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Hitachi, Iwamizawa City, and Iseki launch proof-of-concept test of local production and consumption of energy from battery cycling

Hitachi develops movable battery capable of supplying renewable energy to dispersed agricultural locations and technology for optimizing charge-discharge plans

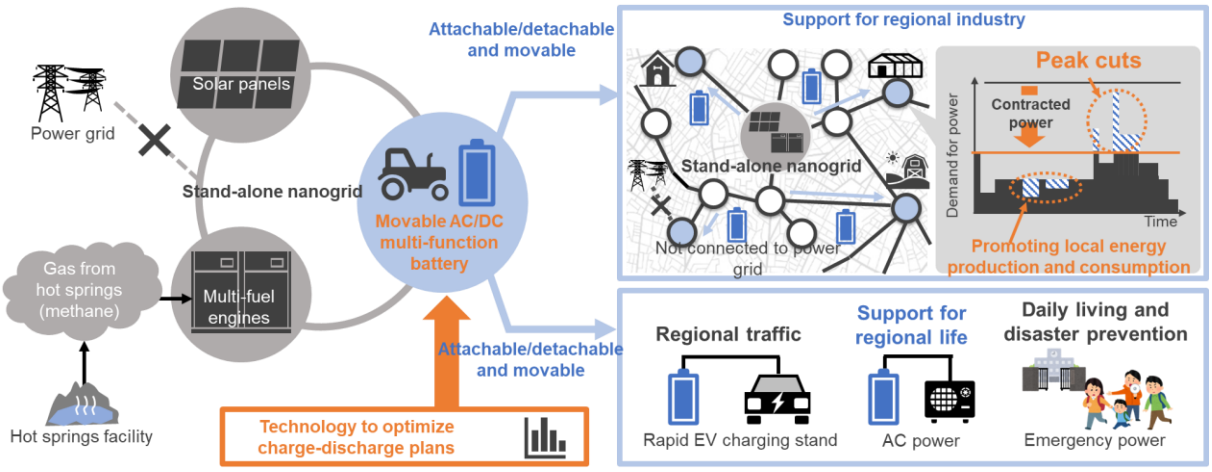

Figure 1 Regional use of locally produced and consumed energy from movable AC/DC multi-function batteries

Tokyo, January 25, 2024 – Hitachi Ltd. (TSE: 6501; hereafter "Hitachi") and the City of Iwamizawa in Hokkaido (hereafter "Iwamizawa City") have launched a test, with Iseki & Co., Ltd. (hereafter "Iseki"), to prove the concept of the local production and consumption of renewable energy utilizing battery cycling, with a view to contributing to regional industries that are both environmentally and economically sustainable.

The test will support life in the regions by providing renewable energy from a stand-alone nanogrid[*1] to support regional industries not connected to Iwamizawa City's distributed power grid and to supply temporary EV fast-charge stations and other infrastructure. Movable AC[*2]/DC[*3] multi-function batteries developed by Hitachi will be installed in electrical farming equipment provided by Iseki, enabling use of the energy in agriculture during the agricultural busy season, and - by detaching or attaching batteries - in the nanogrid and electrical equipment during the agricultural off-season. The test will use Hitachi's technology for optimizing charge-discharge plans to improve operational efficiency and will address local production and consumption of energy.

Hitachi and Iwamizawa City will use the city as a demonstration site to encourage introduction of the technology to regions where there is increasingly large-scale management of primary industry and also promote electrification of work vehicles, thereby contributing to reducing the effects of soaring fuel and to decarbonization of regional industries.

*1 Stand-alone nanogrid: A small-scale power grid that enables local production and consumption of energy by having one's own energy source using solar power, or gas associated with hot springs.
*2 AC (alternating current): Current and voltage change periodically when electricity flows. Applies in products that are plugged in to an outlet for use.
*3 DC (direct current): Current and voltage are always consistent when electricity flows. Applies in products that use batteries.

Backdrop to technology development

The soaring price of fuel and other factors have made an issue of securing energy needed for

production activity in regional industries. The transition to a decarbonized society is happening at a faster pace, and there are ever higher hopes for local production and consumption of renewable energy from solar and wind power generation and for electrification of work vehicles. Hitachi installed a stand-alone nanogrid[*4] in a facility in the Kitamura Akagawa Mine in 2021 in a co-creation project between the Hitachi Hokkaido University Laboratory, Hokkaido University, and Iwamizawa City, and with cooperation from local companies and farmers, has been progressing proof-of-concept testing[*5] of a system for local energy production and consumption that uses solar power and gas from hot springs as fuel. A need emerged from the initiative for a mechanism for supplying necessary energy at low cost from the stand-alone nanogrid to widely dispersed worksites in the city.

The proof-of-concept test involves installing movable AC/DC multi-function batteries developed by Hitachi into electrical farming equipment provided by Iseki, and using technology for optimizing charge-discharge plans to provide charged batteries at the appropriate time to appropriate worksites. The test will investigate the effective use of batteries over the course of a year.

