Analysis of Continuous Development with Nuclear Energy

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Abstract. As the energy crisis gradually approaching, the development of new energy sources has become an inevitable need. The use of solar energy, nuclear energy, wind energy and other new energy continues to grow. In order to study the impact of new energy on the economic side, this paper reviews correlative papers that talk about the advantages and disadvantages of new energy by comparing it with traditional energy. The result of this paper has shown the impact of new energy on the economy. By analyzing the internal and external strength determine a forecast of future trends it could have. And through the analyzing of their shortages the research has shown that its weakness; threat and the difficulties human will face during using new energy, include its highly cost and problems human had on disposal its waste. The advantages and drawbacks of the development of new energy in the future are examined in this article, in addition to some potential solutions that may assist to increase the advantages and reduce the problems.

1 Introduction

As the development of human civilization and the progress of social science and technology, the energy demand of human beings is increasing day by day, the emission of pollutants is also rising, and the aggravation of environmental pollution has become an inevitable consequence. Apart from the problem of environmental deterioration, what is more serious is that human beings are facing the threat of energy exhaustion, or in other words, energy crisis is approaching to human beings. It is not a date that far from us, on the contrary, this is a time that our next generation even ourselves may experience. In order to reduce the emission of pollutants for reduce the negative environmental impact caused by energy use and possible solution for energy crisis, new energy, which is relatively clean compare to traditional energy, has become the best choice for human.

There was a dramatic increase of nuclear energy use since 1960s, this trend last for 30 years, but then it turns to grow slower and even decreased during the following 20 years. The reason of choosing those resources is because they are renewable or their raw materials are abundant and thus could be used by human beings for a long period of time, which means unlike coal and petroleum, they are durable. This could mean that they are a possible solution for people to overcome the problem of energy scarcity. This paper views the usage trend chart, analyzes its advantages and disadvantages, identify the reasons for the different development trends - why some of them seems to have a better development prospects than others do. reveals some advantages and disadvantages for the future development of new energy, some possible solutions are put forward to help expand the advantages and narrow the disadvantages that may benefit the development are then discussed.

2 The birth background of nuclear energy

Einstein's famous formula E= MC2 has been used to estimate the amount of energy released by nuclear fission. Nuclear energy is derived from uranium, and using Einstein's equation E= MC2, the lost mass is converted into energy, which she calculated to be equal to 200 MEV. That 200 MEV of energy is released, just enough for the two newly created nuclei to stand alone [1]. Nuclear power is undeniably powerful, but once scientists discovered the power of uranium, they wondered whether it could be controlled so that just enough uranium could be produced together to provide a huge amount of energy without exploding. The truth is they were right, and they succeeded. The historical context at that time led to the immediate use of it in the production of what we now call nuclear weapons. The Chicago Reactor, the first nuclear reactor ever built, started its construction in October 1942. An elliptical device with a radius of 3.09 meters was constructed by Fermi's team of researchers in the University of Chicago's Stagg football stadium over the course of two 24-hour shifts. The building's wide, sturdy timber frames provide stability. [1]. In September 1945, after the end of World War II, the UK was under the threat of energy crisis and began to try to use new energy as the resource to generate power. Nuclear power had just emerged during the World War II, and with the end of the War, scientists were trying to turn it into a productive force for everyday use. So, the first commercially used nuclear power station was officially opened on October 17th1956 in UK [2].

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3 Analysis of the nuclear energy

3.1 Advantages of nuclear energy

The relative cleanliness of nuclear power. With the continuous development of industry and science and technology, environmental pollution has become a serious problem. The use of conventional energy sources (such as coal, oil and natural gas) is associated with the emission of sulfur compounds and carbon dioxide. Sulphide emissions can lead to events such as soot-induced smog in London, UK, and acid rain in northern Europe, North America and southwestern China. Sulfates in soil are virtually never broken down, and they seep into both surface and groundwater. The majority of sulfate in the atmosphere takes the form of solid particles that fall to the ground through rain or gravity. These solid particles are a significant source of sulfur pollution and the acidity of soil and surface water. Acid rain can change the acidity of soil, which can affect crops or be absorbed by crops, causing damage to humans when eaten. The toxicity of sulfate aerosol and sulfuric acid fog is roughly ten times greater than that of sulfur dioxide, reducing visibility and corroding metals and structures. They are also damaging to the human body, other living beings, objects, and so on. Carbon dioxide, sometimes referred to as a greenhouse gas, has a role in global warming, which in turn may cause issues with food security, increasing sea levels, the spread of deserts in some locations, the melting of two glaciers, the endangerment of some species, and more extreme weather. It is a perfect way to avoid problems that mentioned above by using nuclear power instead of traditional energy, it doesn't emit any sulfur dioxide, soot, nitrogen oxides and carbon dioxide, which could relieve the environmental pollution brought by burning coal or petroleum [3].

