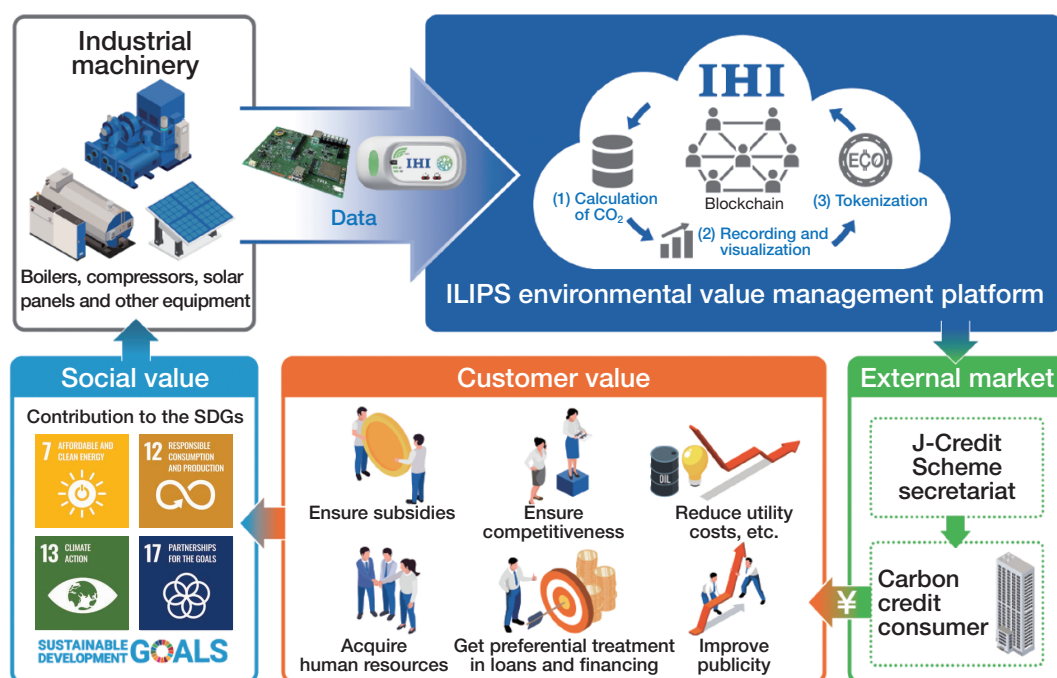


Deployment of the ILIPS Environmental Value Management Platform

Contribution to the realization of a decarbonized society by utilizing blockchain technology

IHI is deploying a digital platform to calculate CO₂ emissions and reduction from equipment operation data obtained through our IoT system, ILIPS[®], etc., record and manage calculation results, and tokenize them as environmental values in the blockchain.



Overall outline diagram of the ILIPS environmental value management platform

Introduction — Challenges to realizing a decarbonized society

The Paris Agreement was adopted in 2015 to solve global-scale challenges, namely, climate change issues. In addition, in October 2020 the Japanese government declared that it would try to achieve carbon neutrality, in other words, reduce greenhouse gas emissions to zero in total, by 2050. In line with this movement, many companies have declared carbon neutral goals and made efforts to reduce emissions. Meanwhile, if goals cannot be achieved with reduction

efforts of a company itself, it can use carbon credits generated from CO₂ emissions reduction activities by other companies for compensation. Carbon credits are issued to represent CO₂ reduction so that companies, individuals, or other parties can trade their reductions.

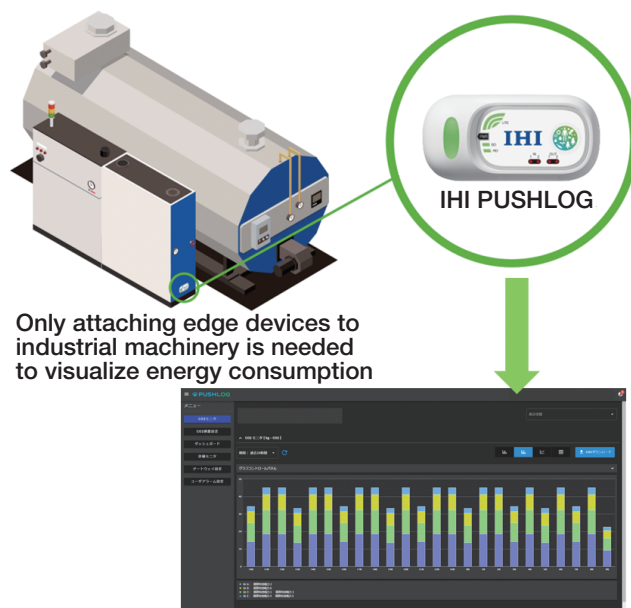
Japan has mechanisms for carbon offset such as the J-Credit Scheme to certify and trade CO₂ emissions reductions realized through efforts such as introduction of energy-saving equipment, use of renewable energies, and forest management as environmental values. However, it is still difficult to ensure the traceability of CO₂ emissions and

