FY2022 Commissioned Project

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City-to-City Collaboration for Zero-Carbon Society

(Promotion of Eco-Industrial Parks Toward Carbon Neutrality in Hai Phong City, Vietnam)

Commission Report

March 2023

Institute for Global Environmental Strategies

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1. Purpose and Outline of the Project

1.1. Purpose

This study aims to establish a zero-emission industrial park through city-to-city collaboration between Hai Phong, a centrally-controlled city (along with Hanoi and Ho Chi Minh) that is the largest port city in northern Vietnam, and Hai Phong's sister city of Kitakyushu in Japan, by promoting the concept of an eco-industrial park (a certification system promoted by UNIDO and the Ministry of Planning and Investment of Vietnam)[1].

1.2. Outline

Specifically, this project aims to transfer Kitakyushu's expertise in the fields of renewable energy and Eco-Towns to Hai Phong. Home to one of the largest eco-towns in Japan, Kitakyushu declared its aspirations of creating a decarbonised society by 2050 with its expressed commitment as a Zero-Carbon City in 2020. In this project, feasibility studies are conducted on exceptional decarbonisation and low-carbon technologies, such as energy efficiency, renewable energy, energy recovery from waste, smart energy and other areas, with the aim of achieving both decarbonisation and advanced resource recycling systems through the formation of actual projects (Fig. 1.2.1).

This project was proposed and adopted last fiscal year as a three-year programme. The results of research conducted last fiscal year provided a foundation for continued studies in the second year of this project. The survey scope was expanded to include the formation of projects focussed on decarbonisation, as there was a notable lack of prospects for the commercial viability of "smart power plants", an area that appeared to hold promise in studies in the previous fiscal year, and requests were received from Haiphong to consider sectors other than industrial parks.

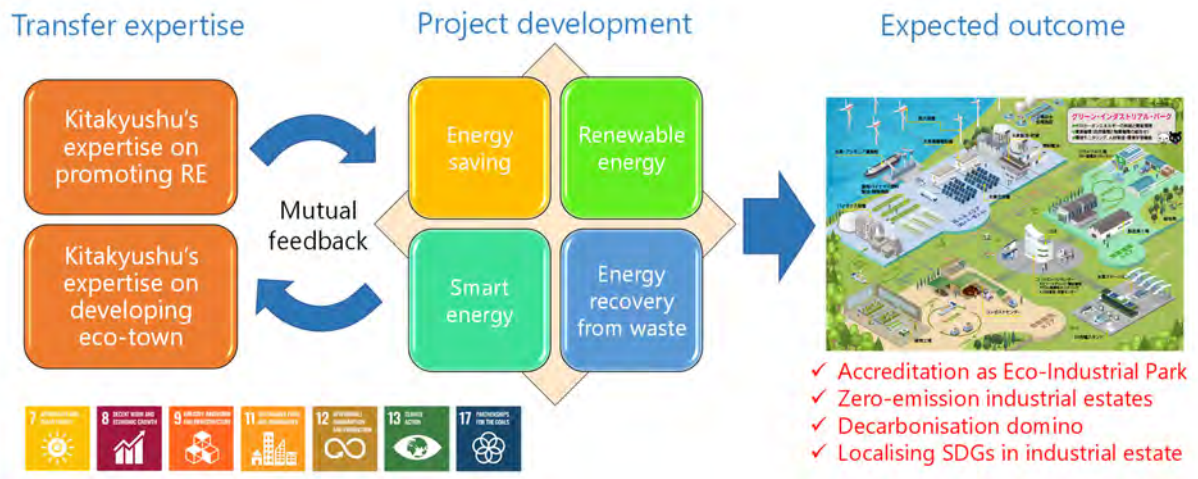


Fig. 1.2.1. Project concept.

[1] UNIDO, "Eco-industrial parks": https://www.unido.org/our-focus-safeguarding-environment-resource-efficient-and-low-carbon-industrial-production/eco-industrial-parks

1.3. Background

1.3.1. Relevant trends in Vietnam

Vietnam has continued to enjoy high, stable economic growth, recording real GDP growth rates in the 5% to 7% range every year from 2010 to 2019, although in 2020 and 2021, GDP growth remained in the 2% range due to COVID-19's global reach. Both exports and imports hit record highs in fiscal 2021, reaching a year-on-year growth rate of 8.02% in fiscal 2022 and a GDP per capita equivalent to USD 4,110 (an increase of USD 393 year-on-year). Trade imports and exports reached record highs in 2022; in fiscal 2022, exports to and imports from Japan ranked fourth and third, respectively, in terms of the value of imports and exports by country.[2,3]

The risk of electricity shortages has grown, particularly in the north, with lower-than-expected electricity generated from coal-fired power plants in fiscal 2022 stemming from coal supply difficulties due to labour shortages at coal mines following an increase in the number of COVID-19 cases, in addition to plummeting coal imports caused by soaring prices for resources, even as demand for electricity has continued to climb in step with economic growth. New electrical power development plans have not kept pace with growing demand for electricity, with persistent concerns about power shortages lasting until 2025.[4]

At 46.4%, coal-fired power remained Vietnam's main source of power for generating electricity (including imports) in 2021, due to new coal-fired power plants coming on line. While renewable energy accounts for only 12.3% of Vietnam's energy mix, this is an 86-fold increase since 2016 (Fig. 1.3.1.1).[5]

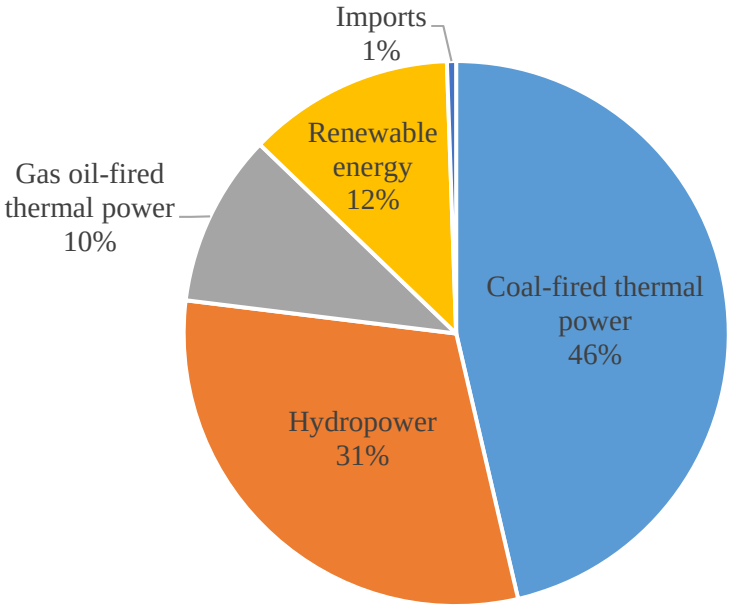


Fig. 1.3.1.1. Electricity generation (including imports) and composition ratio by source in Vietnam in 2021 (Source: Created based on JETRO, 2022[5])

[2] JETRO, "GDP growth in 2022 slows to 8.02% and 5.92% in Q4 (Vietnam)" (10 January 2023): https://www.jetro.go.jp/biznews/2023/01/87ad4ca1c203fc6b.html
[3] JETRO, "Record figures for trade in 2022 to slow in the second half of the year (Vietnam) (17 January 2023), https://www.jetro.go.jp/biznews/2023/01/9fda0768b852c155.html
[4] JETRO, "Fears rise in Vietnam on power shortages due to increased electricity demand and coal supply struggles (Vietnam)", 8 April 2022), https://www.jetro.go.jp/biznews/2022/04/9b562f18eddb0359.html
[5] JETRO, "State of electric power in 2021: Increasing installation capacity for wind power" (31 March 2022): https://www.jetro.go.jp/biznews/2022/03/a48eb6246a8d8e0a.html

Conversely, in terms of installed power generation capacity, the share of renewable energy in the power supply mix in 2021 reached 27%, with photovoltaics (PV) accounting for 21.2% when including roof-top systems. Significant growth was seen in PV capacity in 2020 in particular, with the application of the feed-in tariff (FIT) for PV and easing of regulations for roof-top PV systems. However, development has remained stagnant since 2021, since purchase pricing systems have not yet been finalised. In contrast, wind power is on the threshold of a rapid increase, accounting for 5.3% in 2021 due to the FIT system (Fig. 1.3.1.2). [5]

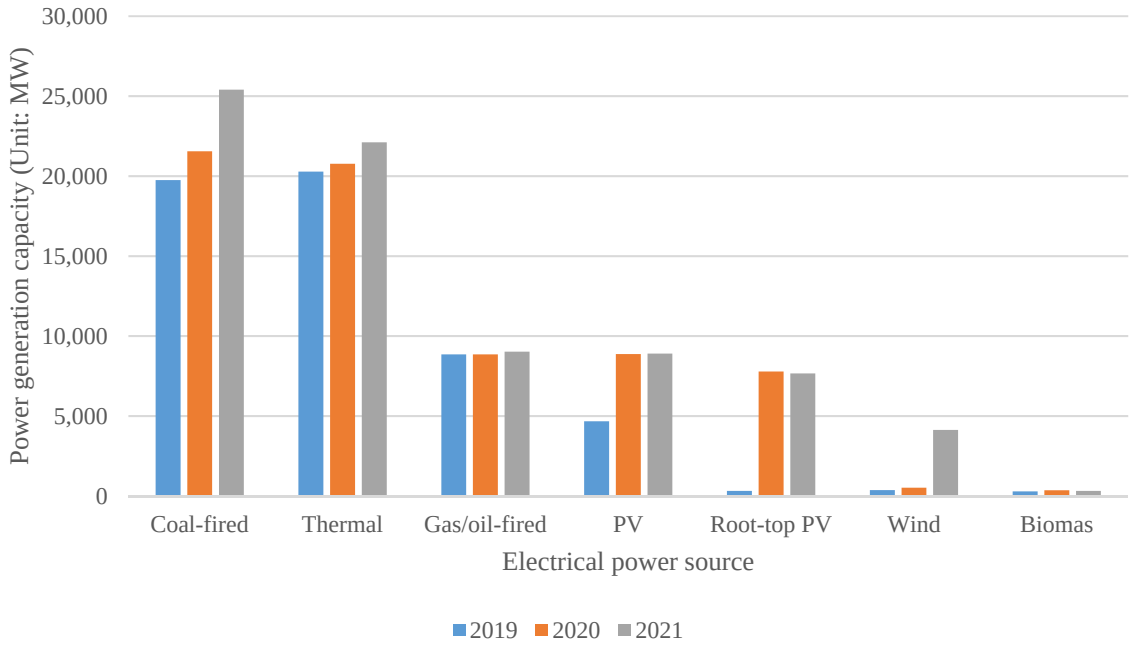


Fig. 1.3.1.2. Changes in installed electricity generation capacity in Vietnam by source, 2019-2021. (Source: Created based on JETRO, 2022[5])

The Vietnamese government launched a series of measures to reduce greenhouse gases (GHGs) in response to rapid economic development and increased energy demand. In October 2021, the Prime Minister issued Decision No. 1658/QD-TTg, the "National Green Growth Strategy for the period 2021-2030 with a view to 2050", which sets a target of reducing GHG emissions by 15% by 2030 and 30% by 2050 compared to 2014 levels. Furthermore, at the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (Glasgow, United Kingdom, 1 November 2021), Prime Minister Pham Minh Chin announced the aim of achieving net zero GHG emissions (carbon neutrality) by 2050. In response to this declaration, revisions were made to Vietnam's National Climate Change Strategy to 2050 (Decision No. 896/2022/QD-TTg) in July 2022 and the country's Nationally Determined Contributions (NDC) under the Paris Agreement in October 2022 to align with the declaration made at COP26. Both included the addition of the goal of achieving carbon neutrality by 2050, as well as significantly higher GHG reduction targets by 2030 (Table 1.3.1.1).

