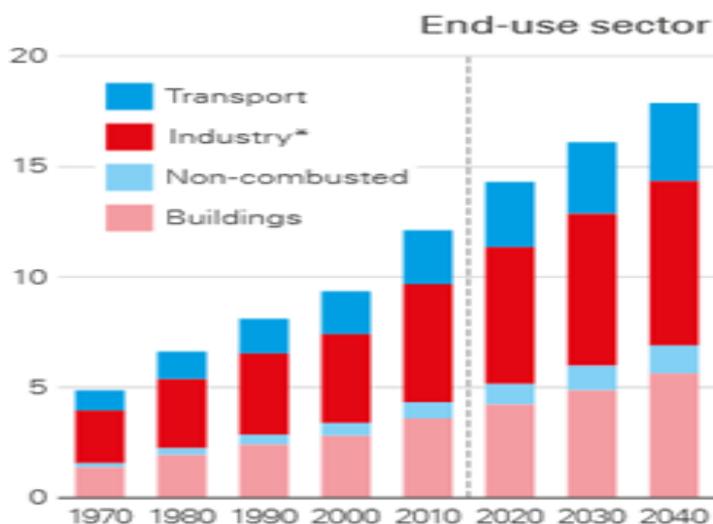


Figure 4. Energy Consumption and Primary Energy Demand in Terms of Final Energy Consumption Segments (Billion Tons) (Source: (Evins, 2013)).

4-2- Final energy consumption in building sectors worldwide from 2005 to 2030

Most of the energy consumption in the building, according to (Figure 5), is related to

cooling systems, and these systems are more in demand and consumed in tropical countries.

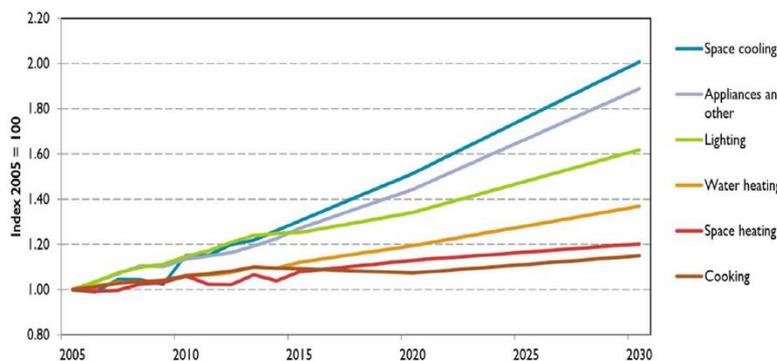


Figure 5. Final Energy Consumption in Different Parts of the Architecture in the World (Source (McKeown,2017))

Energy used in buildings for heating, cooling and lighting accounts for more than 40 percent of carbon emissions in developed countries. Buildings are the areas with the highest potential and lowest cost for carbon reduction (Zabihi, 2011).

5- CO2 emissions in architecture

The concept of sustainable development today is the dominant discourse on natural resources, energy, and the environment. The element of time in this connection becomes even more vital if we do not achieve a consensus over the

future of the world in today's solutions to achieve sustainable development (Walde Thomas, 2004). As the demand for energy in the building sector and the use of fossil energy sources increases, CO₂ gas emission is increased that is illustrated in (Figure 6).

Despite the world's approach to renewable energy, this threat has an upward trend, and this is a warning to the global community regarding the increased environmental pollution in architecture.

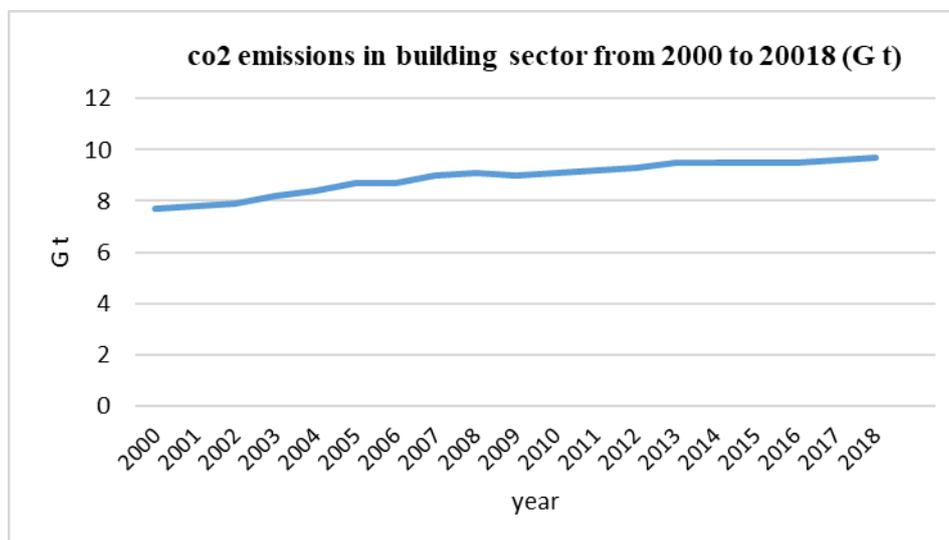


Figure 6. CO₂ Emissions in the Building Sector from 2000 to 2018 (Source: Author with the help of (Walde Thomas, 2004))

