ENERGY AND ECONOMY FROM SENIORS' POINT OF VIEW

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Abstract

Energy plays a vital role in the country's national security, economic prosperity, and environmental quality. Due to increasing demands energy is even expected to be more significant in the coming years. That is why a sustainable energy future requires a transformation of the way we produce, deliver and consume energy. The current energy system is largely dependent on fossil fuels, which have a negative impact to air and water quality. Energy management, as a separate discipline, appeared after the oil crisis of 1970s when the energy prices rose dramatically. Improving energy efficiency in private households, industry and transport sector is the most direct way of increasing the sustainability of the energy system and enhance the countries' economy. Energy efficiency stress the positive attributes of energy (the services it provides) and diminishes the negative aspects (the pollution and financial costs) associated with producing and delivering energy. The buildings, both residental and comercial, account for 40% of the world's energy consumption and 35 % of greenhouse gas emissions. Senior housing is one of the categories of residental buildings with the fastest-increasing demand and greatest savings potential. In this paper some measures for energy efficiency improvement in senior households are presented.

Keywords: Energy, economy, efficiency, residental buildings, seniors

1. Introduction

Energy is essential to human society and economic activity. Providing access to modern energy services is a prerequisite for eliminating poverty and reducing inequalities all arround the world. Undoubtedly, energy represents a key source of economic growth because most production and consumption activities involve energy as a basic input. Investment in energy technologies create jobs and grow the national economy. Thus, there is a very strong correlation between energy consumption and economic development. However, very often this relationship is not quite clear. Namely, there is a question whether an economic growth of a country accelerates energy consumption or whether an increased energy consumption stimulates a country's economic growth? It is likely that in the long-term energy consumption stimulates economic growth.

Global demand for energy has been permanently increasing, particularly in developing countries. For example, before recent the worldwide economic recession China used to have an extended period of double-digit annual increases both in economic growth and energy consumption.

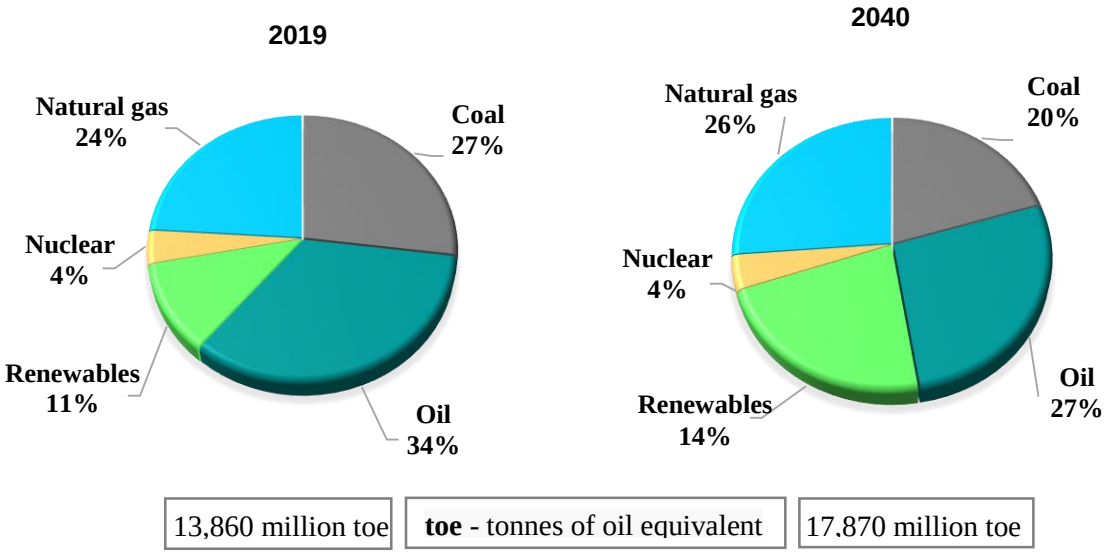
Energy may be delivered to a building in one of two forms: primary or secondary energy.

Primary energy is the raw fuel found in nature (such as natural gas or crude oil) that is burned to create heat and electricity used in onsite generation.

