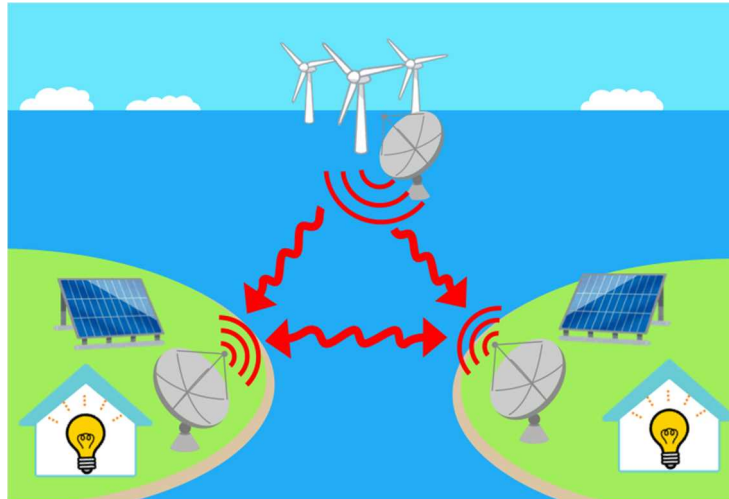


Solving energy problem with wireless transmission of electricity

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With the rapid progress of science and technology, our lives have changed greatly. Especially, electricity is essential energy for our daily lives and industry to drive electronic devices or machines in factories. However, we are now facing the energy problem and the climate change due to the electricity generation. Today, more than half of the electricity is produced from fossil fuels, such as coal, oil, and natural gas [1]. Fossil fuels are finite, and it is claimed that coal and natural gas will run out in the next 50 years and 132 years respectively [1]. In addition to the depletion of fossil fuels, generating electricity from fossil fuels affects the climate change. The consumption of fossil fuel releases carbon dioxide (CO₂) and increases the amount of CO₂ in the atmosphere. Because CO₂ absorbs heat rays and has the greenhouse effect, consumption of fossil fuels for electricity generation is considered one of the causes of global warming.

To solve the energy problem and the climate change, renewable energy has been developed. Renewable energy is energy that does not release additional CO₂ by its generation and can be generated from sunlight and wind by using solar panels and wind turbines. In recent years,

the use of renewable energy has been spreading, and 90% of the newly built power plants in 2020 were renewable energy plants [2]. But at the same time, the issue associated with replacing fossil-fuel energy with renewable energy has been gradually revealed. In 2018, California in the U.S. adopted a rule that requires most new houses to equip solar panels, and increased the use of renewable energy. However, in April 2018, too much electricity was generated by solar panels and exceeded the demand in the daytime. The oversupplied electricity cannot be stored for the nighttime and this incident resulted in the loss of 95 GWh of electricity, which can maintain 30 million homes for an hour [3]. As can be seen from this incident, renewable energy has a disadvantage of supplying an unstable amount of electricity because renewable energy relies heavily on the weather. This drawback prevents us from realizing the world that is powered fully by renewable energy and solving the energy problem and climate change.

Here I would like to introduce a technology that I believe has the potential to solve the drawback of renewable energy. It is wireless power transmission (WPT) using microwave [4]. WPT is one of the methods of sending electrical energy to distant points. Firstly, generated electricity is converted to microwave, which is a kind of electromagnetic radiation, and emitted from an antenna to the target point. When the microwave arrives at the antenna of the target point, the microwave is re-converted to the electrical energy. In this method, the two points need not be connected with power lines. In 2008, in Hawaii, WPT between two points 148 km apart was demonstrated, though transmitted power was as small as 20 W [5].

I believe this technology has a potential to solve the drawback of renewable energy: unstable generation of electricity due to the weather condition. WPT makes it easier to send electrical power to distant points. Therefore, I suppose that by connecting any areas around the world with WPT, it might be able to realize the network of electrical power. By using this network,

if too much electricity is generated by renewable resources, such as sunlight, the extra electricity can be sent to the areas, where electricity is lack at night. In this way, WPT can resolve the instability of renewable energy.

The use of WPT to spread the new types of renewable energy is also currently developing. In recent years, new kinds of power generation such as offshore wind power generation or ocean current power generation have been developed. These methods can use the strong, constant wind and ocean current and have an advantage of stable generation, but have a disadvantage of the much resource for the undersea cables to send the generated electricity to the land. Here, WPT can be applied. By just building antennas at the land and the ocean, the generated power at the ocean can be transmitted to the land. This convenience of WPT will prompt the spread of the offshore wind power generation and the ocean current power generation. Moreover, a dreamlike renewable energy generation with WPT is under development. It is the space-based solar power generation [6]. By expanding solar panels in the space, high-intensity sunlight compared to the ground can be used, and electricity can be generated all day long. In this system, WPT is considered to be one of the methods of sending the electrical power to the ground from the space.

WPT can contribute to the effective use of extra electricity produced by unstable renewable power and can contribute to the spread of the new types of renewable power generation. Although there are still many issues with the WPT, I believe that the development of the WPT realizes the world that is sustained by only clean renewable energy without fossil-fuel energy.

Reference

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