Table 1.3.1.1. Comparison between the Vietnamese government's GHG reduction targets by 2030 in the Nationally Determined Contributions (NDC) under the Paris Agreement (unit: %, 1 million tonnes CO_2eq) (Source: Created based on revised Vietnam NDC)

Item	Domestic efforts only		Inclusion of international aid	
	Reduction rate	Reduction	Reduction rate	Reduction
NDC (September 2015)	8	62.7	25	198.2
Revised NDC (July 2020)	9	83.9	27	250.8
Revised NDC (October 2022)	15.8	146.3	43.5	403.7

1.3.2. Developments in the Japan-Vietnam Environmental Policy Dialogue

The Ministry of the Environment, Japan (MOEJ) has continued to engage the Ministry of Natural Resources and Environment of Vietnam (MONRE) in policy dialogue on collaboration in environmental issues, with the "2nd Viet Nam-Japan Environmental Week" held in fiscal 2021. The "7th Japan-Vietnam Environmental Policy Dialogue" (24 November 2021) was held during this week, at which Mr. Tran Hong Ha, Minister of Natural Resources and Environment, Vietnam, and Mr. Tsuyoshi Yamaguchi, Minister of the Environment, Japan, agreed to and signed the "Joint Cooperation Plan on Climate Change toward Carbon Neutrality by 2050".[6]

The joint plan also incorporated areas of strengthened cooperation between the governments of Japan and Vietnam in "b. The development of city-level LTS[7] especially through analysis of future emission scenarios utilizing AIM[8] and formulation of decarbonizing projects through City to City collaboration such as Hai Phong City and Kitakyushu City;" and "d. The development of joint projects on decarbonization through the implementation of the Joint Crediting Mechanism (JCM) under the renewed Memorandum of Cooperation on Low Carbon Growth between Japan and Viet Nam", suggesting that efforts to decarbonise through city-to-city cooperation between Hai Phong and Kitakyushu and the development of JCM projects are areas of strong interest for both governments in Japan and Vietnam.

1.3.3. Background of city-to-city collaboration between Kitakyushu and Hai Phong

After Hanoi and Ho Chi Minh, Hai Phong is the third largest city in Vietnam, with a population of 2.07 million (2021).[9] The largest port city in northern Vietnam, Hai Phong is one of the country's most important industrial centres. Averaging 15.26%, the city's gross regional domestic product (GRDP) over the past five years between 2017 and 2021 was 2.9 times the national average. Although the GRDP growth rate in fiscal 2021 was lower than in 2017 to 2019 as a result of the impacts of COVID-19, it led the country at 12.38% (GRDP per capita of USD 6,551).

Since signing a friendship and cooperation agreement in 2009, Kitakyushu and Hai Phong have engaged

[6] Outcomes of the 7th Japan-Vietnam Environmental Policy Dialogue: https://www.env.go.jp/press/110238.html
[7] LTS (Long-term Strategies): Long-term strategies under the Paris Agreement
[8] Asia-Pacific Integrated Model (AIM): Integrated assessment model for predicting greenhouse gas emissions and assessing measures and impacts
[9] Vietnam Briefing: https://www.vietnam-briefing.com/news/vietnams-hai-phong-industrial-gateway-and-port-city.html/

in technical (mainly in the field of water supply and sewerage), cultural, and economic exchange. Furthermore, the two cities signed a sister city agreement in 2014 and have been engaged in a comprehensive set of exchanges, both traditional and new, in the water supply and sewerage sectors, as well as in the waste and low-carbon technology fields. This collaborative relationship, extending over a decade, has matured into a solid partnership.

Selected to take part in a city-to-city collaboration programme over a period of six years from 2014 to 2019, Kitakyushu and Hai Phong have supported institutional building and conducted project formation studies. Notably, in fiscal 2014, the first year of the project, the two cities formulated the “Hai Phong City Green Growth Promotion Plan”, and out of the 15 pilot projects identified in the plan, have conducted project formation studies since fiscal 2015 in the energy and waste sectors and on conservation on Cat Ba Island. Specific achievements include the implementation of a project identified through city-to-city collaboration (introduction of an EV bus on Cat Ba Island), which has been linked to the introduction of equipment through the “Low-carbon Technology Innovation for Further Deployment in Developing Countries” (FY 2017).

The promotion of eco-industrial parks and establishment of zero-emission industrial parks, the aim of this study, is a new direction that has been suggested for the formation of a decarbonised society in the future, building on past achievements attained in the collaborative relationship between the two cities through the Green Growth Promotion Plan.

1.3.4. Outcomes and issues in the FY 2021 study and key changes in FY 2022

In the first year of the project (FY 2021), studies were conducted in four major areas to investigate and examine the feasibility of introducing systems and equipment with potential to reduce CO_2 emissions and recycle resources in industrial parks. These studies resulted in the transfer of Kitakyushu’s expertise in promoting the introduction of renewable energy and the identification of issues and points needed to change course for the FY 2022 study (Table 1.3.4.1).

Table 1.3.4.1. Overview and findings/achievements in areas studied in FY 2021

Studies	Overview	Findings/Achievements
Transfer of expertise from the Kitakyushu Model for 100% Renewable Energy	• Systemic studies in Kitakyushu • Interviews with industrial parks • Interviews with local banks	This study found that the only incentive for installing PV was the easing of regulations for roof-top systems (1 MW or less). Know-how was shared on the optimal use and sharing (multi-use) of subscription-, IoT- and AI-based products that can be utilised in industrial parks.
Smart power plants	• Interviews with industrial parks • Studies on legal systems • Calculations on GHG reduction impacts	This study found that the most economical option would be to install PVs with no modifications, as there is no demand for gas engines and energy demand is excessive in relation to supply. The study also found no leeway for the introduction of storage batteries or EMS. Recommendations must be reworked because of the lack of demand.
Use of waste liquid	• Field visits to and interviews with industrial parks • Interviews with tenant companies • Interviews with cement factories • Studies on legal systems	This study found that cement factories have a strong interest in converting waste and waste liquid into raw fuel, but are reluctant to do so due to the lack of legislation. National guidelines must be developed.
Energy-efficient and high-efficiency equipment	• Interviews with equipment suppliers • Surveys to identify companies interested in introducing new equipment	The application for the JCM model project subsidy is delayed to fiscal 2023 because of the need to postpone the timing for delivering equipment, as a result of expansion work on the plant where equipment will be installed.

In addition to the issues listed in Table 1.3.4.1, the survey in fiscal 2021 also identified new local needs through discussions with Hai Phong. A variety of requests were made by relevant authorities in Hai Phong under an MOEJ project implemented around the same time in fiscal 2022 providing support for building institutions to encourage the widespread use and development of exceptional decarbonisation and low-carbon technologies in developing countries, which involved discussions on decarbonisation efforts in Hai Phong in relation to the development of a 2050 decarbonisation scenario for the city using the Asia-Pacific Integrated Model (AIM).

In this context, this year's study included new focus areas and corrected the course of issues found through the fiscal 2021 study. In essence, the basic concept of promoting the introduction of eco-industrial parks was maintained, while the scope was extended to the entire city (and including areas outside the city, where necessary), including non-industrial areas in some parts of the study, as per Hai Phong's needs and requirements (Table 1.3.4.2).

Table 1.3.4.2. Correlation between survey items in FY 2021 and FY 2022 and areas covered

FY 2021		FY 2022	Areas
Transfer of expertise from the Kitakyushu Model for 100% Renewable Energy	⇨	**1. Study on installation of PV systems** • PV + regenerative storage batteries on Cat Ba Island • Introduction of PV equipment in cooperation with Japanese tenant companies • Large-scale PV project at final disposal site	Industrial parks, citywide
Use of waste liquid	⇨	**2. Study on use of energy derived from waste liquid and solid waste** • Use of waste liquid-derived energy • Use of solid waste-derived energy	Industrial parks, citywide
Energy-efficient and high-efficiency equipment	⇨	**3. Study on the introduction of energy-efficient and high-efficiency equipment** • Large blowers + inverters • Installation of energy-efficient equipment for major companies that consume large amounts of energy	Industrial parks
Smart power plants	⇨		
	New	**4. Sharing know-how and studies on decarbonisation in Hai Phong** • Support for the formulation of a green growth action plan for Hai Phong • Studies on DX issues and needs and sharing know-how • AIM scenario analysis and identification of definitive projects in collaboration with JPRSI	Citywide

1.4. Project implementation system

1.4.1. Implementation system

Responsible for the overall coordination of the project, IGES took the lead in this study, providing support for each study in coordination with the representative offices in both cities (Hai Phong's Department of Foreign Affairs (DOFA) and Kitakyushu's International Environmental Strategies Division, Environment Bureau). A research system was established in both Japan and Vietnam with the participation of the most appropriate companies and institutions according to each research theme (Fig. 1.4.1.1).

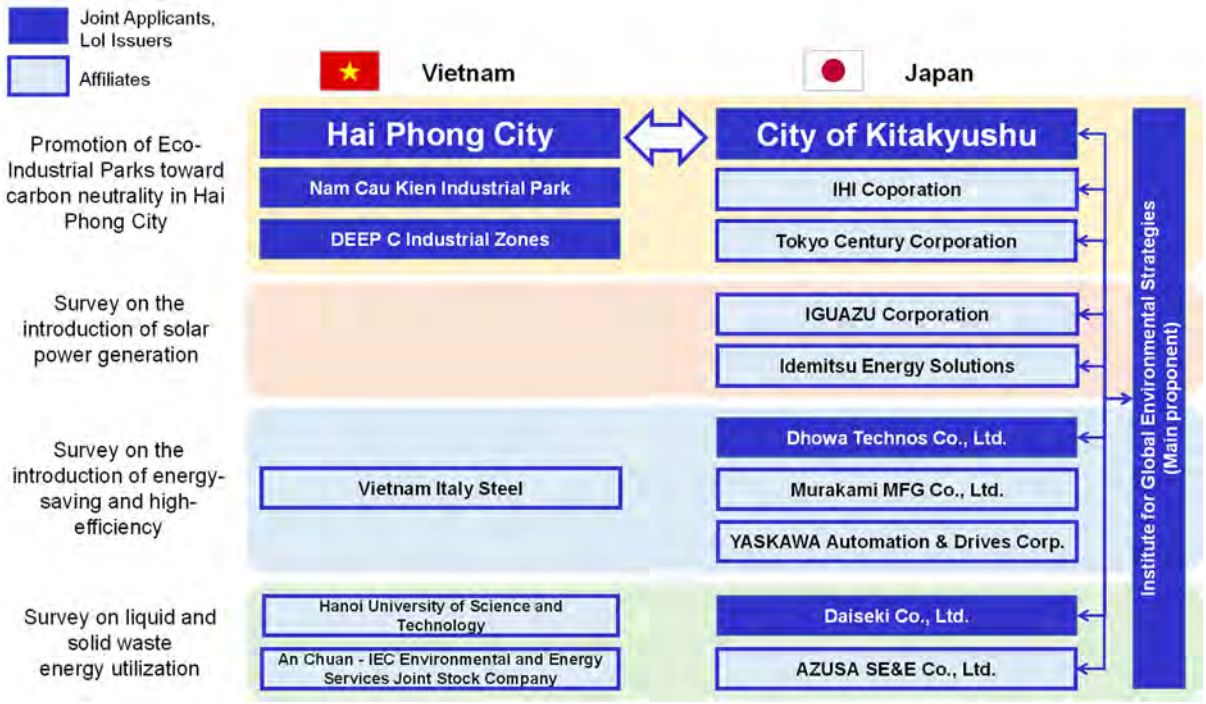


Fig. 1.4.1.1. Project implementation system

1.4.2. Methodology and timetable

This study consisted primarily of research in the field, with teams formed for each research theme. During field visits, appointments were set with local organisations in cooperation with Hai Phong City and other relevant groups, with information collected through interviews and site visits. The results of literature surveys, individual meetings, assessments and investigations, conducted along with field surveys, were also compiled and reported at an online workshop in December. The workshop included the participation of relevant departments in Hai Phong, as well as organisations that had cooperated with the study. The general schedule of the study (actual) is shown in Table 1.4.2.1.