Secondary energy is the energy product (heat or electricity) created from a raw fuel, such as electricity purchased from the grid or heat received from a district heating system.

Primary energy encompasses secondary energy as well as the energy required to transform one form of energy to another (e.g. coal to electricity) and the energy used to bring energy supplies to the consumers (e.g. pipeline). Primary energy consumption has been increasing so far and that such trend is projected to continue in the future [2] (Fig. 1).

Figure 1. Primary energy consumption by fuel type (current and projection)

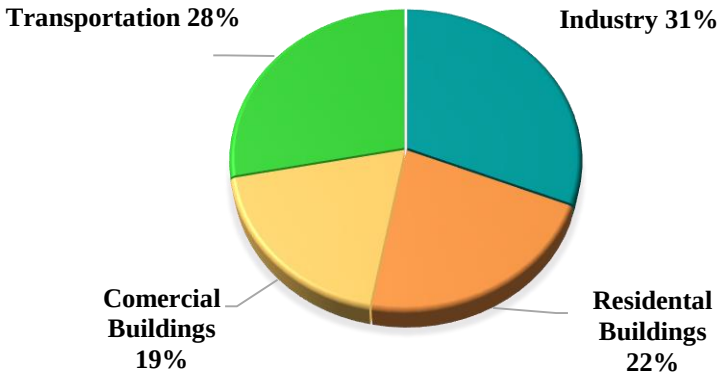


Source:BP Energy Outlook, 2019

Secondary energy is the energy used by final consumers in various sectors of economy: buildings (residential and commercial), industry and transportation. The industrial sector includes facilities and equipment used for manufacturing, agriculture, mining, and construction. The transportation sector comprises vehicles that transport people or goods, such as: cars, trucks, buses, motorcycles, trains, subways, aircraft or boats. The residential sector consists of homes and apartments. The commercial sector includes buildings such as offices, malls, stores, schools, hospitals, hotels, warehouses, restaurants, places of worship, etc. Secondary energy use accouns rougphly about 70 percent of the primary energy.

Global secondary energy use by sectors in 2019 is shown in Figure 2.

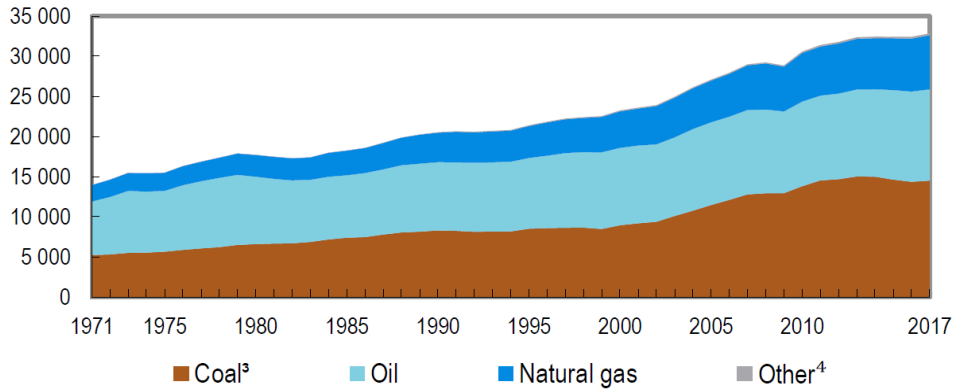
Figure 2. Global secondary energy use by sectors in 2019



Source: Alliance to Save Energy, 2019

From an enviromental point of view, it is generaly believed that energy production and consumption are a major source of air pollution and climate change. Although, more detailed research shows that the relationship between environment and economic development is dynamic and complex. Consequently, it is difficult to decide whether the economic growth leads to degradation of environment or not. According to one view, economic growth results in air, water and land pollution. On the contrary, second view states that economic growth improves environment quality. Namely, by discovering new materials and sources we use less natural resources or even replace them. Whatever, so far, carbon dioxide emissions has been constantly increasing due to permanent rose of global energy consumption (Figure 3).

