A Study on the Application of New Regeneration Energies to Buildings Associated with Smart Grids

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ABSTRACT

The paper presented a problem to establish the energy system for the building by using renewable energy reasonably.

In this paper, based on the consideration of the smart grid, scientific and technical problems were dealt with in applying power generated by using renewable energy to buildings in connection with the smart grid.

Besides, a new structural system was proposed for the application of the additional renewable energy building in connection with the smart grid.

1. Introduction

Here, we will examine the considerations for the application of the new renewable energy, one of the key elements of the intelligent power grid.

2. Definition and Components of Smart Grid

2-1. Definition of Intelligent Power Grid

Smart Grid is an intelligent power grid that optimizes energy efficiency by fusing ICT (Information and Communication Technology) to existing power grids.

E) A grid with prospects (laws, institutions, programs, etc.) to provide and promote opportunities for convergence and collaboration. The intelligent power grid is expected to revolutionize daily life by using energy to find the best rate of payment in the user's standing. For example, the washing machine in the house operates at the time of the hottest electricity bill, and the electric car can be recharged in the electricity bill during the daytime, which is the expensive fee period, by charging the wet fee at night.

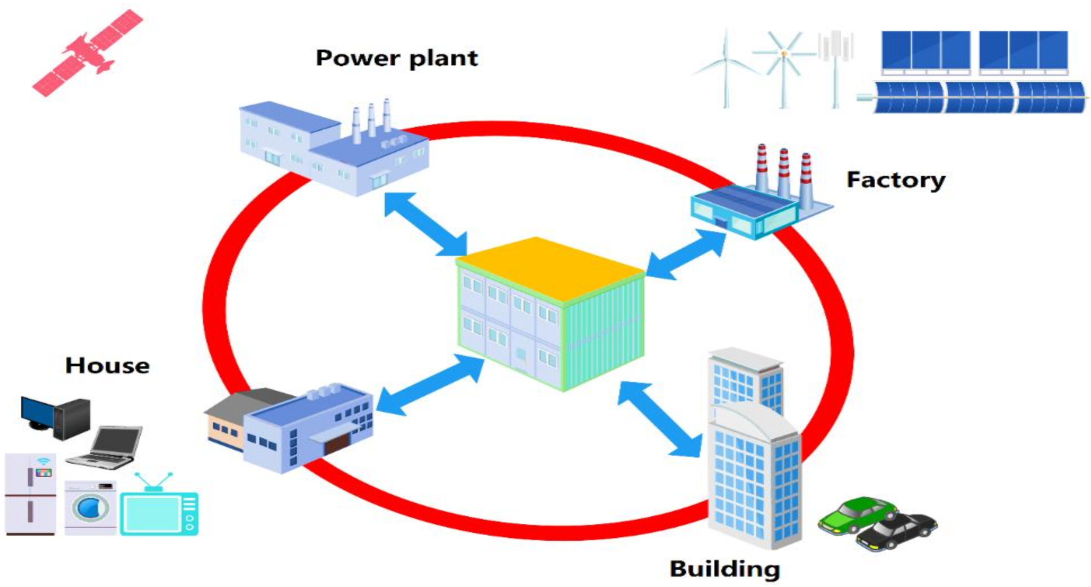

Figure 1. Smart Grid Concept Diagram

2-2. Characteristics of Intelligent Power Grid

The characteristics of the intelligent power grid are as follows.

First, the existing centralized power supply system will be replaced with a digital distribution system.

Second, the supplier-oriented one-way transmission and distribution network calculates two-way real-time power by the interaction of supply and demand.

Third, the electricity bill information, which is limitedly recorded once a month, is changed to a system that can view the information in real-time, so that users can use electricity during the period when the fee is low. By changing demand, there is no need to worry about the lack of reserve demand due to peak demand in summer or winter.