Table 1.4.2.1. Overall timetable (Gantt chart) of the study in FY 2022

Action items	2022						2023		
	7	8	9	10	11	12	1	2	3
4-1. Photovoltaic installation survey									
(1) Introduction of solar power generation equipment in collaboration with Japanese tenant companies									
1) Interview with stakeholders									
(2) Large-scale solar power generation project for final disposal site									
1) Interview with stakeholders									
(3) Photovoltaic power generation + regenerative storage battery survey on Cat Ba Island									
1) Field survey									
2) JCM Model Project, business feasibility study									
4-2. Liquid/solid waste energy utilization survey									
(1) Waste liquid energy utilization									
1) Legal system research, information gathering									
2) Field survey									
4-3. Energy-saving and high-efficiency equipment introduction survey									
(1) Large blower + inverter									
1) Field survey									
2) Equipment calculation, estimation									
3) GHG emission reduction effect calculation									
4) Preparation for JCM Model Project application									
(2) Introduction of energy-saving equipment targeting large energy-consuming companies									
1) Field survey									
4-4. Know-how sharing and research for decarbonization of Hai Phong City									
(1) Support for formulation of Hai Phong green growth action									
1) Interview and consultation									
(3) DX issues/needs research and know-how sharing									
1) Needs survey									
(4) AIM scenario analysis/discovery of specific projects in collaboration with JPRSI									
1) Needs survey									
4-5. Meetings, reports, presentations, etc.									
(1) Monthly progress report									
(2) Progress report meeting to the MOEJ									
(3) Workshop with local people									
(4) Presentations at meetings designated by MOEJ (target city)									
(5) Presentations at meetings designated by MOEJ (domestic)									
(6) Preparation of report									

2. Implementation of Study

2.1. Study on installation of solar PV systems

2.1.1. Background and purpose

The fiscal 2021 study indicated the lack of a need for “smart power plants” in industrial parks in Hai Phong, where electricity supply and demand is optimally controlled by an energy management system (EMS) with the installation of solar PV systems, storage batteries and co-generation. However, the study found that the surveyed areas of Nam Cau Kien Industrial Park (NCK) and DEEP C Industrial Zones (DEEP C) had strong interest in deregulated rooftop solar PV systems with a maximum capacity of 1 MW and voltage of 35 kV or less, with a number of tenant companies expressing interest in installing solar PV systems. The study also determined that DEEP C has plans to introduce a large-scale, solar PV facility on a former final disposal site. The fiscal 2022 study also expanded its scope on solar PV, taking into account these local needs, as Hai Phong also had a strong interest in introducing renewable energy in sectors outside of industrial parks.

2.1.2. Introduction of solar PV equipment in cooperation with Japanese tenant companies

There are 14 similar solar PV cases in Vietnam that have been developed as JCM model projects, as of February 2023. Cost-effectiveness standards have dropped to JPY 2,500/tCO_2, meaning that the benefits afforded by the subsidy are becoming more limited. In this context, the most practical approach is for Japanese companies to install rooftop solar PV systems on their own subsidiaries or affiliate companies. This approach is regarded as having certain advantages because the risk is low, and even if the subsidy itself is small, the installation can be completed within the company’s own area of responsibility. Therefore, in this study, interviews were conducted with managing companies of industrial parks, as well as Japanese companies in those parks, in order to investigate their needs for applying rooftop solar PV systems as JCM model projects.

NCK has received a large number of inquiries about rooftop solar PV systems and is currently in negotiations with two other companies in Asian countries other than Japan. In the event that these negotiations result in the implementation of the project, solar PV panels will be installed on all available roofs in the industrial park for a total estimated generation capacity of 45 MW.

DEEP C has also engaged in a number of talks on rooftop solar PV systems. These systems will be installed gradually in order to supply tenant companies with renewable electricity through the industrial park’s grid. The study found that even without applying the JCM model project, there is a limited need for the subsidy as the system is already being introduced on a business basis. However, the industrial park conducts an energy audit on resource efficiency and cleaner production on tenant companies as part of promotional activities for the eco-industrial park, which found that there may be a need to install equipment using the JCM model project subsidy scheme as a means of implementing the energy-efficiency improvement measures proposed for each factory.

Interviews were conducted with two Japanese companies in DEEP C and one in the Vietnam-Singapore Industrial Park (VSIP). All expressed interest in installing solar PV systems, with the roofs of each factory featuring a load-bearing design that would allow solar PV panels to be installed in the future. However, none

of the factories had plans to install this equipment in the immediate future.

Based on the information above, the survey conducted this fiscal year did not find any specific need for applying to the JCM model project subsidy scheme for rooftop solar PV systems.

2.1.3. Large-scale solar PV project at a final disposal site

DEEP C has routinely received complaints about foul odours from tenant companies due to its proximity to the Dinh Vu final disposal site. Accordingly, a proposal was made to the Hai Phong People's Committee to close the final disposal site and install a solar PV system at the site. This study sought to examine the feasibility of installing a mega-solar project on the former location of the final disposal site.

In interviews conducted with DEEP C about this issue, it became clear that the Dinh Vu final disposal site will remain open for the time being and continue to be used, and that the possibility of installing a solar PV system at the site is unlikely, as the landfill has not reached capacity and has also been selected as one of two candidate sites for a waste-to-energy project in the nation's Power Development Plan VIII (PDP8). In fact, the study confirmed that the landfill was still continuing to be used.

On the basis of the above findings, the survey team decided to abandon the idea of installing a mega-solar power plant on the site of the Dinh Vu final disposal site.

2.1.4. Solar PV systems + regenerative storage batteries on Cat Ba Island

Cat Ba Island is a leading tourist destination both in Hai Phong, as well as Vietnam. The area attracts a large number of tourists from different parts of Vietnam and abroad, with visitors reaching 3.158 million in 2018.[10] The Vietnamese government has also submitted an application for the expansion of the area to Lan Ha Bay, which faces Cat Ba Island, in the designated area of Ha Long Bay, a World Heritage site, in 2021. Hai Phong is highly interested in the sustainable development and management of Cat Ba Island, and if this application is approved, Cat Ba Island will become an entryway to the World Heritage site and an even more important resource for tourism. The decision to inscribe Lan Ha Bay on the list of natural World Heritage sites was scheduled for the 45th session of the World Heritage Committee, which was postponed due to Russia's invasion of Ukraine. At the time of writing, no decision has been made.

This study investigated and examined the feasibility of installing stand-alone power supply units using solar PV power and regenerative storage batteries for persons living on the water on floating rafts in Lan Ha Bay (off-grid areas). The study also investigated the business development potential of this technology and the application of the JCM model project subsidy scheme.

[10] Phan et al. (2021) Perceptions and willingness to pay for water management on a highly developed tourism island under climate change: A Bayesian network approach. Environmental Challenges 5, 100333. https://doi.org/10.1016/j.envc.2021.100333

2.1.4.1. Proposed technologies

(1) Lead-acid battery restoration (regeneration) technology

With lower energy densities than lithium-ion batteries, these highly reliable lead-acid batteries are widely used around the world because they are a mature technology with a long history of use, have a well-established recycling process, and pose no risk for fire like lithium-ion batteries.

Lead-acid batteries are devices that store electrical energy by converting it into chemical energy. These batteries can be used repeatedly as the exact opposite chemical reaction (reversible reaction) occurs during both charging and discharging. That said, if the battery is charged/discharged repeatedly over a certain period of time, lead sulphate, which does not conduct electricity, gradually crystallizes and builds up on the surface of the negative electrode plate, causing the phenomenon of “sulfation”, which makes it harder for electricity to flow. As sulphation progresses, the battery’s charge/discharge functions deteriorate, requiring storage batteries to be replaced.

Traditionally, pulses and additives have been used as a method to remove sulfation and extend battery life, although this has caused damage to electrode plates and inhibited deposits. By comparison, MOTTA, a lead-acid battery regeneration service provided by IGUAZU Corporation, can restore high levels of chemical energy through the application of a unique technology that electrolyses sulfation (Fig. 2.1.4.1.1). (Patent application: JP 2018-066102)[11]

The use of this regenerative technology offers considerable cost savings, as it significantly restores the charge/discharge capabilities of storage batteries. The regeneration of these storage batteries also avoids the generation of CO_2 emissions during the manufacture of new storage batteries, achieving a 67% reduction in CO_2 emissions compared to new storage batteries. In recognition of this performance, MOTTA regenerative services have been awarded the EcoLeaf environmental label from the Japan EPD Program by SuMPO (certified in February 2021), Carbon Footprint (CFP) (certified in February 2021) and the Kawasaki Mechanism certification (in October 2020).[11]

Specific services that use MOTTA include regeneration services for lead-batteries for electric forklifts and the provision of emergency power supply units for disaster preparation and business continuity planning (BCP) measures (Fig. 2.1.4.1.2).[11]

[11] MOTTA (Iguazu Corporation): https://www.motta.tech/

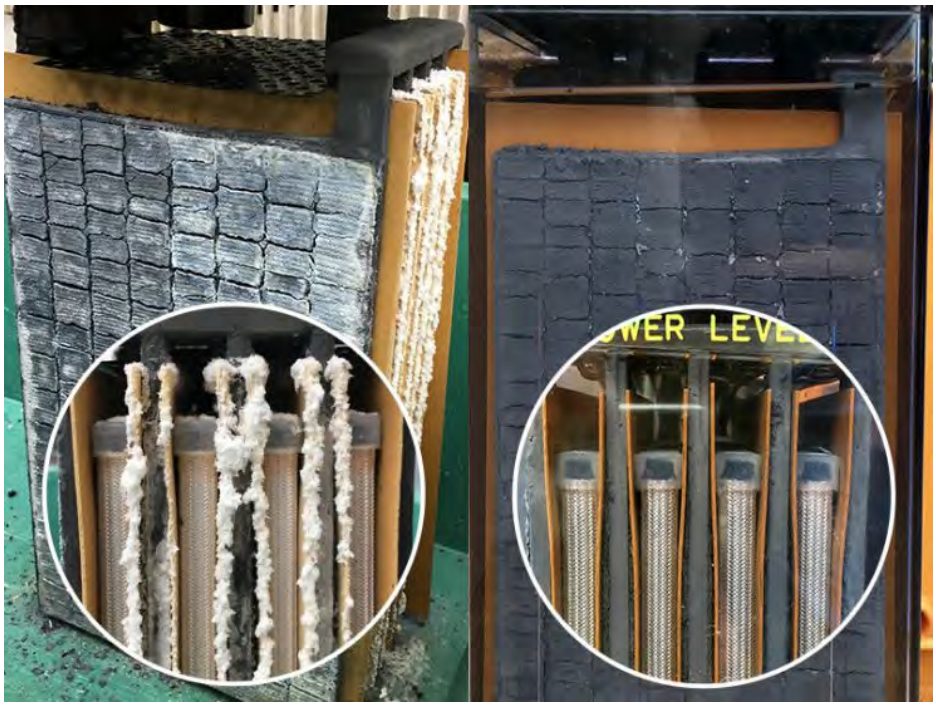


Fig. 2.1.4.1.1. Lead-batteries before regeneration (left) and after regeneration (right) (Source: MOTTA[11])

Fig. 2.1.4.1.2. MOTTA's lead-acid battery regeneration services for electric forklifts (left) and emergency power supply units for disaster preparation and BCP measures (right) (Source: MOTTA[11])

(2) “ReBS”: Low-cost energy storage solution

Idemitsu Energy Solutions Co., Ltd. has partnered with IGUAZU Corporation to implement a demonstration project on “ReBS”, a low-cost energy storage solution using regenerated lead-acid batteries with the application of MOTTA’s lead-acid regeneration technology.[12]

“ReBS” is a packaged service for renewable energy producers offering low-cost storage batteries essential for the self-consumption of generated electrical power and for selling electricity under the Feed-in-Premium (FIP) system[13] launched in April 2022, combined with Battery Management Systems (BMS). The companies plan to offer this service to renewable energy providers at a price of about one-tenth that of lithium-ion batteries by restoring used storage batteries to recover capacity.

(3) Examples of commercialising regenerated lead-acid batteries overseas

Overseas, businesses using the same lead-acid battery regeneration technology are also being developed in cooperation with local companies. Lead-acid batteries are mostly used as back-up power sources at base stations for mobile phones and data centres, so the company is developing a service to collect, inspect and regenerate used lead-acid batteries so that they can be returned to the businesses that dispose of them in large quantities. This will reduce the number of new storage batteries that need to be purchased, resulting in considerable cost savings for businesses. This type of business has already been introduced (and is in the process of being introduced) in Southeast Asia in Myanmar, Indonesia and Thailand. One of the aims of this survey was to ascertain whether similar business development is possible in Vietnam.

(4) Low-cost, stand-alone solar PV units

Even with prices for solar PV systems falling significantly over the past decade, the cost of a residential solar PV system is still high, averaging JPY 280,000/kW (JPY 1.4 million for a 5-kW system) for new installations in residences in 2021.[14] Second-hand solar PV panels have also started to circulate on the market as households complete the 10-year buyback period stipulated by the feed-in-tariff (FIT). Shin-ei Electronic Measuring Co., Ltd. handles a wide range of solar PV inspection equipment. The use of this technology makes it possible to accurately assess the performance of second-hand PV panels and supply those deemed to perform above a certain level for reuse at lower prices.

