Omika Green Network: Co-creation of Decarbonization with Growth from a Regional Perspective

Amid accelerating moves toward decarbonization around the world, companies and industries are faced with the difficult societal challenge of achieving carbon neutrality not only within companies, but also across entire communities and supply chains. To address this challenge, Hitachi Ltd.'s Omika Works has established the Omika Green Network for achieving carbon neutrality, putting the technologies and knowledge gained from GX initiatives at the site to work in local communities and companies in the supply chain while also building a social infrastructure ecosystem made up of many other stakeholders who face similar challenges. This article describes the concepts behind the Omika Green Network and how they are being implemented in practice.

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1. Introduction

Hitachi is pursuing "Hitachi Environmental Innovation 2050," a set of long-term environmental targets that it has adopted to achieve a "decarbonized society," "resource-efficient society," and "harmonized society with nature"[(1)]. For decarbonization, it has announced goals of achieving carbon neutrality at its workplaces (factories and offices) by FY2030 and throughout its entire value chain by FY2050. To accomplish this, it will be necessary to overcome the difficult societal challenges posed by carbon neutrality, not only within Hitachi, but also in local communities and companies in the supply chain.

The issues that companies and workplaces will need to address if they are to achieve carbon neutrality include that of combining economic and environmental value in ways that do not compromise business continuity and growth, the procurement and coordination of renewable energy in ways that can cope with energy price fluctuations and the need to balance supply and demand, and the establishment of frameworks for the co-creation of decarbonization that extend in scope across local communities and supply-chain companies.

This article reports on what Hitachi Ltd.'s Omika Works is doing to address these challenges.

2. Omika Green Network for Decarbonization

Omika Works was established in 1969 in Omika-cho, Hitachi City in Ibaraki Prefecture. With deep roots in the community, the site specializes in variable-mix, variable-volume production, having engaged in the design, manufacture, development, and maintenance of information and control systems for social infrastructure, including electricity, railways, and water and sewage. While its history goes back 50 years, the site has been reforming its production practices over the past 20 years through the "plan, do, check, act" (PDCA) cycle and a highly efficient production model that uses the Internet of Things (IoT) to collect, analyze, and utilize human, machine, material, and method (4M) data, including the movements of people and the operation of machines. By doing so, it has reduced production lead times for key products by more than 50%[(2)].

In addition to the installation of photovoltaic panels and storage batteries as part of its response to the Great East Japan Earthquake, Omika Works also utilizes an energy management system (EMS) and electricity usage data from sensors located at around 900 locations across the site to conserve, generate, and store energy. Moreover, energy efficiencies achieved through interoperation between the EMS and production planning have cut the contracted power consumption by approximately 29% while also reinforcing business continuity planning (BCP). This has included reductions in peak electricity demand, control of the photovoltaics together with the charging and discharging of batteries, and autonomous control.

In recognition of these efforts, including its work on production and energy management, the site was selected as a "Lighthouse" by the World Economic Forum (WEF) in January 2020[3]. Lighthouses are sites identified by the WEF as advanced manufacturing factories that are leading the way to the Fourth Industrial Revolution. Omika Works was the first such factory owned by a Japanese company and located in Japan to receive this recognition.

Drawing on this knowledge of the digital transformation (DX) of factory operations through production and energy management, Omika Works has now embarked on efforts to overcome the difficult societal challenges posed by carbon neutrality, not only at its own site, but also in local communities and supply-chain companies. However, as this is not a goal that any one company can achieve on its own, Hitachi has also established the Omika Green Network to work on improving decarbonization capabilities with a range of other stakeholders facing similar challenges, including companies, public agencies, education and research institutions, and the finance industry[4].

In the Omika Green Network, Omika Works acts as a hub or field for experimental verification of a wide variety of decarbonization initiatives, with the knowledge thus gained being shared with other supplier companies, local businesses and communities, financial institutions, public agencies, technology providers, customers, and others. The goal is to use co-creation to achieve carbon neutrality through green transformation (GX) (see **Figure 1**).

2. 1
Achieving Carbon Neutrality at Omika Works

The first step is the promotion of GX experimental verification aimed at achieving carbon neutrality at Omika Works.

This involves creating a digital twin for decarbonization by mapping the workplace 4M and environmental data that has been collected at Omika Works. By utilizing EMS data and the power sensors located at around 900 locations across the site, this provides building-by-building information about carbon dioxide (CO_2) emissions and can be used to work through the PDCA cycle of estimating potential reductions, developing a roadmap, and measuring actual performance. To increase the use of renewable energy sources, a model of the site electricity network is also used to simulate fluctuations in electric power. Similarly, product-specific CO_2 emissions are assessed from a combination of production line, design, and other data. In this way, use of the decarbonization digital twin allows for an ongoing cycle of testing and implementing new ideas for reducing emissions.