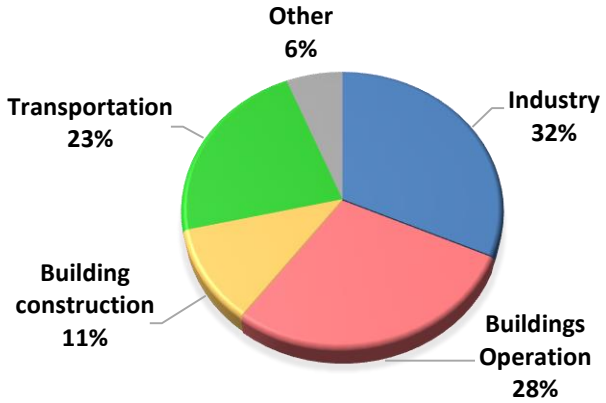
Figure 3. Carbon dioxide emissions by fuel from 1971 to 2017 (Mt)



Source: International Energy Agency (IEA), 2018.

Carbon dioxide emissions are the primary driver of global climate change. It can be seen from the Figure 3 that carbon dioxide emission increased by 136% since 1971. In order to avoid the worst impacts of climate change, the world needs to urgently reduce emissions. The emission of carbon dioxide by sectors in 2019 is shown in Figure 4.

Figure 4. The emission of carbon dioxide by sectors in 2019



Source: International Energy Outlook, 2019

It is known that the long-term reliance on traditional sources of energy, especially oil, remains uncertain due to limitations on resources and political instability. Moreover, the country's energy supply and distribution systems are increasingly vulnerable to natural disasters and acts of terrorism. From the other side, the various alternative energy sources are not receiving sufficient attention. As a result, modest energy efficiency improvement rates will not be sufficient to stabilize or decrease the energy demand in absolute terms. In order to make significant reductions, ambitious energy savings measures need to be implemented.

2. Energy management

Energy management can be described as the organized and proactive process of monitoring, controlling, and conserving energy in all sectors of consumption. The main objectives of energy management is to achieve the required performance with minimum energy consumption, satisfying both economic and environmental requirements.

Energy management, as a separate discipline, began to evolve after the first oil crisis of 1973 and really came into effect after the second oil crisis of 1979 when real energy prices rose dramatically. Since then passed more than 40 years is just the period during which many nowadays' seniors, as young people, started to create the future in this, very important, area.

The development of new technologies and strategies for improving energy efficiency is dominantly based on the knowledge and experience gathered in last 50 years. Without understanding the evolution of the energy efficiecy, new concepts and new solutions to reduce energy consumption and protect the planet from polution will be hard to imagine.

With a share of about 40 percent of global energy demand, buildings are the world's largest energy consumers, ahead of industrial production and transportation. Residential buildings use most of this global share. Therefore, there is a significant potential for reduction of energy consumption. For that reason a good energy menagement in buildings is of great importance.

The energy efficiency of a building is mainly related to two components:

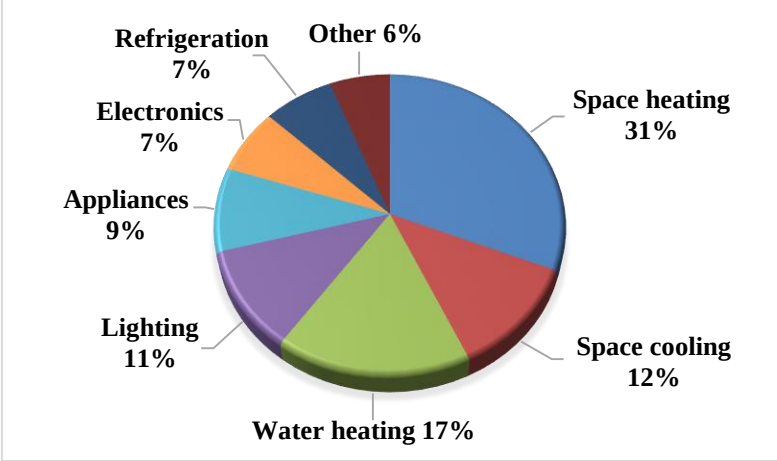
- passive properties, given by thermal insulation, captured solar radiation, natural ventilation, shading, etc.,
- active properties, defined by appliances and use of energy.

In addition to the construction technology, a building's size, age, and type are among the most important physical determinants of energy consumption in buildings.