With ReBS, the companies are also considering the introduction of low-cost, small-scale, stand-alone power supply units (Fig. 2.1.4.1.3) that are a combination of second-hand solar PV panels and regenerated storage batteries, mainly in off-grid areas, such as on the African continent, in addition to providing low-cost energy storage solutions in Japan. This study examined the possibility of providing similar units to people living on the water (in off-grid areas) around Cat Ba Island.

[12] ReBS: https://www.idemitsuenergysolutions.com/2021/04/20/news-press/

[13] FIP system: Mechanism to promote the introduction of renewable energy with the addition of a certain premium level (subsidy) to the price that electricity is sold by renewable energy producers on the wholesale market.

[14] Agency for Natural Resources and Energy (2021), “About solar power”, https://www.meti.go.jp/shingikai/santeii/pdf/073_01_00.pdf

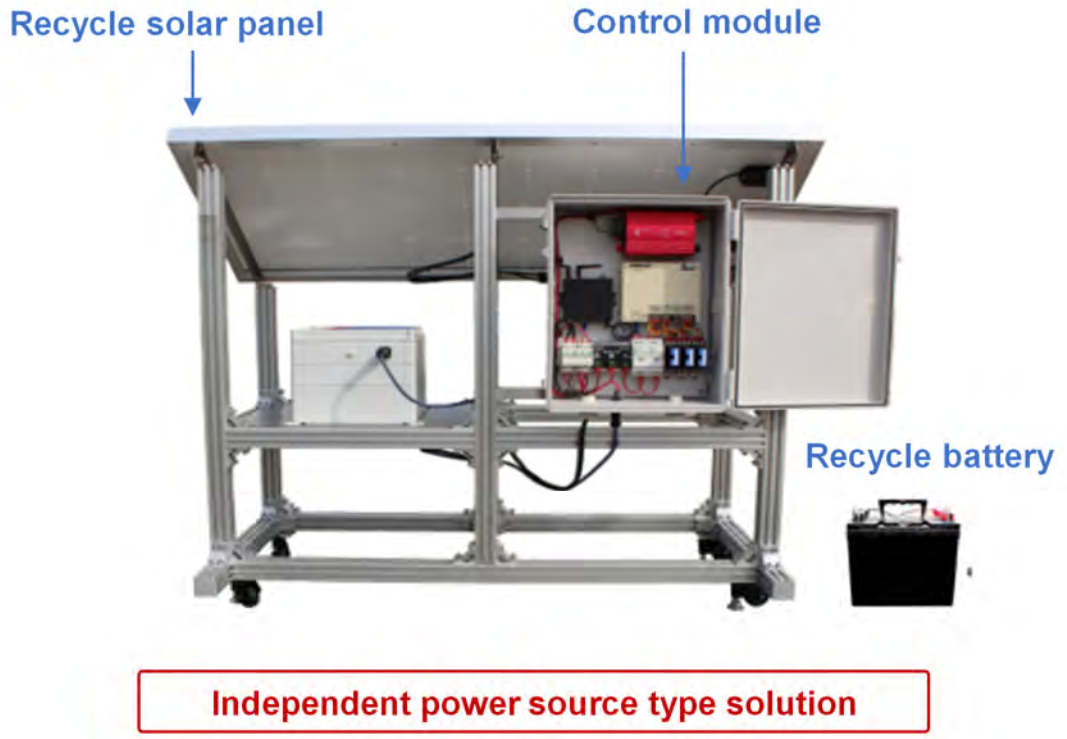


Fig. 2.1.4.1.3. Small-scale, stand-alone power supply units with a combination of regenerative storage batteries and second-hand solar PV panels (Source: IGUAZU Corporation)

2.1.4.2. Field work

(1) Overview of survey

The study team visited Hai Phong to inspect sites of interest, including Cat Ba Island, and interview relevant organisations. A summary of the visit follows.

[Participants] IGUAZU Corporation (1 person), Idemitsu Energy Solutions Co., Ltd. (1 person), Shin-ei Electronic Measuring Co., Ltd. (1 person), Institute for Global Environmental Strategies (1 person)

[Dates] Sunday, 23 October to Saturday, 29 October, 2022

[Areas covered in field work and discussions]

Date	Subject of study	Main respondents
24 October	Japanese companies selected for JCM model project subsidy scheme on solar PV in Vietnam	Staff in charge
	Nam Cau Kien Industrial Park	President, Vice-president
25 October	Water residential settlements on Lan Ha Bay (2 locations)	Lan Ha Bay Management Board, Hai Phong City Department of Natural Resources and Environment
	Cat Hai District People's Committee	Cat Hai District People's Committee (Head, Economy and Infrastructure; Deputy Head, Environmental Management; Vice Chair, Border Control) Cat Ba Town (Deputy Town Mayor) Lan Ha Bay Management Council
	Cat Hai Village People's Committee	Cat Hai Village People's Committee (Vice Chair)
	DEEP C Industrial Park	Head, DEEP C Blue
26 October	Lead-acid battery producer in Hai Phong	Vice-president
	Management Board of the Cat Ba Archipelago Biosphere Reserve	Staff in charge
	Hai Phong Department of Foreign Affairs	Director
27 October	Hotel in Hai Phong	General manager
	Solar PV system installer in Hai Phong	President
	Science Technology Development and Innovation Centre (Hai Phong Department of Science and Technology)	Centre President; Head, International Relations

[Images from survey]

Cat Ba Island, Lan Ha Bay, Cat Hai Village

Water rafts at location #1 (aquaculture business). Located close to the port and connected to the grid.

Lead-acid batteries for storing electricity generated with solar PV panels (water raft at location #1).

Kitchen in house on water raft. Using appliances such as refrigerator, rice cooker, etc. (water raft at location #1).

Generator (water raft at location #1)

Water raft at location #2. Located in an area off-grid.

Solar PV panel (water raft at location #2)

Lead-acid batteries to store electricity generated by solar PV panels (water raft at location #2)

LPG cylinger used in the kitchen of a house on a water raft (location #2)

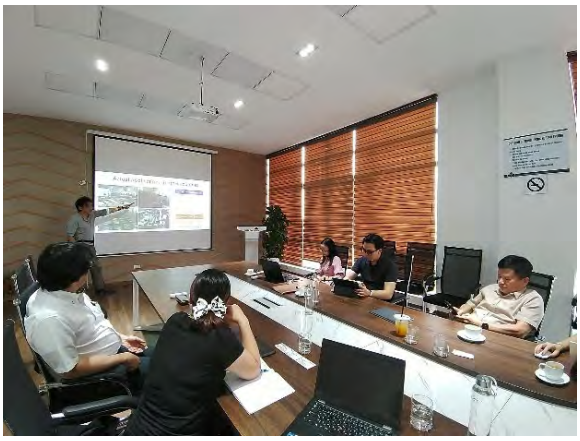
Tourist accommodation (water raft at location #2)

Interviews (water raft at location #2)

Meeting with Cat Hai District People's Committee

Meeting with members from Cat Hai Village

Interviews with representatives from industrial parks, relevant government agencies and companies



Meeting with Nam Cau Kien Industrial Park

Meeting with DEEP C Industrial Zones

Meeting with Management Board of the Cat Ba Archipelago Biosphere Reserve

Meeting with the Science Technology Development and Innovation Centre (ISC)

Meeting with lead-acid battery producer in Hai Phong

Meeting with solar PV system installers in Hai Phong

(2) Key issues identified in the study

Cat Ba Island, Lan Ha Bay

- The Vietnamese government submitted a proposal to UNESCO to extend the area of the natural World Heritage site of Ha Long Bay to cover Lan Ha Bay around Cat Ba Island. The government is still waiting on the result of that application.
- If Lan Ha Bay is inscribed as a World Heritage, a long-term plan must be formulated, monitoring must be carried out, and environmental impact and management capacity assessments must be conducted. However, there are no concrete plans in place at this time.
- There are plans to develop luxury resorts on the islands of Ang Than and Ang Bo Nau in Lan Ha Bay, but these have not come to fruition due to the high costs for development stemming from the need to draw electricity from the grid to the islands.
- There are a number of areas on the remote islands around Cat Ba Island that are not connected to the grid. Generators are used in these areas, but have a short service life as they tend to deteriorate quickly due to the ocean breeze. Consequently, some people are introducing solar PV systems, but that number is still low, as is the capacity of individual systems.
- If solar PV systems were reasonably priced, more people would want to install them. However, the land on Cat Ba Island that could be used for solar PV installations is limited.

Water residential districts

- Until August 2022, there were about 440 households living in floating villages in Lan Ha Bay (mainly people engaged in the aquaculture industry). However, administrative authorities lobbied to reduce the number of households from 440 to about 130, with the application for inclusion in the World Heritage area.
- The remaining 130 households in these floating villages will be forcibly relocated to three designated areas around Cat Ba Island. The relocation is scheduled to be completed by the end of December 2022. Breaking these figures down, about 100 households will be relocated in the largest area near the port on Cat Ba Island, with 22 households and eight other households resettling in the other two areas, respectively. It is possible for the largest area to be connected to the power grid, which is supplied by Vietnam Electricity (EVN), but the other two are not connected to the grid. These designated areas are located outside the World Heritage's core area, although they can be found in the buffer zone.
- Although the unit price for electricity will be higher when connected to the power grid than on land (VND 3,200/kW), people from floating villages engaged in the aquaculture business are generally wealthy and have higher incomes, and are more likely to use grid power, even if the rates are higher. For this reason, demand for stand-alone power supply units for solar PV is not expected to be very strong.
- Household A in a floating village: Lives in an area connected to the grid and owns nine solar PV panels and storage batteries. Electricity is stored in lead-acid batteries, which is used in conjunction with grid power. The family uses electricity to boil water and propane gas (LPG) for cooking. They also own a generator.
- Household B in a floating village: Lives in an off-grid area and was forced to relocate to an area connected to the grid. The only power source is eight solar panels, with electricity stored in lead-acid

batteries. The family owns a generator, but it does not work. They use propane gas for cooking.

Cruise ships

- There are 94 cruise ships available for overnight stays operating in Lan Ha Bay. Electricity required for overnight services is generated on the ships using diesel generators. While most ships do not have solar PV panels installed, the potential for installing stand-alone power sources is believed to be low due to the limited space available to install the panels.

Green Island Plan and EV carts

- The Hai Phong Department of Tourism developed a plan to transform Cat Ba Island into a "green island" by 2030. Achieving the objectives of the Green Island Plan requires that EV carts be introduced, as well as a variety of other energy-efficient and renewable energy technologies.
- Currently, there are about 140 EV carts for tourists being used around Cat Ba Island, which are operated by eight different companies. Fares are as low as VND 10,000 (about JPY 50).
- In 2018, Hai Phong issued Decision No. 42/2018/NQ-HDND on promoting green transportation on Cat Ba Island. The decision incorporates the introduction of EVs and other low-emission vehicles (CNG, LPG) on Cat Ba Island by 2025, and restricts the use of diesel and gasoline-powered vehicles on the island.
- A system is currently being examined in which gasoline- and diesel-powered vehicles would only be able to have access to the ferry terminal, and then would shift over to transport/transfer using low-emission vehicles on the island. A new ferry terminal would also be constructed for this system.

Urban areas and commercial facilities

- There are a number of restaurants and hotels in Hai Phong that are interested in installing solar PV systems; however, their introduction has been hindered because of the lack of cost benefits resulting from EVN's economical and stable grid power costs, difficulty in introducing these systems because of competing interests with EVN's electricity sales contracts, and the risk of reduced levels of sunlight and moving due to increased construction in the surrounding area. For the introduction of solar PV systems, it is essential that electricity costs be lower than that of power supplied by the grid.
- The hotel where the team conducted interviews (80 rooms) pays about VND 200 million (about JPY 1 million) to EVN each month for electricity. The most expensive portion of this bill is the cost for the electric water heater for hot water. The hotel has not considered installing a solar PV system, but may look into this if the system could be installed at a lower cost than EVN's electricity bills.

Cat Hai Eco-Town

- Plans were in place to relocate the residents of Cat Hai Village (2,422 households, population 8,621), which is the planned location of a plant development site for DEEP C, to redevelop the area as an eco-town. However, DEEP C submitted an alternative proposal to the Hai Phong People's Committee that does not require residents to relocate.
- The alternative plan would benefit both residents in the area and the industrial park by promoting the

creation of a liveable town with the aim of creating a balance between Cat Hai Village and the industrial park in the surrounding area. Grid power would be supplied to the town, so there was little flexibility afforded for the introduction of solar PV equipment.