In advance of the proof-of-concept test, the Hitachi Hokkaido University Laboratory linked with Hokkaido University, and based on information obtained from agricultural workers in Iwamizawa City, modelled use of movable batteries connected to the stand-alone nanogrid, and plans for optimizing charge and discharge. This enabled forecasting of optimum number of batteries, reductions in contracted power through control of peak power use during the agricultural busy season, and use of excess power at agricultural locations entering a different agricultural busy season.

While contributing through the testing to sustainable development in Iwamizawa City's industries, Hitachi will roll the technology out to other regions, and by contributing to building regional capability using locally produced and consumed energy, will work towards realization of a sustainable society in which there is both low carbon and economic viability.

*4 Development of a regional stand-alone energy system enabling local production and consumption to both low-carbon local industry and strengthen disaster prevention functions, Hitachi (hitachi.co.jp)
A portion of the results of development relating to the stand-alone nanogrid at the Iwamizawa City demonstration site was obtained from a feasibility study for a Ministry of Economy, Trade and Industry's University-Society Open Innovation Initiative, *Challenge Field Hokkaido*.

*5 Macnica, Inc. and Iwamizawa City, Hokkaido Conduct Public Road Demonstration Test of Self-autonomous driving EV Bus-smart cities/mobility, Macnica (macnica.co.jp)

Supplementary information: Features of the technology

1. Attachable-detachable movable AC/DC multi-function batteries installed in electrical farming equipment

Industrial EVs are fitted with motors and inverters for both driving and working, which are driven by energy supplied by a battery, but the batteries first need to be charged from land-side chargers (such as DC-DC converters). A prototype movable AC/DC multi-function battery has been developed which makes full use of the inverters installed in a piece of electrical farming equipment (Fig. 2). It is possible to drive the electrical farming equipment's AC driving and working motors by rapidly charging the battery with DC current obtained directly from solar panels. In addition, because the charge-discharge part of the battery installed in the electrical farming equipment is safely attached or detached with a CHAdeMO[*6] plug, it can also be used as a self-propelled, movable, multi-function, commercial AC power source for supplying power to home appliances, etc. That also enables power to be supplied to align with temporary power demand at times of peak power at agricultural locations, or in regions that are not connected to the power grid, or in regions that are connected, but where the amount of power available for use is limited by power contracts.

*6 CHAdeMO: The name of a rapid charging method

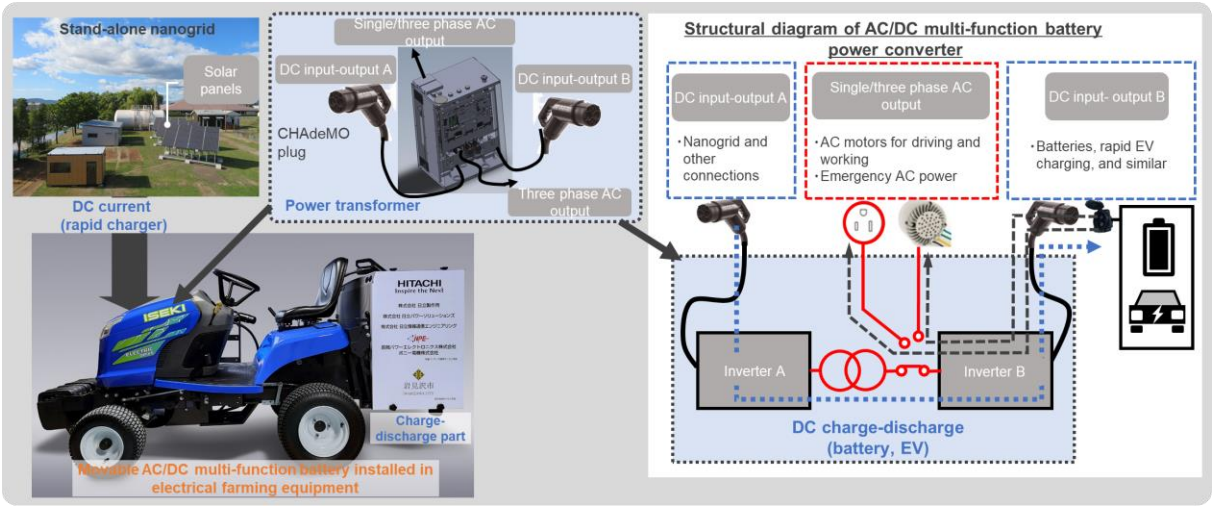

Figure 2 Movable AC/DC multi-function batteries installed in electrical farming equipment, capable of supplying energy to the regions

2. Technology to optimize battery charge-discharge plans for power demand from dispersed agricultural locations

Hitachi developed optimization technology for operating movable AC/DC multi-function batteries in the regions and configured a simulated environment (Fig. 3). Data collected in the environment includes battery capacity and number of transport vehicles, facilities information, such as the generation capacity of the stand-alone nanogrid, power demand data from dispersed agricultural locations, and information about the uncertainty of generated power capacity based on amount of sunlight. The data is used to provide charge-discharge plans for multiple batteries to maximize the power supply success rate appropriate to peak power cuts[*7] at agricultural locations, and cost reduction effects. The plans enable formulation of plans for investment in batteries that will achieve operational cost reductions, and optimal battery operation plans which address routes for battery transport to dispersed agricultural locations, time of battery supply to align with excess power use and peak power cuts at agricultural locations, and timing of battery charging at the stand-alone nanogrid.

