

Procedures through Which Buildings Can Be More Energy Efficient

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Abstract

Ensuring energy efficiency in building has now become as the population is boosting day by day and it is therefore important to provide the shelter to the population. Energy efficiency is extremely needed for skyscrapers to reduce certain environmental impacts. The concept of came due to the population boom and after the invention of concrete and steel panels engineer stated building skyrocketing building which are even above 800 metres. This research study aims to provide an in-depth study about the energy consumption and the energy effect of the buildings. All of this has been discussed in five different section that is introductory part which describes here the aims and objectives of this research, the next section that has been discuss here is the material and methodology part which is the research methodology section. For this resort secondary data has been collated with the help of journals and the it had been further analysed with the help of thematic data analysis. The next section that has been discuss her is the results section here a detailed study has been provided regarding energy effect in global perspective and this part includes the graph and other factual data. After this a brief discussion part have been provided here the discussion have been analysed thoroughly highlighting the useful findings. Finally, this discussion has been concluded with the help of conclusion.

Keywords

Buildings, Efficiency, Energy, Skyscrapers.

INTRODUCTION

Buildings have taken the name of skyscrapers which are above the height of 150 meters. Moreover, these gigantic buildings consumed a huge amount of energy, not only these gigantic buildings but also any normal sized building. There are many of the cities in the world which have huge skyscrapers and that too are based on the urban areas. Top five cities in the world for skyscrapers are New York, Tokyo, Shanghai, Hong Kong, and Beijing. UAE's cities namely Abu Dhabi and Dubai also come among those cities which have sky touching engineering masterpieces [1]. Bur al Arab, Bur khalifa, Taipei Taiwan, and skyscrapers of Hong Kong. Globally, Hong Kong has the highest number of skyscrapers. For example, the average power consumption of a skyscraper like Burj khalifa is around 36 million watts. In a building the power is basically consumed in the form of electricity and water supply.

Due to the energy crisis and rise in the energy prices there has been a continuous challenge for the company to make the process of production sustainable as well as make the energy consumption by the building sustainable. The best way for energy efficiency is using the proper amount of insulation in the walls and the roof. Some other ways that are given here which are useful in energy consumption are turning off the lights properly in the building. Using the LED bulbs instead of the normal CFL bulbs is yet another way for power consumption. Including the green technology in the building operation also helps to reduce the power consumption and make the operation sustainable. Therefore, the aim of this

research is to understand the best possible way in which the energy can be efficiently used by the buildings.

Objectives

- To evaluate the importance of the energy efficiency for the building in modern day
- To investigate the technological aspects that can be used to enhance the energy consumption by the building in more efficient ways.
- To analyse the buildings that has taken significant steps in making them energy efficient.

MATERIALS AND METHOD

The methodology is the vital part of any of the research that basically helps to develop a research paper. In the preparation of this research the data collection and data analysis is going to be discussed in this section. For this research the data have been collected on the basis of a secondary data collection method. The collected data have been analysed with the help of thematic analysis. Data analysis is the important part of any research and there are various types of data analysis methods that basically depend upon the data collection method [2]. A thematic data analysis is the process of analysing the data by preparing the themes according to the research aims and objectives. In other words, it can be said that thematic data analysis is often used to analyse data that are used to conduct qualitative research. It includes analysing and interpreting patterns with the help of logical thinking. In thematic data analysis the data are collated from surveys, diaries, journals, observations and

theories. While conducting the research the subject that has been chosen is based on the buildings and its power efficiency methods. In the preparation all the ethical considerations have been taken and it has been sure that the research should be reliable and its data is valid.

RESULTS

There are a lot of people who are living their life in the building as the real estate industry has seen a significant

boost. Due to this the process of energy and power consumption has risen in recent years. The concept of building was emphasized due to the continuous domination of the people from the rural area to the urban areas [3]. The land in Urban areas was constantly decreasing and for that the building became the best possible settlement as many of the people lived in limited areas of land. Most of the developed nation have building but whether that are edited it is question mark.

