Power Source-Related Technologies Offering Value in New Fields

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1. Introduction

The Paris Agreement was adopted at COP21 in 2015 as a groundbreaking initiative seeking efforts to reduce greenhouse gases by all major greenhouse gas-producing nations including the U.S. and China, and to establish their own targets, and conduct mutual reviews on a global level.

Japan established the target of reducing greenhouse gas emissions by the year 2030 by 26% compared to the 2013 level. This was verified to be an extremely high target from the global comparison indicator of cost required for such reduction by individual countries announced afterwards.

Meanwhile, following the Great East Japan Earthquake, Japan's energy self-sufficiency rate fell from 20% to 6%, its dependence on fossil fuels climbed from 62% to 88% and electricity prices rose by around 20% for households and around 30% for industrial. The increasing cost of energy procurement is a major issue impacting the ability of the manufacturing industry to maintain its competitiveness. To advance energy conservation while raising the economic growth rate, we must engage in fresh initiatives for overall energy management using AI, IoT (Internet of Things), and related new services and products as well as developing technological innovations for next-generation power semiconductors, hydrogen utilization, and storage batteries. SANYO DENKI must promote product development with these new fields in mind.

This article introduces initiatives by the Power Systems Division relating to UPS and renewable energy products that can offer value in new fields.

2. Development of *SANUPS N11B-Li*: Power Supply Technology for Fields Seeking Environmental Durability

Until recently, small-capacity UPSs (uninterruptible power supply) with an output capacity of 5 kVA or less were primarily used in indoor equipment such as backup for servers and ICT devices or for embedding in industrial devices. In recent years, due to the recent spread of mobile devices and lessons learned from natural disasters, use as backup power for outdoor equipment has emerged as a new field for small-capacity UPSs, such as cellular base stations, parking meters, outdoor surveillance cameras, traffic lights, and emergency equipment.

UPSs used for these outdoor equipment must have a wider operating temperature range due to environmental requirements. Moreover, since regular inspections and replacement cannot be easily carried out for UPSs of this use, UPSs for outdoor use must be maintenance-free. Furthermore, social infrastructure equipment such as traffic lights and equipment used during disasters such as emergency wireless systems are required to have longer power failure backup time due to lessons learned from previous natural disasters.

Also, because UPSs used outdoor often have only limited installation space available, they must be compact as well as provide prolonged backup. Conventional lead-acid batteries can provide a relatively short backup time per battery volume and mass, so a large installation space is necessary to achieve prolonged backup. Moreover, deterioration of lead-acid batteries is severe at high and low temperatures, therefore the battery must be replaced after only short periods of outdoor use.

To solve these issues, we developed the *SANUPS N11B-Li* series that uses a Li-ion battery (hereinafter "LIB") with superior energy density and service life. This UPS also has a power conversion unit that generates minimal heat, and a housing for outdoor use.

Compared to conventional lead-acid batteries, LIB offers the benefits of prolonged backup in smaller installation space and eliminated battery replacement reduces maintenance work. Moreover, by creatively mounting UPS components, improving the performance of its cooling system, and by adopting LIB with high temperature resistance, the *SANUPS N11B-Li* series has achieved a wide

operating range between -20 and +50°C. Also, thanks to its stainless steel IP65 housing, it can be used outdoors even in harsh environments.

As a power backup technology, the *SANUPS N11B-Li* series is anticipated to be used in high-growth sectors such as outdoor ICT equipment, traffic lights, and disaster-prevention equipment.

Fig. 1: *SANUPS N11B-Li*

3. Development of *SANUPS P73L*: Power Supply Technology for Fields which Effectively Utilize Renewable Energy

Power storage systems are anticipated to contribute to the realization of a low-carbon society and are a core technology of the smart grid. In recent years, competition has intensified due to market participation by Chinese and Korean manufacturers and venture companies mainly from the U.S., leading to a wide-range of storage battery types and applications. Also, the importance of storage batteries is growing in terms of both industry and everyday living. Amidst this, LIB is gathering a lot of attention for achieving high energy density and long service life, as well as being small and light compared with conventional lead-acid batteries.

Moreover, there is an increasing demand from local governments and private businesses considering installing backup power sources in preparation of prolonged power outages during disasters. Of the available systems, power generation systems combining PV panels and LIB are attracting interest due to their numerous advantages, such as the ability to generate renewable energy at point of use, act as an independent power source during disasters, and minimize power consumption during peak times.

By incorporating an LIB, SANYO DENKI responded to these market needs with the development of the *SANUPS P73L* PV inverter. Below is an overview of the product and its features.

The *SANUPS P73L* comprises of a 10 kW PV inverter unit, 10 kW charging unit, and I/O box. It is scalable up to six 10 kW PV inverters.

This product comes in the "grid-connected isolated charging type" and "grid-connected isolated type," with output capacities ranging from 10 to 60 kW. This section will describe the "grid-connected isolated charging type" as a model that can be used as a storage battery system.

This model features a peak cut function wherein the power from the PV panels and storage batteries can be supplied to a general load. Also, it can supply AC power to a specific load even during power outages through isolated operation. Moreover, during isolated operation, the storage battery can absorb the power difference between the electricity supplied to the load and the power generated by the PV panel while the inverter unit performing tracking control to maximize the output of PV generation for effectively utilizing the PV-generated power.