It has been shown that older, larger, detached homes consume more energy than newer, smaller, multifamily housing units. The reasons for these are because the newer buildings usually have better insulation, smaller buildings have smaller areas that need heating and cooling, and multifamily buildings often have smaller units and smaller exposed surfaces.

Space heating, cooling, and ventilation are the largest consumers of energy in buildings, followed by lighting. It should be stressed that there is a wide variability due to the different climatic conditions, and due to the geometric and physical characteristics of buildings envelope. Average distribution of energy consumption in households is reported in Figure 5.

Figure 5. Average distribution of energy consumption in households



Source: Alliance to Save Energy, 2019

3. Energy consumption in an ageing population

Population ageing is one of the most significant global social trend in 21st century. Population age 65 and above makes 9.1% of total population (in 1990 it was 6.1%), and this percentage is going to grow. Global population ageing has significant implications for public policy in areas such as health, housing and economic security. As the population is ageing, gaining a better understanding of the role of age as an important driver of energy demand can create opportunities to align climate change, energy, and population policies in order to make these policies more effective.

A range of physiological, psychological and environmental factors influence thermal comfort for members of a household during the day and over time. These factors may be variable for the household members and they include the level of humidity and ventilation, air temperature, temperature of surrounding surfaces and air movement. Also, these factors do not remain stable even within the household.

Ageing could lead to an increase in the proportion of the population with high energy consumption levels. It is proved that there is a correlation between age and many other socio-demographic variables (e.g., income and household size), and the corresponding consequences for consumption behaviors like housing needs, residential mobility, and energy demand.

The impact of income on energy consumption occurs mainly through its impact on lifestyles and housing characteristics, as higher-income families often live in larger detached homes. Levels of older people's comfort may not only be a useful factor in explaining their use of energy but also be an important part of a holistic view of well-being. Some interventions can increase comfort and reduce energy bills thereby increasing disposable income which may have a positive effect on well-being.

The research has shown that the ages of residents predict their residential energy consumption behaviors, as well as their income levels, do. Energy consumption increases rapidly among the elderly after age 70, regardless of their income and housing characteristics.

Households with elderly people tend to have lower household incomes and are usually composed of one or two people. At the same time, those people owe the houses which are usually larger than average, older and less energy efficient. It happens because parents usually continue to live in their houses, even after their children become independent. Moreover, during retirement elderly people re-orient themselves from work to more passive activities and are less likely to socialize outside the home. Some statistics says that elderly people stay at home longer, approximately 18 hours per day. In line with this, elderly people use air-conditioners, televisions and other home appliances longer, which results in greater energy consumption. All these factors cause that seniors spend a larger share of their income on utility costs. There is a concern that seniors with low income, facing financial constraints, are less likely to heat or cool their homes appropriately which has direct impact on their own health and well-being.

Although there are many techniques to improve the energy efficiency of the buildings they are still not suficiently implemented. Very often the terms “energy efficiency” and “energy conservation” are used interchangeably, but it should be stressed that they refer to different concepts. Improving energy efficiency means achieving some goal (e.g., heating a room to a certain temperature) while using less energy. Energy conservation implies a change of our behaviours and attitudes in order to reduce energy consumption (e.g., lowering the thermostat in winter). The further consideration refers to the first term – energy efficiency, because the second one (energy conservation) can endanger people's health and well-being.

Implementing energy efficiency measures to provide financially-accessible housing is important for all demographics. Therefore, improving the energy-efficient use of high-energy

demand systems as well as identifying less energy-intensive ways of achieving thermal comfort is likely to be a key area for improving the energy efficiency and comfort of low-income seniors.

The efficient use of high-energy demand systems is also important to enable households to manage their energy costs. It is clear that effective programs for low-income senior householders should focus on their need to balance energy efficiency and reduced energy costs with health and well-being demands.

The efficiency of the appliances and equipment used in households, such as air conditioners, gas furnaces, clothes washers, and dishwashers, has increased greatly over the past four decades. For example, the average electricity use of new refrigerators sold in 2016 was about 450 kWh per year that is 70 percent less than the average electricity use of new refrigerators sold in 1975. Significant energy efficiency gains have also been made in lighting.