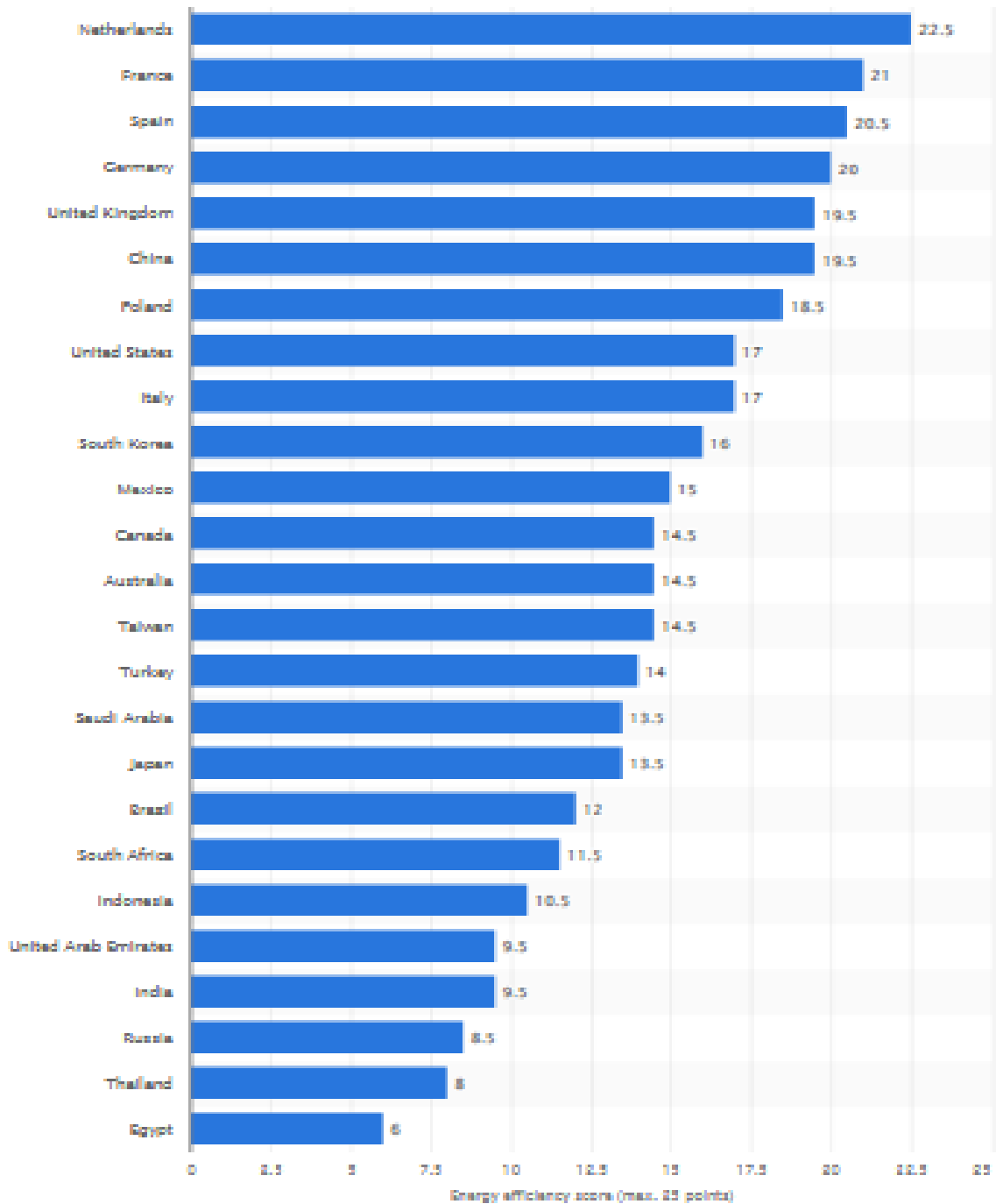


Figure 1: Global energy efficiency score in the year 2022

In figure 1 the energy efficiency scores have been given on the basis of the countries globally and the country which has outperformed is the Netherlands. The Netherlands got 22.5 out of 25 and it has the best energy efficient buildings [4]. In other global rankings like the human development index, happiness index the Netherlands always ranked in the top ten of the list. The Netherlands is a developed nation and it can be said they have made a lot of effort and invested in their country for the development of the technological infrastructure. According to the graph provided the second ranking country here is France with an overall score 21 out of 25. France is also the developed country of Europe and it also has a considerable amount of buildings [5]. The performance of France is good due to tests that had been taken by the people of France to make the power consumption more efficient.

In the top ten ranking of those in that figure it can be figured out that most of them are developed countries like Germany, the Netherlands and USA, UK, Canada, Italy and Japan. All of these countries are part of the G7 group and they are often termed as the highly developed economies. In the top ten lists China is the only developing economy and after that India, Russia and Mexico are there. Moreover, countries like Brazil, Indonesia, Egypt, Saudi Arabia and UAE are making continuous efforts to improve the energy efficiency of the building of their country. This score generally gives a brief idea about the impact of the energy efficiency of the building globally [6]. The efforts that are made by China and UAE are manageable but they need to take more steps to increase the efficiency of the building. The reason being the availability of skyscrapers in these two countries is gigantic and enormous.

