Smart Energy Targeted by NTT Anode Energy

Shinya Date and Naoyuki Suzuki

Abstract

Established as a wholly owned subsidiary of NTT on June 3, 2019, NTT Anode Energy aims to contribute to solving social issues related to the environment and energy by leveraging NTT's technologies and assets. This article introduces the projects that are being undertaken at NTT Anode Energy.

Keywords: energy policy, power supply for telecommunication, renewable energy

1. Energy situation and policy in Japan

Japan has small reserves of fossil fuels, so its energy-self-sufficiency ratio* is low. Under an energy policy to reduce geopolitical risks such as high dependence on fuel imported from overseas, construction of nuclear-power plants, and introduction of renewable energies, such as hydroelectric-power generation and solar-power generation that use the rich natural environment, have been promoted. As a result, the energy-self-sufficiency ratio has increased, contributing to a stable energy supply. However, large-scale natural disasters are increasingly threatening stable supplies. Some examples of power outages are (i) the implementation of planned power outages in the Tokyo metropolitan area triggered by the accident at the Fukushima Daini Nuclear Power Station due to the aftermath of the Great East Japan Earthquake on March 11, 2011; (ii) a prefecture-wide power outage triggered by the Hokkaido Eastern Iburi Earthquake on September 6, 2018; and (iii) long-term power outages due to problems with power transmission and distribution networks caused by Typhoon No. 21 (Jebi), which struck Japan's Kansai region (southcentral region of the main island of Honshu) in September 2018, and Typhoons Nos. 15 and 19 (Faxai and Hagibis), which caused significant damage to the Boso Peninsula in Chiba (southeastern Honshu), in September and October 2019, respectively.

The Japanese government decided on the Fifth Energy Basic Plan on July 3, 2018 with the aim of reforming the energy supply-and-demand structure. Specifically, a policy was established called 3E+S, where "S" means *safety* (a prerequisite), and "3E" stands for stable *energy supply* (a top priority), secure energy supply at low cost by improving *economic efficiency*, and ensuring *environmental compatibility*.

Regarding the Paris Agreement, Japan declares that it will reduce its greenhouse-gas emissions by 26% by 2030 compared to 2013 levels. To achieve this goal, the basic policy is to carry out thorough energy saving and increase the ratio of zero-emission power sources such as renewable energy. In particular, renewable energy accounted for about 11% of the total amount of power generation in 2013, and the target for 2030 has been set to 44%, including nuclear-power generation.

In some cases, however, the introduction of solar-power generation or wind-power generation, which have high potential but are unstable means of power generation, is restricted due to constraints on the power grid system. In the worst case, if the electricity supply and demand are out of balance, large-scale power outages will occur, so it is necessary to always match supply and demand. To balance supply and demand, the amount of power generation is controlled according to fluctuations in demand. If this

* Energy-self-sufficiency ratio: The ratio of energy that can be secured within one's country to primary energies required for life and economic activity.

controllable capacity is exceeded, connection between the new power plant to the power grid system is limited, or it becomes necessary to suppress the output of solar power plants. This is a bottleneck to introducing a large amount of renewable energy and turning that energy into the main power source.

To solve this problem and promote the spread of renewable energy, it is necessary to adjust fluctuations in the supply-and-demand balance in combination with supply from storage batteries and achieve locally produced and locally consumed energy in a small area to strengthen the regional energy supply. This requires incorporating power from electric vehicles (EVs) and storage batteries into distributed energy systems, supplying the power to multiple facilities, and controlling energy consumption and consumption patterns with an energy management system. To satisfy these requirements, storage batteries that can charge and discharge electric power will become key.

2. The NTT Group's efforts thus far

From operating approximately 7300 telecom central offices nationwide, NTT has accumulated knowledge on a power-supply system for over 100 years with the purpose of continuously providing telecommunications services without interruption. Alternating current (AC) power received from power companies is converted to direct current (DC) power with rectifiers and supplied to communication equipment. These central offices are also equipped with storage batteries and emergency power generators as backup-power sources as well as mobile power-supply vehicles in case of long-term power outages or failure of emergency power generators.

DC power supply has the advantages of reliability and high efficiency. For an uninterruptible power supply (UPS) commonly used in datacenters, three-stage power conversion is normally required: (i) AC power is converted to DC, (ii) the DC power is converted to AC and supplied to information and communication technology (ICT) equipment, and (iii) AC is converted to DC again in the ICT equipment. In a DC power supply, one-step conversion is sufficient, and the failure rate of ICT equipment is reduced due to the small number of conversions, reliability of the power supply is increased approximately 10 times, and conversion loss is reduced by up to 20%. For these reasons, the telecommunications industry, which requires continuous power supply 24 hours a day, 365 days a year, has selected DC power supply as standard.