Industrial park

- The four Japanese companies visited for this study use electric forklifts and expressed interest in services to recondition lead-acid batteries for use in these forklifts. Many Vietnamese factories use engine-powered forklifts, while most foreign companies use electric forklifts. This is an indication that a certain level of demand is available for reconditioning lead-acid batteries for electric forklifts.
- The study found that, in many cases, staff conduct visual inspections on meters for various types of equipment on the site of a large industrial park using motorbikes on a daily basis. In some cases, data cannot be collected electronically because of the limited number of locations with electric power lines. Therefore, it appears there may be a need for a system in which sensors and monitoring cameras could be mounted at these inspection points and transmit data via WiFi using small solar PV systems and regenerated batteries.

Solar PV system installation companies

- Company C, a solar PV installer, has a head office in Hanoi and a branch office in Hai Phong. The company launched a solar PV business in 2018 and handles surveys, design, installation and maintenance of solar PV systems (EPC contractor). The company mainly works in the north, but also has experience in the central area, in addition to a track record in constructing several rooftop solar PV systems on factories, including for Japanese companies. In all these cases, the prime contractor (major foreign-owned renewable energy company) owns and installs the equipment and sells the electricity to factories under a PPA project.
- A possible collaboration with Company C in obtaining logistical and technical supports in installing small-scale, stand-alone solar PV power supply units in Lan Ha Bay was discussed.
- A possible collaboration with a PPA provider with which Company C does business on potential for developing a JCM model project with factory rooftop solar PV systems and regenerative storage batteries was discussed.

Lead-acid battery producer

- Established in 1960, Company D, a lead-acid battery producer in Hai Phong, was the very first battery producer in Vietnam, mainly engaged in the manufacture of lead-acid batteries. Since introducing Korean AGM (Absorbed Glass Mat) technology in 2001, the company has produced two types of lead-acid batteries: AGM and Glass Mat. The company purchases ingots and other components for the assembly and production of these batteries, but does not perform recycling. They mainly produce lead-acid batteries for sale on the domestic Vietnamese market, although batteries are also exported to countries in the Middle East and Southeast Asia.
- AGM batteries are produced for products for use in automobiles, motorcycles/motorbikes, ships, solar PV systems, and telecom base stations, but not for electric forklifts.

- Company D does business with a telecom company that delivers batteries for mobile base stations, to which an introduction can be made.

2.1.4.3. Potential for business development and technical cooperation

In light of the results of the studies, information was compiled on potential projects that could be expected to be developed and deployed in Hai Phong (and potentially outside of the city in some cases) and shared with the Hai Phong Department of Foreign Affairs. In the future, additional studies and verification on details for each proposal will be required.

(1) Introduction of small-scale, stand-alone power supply units to the residents in Lan Ha Bay's floating villages

A decision was made to develop a demonstration unit of a small-scale, stand-alone power supply unit equipped with second-hand solar PV modules and regenerative storage batteries to be transported to Hai Phong, where it will be put to use by residents in Lan Ha Bay's floating villages in order to collect data, since there may be a certain level of need for such a system. The level of convenience and costs can be verified through this unit and used to identify and uncover potential needs.

The demo unit was produced in December 2022, created with a simple design to keep initial costs low and to allow for flexibility in modifications depending on local conditions. The unit is equipped with a second-hand solar PV module (600 Wh), reconditioned lead-acid battery (24V), inverter, and control panel that have been put through performance tests (Fig. 2.1.4.3.1). Testing was completed on the system in Japan between January and February 2023. The system is scheduled to be shipped to the site by the end of fiscal 2023 and installed with the cooperation of the Hai Phong city authorities and Company C, a solar PV system installation company, for operation as a demonstration project throughout the next fiscal year.

Fig. 2.1.4.3.1. Small-scale, stand-along power supply unit. Specifications differ slightly from those actually will be installed in Hai Phong. (Source: IGUAZU Corporation)

The unit is expected to be sold on a subscription basis (instalment sales) in off-grid and other non-electrified areas, where customers are not responsible for initial costs and equipment costs are recovered through monthly usage fees (electricity charges). The key to the success of expanding the use of this unit will be in the ability to set electricity fees so that they are lower than those available through EVN's grid power.

(2) JCM model project for factory rooftop solar PV equipment + regenerative storage batteries

The installation of factory rooftop solar PV equipment has made headway in Vietnam since Prime Minister's Decision No.13 permitted rooftop solar PV systems with a maximum capacity of 1 MW and voltage of 35 kV or less to sell electricity without EVN's involvement. However, there have been few solar PV systems installed with storage batteries because these types of batteries are still costly. By contrast, if inexpensive regenerative storage batteries could be supplied, there may be a certain level of demand in factories that operate at night. For this reason, the potential for applying for a subsidy under the JCM model project scheme was considered for the introduction of a system combining factory rooftop solar PV equipment and regenerative storage batteries.

Project model vision

The vision for the JCM model project application includes cases where solar PV facilities with a maximum capacity of 1 MW and voltage of 35 kW or less are installed on the roof of a factory under a private power purchase agreement (private PPA). The equipment is installed and owned by a joint venture, with an electricity sales contract set up with the factory (customer) to recover the investment. All the electricity stored in storage batteries is expected to be generated by the solar PV system installed on the roof of the factory, with all the electricity supplied by storage batteries expected to be used by the factory itself. (Fig 2.1.4.3.2).

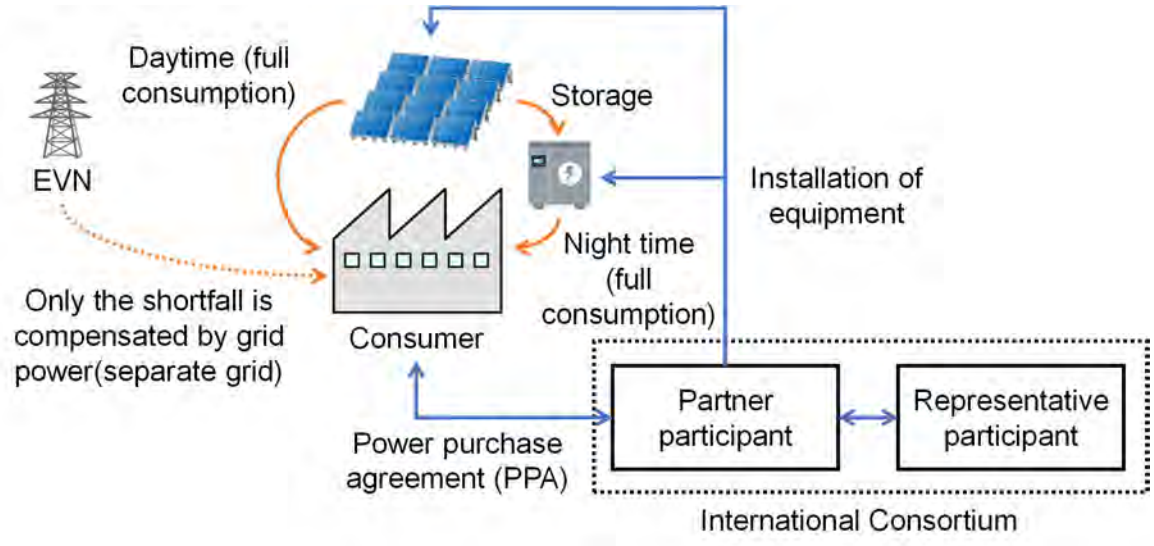


Fig. 2.1.4.3.2. Vision of "Solar PV + storage battery" business model

In Vietnam, electricity rates are generally low, but the unit price of electricity sold during peak hours in the morning and evening is set high. So by using part of the stored electricity that is generated during the daytime in the peak hours in the evening, it is expected that the electricity bill can be reduced and the payback period can be shortened. (Fig. 2.1.4.3.3).

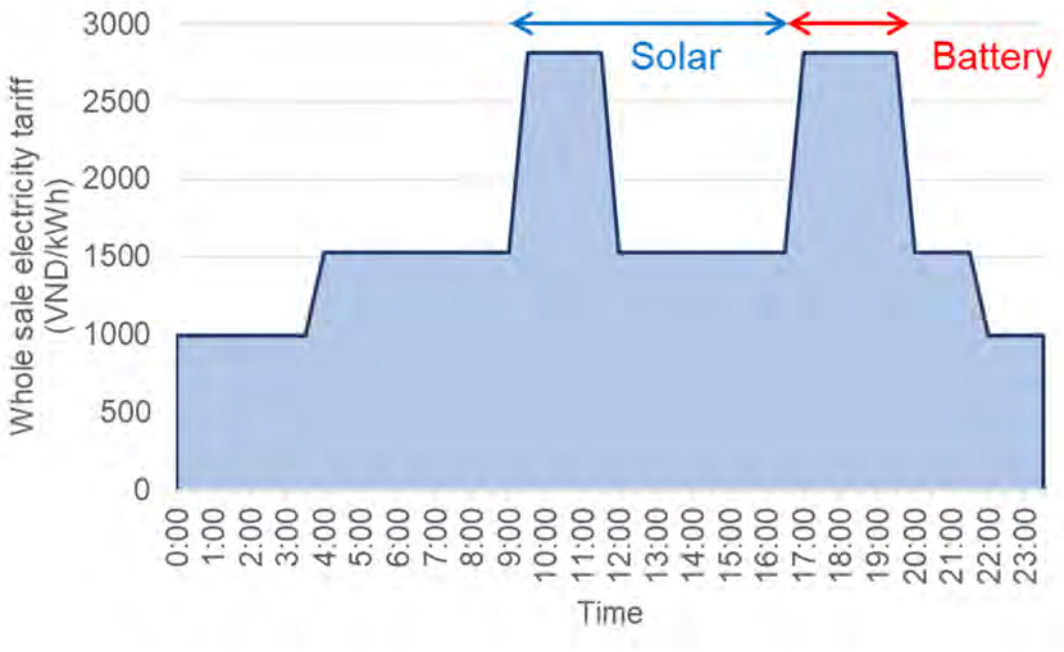


Fig. 2.1.4.3.3. Hourly electricity rates in EVN's industrial parks (22-kV to 110-kV voltage levels) and an image of charging/discharging based on these rates (Source: Created based on EVN[15])

Subsidy rates

There are no "solar PV system + storage battery" projects found among the JCM model projects that have been adopted to date in Vietnam, allowing for the possibility of receiving the maximum subsidy rate of 50% in this category. There are only two such projects in other countries: one "solar PV system + storage battery" project in Indonesia (adopted in FY 2014; 500-kW solar PV equipment + 100-kWh storage battery) and one in Thailand (adopted in FY 2021; 35-MW solar PV equipment + 36-MWH storage battery). The project in Indonesia is for private consumption, while the one in Thailand is based on electricity sales.[16]

JCM methodology

There are three methodologies for "solar PV equipment + storage batteries" under the JCM: MV_AM002, ID_AM017, and CL_AM002. In the case where no energy management system (EMS) or other power generation equipment is attached to the system, and all the electricity stored in the storage batteries is generated by solar PV equipment, the Option 3-1 methodology of ID_AM017

[15] EVN: https://en.evn.com.vn/d6/news/WHOLESALE-ELECTRICITY-TARIFF-9-28-260.aspx
[16] JCM projects/studies (GEC): https://gec.jp/jcm/jp/projects/

(Figure 2.1.4.3.4) would be considered to apply. This methodology requires quantitative monitoring of the amount of electricity generated by solar PV, the amount stored in the battery, and the amount discharged from the batteries, respectively. The CO_2 emission factor for electricity is defined as 0.333 tCO_2/MWh[17] for renewable energy sources, except when only substituted for power generated in-house, so this value will be used.