The results of this GX experimental verification are collated in the "Omika GX model," which is then put to use not only at Hitachi, but also by customers and other partners.

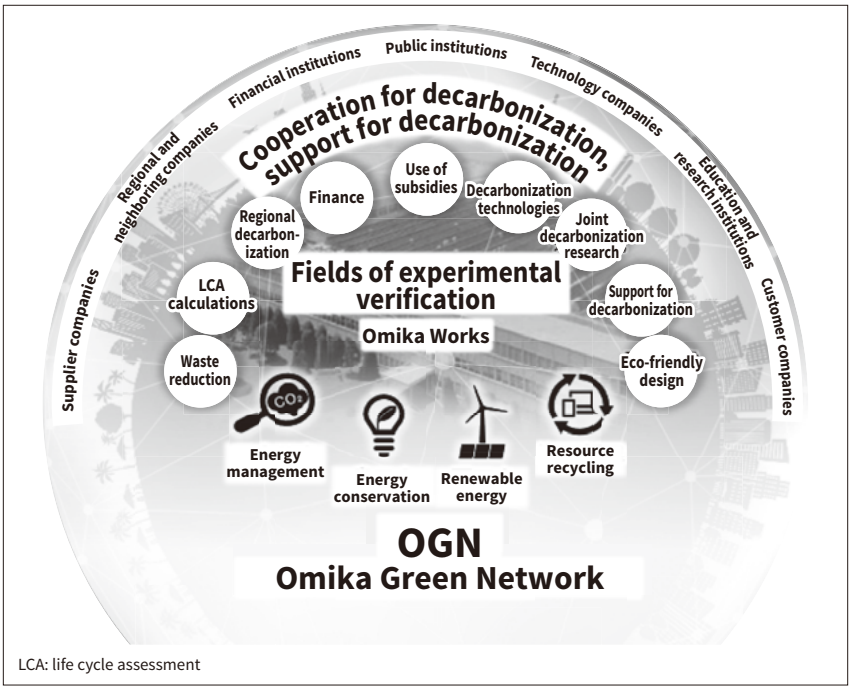


Figure 1 — Conceptual Diagram of Omika Green Network

As it works to overcome the shared challenge of achieving carbon neutrality, Hitachi is using Omika Works as a hub or field for experimental verification of green transformation initiatives that involve co-creation with stakeholders.

2. 2
Achieving Carbon Neutrality in Local Communities and Supply-chain Companies

The next step is the horizonal deployment of the results of GX experimental verification to local communities and supply-chain companies.

Among the important requirements for carbon neutrality are the use of renewable methods of energy generation that emit very little CO_2 while making full use of energy storage to maintain a reliable supply of electric power. Given the limits to how much energy generation and storage infrastructure any one company can install on its own, mechanisms such as off-site power purchase agreements (PPAs) for the procurement and optimal use of green energy are essential. Moreover, while balancing electricity supply and demand is another prerequisite for the reliable supply of electric power, controlling the weather-dependent output of renewable energy sources such as photovoltaics and wind is extremely difficult.

Hitachi has a track record of supplying solutions for the distributed control of electric power in Japan and elsewhere and is utilizing this technology in trials at other nearby sites in the Ibaraki region with a view toward application over a wider area in the future. As well as incorporating this expertise in green energy management into the Omika GX model, Hitachi is also aiming to expand the local use of renewable energy by establishing a framework in the form of a regional energy management platform designed to work with cross-regional electricity supply and the balancing market.

Other efforts associated with supply chains include consolidating the data needed to estimate CO_2 emission volumes across entire supply chains and the establishment of an environmentally trusted digital platform for supporting environmental management in partnership with financial institutions and local government. In this way, Hitachi is building a data-driven ecosystem made up of supply chain stakeholders and using real-world data and activities to trial decarbonization initiatives.