The main environmental problem is the emission of toxic chemical pollutants, greenhouse gases such as CO₂ and other air pollutants that has caused climate change and environmental pollution, which has a negative impact on human health and quality of life. Global environmental issues can significantly affect the pattern of energy consumption worldwide (Bilgen et al., 2008). Considering the share of the building sector in increasing fossil fuel consumption and its impact on increasing global pollution, it is necessary to switch to renewable energy because these types of energy have unlimited and available resources.

6- Conclusion

In today's world, energy, as one of the factors of production, plays a major role in the growth and development of different countries. Increased energy demand is influenced by industry development, increased world

population, and decreased fossil fuel resources. Energy statistics show a significant share of the building's energy consumption for cooling, heating and ventilation, and this amount of consumption results in an unprecedented increase in greenhouse gas emissions. Turning to earth-friendly energy sources and the use of new technologies that can convert renewable energies into usable energy is a necessity for the development and exploitation of these types of clean energy more than ever before. This paper summarized the important role of architecture in increasing energy consumption and greenhouse gas emissions. In order to avoid the environmental pollution caused by fossil fuels consumption in this sector, the need for renewable energy sources is high to significantly reduce environmental pollution, while supplying energy needs and adapting to the earth.

References

- Manzoor D. & Kohan Hooshnezhad R. (2014), A Comparative Study of Forecasts of the Global Energy Outlook, *Iranian Energy Journal*, 17(1): 147-160.
- Zhang M. & Li P. (2015), Analyzing the impact of Urbanization on energy consumption in Jianhsu Province, *Natural Hazards*, 7(6): 177-190.
- Alayi R. & Sobhani E. & Najafi A. (2020), Analysis of Environmental Impacts on the Characteristics of Gas Released from Biomass, *Anthropogenic Pollution Journal*, 4(1) :1-14.
- Seif F. (2010), *Energy and the Future*, Tehran: Science Publishing Center, 15(6): 110-124.

- Hotelling H. (2018), “The Economics of Exhaustible Resources”; *The Journal of Political Economy*; 15(2): 75-89.
- Alizadeh S. & Mohammadi A. & Fataei E. (2020), Evaluate the potential of energy recovery from organic waste Orumiyeh, First national conference on health and environment, Ardabil, Iran,1: 33-40.
- Ebrahimi M. & Rahimi Mogoooyi F. (2011), The Threshold Effect of Economic Growth Rate on the Development of Renewable Energy as a Result of Energy Price Change: A Study of the D8 Countries. *Road Economic Research Quarterly*, 1(4): 112-126.
- McKeown R. (2017). “Energy myth tow, the public is well informed about energy; in Sovacool, B. K.; Brown, M. A.(eds); *Energy and American Society:Thirteen Myths*; Berlin: Springer, 14(2): 51-74.
- Bahrami M. & Abbaszadeh P. (2013), An overview of renewable energies in Iran, *Renewable and Sustainable Energy Reviews*; 24(5): 198-208.
- Scheepers M. (2007), EU Standards for Energy Security of Supply; *Energy research Centre of the Netherlands*; 17(2): 33-40.
- Vijayalakshmi M. & Natarajan E. & Shanmugasundaram V. (2006), Thermal Behaviour of Building Wall Elements, *Journal of Applied sciences*, 6(1): 3128-3133.
- Gann David M. & Yusi W. & Richard H. (1998), “Do regulations encourage innovations, the case of energy efficiency in housing”; *Building Research & Information*; 26(5): 280-96.
- Steamers K. (2003), Energy and the city: Density, Buildings and Transport: “Energy and Buildings”, 35(4): 3-14.
- Evins R. (2013), A Review of Computational Optimization Methods Applied to Sustainable Building Desing, *Sustainable Energy Reviews*, 22(1): 230-245.
- Zabihi A. (2011), Energy planning in Iran, Tehran: Water and power industry university ublications, 12(1): 69-76.
- Walde Thomas W. (2004), “International Energy Law and Policy”; *Encyclopedia of Energy*; 16(4): 236-247.
- Bilgen S. & Keles S. & Kaygusuz A. & SarI A. & Kaygusuz K. (2008), Global warming and renewable energy sources for sustainable development: a case study in Turkey. *Renewable and Sustainable Energy Reviews*; 12(5): 372-396.