2-3. Components of the Smart Grid

The components of the smart grid are produced in the vicinity of the smart user and consumer who can be connected to the intelligent meter (AMI: Advanced Metering Infrastructure) and IHD (In-Home Display) in real-time. Intelligent new renewable energy that can be used directly from the market or resold to the power system, Smart Electricity Service that recharges distributed or power system power and sells it by reverse transmission, efficient and stable supply of power There is a smart power grid for electric vehicles, and electric transportation that can reduce environmental pollution and even serve as an electric storage device. To construct an intelligent power grid, self-diagnostic power grids and advanced communication networks, metering systems that can transmit and receive information through these grids and communication networks, and energy production and consumption that can be produced, consumed, and reverse-transmitted in individual households, rather than the existing power grid power supply, A storage system is needed

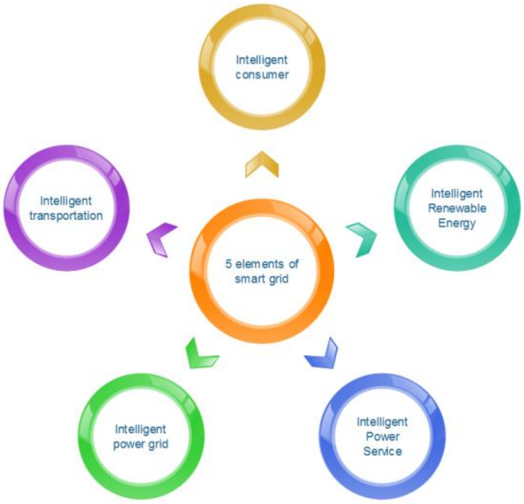

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Figure 2. Smart Grid component

3. Application of New Regeneration Energies to Buildings Associated with Smart Grids

3-1. Type of new regeneration energy

The new renewable energy is divided into new energy used to directly convert energy such as natural sun, water, wind and waves, and renewable energy used to convert existing fossil fuel into another type of energy. New energies include solar power, wind power, bioenergy, geothermal energy, tidal power, waste energy, and solar energy, and renewable energies include fuel cells, coal gasification, and hydrogen energy.

3-2. New Regeneration Energies

The new renewable energy is clean, unlimited energy that lowers CO2 emissions and enables the system to be installed anywhere. However, there are the following deficiencies in the distributed power system to use the new renewable energy as the basic infrastructure of the intelligent power grid. The development is discontinuous, making it difficult to predict and control the amount of development, and is directly affected by weather and features.

Besides, commercial power with large output frequency and voltage fluctuations is AC power. Since new renewable energy is DC power, advanced grid technology is required for reverse transmission to power through the grid system and power conversion.As a component of the intelligent power grid, distributed power supplies can be largely defined by two concepts

3-3. The Concept of distributing Power Supply in Intelligent Grid

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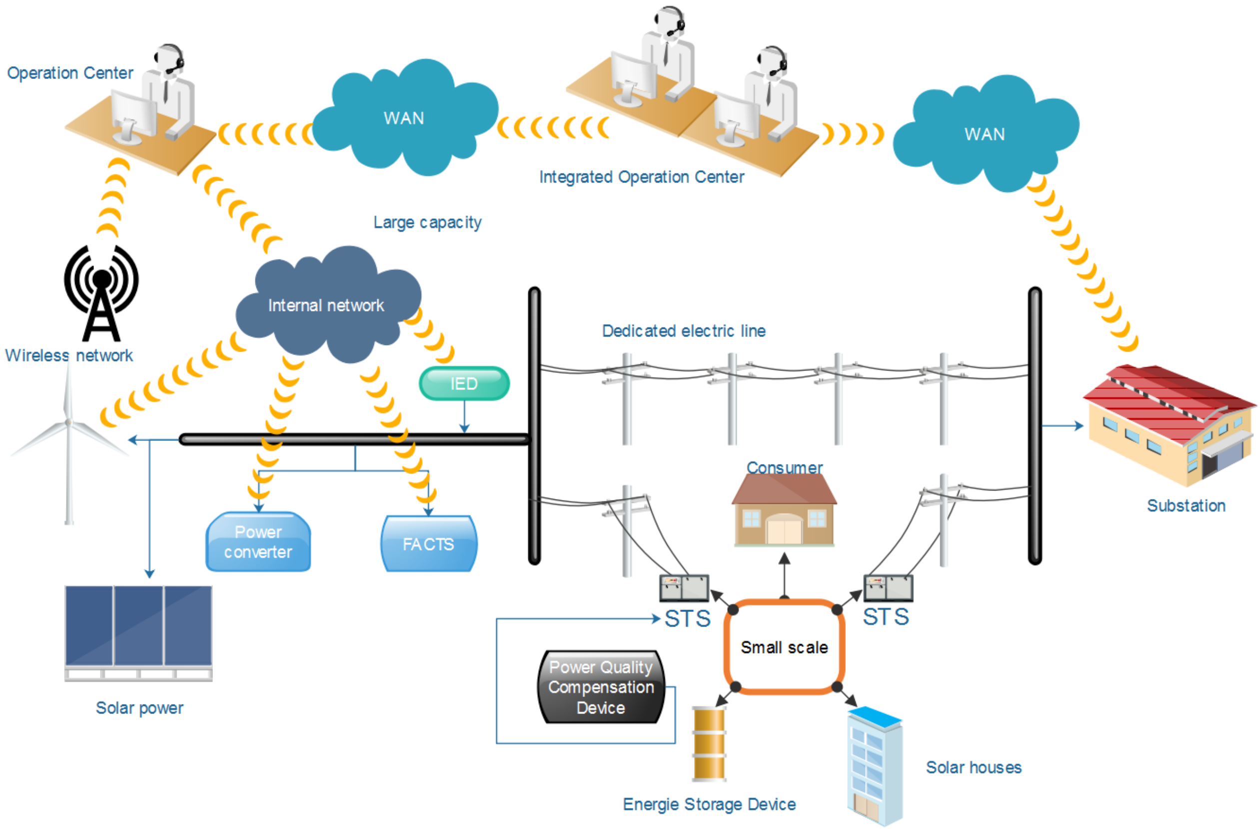