cumbersome procedures and costs are required to use the J-Credit Scheme. In other words, this scheme is too burdensome for small and medium-sized companies or self-employed people to use. As a result, many small environmental values seem to be left unused widely across Japan. Japan must create a mechanism to collect these unused values and promote CO₂ reduction across the country.

ILIPS environmental value management platform

IHI studied how to build such a mechanism based on the ILIPS (IHI group Lifecycle Partner System). The ILIPS is an IoT system used throughout the IHI Group to accumulate data on the products of the IHI Group in a cloud server and utilize the data for the lifecycle business. We eventually launched the ILIPS environmental value management platform extended from the ILIPS.

In certification and trading of environmental values, it is important to monitor CO₂ emissions and reduction in a way in which reliability is guaranteed and to report and verify results. This platform calculates CO₂ emissions/reduction, records and visualizes them using blockchain technology. Blockchain technology is intended to retain data distributed across a network and use a data structure that allows tampering to easily be detected with the aim of enhancing transparency, reliability and data tamper resistance. This technology also provides the smart contract function to automatically perform trades and calculations according to rules predetermined between related parties such as companies and individuals. By utilizing these technologies and functions, the ILIPS environmental value management platform automatically calculates CO₂ emissions and reduction based on operation data such as the power consumption and fuel consumption of equipment accumulated in the ILIPS and third-party IoT systems and records calculation results as tokens in the blockchain. Tokens are electronic vouchers issued using blockchain technology. They can be transferred and exchanged. This platform implements tokens with an eye to CO₂ reduction trading between various parties.

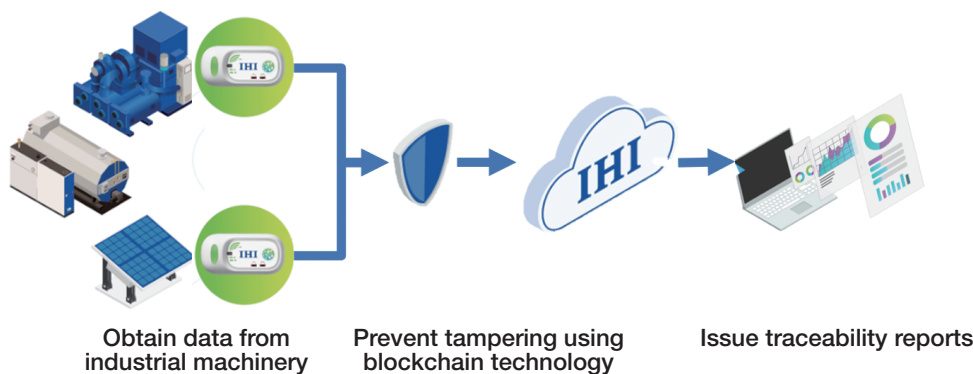


Only attaching edge devices to industrial machinery is needed to visualize energy consumption

Overview of the equipment operation data visualization service

We provide the following three services for customers by utilizing this ILIPS environmental value management platform.

- (1) Equipment operation data visualization service
This service is for automatically measuring and remotely monitoring equipment operation data. Operation data can be collected from industrial machinery via sensor devices and edge devices to visualize energy consumption and other data. Data is collected from IHI Group products using edge devices specially designed for the ILIPS, for which high reliability is guaranteed, and from the other products, using the IHI PUSHLOG, an edge device that can easily be connected and started without expertise and programming.
- (2) CO₂ emissions traceability service
This service is for tracing CO₂ emissions data and showing past CO₂ emissions data retroactively. With this service, users can easily provide reliable data when CO₂



Overview of the CO₂ emissions traceability service

information must be disclosed to companies downstream of the supply chain, municipalities, financial institutions, investors, and other parties.