Option3-1 (In case the project storage battery system(s) are only charged by the project PV system(s)):

$$RE_p = \sum_{i,j} \{EG_{i,p} - EC_{i,j,p} + ED_{j,p}\} \times EF_{RE}$$

RE_p : Reference emissions during the period *p* [tCO_2/p]

$EG_{i,p}$: Quantity of the electricity generated by the project solar PV system *i* during the period *p* [MWh/p]

$EC_{i,j,p}$: Quantity of the electricity charged by the project solar PV system *i* to the project storage battery system *j* during the period *p* [MWh/p]

$ED_{j,p}$: Quantity of the electricity discharged from the project storage battery system *j* during the period *p* [MWh/p]

EF_{RE} : Reference CO_2 emission factor for the project system [tCO_2/MWh]

Figure 2.1.4.3.4. Approved methodology by JCM: Option 3-1 of "ID_AM017"
(Source: JCM website[18])

Statutory useful life

As a JCM model project, it is necessary to monitor the period of the statutory useful life of the equipment that will be subsidised. We confirmed with the Global Environment Centre (GEC), which is in charge of the JCM model project, whether the proposal falls under the category of power sales or private consumption, and how many years the legal statutory useful life would be. GEC responded that if the international consortium members conclude a private power purchase agreement (private PPA) to sell electricity to other companies, it would be considered an electricity sales project, and that the statutory useful life for electricity sales would be 17 years, as specified in "Appendix 2 / Electricity industry equipment / Other equipment / Equipment mainly made of metal".

Since 17 years is a long period of time and it may be difficult to reach an agreement on a long-term contract with a joint venture partner, it is necessary to consider structuring projects for private consumption that are not private PPAs. GEC also confirmed that the statutory useful life of a "PV + storage battery" project that includes different types of equipment will be the statutory useful life of the type of industry in which the equipment is installed in the case of private consumption. For example, the statutory useful life for equipment used in food product manufacturing is 10 years,

[17] GEC (2022), Application guidelines for CO_2 emission reduction project subsidies for FY 2022 to FY 2024
[18] JCM Methodology: ID_AM017 Ver1.0 https://www.jcm.go.jp/id-jp/methodologies/78

while equipment used in manufacturing plastic products is eight years, and nine for rubber manufacturing.[19]

GHG emission reductions

A total of 14 JCM model projects for solar PV systems have been adopted in Vietnam (as of February 2023). GHG emission reductions per MW range from 248 to 501 tCO_2/year (average 417 tCO_2/year) (Table 2.1.4.3.1). GHG emission reductions per MW tend to be higher in the southern and central regions which have better sunlight conditions.

Table 2.1.4.3.1. List of JCM model projects adopted on solar PV power generation in Vietnam (as of February 2023) (Source: Created based on JCM projects/studies[16])

Lead entity	Partner	Location	Year adopted	PV capacity (MW)	Assumed GHG emission reductions (tCO_2/year)	GHG emission reductions per 1 MW (tCO_2/year)
The Kansai Electric Power Co., Ltd.			2022	0.8	379	473
The Kansai Electric Power Co., Ltd.	Kansai Energy Solutions (Vietnam) Co., Ltd.	Ho Chi Minh, Danang	2022	1.8	815	452
Marubeni Corporation	Marubeni Green Power Vietnam Company Limited	Hanoi (north), Ho Chi Minh (south)	2022	5.7	1,416	248
Sumitomo Mitsui Trust Panasonic Finance Co., Ltd.	Enkei Vietnam Co., Ltd.	Hanoi (north)	2022	0.4	156	390
The Kansai Electric Power Co., Ltd.	Kansai Energy Solutions (Vietnam) Co., Ltd.	North, central, south	2022	7.9	2,634	333
Asian Gateway Corporation	VES Joint Stock Company	Binh Duong province (south)	2021	5.8	2,531	436
Osaka Gas Co., Ltd.	SOL Energy Company Ltd.	Dong Nai province (south)	2021	9.8	4,312	440
The Kansai Electric Power Co., Ltd.	Kansai Energy Solutions (Vietnam) Co., Ltd.	Ho Chi Minh (south), Nghe An province (north)	2021	2.5	984	393
Marubeni Corporation	Marubeni Green Power Vietnam	North, central, south	2021	12	4,975	414
Sharp Energy Solutions Corporation	I RENEWABLE ENERGY VIETNAM CO., LTD.	Hanoi, Bacninh province, Ha Nam province (north), Ba Ria-Vung Tau province, Ho Chi Minh (south)	2021	9	3,618	402
Idemitsu Kosan Co., Ltd.	TTCL Public Company Limited	Binh Dinh province (central)	2020	2	945	472
Kanematsu KGK Corp.	SAO MAI GROUP CORPORATION	An Giang province (south)	2020	57	28,244	495
Kanematsu KGK Corp.	SAO MAI GROUP CORPORATION	An Giang province (south)	2019	49	24,570	501
AEON RETAIL Co., Ltd.	AEON VIETNAM Co., Ltd.	Ho Chi Minh (south)	2015	0.32	125	390

[19] Ministerial Ordinance on the Useful Life of Depreciable Assets (Ministry of Finance Ordinance NO.15 of 1965): https://elaws.e-gov.go.jp/document?lawid=340M50000040015

Cost effectiveness

As there are no “solar PV equipment + storage batteries” projects adopted as JCM model projects using similar technology in Vietnam at this time, JPY 4,000/tCO_2 eq will be applied as the standard for the cost effectiveness of the subsidised amount for GHG emission reductions.

If a standard for cost effectiveness of JPY 4,000/tCO_2 eq or less is applied to equipment with a statutory useful life of ten years, the maximum subsidy provided would be JPY 20 million, if estimated annual GHG emission reductions per 1 MW is 500 tCO_2/year. As the maximum subsidy available falls to JPY 12 million if estimated annual GHG emission reductions per 1 MW is 300 tCO_2/year, it is important to select locations with better sunlight conditions (southern to central region) and choose cost-effective equipment (low cost with high efficiency) in order to increase the amount of the subsidy available.

The average value of commercial solar PV systems (max. 10 kW) installed in Japan in 2021 was JPY 250,000/kW (JPY 250 million per 1 MW),[20] indicating that the maximum subsidy available is less than 10% of the cost of the equipment.

Requirements for solar PV equipment + storage battery systems

The guidelines shown in figure 2.1.4.3.5 are the requirements for the adoption of a “solar PV equipment + storage battery” project under the JCM model project scheme.[17] A “conversion efficiency of 20% or higher” is set for the performance of solar PV modules. Even if using the latest industrial solar PV modules that are currently available in Japan, the ability to meet a conversion efficiency that exceeds 20% is limited to those with high output. It is likely that it will be difficult to meet this requirement using second-hand modules from years back when output was relatively small, so this project will consider the use of new solar PV modules.

Storage batteries can only be charged with the electricity generated by the solar PV modules installed, and the amount of electricity supplied by these batteries must be able to be measured, so a measurement device must be included that can monitor charge/discharge.

If storage batteries are installed for personal consumption in the factory, they will be charged/discharged on a daily basis and must have a capacity of at least 20% of the capacity of the solar PV module. In addition, it is necessary not to store power outside of the subsidized facilities. The capacity of the storage batteries will be considered according to the electricity storage needs of the factory where they are installed and meet the criteria that they are at least 20% of the capacity of the solar PV modules.

[20] Agency for Natural Resources and Energy (2021) About solar power: https://www.meti.go.jp/shingikai/santeii/pdf/073_01_00.pdf

2. Solar Power Plant with Battery

All the following conditions must be met.

- Photovoltaic module

  The efficiency of photovoltaic modules must be 20% or higher.

  *Except for particular technologies such as installation of building-material integrated photovoltaic modules.

- Battery

(1) A battery charges only the power generated by photovoltaic modules to be introduced, and the amount of power supplied from the battery can be measured.

(2) Regarding the installation necessity of a battery, one of the following requirements must be met.

1) Installation at off-the-grid areas

2) In case of supplying the generated power to grid, the installation of batteries is required by the laws or the regulations of the partner country, such as for the purpose of stabilizing the grid system.

3) All of the followings must be met for the self-consumption in the factory or the local power supply business.

(a) In principle, the battery should be charged and discharged every day.

(b) The battery capacity is 20% or larger than the wattage of photovoltaic modules installed and within the maximum daily chargeable amount of generated power. Storage battery capacity must be at least 20% of the power generation capacity of the solar PV module during hours when power is generated, and shall be less than or equal to storage capacity on days when the difference between power generation and demand is at a maximum.

Fig. 2.1.4.3.5. Conditions for adoption by technology under the JCM model project scheme as a “solar PV equipment + storage battery” project[17]

Use of second-hand/used equipment

A collection of questions and answers[21] on the JCM model project subsidy scheme offers the following guidelines on the applicability of subsidies for second-hand/used equipment.

[21] GEC (2022), CO2 emission reduction project subsidies from FY 2022 to FY 2024: Responses to questions received.

Q2-11	Equipment used for several years in Japan will be relocated to the site. If the second-hand/used equipment from Japan is more efficient than the latest general-purpose equipment that can be found locally, could the subsidy be applied?
A2-11	Although there have been no projects adopted to date, the equipment must be determined to have a higher efficiency rate than reference rates and to be expected to reduce CO2 emissions. In this situation, cost effectiveness and the potential for expansion and development of the equipment/technology will be reviewed based on screening criteria for adoption as a JCM model project. Refer to the National Tax Agency's notification on the useful life of second-hand/used assets for more information on statutory useful life.

Lead-acid batteries can be reconditioned repeatedly, in principle. However, the number of times storage batteries can be reconditioned is limited to those with less robust structures to ensure safety. Testers perform inspections on second-hand lead-acid batteries, and only those that meet specific requirements are reconditioned. Lead-acid batteries produced locally, and that are mainly distributed in Southeast Asia, generally have a less robust structure. Therefore, only about half of the second-hand batteries used in lead-acid battery recycling projects in Myanmar, Thailand and other countries are being reconditioned. In contrast, lead-acid batteries manufactured in Japan, Europe and the United States have a more robust structure and higher reconditioning rates.

In general, the statutory useful life of reconditioned storage batteries must be calculated using the simplified method[22] prescribed by the National Tax Agency because they are second-hand/used assets. As mentioned above, the "solar PV equipment + storage batteries" project is not expected to be affected by the use of used assets because the statutory useful life of the industry of the factory where the equipment is installed will be applied. However, if the statutory useful life is 10 years, the storage batteries would need to be replaced (regenerated) during the monitoring period due to their deterioration. In addition, it is necessary to investigate and study how CO2 emissions, etc. generated when the storage batteries are regenerated during the monitoring period will be reflected in the methodology. Regarding "higher efficiency than reference and expected to reduce CO2 emissions" as one of the requirements for used equipment to be eligible for subsidies, data showing that recycled storage batteries made in Japan are more efficient than new storage batteries procured locally is considered necessary. With regard to "cost-effectiveness and diffusion and deployability of equipment and technology," the recycled storage batteries can be introduced at a lower cost, and thus are considered to be superior in terms of cost-effectiveness and diffusion and deployability.

(3) Reconditioning services for lead-acid batteries for mobile base stations in collaboration with telecom companies

It is important to get the process of lead-acid reconditioning on the right track as a business, in order to commercialise small-scale, stand-alone power supply units and factory rooftop solar PV equipment + regenerated storage batteries in Vietnam. The most realistic way to commercialise the

[22] National Tax Agency, "No.5404 Useful life of second-hand/used assets": https://www.nta.go.jp/taxes/shiraberu/taxanswer/hojin/5404.htm

process of reconditioning lead-acid batteries in Southeast Asia, an area of growing demand, is to collaborate with telecom companies in reconditioning backup lead-acid batteries for mobile phone base stations, an initiative that has already been introduced in Myanmar, Indonesia and Thailand (includes projects in the process of being introduced).

In this model business, a battery reconditioning plant will be set up on site to accept used batteries from telecom companies. These batteries will be inspected by testers and those that meet conditions (about 50%) will be reconditioned and returned to the telecom companies at a profit. Storage batteries that do not meet conditions will be sold as scrap to metal recycling companies. This process has benefits for both parties, with telecom companies able to reduce costs in comparison to the need to purchase new storage batteries, and battery reconditioning plants will be able to have a stable supply of large quantities of batteries to recondition. This will also be instrumental in reducing CO_2 emissions related to the manufacture and transportation of new batteries.

This study offered an opportunity to be introduced to telecom companies in Vietnam through several local partners. The feasibility of developing this as a model business in Vietnam will be investigated from FY 2023 and beyond.