Figure 3. Centralized Renewable Energizer System

First, decentralized power is an energy form that is an energy supply source of the centralized power generation idea associated with the system, and can be composed of large-capacity power generation sources (such as wind power and sunlight) and energy storage system. Distributed power supply using new renewable energy is discontinuous development, but it is stored in the energy storage system that performs continuous progress until the breakdown of the generator and then supplies to the system in connection with the demand response signal of the intelligent power grid. Therefore, together with the above-mentioned system linkage technology, a wide area network (WAN) and integrated information management system are needed for the exchange of information on demand response and fee information communication data.

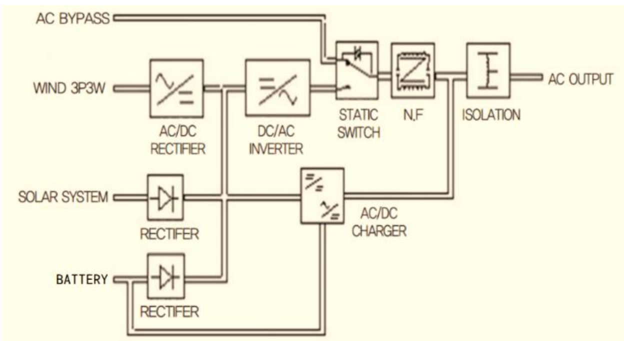

Figure 4. Hybrid Inverter Diagram for Smart Grid

Secondly, it is a system producing electricity near the consumer area and receiving electricity from the new renewable energy source first, and then back-transmitting it to the power system, mainly small wind power, building-integrated solar power generation (BIPV), and fuel cell system. This could be the target. Although the production volume is small, the use of a combination of many distributed energy sources and energy storage can reduce the peak demand of the consumer, which will save even more on electricity bills and continuously improve the efficiency of solar and wind power generation. If the energy efficiency of power generation is improved, the intelligent new renewable energy that Smart Grid pursues can be realized.

3-4. Building an application plan

In the concept of the smart grid, the new renewable energy can be applied in two forms, but we will look at the new renewable energy sources such as PV or BIPV, wind power, and fuel cells that can be applied to buildings. First, the solar power generation can be classified into a fixed PV module installed on the roof of a building and BIPV (Building Integrated Photovoltaic) applicable to the facade façade, the top ceiling, and the ceiling of the building. As it occupies a large area, it is applied to FACADE which plays the role of awning and PV module as shown in [Figure 5] in urban-centered buildings and high-rise buildings.