Although reports were generally issued based on operation data accumulated on the cloud, information of equipment to be measured and measuring devices used for calculation was not linked with operation data and bases for calculation were hidden in a black box. This platform links various information with operation data and tokenizes it to ensure traceability. In addition, it can issue highly transparent reports by managing various information and calculating formulae which calculations are based on using blockchain technology.

(3) Carbon credit generation service

This service is for generating carbon credits based on tokens generated by the service (2). This service solves current issues of the J-Credit Scheme by collecting operation data from equipment of multiple customers and collectively processing the data at IHI to minimize the costs and work customers incur for certification and examination.

Case studies

This section introduces a specific case where we have utilized this platform in collaboration with Ena City in Gifu Prefecture, NGK Insulators, Ltd. (NGK), Ricoh Company, Ltd. (RICOH), and Ena Electric Power Co., Ltd and another case with IHI Packaged Boiler Co., Ltd. (IBK).

(1) Joint trial project with Ena City, NGK, RICOH, and Ena Electric Power

NGK and RICOH have been working on a trial project to track all processes including the generation of renewable energy by Ena Electric Power through consumption as well as charge and discharge of NAS[®] batteries to store surplus electricity. Self-consumption of solar power at public facilities in Ena City is considered to be CO₂ reduction and is regarded as environmental values of the city. This platform converts these environmental values into J-credits. Selling the city's environmental values in the form of credits to businesses in the city promotes the creation of carbon offset products with added environmental values. In addition, selling

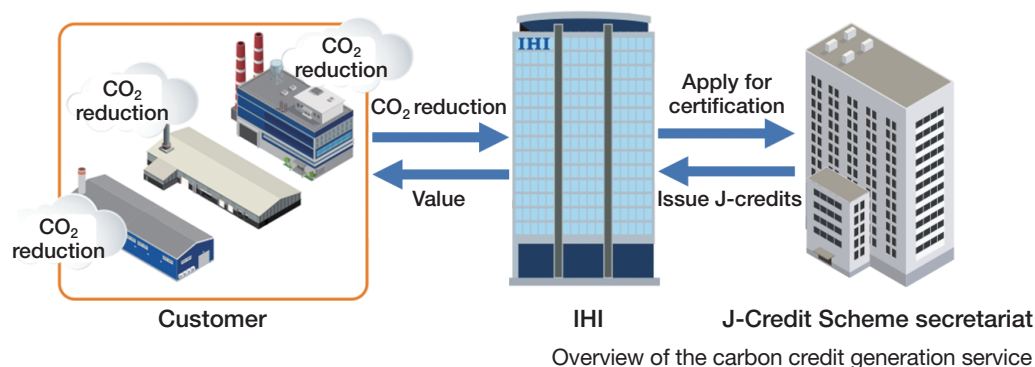
these carbon offset products in and outside the city helps enhance the awareness of the environmental brand of Ena City. Capital gained from outside Ena City through this trial project is used to further increase renewable energy generation, introduce additional renewable energy generation methods and promote energy saving, which helps Ena City shift to a zero-carbon city. At the same time, the city aims to establish a decarbonization and economic circulation system that will be a model case for municipalities across Japan and be carbon neutral by 2050.