The relative durability of nuclear power. The issue with conventional energy is that it will ultimately run out, which is one of the largest issues the world is now experiencing. This is in contrast to the environmental issues that traditional energy has caused. The new method, which is based on the Klass model, calculates the depletion periods of fossil fuel reserves as around 35, 107, and 37 years for oil, coal, and natural gas, respectively. The remaining fossil fuel after 2042 will only be coal, which reserves might last until 2112 [4]. It can be seen clearly from the data that it is not a date far from us, and human also understand that this problem can't wait to find solutions until the urgent situation. New energy is the possible solution, The International Atomic Energy Agency (IAEA) and the Organisation for Economic Co-operation and Development (OECD) released a joint report today saying that at current rates of mining, the world has 85 years of uranium supply. If fast reactor technology is used, the uranium ore could last 2,500 years [5]. As a renewable kind of new energy with abundance of raw materials for use, nuclear power become an ideal solution to avoid this problem.

3.2 Development of nuclear energy

A Nuclear power generation enters the global scene as a result of the emergency at the first nuclear power facility in the UK. With a power of 90MWe, 16 times compared to the oblingsk nuclear power station, the United States successfully constructed the shipping port prototype nuclear power plant in 1957. (5MWe) [6]. The commercial use of prototypes in the former Soviet Union and the United States has also successfully demonstrated the feasibility of nuclear power as a power source for society. The above experimental and prototype nuclear power units are known internationally as the first generation nuclear power units.

Fourth generations may be approximately distinguished in nuclear power technology. In the mid-1950s to mid-1960s, the first generation of nuclear power technology was developed. Early prototypes that use natural uranium as fuel and graphite as a moderator are the major characteristics. Although the producing capacity of the unit is not very high—generally around 300,000 kilowatts—the design is very sloppy, and the bulk is substantial. There are several safety risks when a system is designed without using norms, scientific safety standards, or other guiding principles. Its relevance comes from the fact that it functions as an experimental prototype reactor for study and exploration, demonstrating the viability of nuclear power production on a technological level.

The second generation of nuclear power technology began in the late 1960s. The second generation of nuclear power technology is a better developed commercial reactor as compared with the initial generation. The likelihood of the core melting and the widespread radiation release of radioactive elements are on the order of 10-4 and 10-5, respectively. The cooling and moderator materials are enriched uranium fuel and water. It has a service life of about 40 years. The second generation nuclear power station is significant in that it demonstrates the technological viability of nuclear power generation and its economic parity with thermal and hydroelectric. The second-generation nuclear power technology has been commercialized and standardized on the basis of the first-generation nuclear power technology, and the power level of a single unit has been greatly increased on the basis of the first-generation nuclear power technology, reaching a million kilowatts. The majority of the more than 400 commercial nuclear power units in existence in the world now were established in the 1970s as a result of the energy crisis brought on by rising oil prices [6].

So far, the use of nuclear power has been rising at a fast and steady pace, but as it has increased, some potential problems have emerged. Nuclear power accounted for 16% of the world's electricity in 1986 (see Figure 1), but it has stagnated as the problem has unfolded.

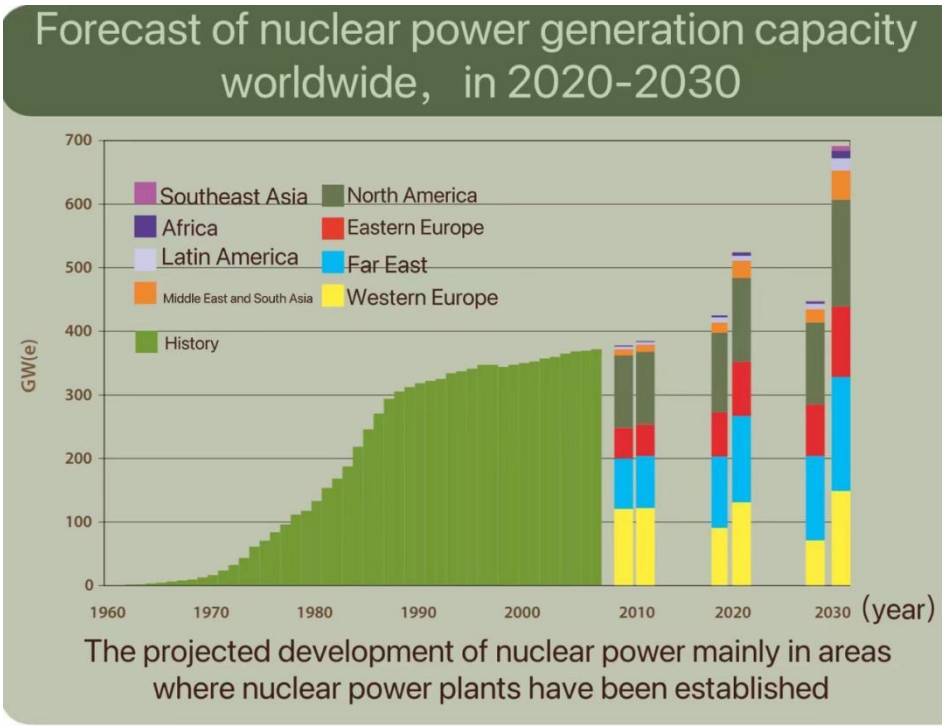

Figure 1. History and forecast of nuclear power generation capacity in worldwide [7]

Source: Alan McDonald, World Nuclear power Situation.