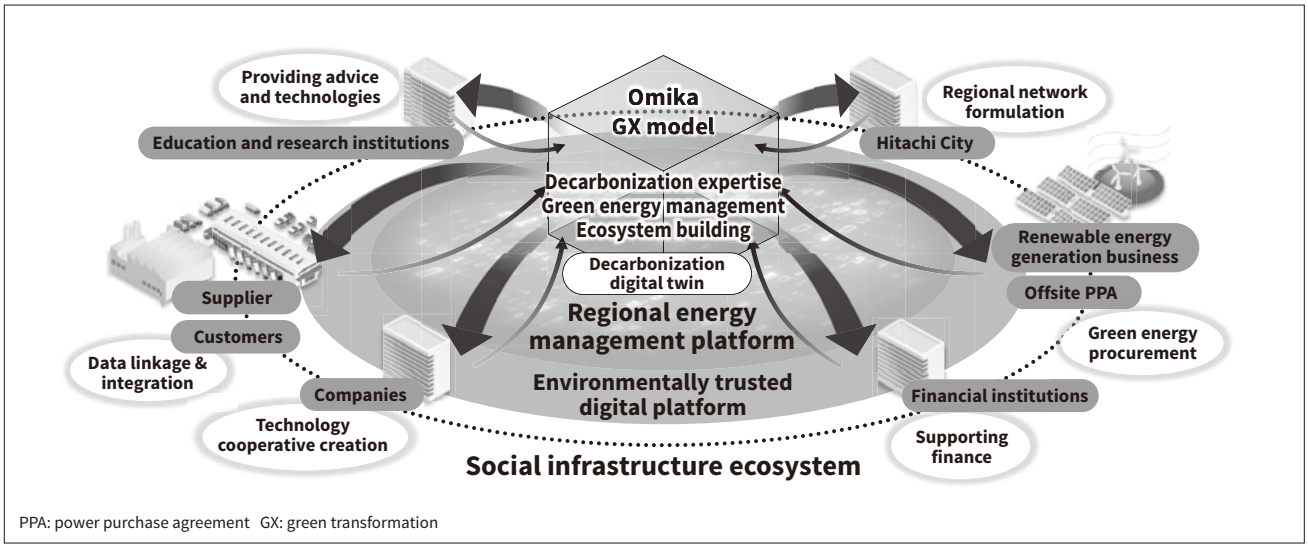
Activities in partnership with stakeholders are already underway. A consortium that includes Hitachi City companies and the Regional Technical Support Center has been established to promote decarbonization management in small and mid-sized businesses. As a responsible business with roots in the local community, Omika Works is also participating in the consortium, which is encouraging decarbonization by local small and mid-sized businesses and underpinning emission reduction efforts, offering ways of utilizing its digital technology and knowledge to estimate, publish, and reduce Scope 3 emissions. As it works to achieve decarbonization, Hitachi plans to continue such efforts that combine digital practices with real-world activities.

3. Conclusions

While many companies have announced their intentions to become carbon neutral, few have yet come up with a road map of practical measures for achieving this across their supply chains. Even when it comes to achieving carbon neutrality in factories and offices, generic solutions are difficult to come by. While there are many useful examples of companies estimating and publicizing their CO_2 emissions, going on to implement actual emission reduction measures requires in-depth consideration of such factors as the investment cost and how such actions will fit into their growth strategies.

Figure 2 — Social Infrastructure Ecosystem Envisaged by Omika Green Network

Hitachi is building a social infrastructure ecosystem as a way to take on the grand challenge of achieving carbon neutrality both in local communities and in supply-chain companies.



PPA: power purchase agreement GX: green transformation

Given these circumstances, Omika Works has been considering ways to confront the challenge of carbon neutrality head on, both in its factories and in local communities. Through the Omika Green Network, Hitachi intends to continue sharing with its many stakeholders both the portfolio of technologies and knowledge for the digital transformation of plant management built up at its Omika Works hub and what it has learned from experimental verification of GX practices for environmental management. Likewise, it will continue to build its social infrastructure ecosystem with the goal of achieving carbon neutrality across local communities and supply-chain companies while also supporting the formulation of company-specific scenarios for decarbonization (see **Figure 2**).

This work is extending beyond Hitachi City to encompass a number of other regions. One example is the launch of new services[(5)] where Hitachi partners with regional banks to support decarbonization efforts by small and mid-sized businesses as they work toward achieving carbon neutrality by 2050.

Hitachi intends to continue with its efforts to overcome the grand challenge of achieving carbon neutrality across all areas of society, leveraging the locally developed social infrastructure ecosystem of the Omika Green Network as one way of doing so.

References

1) Hitachi, Ltd., Hitachi Sustainability Report 2022 (Sep. 2022), https://www.hitachi.com/sustainability/download/pdf/en_sustainability2022_print.pdf
2) Hitachi News Release, Hitachi Establishes High-Efficiency Production Model Using IoT at Omika Works (Oct. 2016), https://www.hitachi.com/New/cnews/month/2016/10/161025.html
3) Hitachi News Release, Hitachi is first Japanese company to be listed, Hitachi's Omika Works Recognized as an "Advanced 4th Industrial Revolution Lighthouse" by the World Economic Forum (Jan. 2020), https://www.hitachi.com/New/cnews/month/2020/01/200110.html
4) Hitachi, Ltd., Omika Green Network, https://www.hitachi.com/products/it/control_sys/ogn/
5) Hitachi News Release, Shiga Bank and Hitachi to Create a Carbon-Neutral Society by 2050, Collaborating in Managing CO_2 Emissions (Dec. 2022) in Japanese, https://www.hitachi.co.jp/New/cnews/month/2022/12/1209.html

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