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The tentative idea of energy recovery based on "3R" principle

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Abstract

Starting from the current situation of the energy crisis, this paper analyzes the pros and cons of two ways to solve energy issues, and indicates that energy conservation plays an important role in solving energy problems. Around the "3R" principles in Green design, this paper discusses the "3R" thought of energy recovery. Finally, through the tentative plan of one practical case, it demonstrates the great application prospect of the "3R" idea in the energy recovery.

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1. Introduce

18th century, the invention of the steam engine opens the door to modern industry. With the continuous development of science and technology, steam engines had been replaced by internal combustion engines. But no matter how the development of technology, there is one thing that has not changed - the high dependence of industry on energy. In general, the whole modern industry is a machine driven by energy.

Since the industrial revolution, modern industry has made rapid development. However, the costs of development are the uncontrolled consumption of energy on coal, oil, gas and other natural energy. The consequences of excessive consumption of natural energy, on the one hand, it caused the energy crisis, which restricted the development of human society and economy; the other hand, the perennial use of fossil fuels caused the greenhouse effect and environmental pollution, threatening human survival.

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So, throughout the development of the whole community, whether oil shortage, or environment damage, energy will be a stumbling block to the sustainable development of society, so the problems of energy will be undoubtedly imminent.

2. The energy problems

Energy resources as the carrier of energy, in fact, to solve the energy problem is to solve the problem of energy production or source.

2.1. *The two ways to solve the energy problem*

Since the energy of universe observes the law of energy conservation, there are two main ways to solve the current energy problems: First, the development of new energy sources, using other forms of energy which have not be developed, such as solar, wind, biomass, geothermal, ocean energy, nuclear energy, hydrogen energy and other energy; the second is to save energy, reducing the energy consumption in the process of production or life, recycling and reusing the energy consumed in the process of using. For example, lead the natural light into the indoor, reduce the use of interior lighting, and convert the energy lost by braking the car into the electrical energy for automotive lighting.

2.2. *Compare the merits of two ways*

The development of new energy sources is of course the best way to solve the energy crisis. Among the many new energy sources, solar and nuclear energy is undoubtedly the best choice.

Solar energy has heat energy and light energy, which can be directly used or be converted into electrical energy. However, the use of solar energy is often affected by time and weather change. Solar energy can generate electricity during the day but not rainy days, so it is difficult to ensure continuous power supply. Compared with other energy sources, the current investment of solar power costs 2 to 3 million / kW, or even higher.

In the process of solving the energy crisis, high hopes have been given to the nuclear power. In fact, since 1954 when Soviet Union ran its first nuclear reactor, the use of nuclear energy has always been restricted by the nuclear leaks and nuclear pollution. Since that time, the major nuclear accidents have happened three times: the Three Mile Island nuclear accident of U.S. in 1979; the Chernobyl nuclear accident Soviet Union in 1986, and the Fukushima nuclear power plant accident not long ago. The leakage of nuclear and nuclear pollution caused by the earthquake in Japan warned the whole world that nuclear power should be used carefully.

As for the development of other new energy sources, there are also many constraints: it often costs a very long time from the development of a new energy to final application to life. A slow remedy can not meet an emergency. What is more, it may damage the ecological environment and threat human survival.

In fact, as long as the sun existing, the earth constantly rotating, energy will not die out. The energy is ubiquitous in our lives. The key is how to effectively collect these scattered energies?

"Design" provides the best answer to solve this problem. Back in ancient China, people have a design consciousness to use the natural power, such as waterwheel and windmill in ancient China. Today, design is widely used in every corner of life. Carefully conceiving, people have designed a lot of products which can recycle and reuse energy, such as the floor that can transform the pressure of human activities into electricity; the shoes charger that can recycle the energy during walking.

Compared to the development of new energy sources, the ways of design to save energy is easier to implement, and the cost is relatively low. The recovery process will not damage the ecological

environment. In addition, as long as making full use of this approach, the collected energy is considerable. Thus, the design in solving the problem of energy recovery has far-reaching prospects. In particular, the concept of green design is proposed, which provides us with a set of methods that can be used as a reference.

3. The idea of energy recovery based on "3R" principle

3.1. The origin of "3R" principle

The so-called "3R" principles, namely: reduce, recycle and reuse, which is firstly proposed to solve the solid waste management. As the whole process of design, production and manufacture is closely related with the waste generation, it is introduced to these fields. As the core part of product development, the phase of design directly restricts the phases of production and manufacturing. Thus, it is an important target of green economy to initiate "3R" principle in the design field.

The "3R" principle of green design is accompanied by the development of green economy. It is expected to build a coordinated development mechanisms among the people - society - environment by design thinking to reduce the waste of the world's resources.

3.2. The idea of energy recovery based on the "3R" principle

From the generation, development and application of the "3R" principles, we can see that its aim is to handle the relationships of the sustainable development and nature. Therefore, "3R" principles have an important reference for solving the energy problems. Through the ways of reducing, recycling and reusing, we can effectively collect the scattered energy in life for reusing, which is indirect to achieve the purpose of producing energy.