NTT's first initiative concerning renewable energy was the introduction of a 32-W solar-power generation system in Oronoshima, Fukuoka Prefecture in 1962 with the aim of enhancing disaster countermeasures involving public telephones. In 1989, Japan's then-largest (10 kW) solar-power generation system was installed in a public telephone box at Konpoku Pass in Hokkaido. Since then, to promote the use of natural energy, NTT has installed solar-power generation systems providing more than 5 MW of power centered on NTT Group office buildings and research laboratories. In addition, NTT FACILITIES is working on the construction of large-scale solar power plants. As of the end of 2017, the company owns 80 solar power plants providing 269,000 kW of power. Using its construction and operation expertise, NTT FACILITIES is engaged in the construction, maintenance, and operation of solar power plants providing approximately 880,000 KW of power at about 1400 locations nationwide.

In 1999, following the liberalization of the electricity market, Ennet was established as a retail electricity business through joint investment by Tokyo Gas, Osaka Gas, and NTT FACILITIES. For over 20 years, Ennet has been a leader among newly entered power producers and suppliers and is currently supplying electricity to approximately 90,000 customers. In 2011, NTT Smile Energy was established as a joint venture with OMRON and NTT WEST to sell remote-monitoring equipment ("eco-glasses") for solar-power generation systems and develop a small-scale renewable-energy power-generation business. It has gained a large market share in visualization services for solar-power generation.

3. Smart energy targeted by NTT Anode Energy

NTT Anode Energy is developing a smart energy business that complements existing power grids by leveraging the NTT Group's renewable energy and DC power supply technologies and expertise as well as using its ICT assets. It plans to provide backup-power supply, virtual power plants, green power generation, and power retailing businesses as well as data utilization services for these businesses. This will be enabled by ensuring power reserves using power storage and digital technology, making renewable energy the main power source, and building a distributed energy system integrating renewable energy, EVs, micro grids, etc.

To facilitate the development of the smart energy business, NTT Smile Energy and Ennet were respectively made subsidiary companies of NTT Anode Energy in September and October 2019. In the future, we will provide services using the B2B2X (business-to-business-to-X) model in collaboration with other partners.

Considering recent large-scale disasters and the growing worldwide need for backup-power supplies, we want to contribute to strengthening regional disaster resilience by providing backup-power-supply services. The number of long-term blackouts due to disasters of an unexpected scale is increasing. In line with this trend, it is becoming important—from the perspective of self-preservation—to own independent power sources (self-help) and help one another in the local community (co-help) rather than waiting for restoration of power supplies by power companies and government support (public assistance). During typhoons Nos. 15 (Faxai) and 19 (Hagibis) that struck Japan in 2019, for example, the solar-power generation systems installed at roadside charging stations supplied power to local facilities during power outages, and electricity was supplied to the local evacuation shelters by using EVs.

In the future, we plan to make proposals for installing solar-power generation systems, storage batteries, and EVs as distributed energy sources in, for example, evacuation shelters of local governments. We aim to provide a system to control these distributed energy sources across areas and deliver limited energy to the appropriate places in the event of emergencies. We also plan to use the technologies of Cognitive Foundation® and Digital Twin Computing to create a mechanism for precisely controlling energy and supporting power supplies during emergencies.

Current electric devices generally use AC power, but personal computers, smartphones, and other devices support USB (universal serial bus) and use DC power internally, and such devices are becoming widespread. Solar-power generation systems and storage batteries also use DC power. Accordingly, we will study services that use DC power that effectively use the affinity between devices.

Shinya Date

Vice President, Business Planning, Planning Division, Smart Energy Business Department, NTT Anode Energy Corporation.

He joined NTT WEST in 2000 and developed virtual private network services and planned the transportation layer for the grand design of next-generation optical networks. He is currently responsible for managing a smart-energy infrastructure project.

Naoyuki Suzuki

Senior Manager, Planning Division, Smart Energy Business Department, NTT Anode Energy Corporation.

He joined NTT FACILITIES in 2003 and planned the maintenance of electric power facilities and energy conservation measures. He is currently responsible for managing a smart-energy infrastructure project.