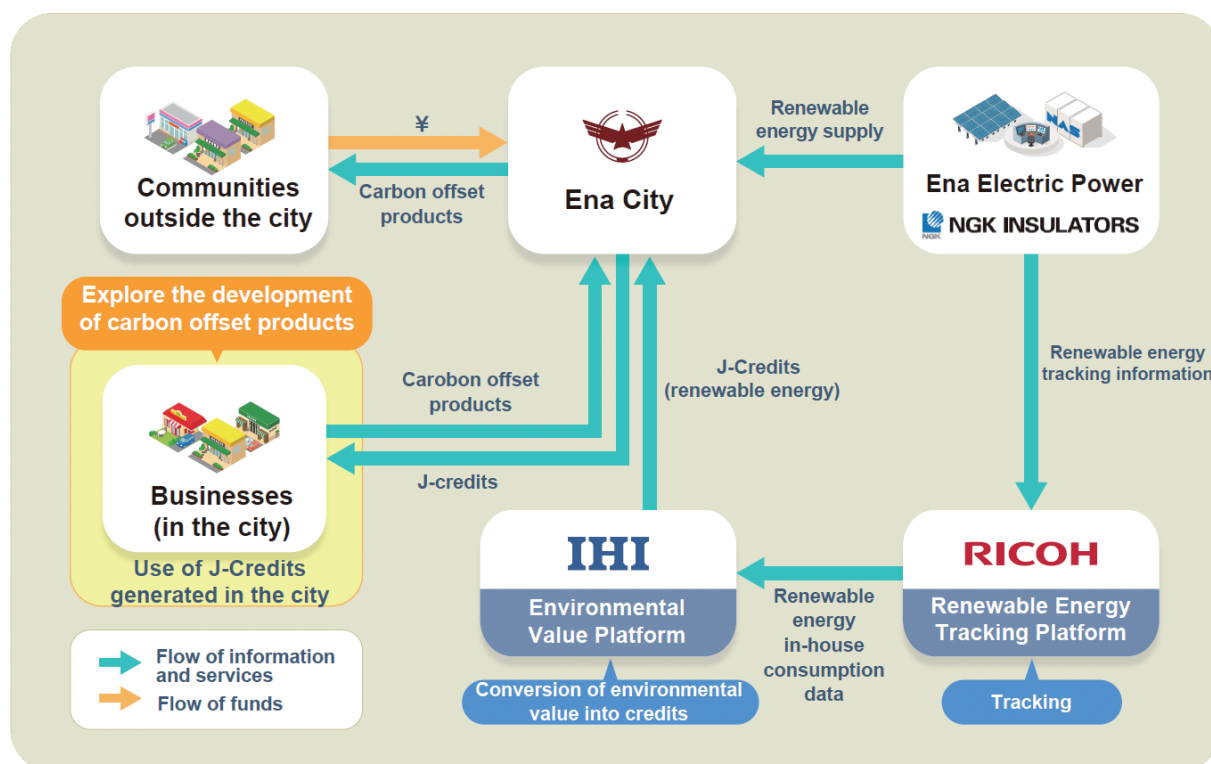
(2) Project with IBK

IBK has been operating the i-Labo system to visualize the operation status of boilers that generate steam required for manufacturing by customers, offer the optimal operation that satisfies customer needs, and support boilers. Operation data collected by the i-Labo system is linked with this platform to provide the above-described services: (1) the equipment operation data visualization service, (2) the CO₂ emissions traceability service, and (3) the carbon credit generation service. IBK supports customers through these services in gaining J-credits for CO₂ reduction associated with the introduction of new boilers or replacement with high-efficiency boilers and conducting business activities. IBK will extend the scope to fans, compressors and other equipment in addition to general-purpose boilers and expand the services to realize carbon neutrality across factories.

Future outlook

IHI has jointly built a mechanism to collect many small environmental values that seem to be left unused in small and medium-sized companies and by self-employed people across Japan in collaboration with various companies and organizations because this is not something IHI can achieve alone. For example, with Fujitsu Ltd. (Fujitsu), we have started a mechanism to safely mutually connect tokens generated in this platform with third-party blockchain systems to distribute them in the environmental value trade market for efficient distribution. Furthermore, we will work with financial institutions such as banks to create financial





Outline diagram of the joint demonstration project with Ena City

schemes such as digitized green bonds and sustainability link loans that utilize highly transparent and reliable CO₂ emissions reports generated with this platform.

Meanwhile, we are also developing a different platform to record the carbon footprints of next-generation fuels that support our decarbonization business such as carbon neutral ammonia, hydrogen, and methane. Firstly we started with ammonia and calculated, recorded and visualized CO₂ emissions at each of the production, transport & storage, and usage stages using highly reliable data-tracking blockchain technology to realize CO₂ traceability. This platform allows each player in the value chain and ammonia consumers to prove CO₂ emissions and reduction to stakeholders who need information on decarbonization efforts. To validate this platform, we built a value chain that consists of renewable energy generation and hydrogen production equipment in the Soma IHI Green Energy Center and equipment from ammonia synthesis, storage through gas turbines in IHI Yokohama Works and are conducting a verification test.

We believe that recent trends in carbon neutrality are not limited to a single business domain such as the energy business but span the whole value chain and that blockchain technology efficiently connects and visualizes all related domains. Although the system introduced in this article is available only in Japan for now, we plan to consider overseas deployment with the projects in Japan as a beginning. Involved in various businesses, the IHI Group will realize a carbon neutral society where nature and technology are in

harmony by linking these businesses using platforms that support environmental values including the ILIPS environmental value management platform.