

Seeking Optimum Solutions to the Challenges Facing Stable Power Supply Hitachi's Collaborative Creation with Customers-based Work on Energy Solutions to Boost Business in North America

The North American energy market is growing steadily amid a rapid switch to renewables. 2016 saw the establishment of the Energy Solutions Division (ESD), a new Hitachi business unit designed to grow our energy business in North America. We have started a full-scale move into the North American energy market that will draw on the experience and expertise we have accumulated from several overseas demonstration projects and our work in Japan. We want to provide the region's power transmission grid and local distribution grids with advanced energy solutions tailored to local needs.

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Market Scale and Advanced Technologies Direct Focus to North American Market

What made you choose North America as the starting point for your entry into the global energy markets?

Seiji Hitachi's work in the energy sector has so far focused on the domestic market, encompassing areas such as power transmission/transformation, substation and grid systems, consumer management services, and constructing and operating systems designed to take advantage of the full liberalization of Japan's retail electricity market that took place in 2016. This work has enabled us to acquire technology and knowledge that we

have been using to provide energy solutions. Our global activities have consisted of providing the technology development and business model corroboration needed for several demonstration projects, such as a smart grid demonstration project in Hawaii. We are now working on expanding into global energy markets by drawing on the technology and expertise we have acquired from our role in these demonstration projects. We chose North America as the starting point for the large size of its market, the advanced liberalization, and the big changes of markets and technologies it involves, which we felt could benefit us in various ways.

Morita The Global Center for Social Innovation (CSI) is Hitachi's front-line organization for co-developing solutions with customers. With the reorganization of the R&D Group in 2015, CSI became the North American base, coordinating activities primarily from its Santa Clara office. Considerations such as energy safety assurance restrictions and corporate privacy have really made it important to be located close to customers when working on R&D projects with them.

Aram Hitachi established the Energy Solutions Division (ESD) in June 2016 to grow its energy business in North America. Hitachi Energy Solutions business development efforts in North America have been mainly reactionary or opportunistic in the past. The establishment of ESD with local expertise and customer relationship has provided an organization which can



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directly act as a fronting unit and build local references and track records. There are currently two very significant trends taking place in the US—a shift to distributed energy, and the development and use of advanced IT and digital operation technologies. We want to capture major business opportunities here by playing a leading role in these trends.

Microgrids Provide an Entry Point for Utility Solutions

What are you working on specifically?

Seiji Our three main work areas are microgrids, grid stabilization systems and storage battery systems. Demanding national security requirements are imposed on SIPSs for the transmission grid, making it difficult to take part in them all at once. But we're doing well in the area of microgrids, receiving orders for microgrid feasibility studies in New York and other states. So we're going to start by using microgrids as a foothold for getting actual orders.

Aram The U.S. Grid is very vulnerable. Policies have led to significant infrastructure under investment. When combined with increased severity of weather events and cyber and physical attacks, vulnerability to prolonged power outages has increased significantly. Customers, utilities and policy makers are looking at microgrids as one way to provide greater energy resilience. The market is early though and microgrids are complex technically, and from a business model standpoint. We are focused on streamlining the evaluation, design, project execution, financing, operations and maintenance to make it easier for customers to choose and deploy a microgrid. The vendors that truly enable a 'one stop shop' experience will capture significant early market share.