From the other side, the progress has been minimal for other products, such as water heaters among the others, due to less policy attention paid to the energy use of these product.

4. Energy efficiency measures in senior households

There are several areas of overlap between energy-efficiency and senior-friendly housing. It is already mention that lifestyle and energy-use patterns change as people move into retirement. Making some changes can save money, energy and water as well as making home more comfortable place to live.

Heating and cooling, depending on the climate zone, are responsible for up to 50% of overall home energy consumption. Controling room climate is an excellent way for saving energy. It should be known that by increasing/decreasing heating/cooling for every degree energy consumption is increased between 4% and 8%. The recomendations are to set the heating in winter between 18°C and 20°C, and to set the cooling in summer between 25°C and 27°C. Also, if possible, the unused rooms should be excluded from the heating and cooling. In addition, a better-sealed and insulated homes maintain a more comfortable temperature and reduce drafts.

In summer, it is recommended to make the most of natural airflow in the cooler parts of the day by opening windows to bring in the breeze and let the hot air out. Also, when there is no much difference between indoor and outdoor temperature, the option is to use fan rather than air-conditioner because it is more economical. Air movement from the fan evaporates moisture on the skin and makes a person feel cooler. Fans can be used to supplement air conditioning and save energy by permitting a higher thermostat setting. For every degree you raise the air conditioning thermostat, you can save 7 percent to 10 percent on cooling costs. Moreover, fans are far more transportable than air conditioners and can be used in multiple locations in the home.

Heating water accounts for around 15% to 20% of household energy use. The recommended setting for thermostats is 60°C in case of storage hot water systems, but no more than 50°C on instantaneous systems. In case of leaving home for some days the water heaters should be switched off. However, when turning back home, in order to kill bacteria that may have appear, it is advisable to heat water above 60°C and allow at least half an hour time before use it. Installing a water- efficient showerhead also can help in saving energy used to heat water. It is highly recommended not to use the shower to warm up because it consumes up to 20 times much energy as a heat lamp or fan.

Appliances (including computers and electronics and refrigeration), account for up to 30% of household energy use. By making simple changes it is possible to reduce energy consumption. These changes, among the others, include the following: make sure appliances and electronics are turned off when not in use - anything with a standby mode is still use power; for smaller

meals it is more efficient to use microwave and toaster instead of stove or oven; washing clothes with cold water can save up to 10 times more energy than a warm wash.

Lighting uses around 10% of the average household electricity budget. In order to reduce electricity consumption and increase the energy efficiency some measures can be undertaken: use of natural light and lighter coloured furnishings reduce the need for artificial lights; do not use a more powerful bulb than is needed; switch to energy-efficient lighting by replacing old-style bulbs with light emitting diodes (LEDs) which use around 80% less energy and last much longer; switch lights off when leaving the room and consider sensors for indoor and outdoor lights;

LED (Light-emitting diodes) lighting provides better visibility and can be connected to motion sensors for ease of use; and programmable thermostats automatically follow a heating/cooling schedule without the need to remember to make daily adjustments.

5. Conclusion

Global energy consumption has increased rapidly in recent decades and is projected to continue to increase. That is due to population and economic growth, especially in emerging market economies. While providing chances for greater prosperities, growing demands for energy creates two main challenges. The first one is that more consumers require ever more energy sources, which are still highly based on fossil fuels. At the same time, higher consumption of fossil fuels leads to higher greenhouse gas emission and consequently to the environmental polution.

A sustainable energy future requires a transformation in the way we produce, deliver and consume energy. This approach should be based on renewable energy sources and more efficient use of energy.

The efficient use of energy in residental buildings is an important component of green economy, because it contribute to reducing of the negative impacts of energy consumption. Energy demand in residential buildings is influenced by several factors - building characteristics, the willingness and possibility to invest in energy efficiency measures, as well as households' socio-economic and demographic attributes – including age. Much of the research literature has shown that households' age has a significant influence on residential energy demand. They found that elderly households have a tendency to higher energy consumption. Therefore, identifying less energy-intensive ways of achieving thermal comfort is likely to be a key area for improving the energy efficiency and comfort of seniors, especially of those with low-income.

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