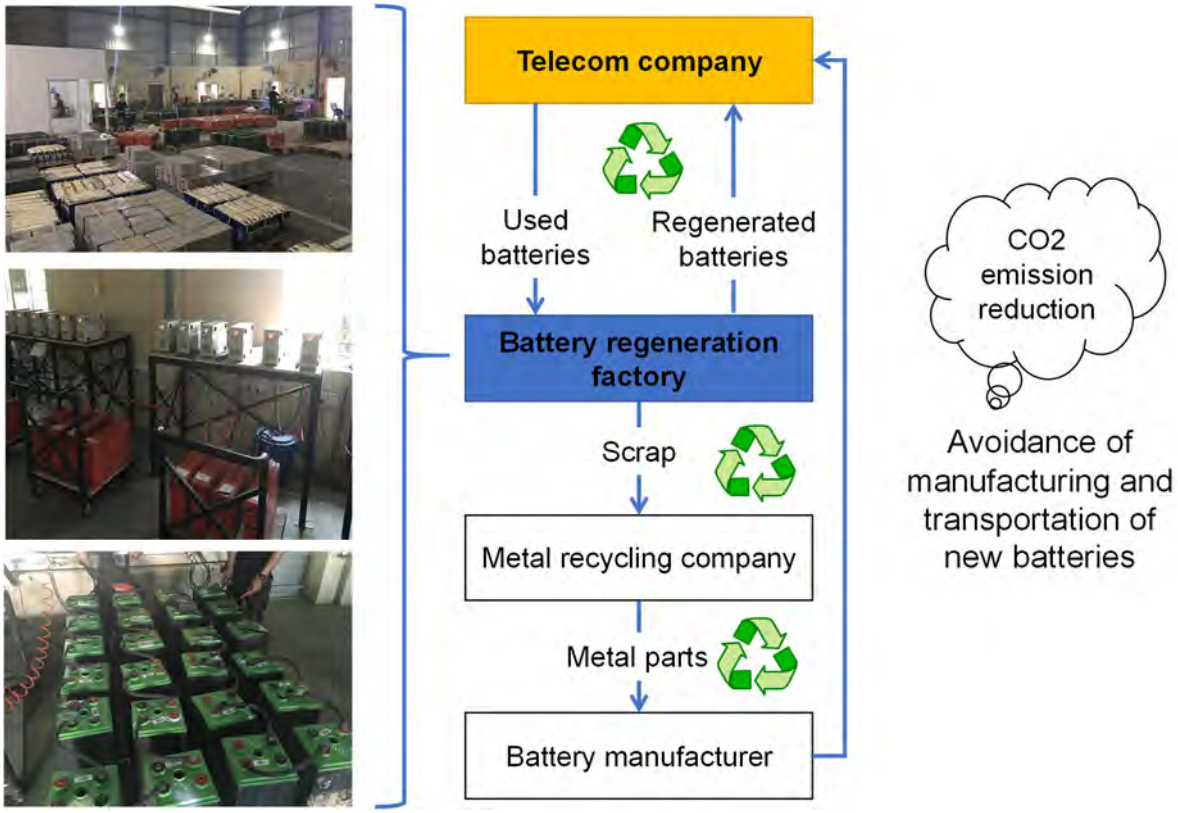


Fig. 2.1.4.3.6. Model business on reconditioning lead-acid batteries in collaboration with telecom companies. Photos show a battery reconditioning plant in Myanmar (Source: IGUAZU Corporation)

(4) Reconditioning services for lead-acid batteries for electric forklifts

This survey found that a number of Japanese and other foreign-owned companies use electric forklifts, an indication of expected demand for reconditioning the lead-acid storage batteries used in these forklifts. The process of reconditioning batteries for electric forklifts is already operating as a business in Japan under the MOTTA brand, with similar business models expected to be expanded outward to Vietnam.

In more specific terms, a potential business model may make use of electric forklift rental services (which would also include battery reconditioning) for companies occupying rented factories that do not own their own forklifts, in addition to providing reconditioning services for second-hand/used batteries as are available in Japan.

These services will help factories that own their own electric forklifts to lower battery costs, while also providing factories that do not own forklifts the opportunity to use high-performing electric forklifts at lower costs through sharing and eliminate the need for capital investment. The application of shared forklift services will allow factories to avoid the need to manufacture and transport new batteries and use engine-powered forklifts, thereby reducing CO2 emissions.

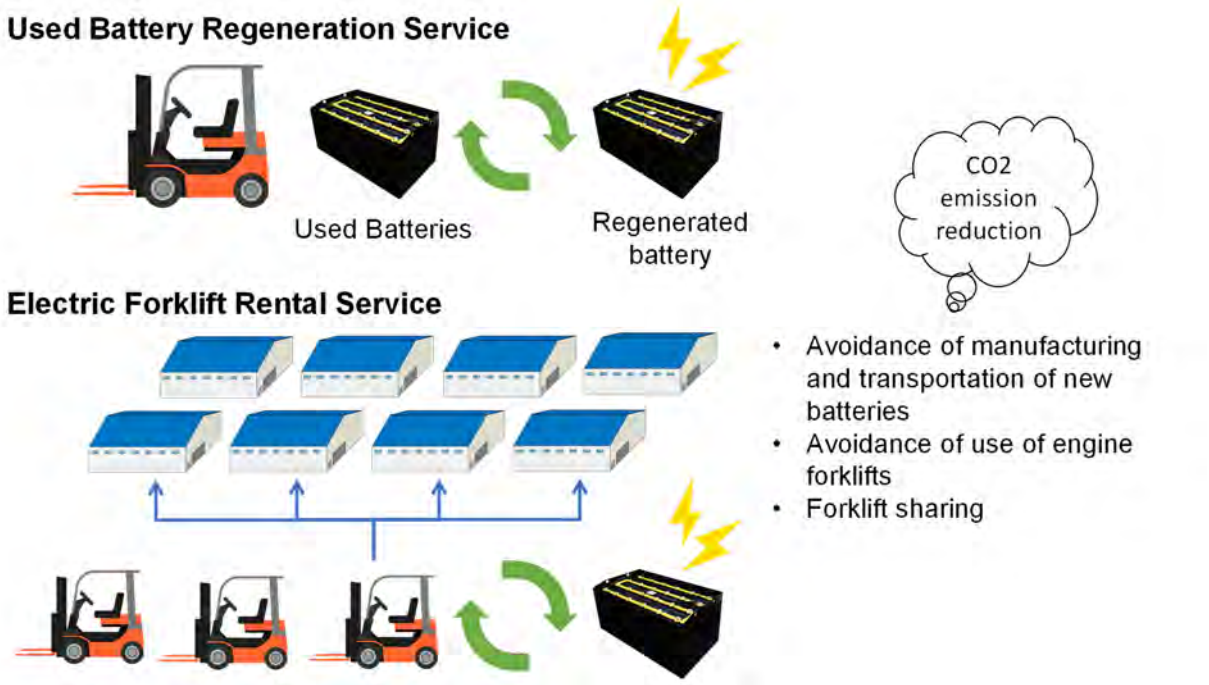


Fig. 2.1.4.3.7. Visual image of business model for electric forklifts

(5) Development of renewable energy-powered EV carts and sustainable tourism tax system on Cat Ba Island

The 140 EV carts in operation on Cat Ba Island are expected to increase in number, since diesel- and gasoline-powered vehicles will be restricted on the island by 2025 in accordance with the Green Island Plan. Currently, EV carts run on lead-acid batteries charged with grid power generated primarily by coal-fired power generation. However, there is a need to make the shift to renewable

energy sources (solar power) to position the island as fitting with the concept of a green island and as the approach to a natural World Heritage site.

The steps proposed to promote the development of renewable energy-powered EV carts are outlined in Fig. 2.1.4.3.8. The development of renewable energy-powered EV carts is considered to be too difficult under the current low fares (VND 10,000), so fares must first be revised to a level that is appropriate for the island's status as an entranceway to a natural World Heritage site (1). Next, storage batteries on board the vehicles must be reconditioned (2), and roofs remodelled to allow for the installation of solar PV panels (3). Next, the power source must be converted to a solar PV and storage equipment system (4), followed by the creation of a tourism fund to serve as a stable financial resource that can cover the costs of environmental-related activities (5).

These activities are expected to contribute not only to achieving the objectives of the Green Island Plan, but to also reduce CO2 emissions.

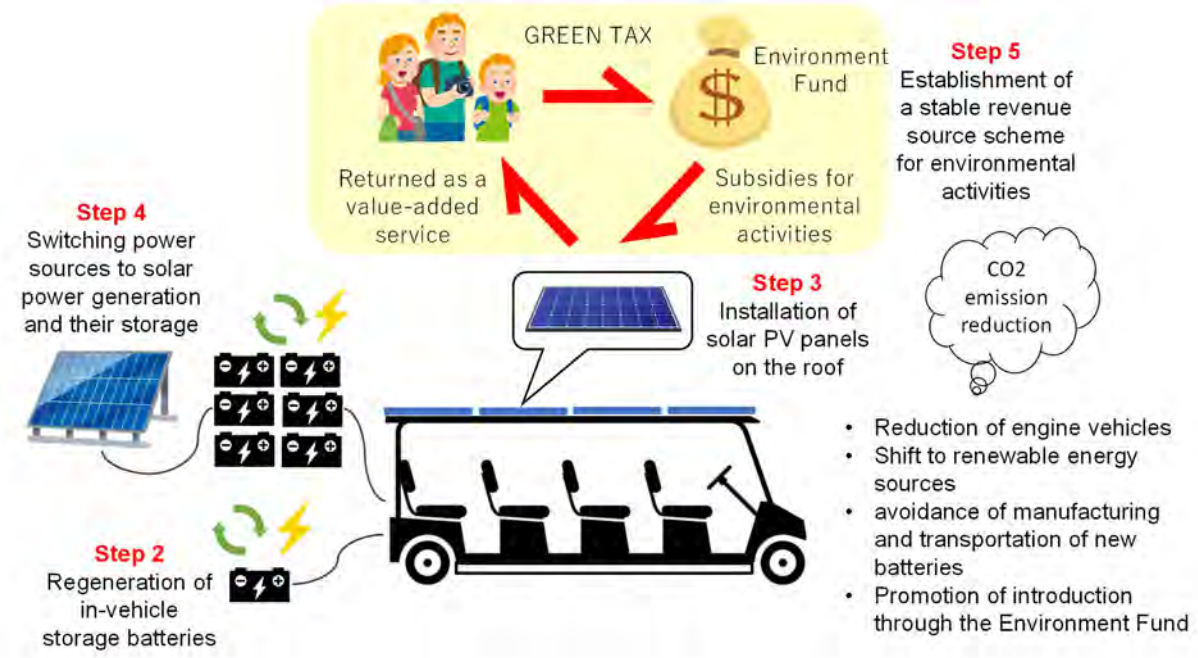


Fig. 2.1.4.3.8. Visual image of steps for the transition to renewable energy-powered EV carts

(6) Off-grid, wide-area monitoring system on Cat Ba Island, Lan Ha Bay, and industrial parks

If Lan Ha Bay is registered as a natural UNESCO World Heritage site, activities to collect marine litter and monitoring must be enhanced further. However, many areas around the bay are off-grid and uninhabited, necessitating the use of manual labour to conduct monitoring activities and implement measures in order to acquire information on various areas. Many of the industrial parks in Hai Phong also have extensively sized areas and only a limited number of places with power lines installed, and manual labour is being employed to inspect and monitor wide areas. However, conducting inspections and monitoring activities using boats or motorbikes is inefficient in terms of labour and fuel costs.

If sensors and monitoring cameras can be connected and operated by small, stand-alone power supply units equipped with a combination of solar PV modules and storage batteries, data can be transmitted via WiFi, making it possible to monitor wide areas more efficiently and at lower costs, even in off-grid areas. Using second-hand/used solar PV panels and reconditioned storage batteries will be effective in reducing equipment installation and running costs.