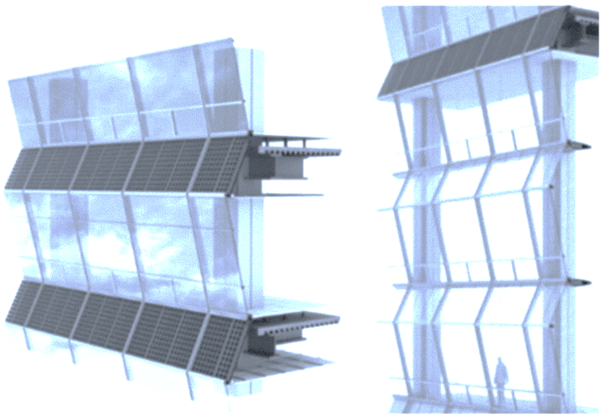

Figure 5. Application of FACADE BIPV in Building

Recently, a lot of investment has been made in the development of transparent window type BIPV considering the lighting and view, and the necessary conditions for the BIPV include installation angle, transmittance, wiring color and module color, module shape, Along with the design elements of size, the final finish should be examined for stability, workability, maintainability, waterproofing, windproof, windproof, and shockproof. Also, it must have a thermal insulation performance with a constant heat transmission rate. Considerations for installing BIPV include the influence of the sun's tilt and azimuth, shadows, and temperature. The angle of inclination and azimuth of the sun is determined based on the survey data on the solar insolation of the rounded structure as showed in [Figure 6].

In this case, heat dissipation design such as a vent pipe is required at the back of the module because it is inversely related to temperature and power generation efficiency. Secondly, urban center wind turbine system is mainly used for vertical wind turbines that are less influenced by the direction of the wind and have less noise, and use large-capacity Lithium-ion batteries to store electricity. Recently, a system that can turn on lighting without commercial power supply has been installed by applying integrated street light that combines solar light, wind power, LED light, and high-efficiency storage battery.

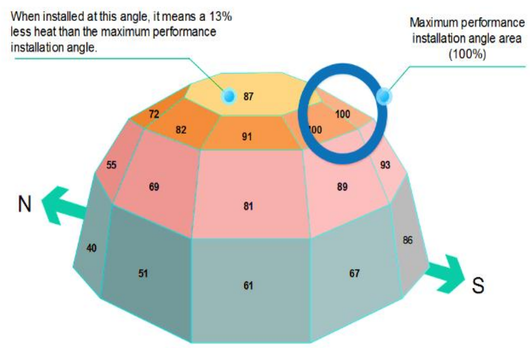

Figure 6. Monogram selection of installation angle according to the tilt and azimuth of the sun