3.2.1. Reduce

Reduce the use of unnecessary energy, or maximize energy. There are many situations in life that we can achieve the energy conservation by developing good habits or using new technological means, such as developing the habit of turning off lights at home or in public places; using the compact fluorescent lamps to replace the traditional lighting facilities; using natural light to replace the part of the interior light; using electric vehicles instead of conventional gasoline vehicles to improve energy efficiency.

3.2.2 Recycle

Recycle the energy. There are two main ways to recycle energy: First, to further enhance the conversion of the natural renewable energy, such as wind, hydro, solar.; the second is to recycle the energy consumed in the production process, such as Haier Family Cycling Energy Center can recycle the waste heat which is exhausted to the outside from air condition, and transform it into hot water to meet the purposes of family bath or kitchen washing.

3.2.3. Reuse

Reuse the energy by collecting and processing the carrier of the energy in order to achieve the new energy. In use, energy is always in constant movement and change. By processing the energy carrier, we can again gain energy, such as: turn sour the plant stems and leaves or straw to produce biogas, satisfying the daily need for electricity. Another example, collect the garbage or waste by category to release the energy by processing, turning waste into treasure.

4. The tentative plan of energy recovery based on "3R" principle

As aesthetic, life does not lack beauty but a lack of vision, so as well as energy. In our lives, although energy is invisible and intangible, it does always be with us, hand in hand. However, we are too accustomed to the surrounding environment not to consider the existence of energy. When you think about it consciously, you will find that we can collect the energy for reusing in many places of our life.

All we should have this kind of life experience: standing near the bus station or train tracks, when the car or train passing, you will obviously feel there is a cool breeze going from your (Fig.1). Why is that? How so?



Fig. 1. Some occasion where energy can be recovered

In fact, this is caused by the friction between car and the air. In this process, in order to overcome the resistance of the air, car loses some of the energy to form the winds.

In the subway or tunnels, vehicles coming and going, it goes on the conversion of energy between the air and the vehicle. According to the related technologies of wind power, we can install the generation equipment of wind power on both sides of the tunnel, which will convert the energy lost by overcoming the resistance of the air into electricity for lighting in these areas (Fig.2).

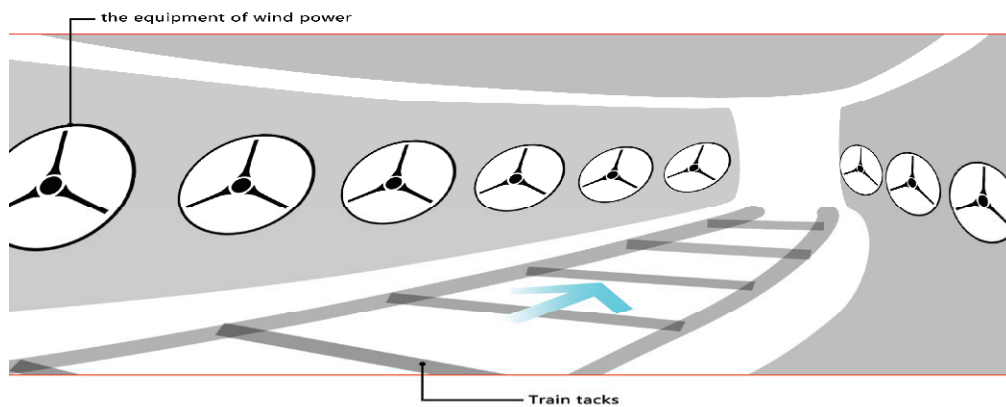


Fig. 2. The diagram of recycling energy model

5. The summary

Energy as the driving force of the world economic development, if the problem of energy crisis is not

resolved, the development of the world economy will face the danger of stagnation. However, the development of new energy sources is not necessarily the most effective way to solve the problem. To fundamentally solve the problem, we have to return to the source of the problem - the production and the life. Using the "3R" principles, we can effectively recover the energy in our daily life to meet the part need of producing and living. By this way, we can find an effective way to reduce the consumption of fossil fuel and to solve the energy crisis and ecological issues.

References

- [1] (U.S.) Li Po ed. Li Wei translate. *The coming energy crash*. Renmin University of China Press; 2009.
- [2] Dong Chongshan ed. *Deadlock and Breakthrough - the general crisis of human energy and its way out*. People's Publishing House;2006.
- [3] Zong Min ed. *Principles of green building design*. China architecture and Building Press;2010.
- [4] Beijing Fang Liang Culture Communication Co. Ltd. ed. *The green building design of the world*. China architecture and Building Press. 2008.
- [5] "Green Future Series" edited by the editorial board. *"Green Future" series: The urban life of future: the living environment and green homes*. World Publishing Company;2010.