*7 Peak power cut: Reducing power used at peak power usage times. Leads to reduction in basic electricity tariffs.

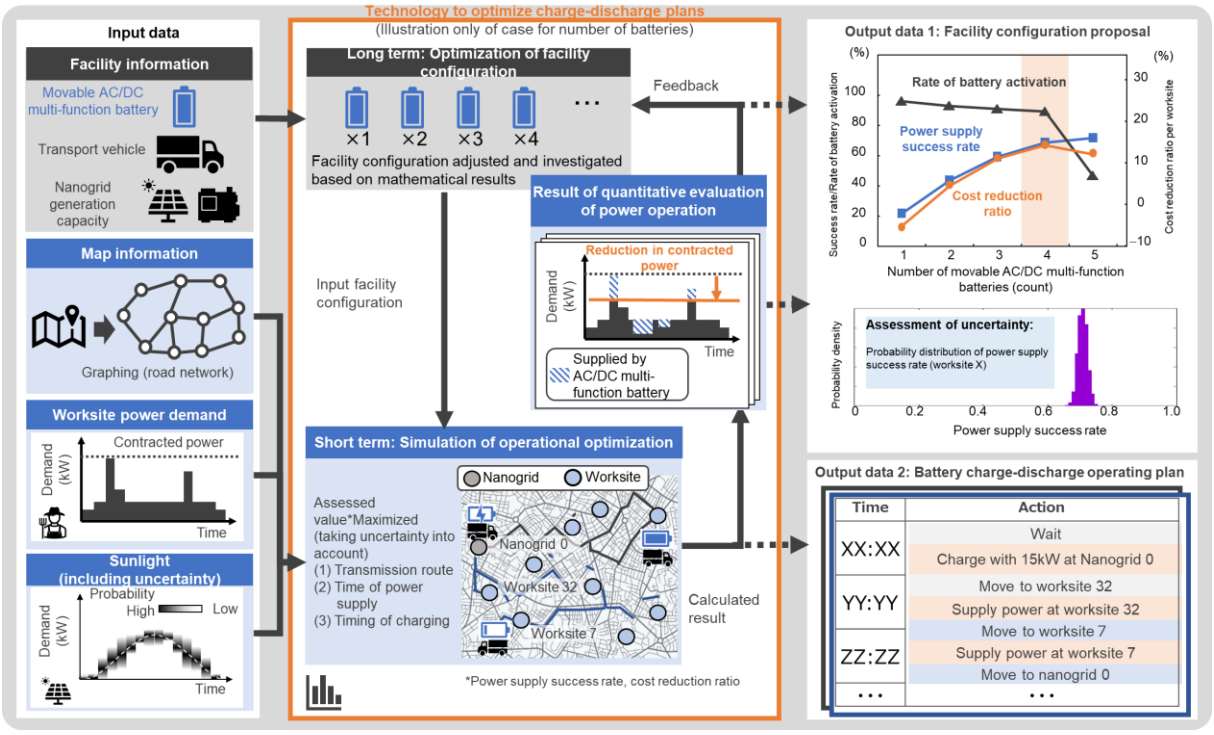

Figure 3 Modelling of battery charge-discharge plan optimization and sample output data

About Hitachi, Ltd.

Hitachi drives Social Innovation Business, creating a sustainable society through the use of data and technology. We solve customers' and society's challenges with Lumada solutions leveraging IT, OT (Operational Technology) and products. Hitachi operates under the business structure of “Digital Systems & Services” - supporting our customers’ digital transformation; “Green Energy & Mobility” - contributing to a decarbonized society through energy and railway systems, and “Connective Industries” - connecting products through digital technology to provide solutions in various industries. Driven by Digital, Green, and Innovation, we aim for growth through co-creation with our customers. The company’s consolidated revenues for fiscal year 2022 (ended March 31, 2023) totaled 10,881.1 billion yen, with 696 consolidated subsidiaries and approximately 320,000 employees worldwide. For more information on Hitachi, please visit the company's website at https://www.hitachi.com.

About ISEKI CO., LTD.

Iseki & Co Ltd, as a solution provider for "Agriculture and Landscape," has continued to provide high quality products and services of agricultural and landscape maintenance machinery, and developed such essential businesses in Japan, Europe, North America, and Asia.
Through our business, we will create new value by promoting initiatives related to "Supporting the enhancement of resilience in agriculture", "Landscaping for comfortable villages and towns" and "Environmental preservation for a recycling-oriented society."

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