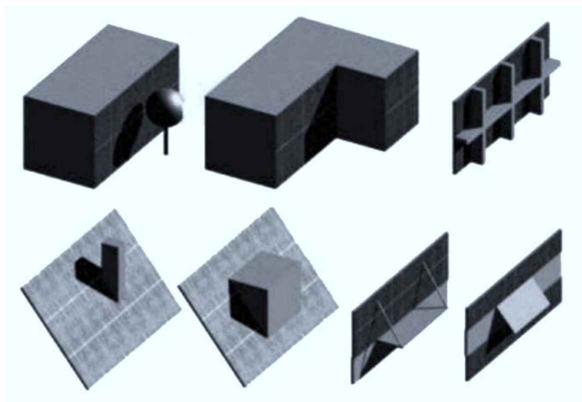

Figure 7. Types of shades to consider when selecting a BIPV

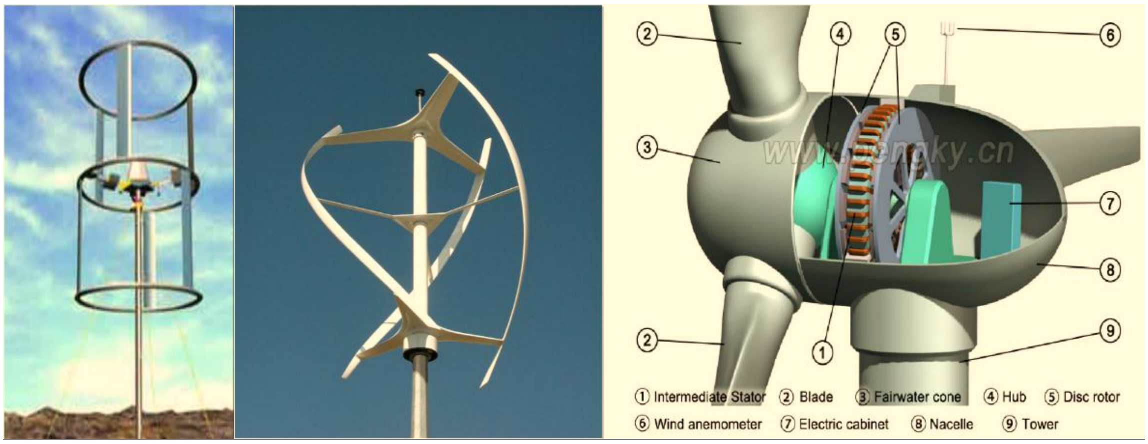

Figure 8, Wind Power Generation System

Consideration of wind condition, turbulence, Hall Effect, noise, and aesthetics should be taken into consideration when installing an urban wind power generator. The wind condition should be identified based on the average wind speed of the installation site, referring to weather data. B) Wind turbines should be avoided in areas with turbulence and hill effects on the side, and noise needs to be reviewed for the wind turbine's material so that the noise level is less than 50dB. Design should be selected. Third, the fuel cell is a system that generates electricity by reforming hydrogen from fuel such as natural gas or LNG and reacting with oxygen to directly convert chemical energy into electric energy, and heat generated during the chemical reaction between hydrogen and oxygen. It is a high-efficiency power generation system that can be utilized up to 80% in cogeneration. Also, unlike wind or solar power generation, it is very easy to predict and control power generation, so if the price competitiveness of the battery module is secured, it will be considered as a reliable distributed power source in the future. Finally, we can consider the premise's DC distribution associated with such a small distributed system. Since DC has a 100% power efficiency, it has a higher distribution efficiency than AC and has a higher absorbing shock voltage limit than the same voltage compared to AC. It is safe, and it has many advantages such as power distribution can be increased by the distribution of higher voltage than AC.

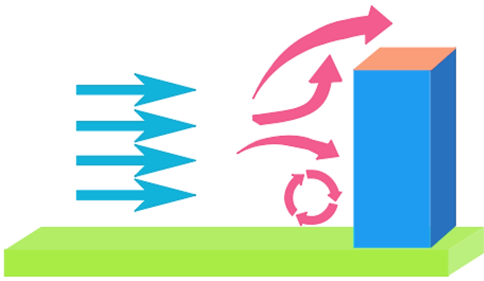

Figure 9. Wind influence of building

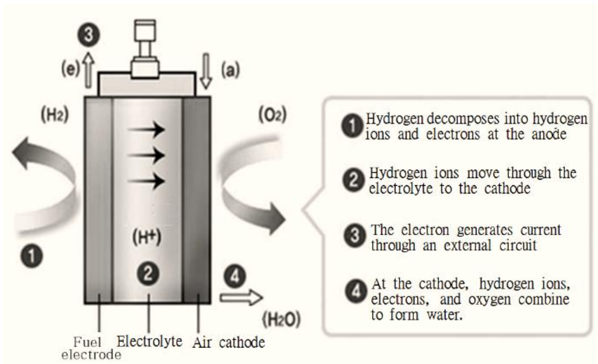

Figure 10. Principle of electricity generation of fuel cell

Currently, most distributed power sources such as sunlight and fuel cells produce direct current, minimizing losses due to cross-flow conversion, and increasing energy efficiency by supplying small DC home electrical appliance loads and LED lighting in homes. It can contribute to building a greenhouse.