Morita Local distribution microgrids are important



Image of microgrid solution

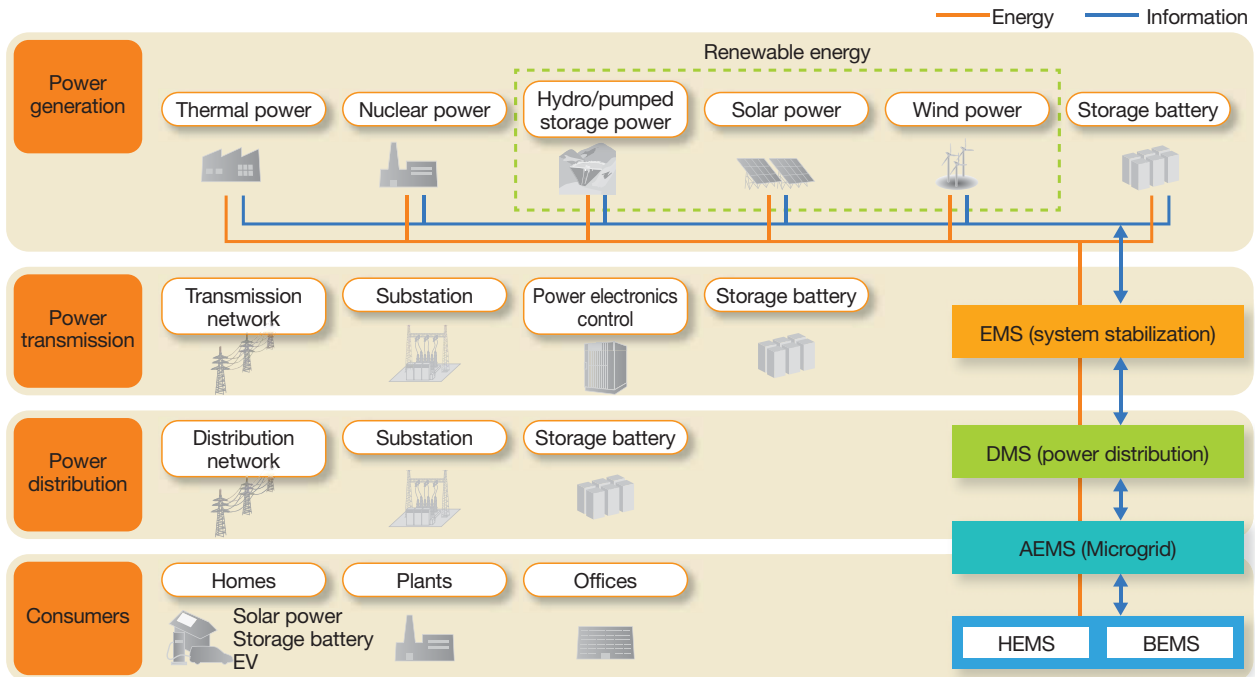
for ensuring stable power supply and operation, but transmission grid approaches are also crucial. Our work on the transmission grid includes developing an online remedial action scheme (RAS). It's an online protection/control system for ensuring grid stability. We are also working on using phasor measurement units (PMUs) with the transmission grid. (A PMU is like a stethoscope for grids.) Since the Northeast blackout of 2003, grid stability has become an area of major concern in the US. The grid protection systems currently in use are offline RAS systems, but we're assuming demand for online systems enabling real-time control when operators need to respond immediately to output variation and other dynamic changes in power sources. We already have a domestic track record in this area, and are looking to expand into global markets through collaborative creation activities with the overseas power companies.

Reimporting Successes from North America Back to Japan

Finally, what are your plans for the future?

Aram Microgrids are just one of many opportunities

Energy solution provided by Hitachi



EV: electric vehicle, EMS: energy management system, DMS: distribution management system, AEMS: area energy management system, HEMS: home energy management system, BEMS: building energy management system

emerging as the market transitions to a more distributed, digital system. ESD plans to further strengthen its portfolio and provide solutions tailored to market needs. We will continue to work with our customers to develop solutions that would help solve the challenges they are facing.

We want to expand our range of energy solutions offerings to include grid stabilization technology, energy storage systems, demand response programs and virtual power plants.

We will provide solutions that would help to resolve issues caused by increased penetration of distributed energy resources in the grid, and are working very closely with various teams in Hitachi. An example of this is the collaboration with Lumada team to provide an Energy IoT platform supporting our multiple business models mentioned before. The Lumada team is primarily responsible for the IT side of the solutions. The ESD team acts as system integrator and is primarily responsible for the OT aspects of the systems and any "custom" software module needs for the IT system, such as OT configuration, data filtering, and optimization algorithms.

Morita To create a new value through microgrid related R&D, we want to create more opportunities for

talking directly to operators to identify genuine issues that even customers haven't noticed. CSI North America wants to use the Lumada internet of things (IoT) platform to create an energy-IoT environment. Edge computing will be applied to distributed energy resources such as wind power, and remote machine learning used to predict power generation output. We're going to augment this set of core solutions, using them to drive business growth. We plan to work on various endeavors as a member of a unified global team.

Seiji Power system reform is moving ahead in Japan. The full liberalization of Japan's power industry started in 2016, and the power transmission and distribution sectors will be separated in 2020. With the creation of real-time markets providing a 'negawatt' transaction environment acting as a coordinating force, Japan is probably going to end up having the same type of environment as the US, which is a world leader in power industry liberalization. As we do business in North America, we want to reimport the successes and expertise we acquire there back to Japan to provide system solutions tailored to Japan's unique rules and environment, and to demands for stabilization arising from the use of renewables on a mass scale.