In addition to these functions, the *SANUPS P73L* has achieved parallelization of isolated output, batch PV panel input, and automatic switchover to isolated operation, and can therefore be proposed as a flexible system to meet customer needs.

We expect that the technologies evolved during the development of *SANUPS P73L* will contribute to the effective utilization of renewable energy.

Fig. 2: *SANUPS P73L*

4. Development of Generation System Status Monitoring Service *SANUPS NET*: Information Transmission Technology for the IoT Field

In recent years, there has been an extremely high level of interest in IoT, or Internet of Things. SANYO DENKI's power management products adopted network communication technology over twenty years ago and have offered technologies to manage and monitor via a network. With the expanded utilization of networks, we have constantly continued to develop new communication methods and accumulated network communication technologies that serve as the foundation of IoT.

We have offered power monitoring products for use with backup products such as UPS, but they primarily assumed use in in-house LANs. The monitoring of these products aimed at power supply devices within the same in-house LAN.

Meanwhile, PV systems are installed outdoors, therefore many cases exist in which installation of a dedicated line as part of an in-house LAN is difficult. However, it has been demanded from generation system operators, who introduce PV systems for selling electricity, to centrally manage the data from multiple systems and monitor the operating status of PV systems from remote locations.

In order to satisfy this kind of demand, SANYO DENKI developed *SANUPS NET* as a PV system status monitoring service.

Figure 3 shows an example of system configuration for this service.

This service collects information on the PV inverter by using the *SANUPS PV Monitor* (hereinafter "PV Monitor"). The collected information is transmitted to an online cloud server, then customers can check this information using a smartphone or other Internet-connected devices, thus enabling remote monitoring of the PV system's status.

The cloud server uses SMTP, a standard email transmission protocol, to request various information from the PV Monitor (① in Fig. 3).

The PV Monitor uses POP3 protocol to verify request emails from the cloud server (② in Fig. 3) and, if there are any requests, uses SMTP to send the requested data to the cloud server (③ in Fig. 3).

The cloud server uses POP3 protocol to check if any emails containing information have been received from the PV Monitor and, if any, saves the information contained (④ in Fig. 3).

This communication method is secure as all the information transmission within the customer's network environment is conducted with the PV Monitor as the base point, meaning there is no direct access to the customer's network from outside. Moreover, security is assured also in that spam is blocked through SMTP authentication when sending emails.

By using this service, customers can safely monitor the power generation status and operating status of a PV system via a web browser from a remote location with a computer or smartphone as long as there is an Internet connection without the need to install any special software.

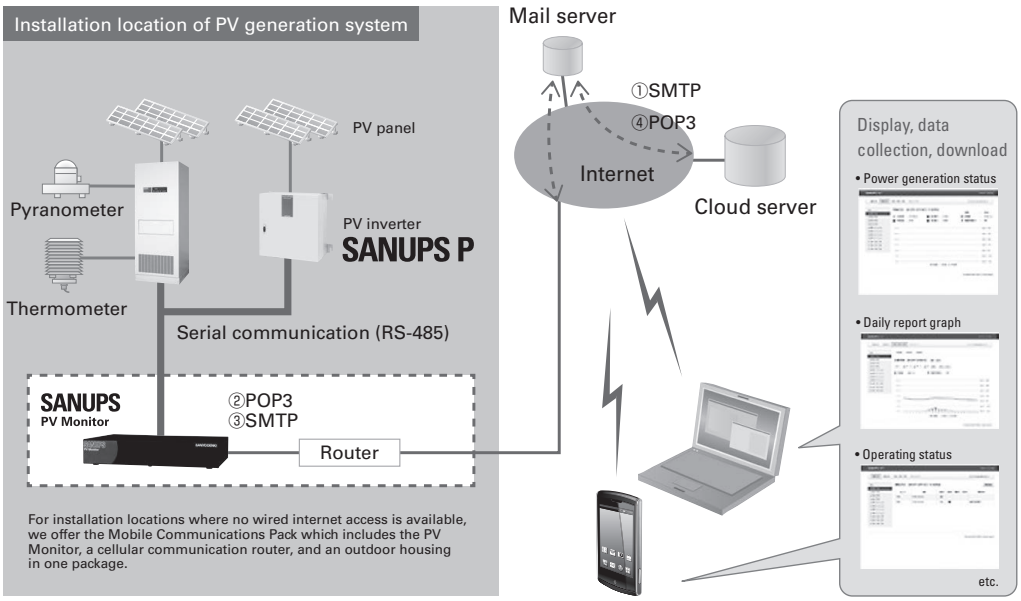

Fig. 3: System configuration

SANYO DENKI wishes to broaden the applicable scope of this service so that it can monitor not only PV systems, but all kinds of systems and provide a technology for the utilization of products for IoT.

5. Conclusion

This article has introduced the initiatives of the Power Systems Division which offer value in new fields of the power supply market.

SANYO DENKI will continue to seize upon new opportunities born from future market changes and exert every effort in developing technologies that offer new value.

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