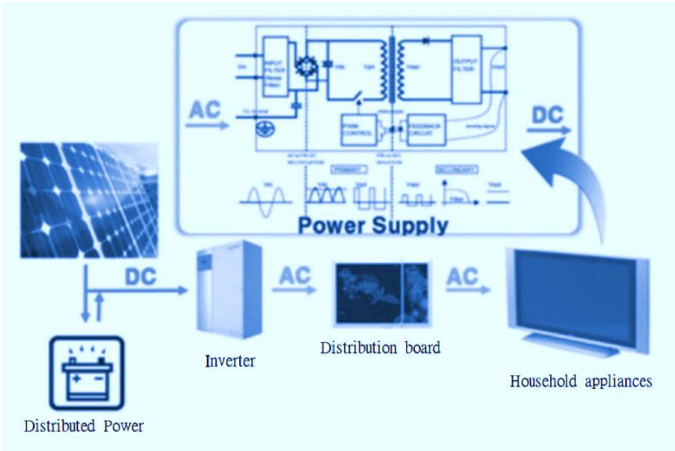

Figure 11. Configuration diagram of premises DC power distribution

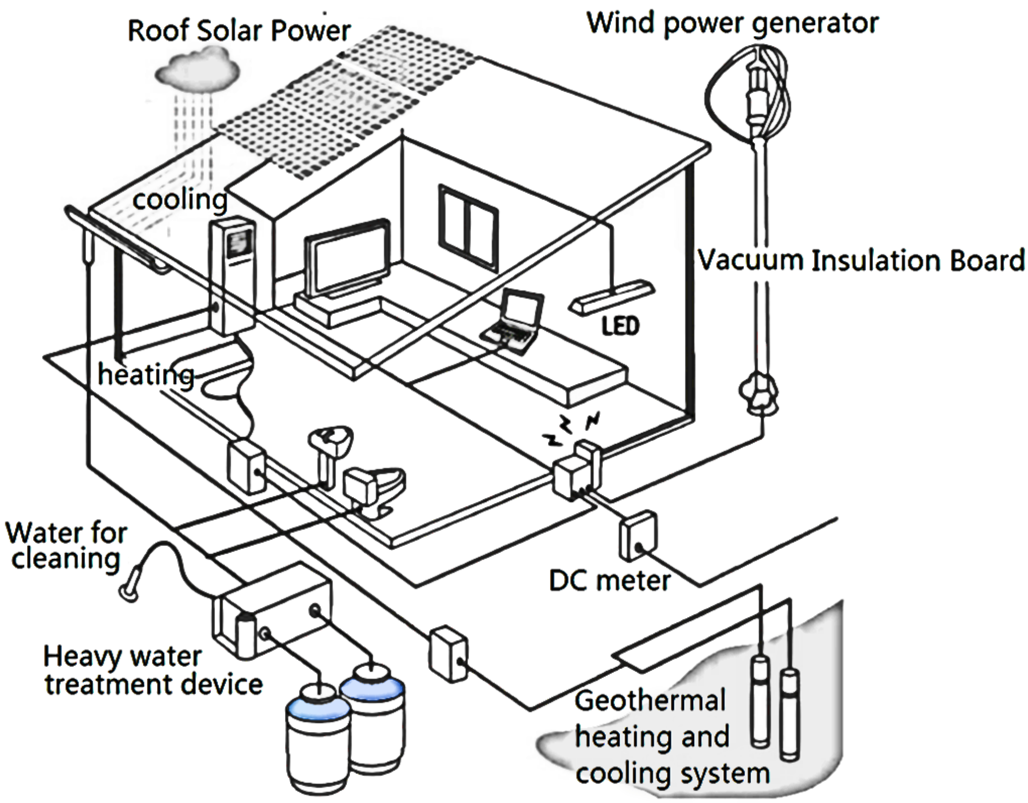

Figure 12. Green Home Implementation Using Renewable Energies and DC Power Distribution

4. Conclusion

In the paper, the concept of intelligent power grid and related application of new renewable energy is described. The intelligent nationwide power grid can be realized only if the efficient integration of distributed power supplies in each home is not compatible, as well as the organic integration of the power grid and communication network. Therefore, in the construction site for designing and constructing a building, it is necessary to first select a system suitable for the function of the building and to consider scalability and maintenance in the future. Besides, it is necessary to accurately consider the laws and investment policies related to the system considering economically of investment, new renewable energy supply, installation, etc., and select the best materials and construction methods by life cycle assessment (LCA) It should contribute to the low carbon green growth of the country.

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