3.3 Potential problems with nuclear power that people are facing

Safety hazards in the use of nuclear energy. Workers at the nuclear power facility close to Chernobyl in Soviet Ukraine turned off the emergency warning system at reactor No. 4 early on April 26, 1986, in preparation for a planned test. They would be in the dark regarding what was going to occur without an early warning system. However, their test resulted in a massive explosion. The entire reactor caught fire and exploded, spewing debris into the air [8]. The Soviet Bureau took actions to cover up the occurrence, which had considerably more severe consequences. The Chernobyl disaster caused thousands of individuals to develop cancer. Since then, the construction of nuclear power plants has been halted in a number of countries as they do further research to make them trustworthy and safe. It took more than twenty years after Chernobyl before certain nations started to support nuclear energy once more and it entered the third generation. In the 1990s, the United States and Europe responded to the accidents at the Three Mile Island nuclear power plant in 1979 and the Chernobyl nuclear power plant in 1986 by publishing the Advanced Light Water Reactor User Requirements Document (URD Document) and the European User Requirements for Light Water Reactor Nuclear Power Plant (EUR Document). The third generation nuclear power unit in the globe is typically referred to as one that complies with one of the two documents. In comparison to second generation nuclear power technology, the third generation nuclear power plant is a new generation of advanced nuclear power plants with greater safety and higher power. The likelihood of the core melting and the emission of a significant amount of radioactive material are on the order of 10-7 and 10-8, respectively. Reactors typically last for 60 years [6]. Third-generation nuclear power plants are also the type of technology that people still using today.

Disposal of nuclear waste. Along with the safety dangers posed by nuclear power plant leaks, disposing of nuclear waste presents significant challenges. Nuclear energy production generates large amounts of radioactive waste that is extremely difficult to manage. The typical treatment approach involves filtering the waste using scientific means, packing it, and then burying it underground. Distribution costs are quite expensive. There are now seven primary methods for disposing of nuclear waste: deep drilling, sub seabed storage, burial in subduction zones, cryotreatment, and sealing with artificial rocks [9]. However, no method is currently flawless, and if nuclear waste is managed improperly or if more issues arise, there might be significant repercussions. This is why Japan's proposal to dump nuclear waste water into the sea to save money has caused a huge controversy in the international community, which has been widely criticized.

4 Future prospects and expectations for the use of nuclear energy

Mention of the future development of nuclear power first need to mention the fourth generation of nuclear power technology. The Clinton Administration's Department of Energy originally floated the idea of fourth generation nuclear power technology in June 1999. China, the United Kingdom, and Japan have all shown support for the idea.

The term "fourth generation nuclear power technology" refers to upcoming, advanced nuclear power

technology, which is distinguished by superior economy, high safety, reduced waste production, no requirement for off-site emergencies, and the capacity to stop nuclear proliferation. The fourth generation of nuclear power reactors includes molten salt reactors, fast reactors with sodium cooling, fast reactors with lead cooling, fast reactors with gas cooling, fast reactors with very high temperature gas cooling, and fast reactors with supercritical water cooling. [5]. To be precise, mankind has not fully entered the era of fourth-generation nuclear power technology, which still needs to be developed, and mankind is now more at the intersection of the third generation and the fourth generation. The full development of the fourth generation technology will bring about a great advance in the use of nuclear energy. On the basis of retaining the original advantages, the disadvantages are greatly reduced, so that people's concerns in use are reduced.

But human demand for nuclear power will only continue to grow. In China, for example, a senior executive in the country's nuclear power industry confidently predicted in November 2017 that China's demand for electricity would "double in 20 years" if the country's power demand grew at an unlimited rate of 5% a year [10].

5 Conclusion

The benefits and drawbacks of nuclear energy have been discussed thus far, as well as how it compares to other forms of energy. Nuclear energy, on the other hand, has a higher degree of cleanliness (more environmentally friendly), can meet longer use needs, and has a high degree of technology to be developed. In contrast, conventional energy has a higher level of stability and safety, and is more advanced in use and technology. At this time, nuclear energy's development objective is the fourth stage technology. Whether on an economic, human use safety, or environmental protection level, its achievement will have a significant positive impact on society.

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