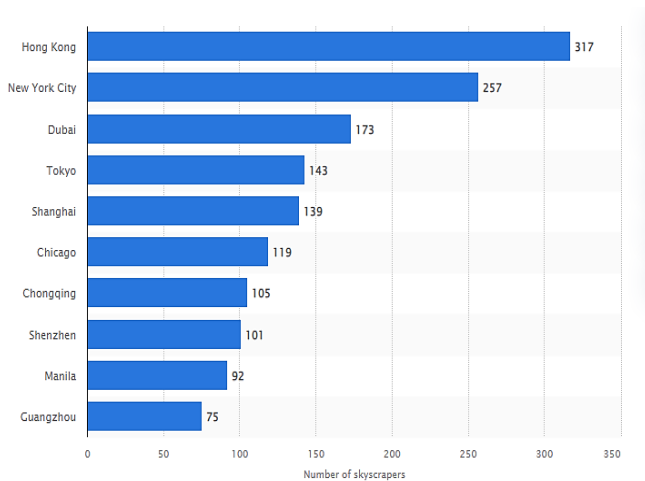


Figure 2: Total skyscraper globally as of the year 2018

The next figure is figure 2 that clearly states that countries globally have the highest number of skyscrapers city wise. According to the figure it can be said that Hong Kong is the only city in the world that has the highest number of skyscrapers globally [7]. As of the year 2018 the total number of skyscrapers is around 317. The second spot has been gained by New York City, which was once known as the city

of skyscrapers. As of the year 2018 New York have around 257 skyscrapers which and it can be said that most of the buildings of New York definitely are more energy efficient as compared to that of Honking. In the energy efficiency rating of the building globally USA ranked in eighth place which is a good score. The overall GDP of Hong Kong and New York are pretty much similar as both cities are the financial hub of the USA and China [8]. If the whole list is closely observed the five of the cities are from China. China's effort in making energy affect buildings is remarkable and the level of construction of buildings in China is also remarkable. Dubai is another country that has so many skyscrapers and the UAE building of UAE also needs tremendous energy supply.

The UK performed best in the energy efficiency of the building but the country has fewer skyscrapers and most of them are in London. There are a lot of advantages to building an energy efficient building and those benefits are as follows; it increases the owner of the building to gain the trust of the customers that are living in the building. If the country is supportive in promoting the energy efficient building more it can clean its image globally and become a popular destination for residence. The threat of climate change is all over the world hence if a building starts becoming energy efficient it can fight climate change in the best possible manner [9]. The final advantage that is often given for the energy Eiffel buildings are they help to maintain the sustainability of the building. Including the process of energy effect is a little bit costly as it needs expertise and skilled people. The benefits on the other hand of the energy efficient building are many. If the building is a skyscraper, then it becomes a very important design it in a way that it will be energy efficient.

Dynamics and structure of a building also plays a critical role in making the building energy efficient. Structure of the building in a sense should be properly located and it should have a proper insulation, proper ventilation as well as it had the proper access to the water [10]. Along with all these the soil of the base of the building also plays a larger role in making the building more energy efficient and stable. It could be understood with the help of an example like if a skyscraper is built on the land where the base of soil is, there is a high chance that for making the base of the building engineers need not to dig more as compared to sand base. Construction of skyscrapers in the desert has its own benefits but the main challenges are strong and dry wind that blows in the desert which is detrimental for the structure of the building [11]. If the structure of the building will not remain up to the mark serious misfortunes can happen along with the reduction in its energy efficiency. Therefore, for the energy efficiency in the process it is important to invest more in making the buildings more efficient.

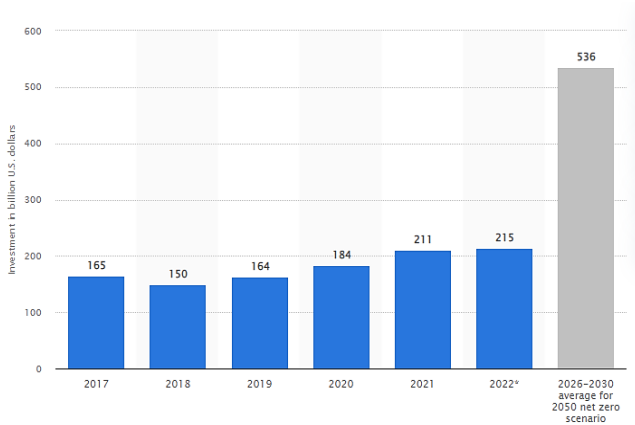


Figure 3: Annual investment energy efficient buildings and green energy.

In figure 3 it has been shown worldwide how much is invested in increasing the energy efficiency of the building. The efficiency of the building could be understood by closely monitoring the process energy consumption of the building along with the energy savings. According to the graph that has been provided here is the clear symbol that the countries have invested a huge sum of money in increasing the efficiency of the building [12]. In the year 2022 worldwide investment in energy efficiency buildings was around 215 billion US dollars. In the year 2021 worldwide investment in increasing the efficiency of the building was around 211 billion which is slightly less than the previous year. From the year 2018 global investment towards energy efficient buildings has significantly risen and due to which it has become quite challenging to cope with such a situation. Statista has estimated that the year 2026 to 2030 will be the year where people are going to invest huge amounts of money, which is around 536 billion dollars. With the investment of this much amount of money it is possible to make the process more and more sustainable and energy efficient.

Countries in the world like the Netherlands which ranks in the top of the list regarding investing in energy efficient buildings and the building of USA, UK, the Netherlands and other EU nations are better than those of buildings of developing nations. Moreover, as the figure seems to increase from 2026 to the year 2030 it is clear that making the process more energy efficient will spread in the other nations as well. Energy efficient buildings have a lot of benefits and among those benefits the most significant one is that it helps the owner of the company to reduce expenditure and invest those monies in other areas. There are above 190 countries in the world and most of the countries in the world either come under the emerging economy and developing economy [13]. The countries which have emerging economies have significantly higher chances that they will invest in energy efficient buildings. For the country which falls under the category of emerging market it is viable that these countries have lower investment in improving the energy efficiency of the building.

Countries like China which have the world's largest real estate industry and it currently had the highest number of skyscrapers. A vast majority of the Chinese skyscrapers are in the city of Hong Kong and in Shanghai [14]. Here, the economic growth is very high due to world trade and the majority and lot of people from around the world come to the country to visit the sources. During the pandemic a lot of sectors of China were affected and the real-estate sector were among the most affected sectors. Moreover, it can be said that there are as many buildings in China that have been unsold for years. The energy management of China is best among the developing countries and it is comparable to the USA [15]. According to statistics the energy management segment revenue that is projected to reach is around 1.48 billion US dollars. If the figures are compared globally it will be surprising to say that USA performs best in the list in terms of revenue generation while countries like China can be seen as its rival as well as competitors. Due to this it becomes extremely important for China to improve the energy efficiency of the building of China.

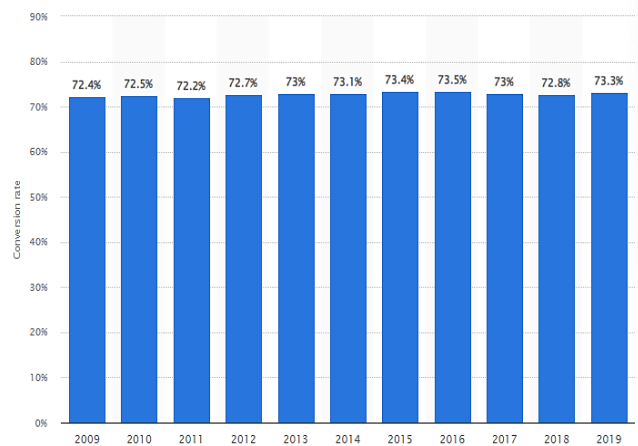


Figure 4: Efficiency in the energy conversion in China from the year 2009 to 2019

The figure 4 talked about energy efficiency in China from the year 2009 to the year 2019. After the USA China is the largest consumer of energy and most of its energy is used to develop its infrastructure of development and supplying for its manufacturing industries [16]. But most of the energy consumed by its manufacturing industries and construction of buildings. China has the largest population in the world and most of its population lives in mainland China that is near the sea coast. Therefore, most of the energy efficiency measures have been taken by China are specified to the areas of the highly populated, Cities like Beijing, Shenzhen, Hong Kong are the prime example of the places where the energy efficiency is requirement.

If the energy efficiency conversion is closely observed it can be said that from the year 2009 to the year 2019 the Statista is more or less the same. In the year 2009 the it was around 72.4% and now in the year 2019 the figure is 73.8%. It has been said many times that energy is converted to a

certain amount of the energy then some of the amount of energy is often lost and due to which it can be said that the score of China is consistent. Consistency has resulted in the tremendous growth of the Chinese economy from the year 2009 to the year 2019. The Advantages of energy efficient buildings are a lot and some of the advantages are it helps to reduce the CO₂ emission and reduces global warming [17]. In cities the operation costs have been rising day by day and most of the expenses are either spent by the people living in the building, government if the building belongs to the government or finally by the organization if it belongs to any of the private entities. In China most of the buildings are currently owned by private entities and businessmen. Therefore, for the private business entity it is mandatory to invest and secure more money while investing less. For that purpose, increasing the energy efficiency of the building becomes important. Moreover, in the hospitality industry the buildings play a very important role. They invest millions in the energy production and supply to the buildings and hotels but if the energy bills go higher it becomes difficult to operate the hospitality business as if the cost goes high less people will be interested to visit their hotels.

The operation of building has been becoming costlier and it will worsen in the coming years. Hence, it will be significantly important for the real estate business owner, the owner of hotels whether it is 5 star or it is seven star it needs to be as energy efficient as possible. Then only the overall optional cost will be reduced and these business owners will make profit. While the government's role can be seen as a supporting role as it plays the role to assist and help its small business to grow [18]. There are many of the small hospitality businesses and real estate businesses which do not have that much of investment to invest in green technology and for that role of government becomes significant. Globally, due to the shortage of energy and power the construction of energy efficient buildings or including the energy efficient method in the process have become the need of the hour. Developed nations which are better technologically equipped and skilful are more significant should assist the other developing as well as poor nations to get the technology of becoming energy efficient.

DISCUSSION

Globally there is shortage of land and building is the best possible alternative to settle a huge number of population in a particular place. There has been a shortage of energy as well and thus for fulfilling the need of the energy scientist and researchers around the world are working day and night to cope with the energy needs along with the process of generation of energy must be sustainable. After the founding the methodology of making skyscrapers and the engineering of making lofty towered buildings have become easy and this can be noticed in today's world. There has been tremendous growth in the size of the building as the population has been boosted in the past century. Hence, it has become mandatory today for construction of building. There are a lot of benefits

of building and those benefits of the buildings are like it takes less land space, it can give space to more people in the same land also it helps people to have a great view of the surrounding.

Today most of the buildings are constructed with the help Steel panels and concrete material and both of them are not considered as the most energy efficient material. Therefore, for increasing the efficiency of the building along with the energy efficiency of the building it will be important that the building should have better planning. Some of the things that help to increase energy efficiency of a building like the proper ventilation, including the solar panels in the terrace of the building or the roof tops. Gardening inside the building as well as nearby the building both is considered as useful. According to the graphs that have been provided in the results section, developed countries have better and more energy efficient buildings as compared to the developing and third world countries. The Netherlands, USA, UK and other European Union nations have proved themselves that their technological atmosphere is far better than any other countries and it can be noticed with the energy efficiency rankings. Also in the other graph it has been clearly shown that energy efficiency investment has risen in recent years especially after the Paris agreement and knowing that climate change is a threat to humanity. Energy efficient buildings will help to make the building sustainable for a long time and help to fight climate change.

CONCLUSION

Making energy efficient buildings is becoming popular day by day for this it is important to make more investment in innovation. In this research study the procedure by which the efficiency of the building can be increased has been discussed thoroughly. It has been discussed in four different parts namely the introduction part, material and methodology part, results part and the discussion. Finally, the whole discussion has been concluded in the conclusion part.

Introduction of this research has talked about a brief background of the research topic, that is the procedures by which the buildings can become more and more energy efficient. The background detection ends with the research aims and objectives of the study which is to evaluate the importance of the energy efficiency for the buildings in the modern day. The other objectives of this study being to include the technology to enhance the energy consumption and finally with the help of those buildings who have performed well in energy efficiency. The material and methodology section of this research has discussed the type of research methodology that has been followed for this research. In this section data collection and data analysis have been discussed. The data that has been taken here in this research is one the basis of the secondary data collection method while the data that has been collected is analysed on the basis of thematic analysis. Thematic analysis is the type of data analysis by which any of the research topics is analysed with the help of preparation of themes. Here the

themes are prepared on the basis of the research aim and objectives.

The next section is the results part that can also be said as the rationale part. Here, it has been critically discussed what are the pros and cons as well the importance of energy effects for the buildings. The results part includes a graph with the help of this. It has been shown how significant the energy effect is for the world as well as for the developing countries. The first graph has shown the global energy efficient building score where in the top ten list all of the countries are developed nations. The next graph is about the countries in the world that have the highest number of skyscrapers. After that the next graph talked about the global investments in green energy and finally the energy efficiency conversion of China. After this a discussed part has briefly discussed all the necessary findings of this section.

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