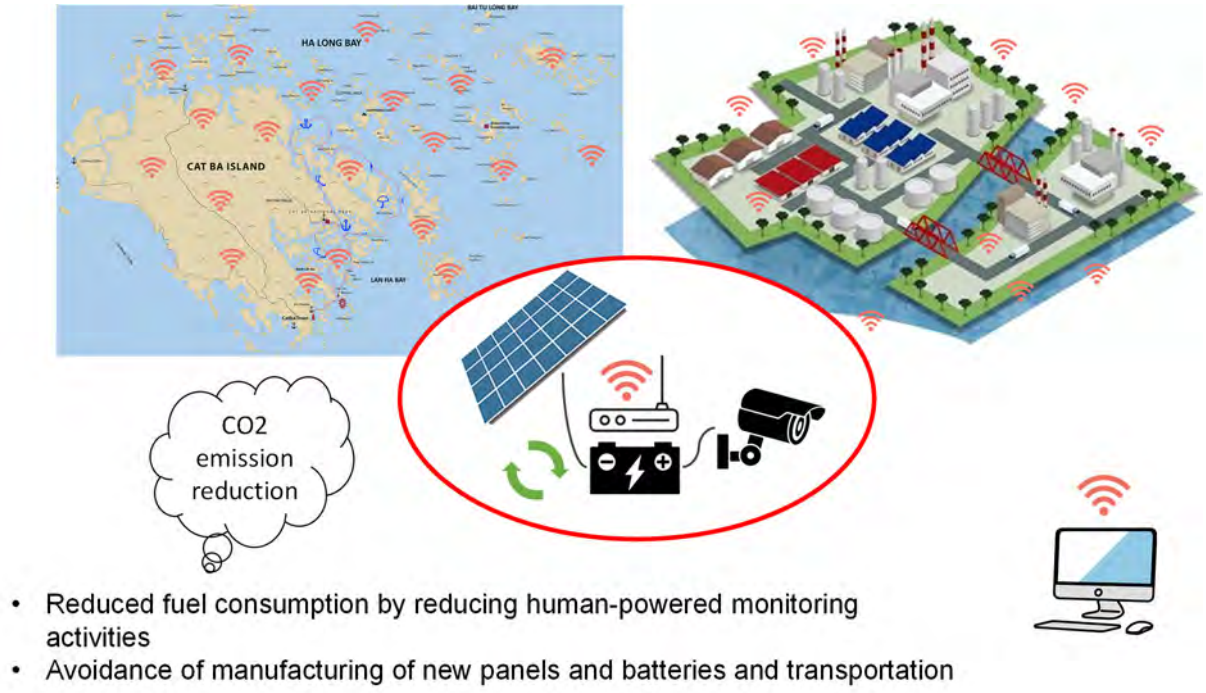


Fig. 2.1.4.3.9. Visual image of an off-grid, wide-area monitoring system on Cat Ba Island and Lan Ha Bay (left) and in industrial parks (right)

2.1.4.4. Future development potential

Local needs and the direction of technology-based proposals have been identified in this fiscal year's survey, and plans are in place to conduct in-depth surveys in the fiscal 2023 study on individual proposals and issues. In the wide range of proposals mentioned here, there are three clear directions that can be seen based on the types of proposals.

- JCM model project development study: Conduct studies on the feasibility of developing a JCM model project for a factory rooftop solar PV equipment + regenerative storage battery system. In more specific terms, potential local partners and factories where equipment will be installed will be identified through in-depth investigations, in addition to calculations on cost effectiveness and other matters that must be cleared before submitting an application for subsides under the JCM model project scheme.

- Business development survey on reconditioned storage batteries: The development of reconditioning services for lead-acid batteries for mobile phone base stations with telecom companies and lead-acid

storage batteries for electric forklifts as a business is considered possible through business-to-business partnerships, without the use of subsidies. Therefore, the potential for business development in Vietnam in these areas will be investigated through negotiations with local companies. These types of business foundations must be built prior to developing JCM model projects and other CO_2 emission reduction activities that utilise regenerative storage batteries.

- Technical partnership program survey: Small-scale, stand-alone power supply units to be introduced to residents in Lan Ha Bay's floating villages, conversion to renewable energy-powered EV carts, and off-grid, wide-area monitoring systems for Cat Ba Island and Lan Ha Bay are not appropriate for subsidies under the JCM model project scheme due to their small individual scales, and they are not anticipated to be profitable from a business perspective. After securing a business foundation for these projects (that are more grassroots and technical partnership in nature), their feasibility could be explored with a view to engaging in activities over the medium to long term in cooperation with local stakeholders.

2.2. Study on the use of energy derived from waste liquid and solid waste

2.2.1. Background and purpose

(1) Purpose

This study was conducted in Vietnam with the aim of realising significant reductions in CO2 emissions through the reduced use of coal and other natural resources by recycling industrial waste such as waste oil, waste solvents and sludge into raw cement fuel, using the intermediate waste treatment technology of Daiseki Co., Ltd. (hereinafter, 'Daiseki').[23]

The cement industry is the third largest energy consumer in the world and the second largest CO2 emitter.[24] However, this offers a significant scope for utilising waste as alternative fuels and raw materials. In Japan, the cement industry and industrial waste intermediate treatment companies such as Daiseki have traditionally worked together to convert waste into raw cement fuel (Fig. 2.2.1.1), resulting in a waste utilisation rate of approximately 50% (Fig. 2.2.1.2).

Vietnam has a thriving cement industry, ranking third[25] in the world in cement production in 2021 and first in cement exports in 2018,[26] but the move to converting cement into raw fuel has only just begun. Russia's invasion of Ukraine, which began in 2022, has led to a notable global rise in the price of coal and other energy sources. This has hit the cement industry, which is a major consumer of coal, particularly hard and has led to a search for alternative fuels, but with limited technology and knowledge.

Given this situation, if Daiseki's collective technology for converting industrial waste into raw cement fuel over the years could be introduced to the Vietnamese cement industry, it would not only offer advantages to Vietnam's cement industry, but also solve some administrative issues related to waste disposal, and have a positive impact on both international and domestic issues, such as global warming. Specific advantages include (1) reduced fossil fuel use, (2) reduced carbon dioxide emissions, (3) reduced raw material costs, (4) stable raw material supply, (5) reduced fuel costs, (6) stable fuel supply, and (7) reduced electricity consumption charges, in addition to others.

[23] Daiseki Co., Ltd.: https://www.daiseki.co.jp/
[24] IEA: https://www.iea.org/news/cement-technology-roadmap-plots-path-to-cutting-co2-emissions-24-by-2050
[25] U.S. Geological Survey (2022) Mineral Commodity Summaries 2022: https://pubs.usgs.gov/periodicals/mcs2022/mcs2022.pdf
[26] VIETJO [2019/04/05] Vietnam is the world's largest cement exporter in 18 years: https://www.viet-jo.com/news/economy/190405193706.html

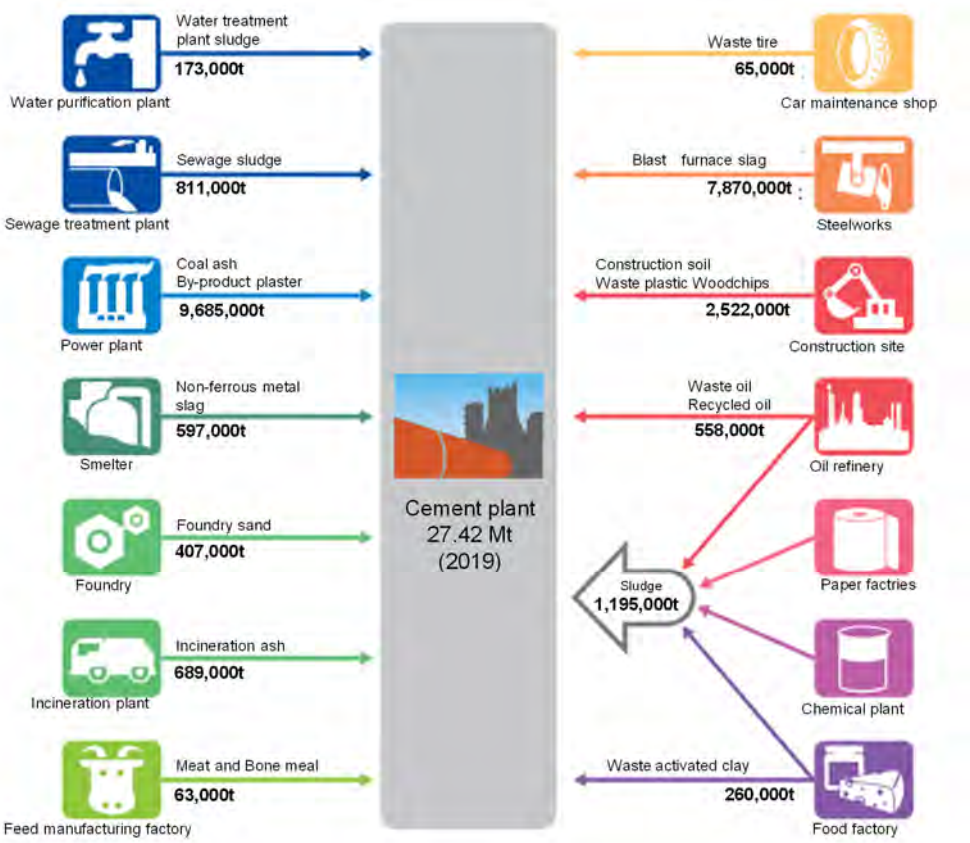


Fig. 2.2.1.1. Actual use of waste in cement plants in Japan

(Source: Modified from Japan Cement Association[27])

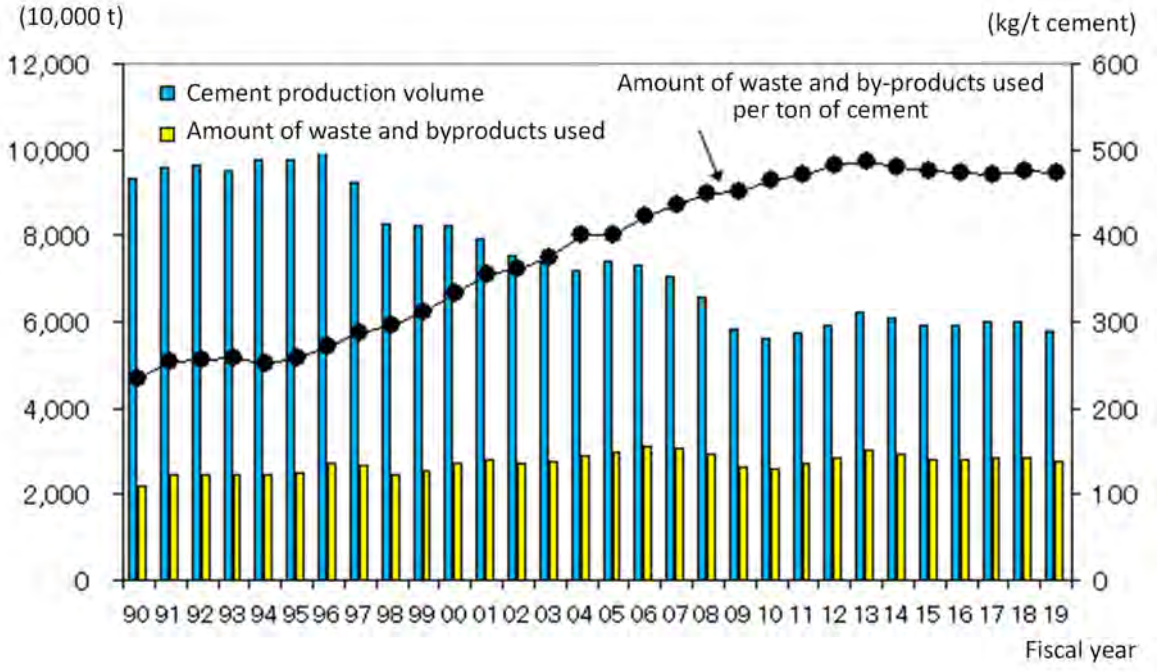


Fig. 2.2.1.2. Volume and rate of waste utilisation in the cement industry in Japan

(Source: Modified from Japan Cement Association[27])

[27] Japan Cement Association: https://www.jcassoc.or.jp/seisankankyo/seisan01/seisan01a.html

(2) Proposed technology and advantages

Daiseki collects and treats industrial waste such as waste oil, waste solvents and sludge at six sites in Japan. The company employs three main treatment methods: (1) waste oil treatment and recycling, (2) wastewater treatment and recycling, and (3) sludge treatment and recycling. Its primary business is waste oil treatment and recycling.

In waste oil treatment, waste oil and solvents in various forms, such as waste lubricating oil, cutting oil, paint and other solvents, are collected and treated according to their properties. Oil that is not mixed with water, such as waste lubricating oil and cutting oil, is refined by removing impurities and then reused as recycled lubricating oil. Oil with high water content is used in boiler fuel and other types of fuel as recycled heavy oil, after water content is removed. Waste oil and waste solvents, which are difficult to convert into recycled heavy oil, are also used as auxiliary fuels and alternative fuels in cement plants. In this way, Daiseki has achieved a recycling rate of approximately 90% and a reduction in CO2 emissions of approximately 90% compared to simple incineration by thoroughly and effectively utilising waste according to its properties, and by adding high value to waste, contributes to the creation of a recycling-oriented society.

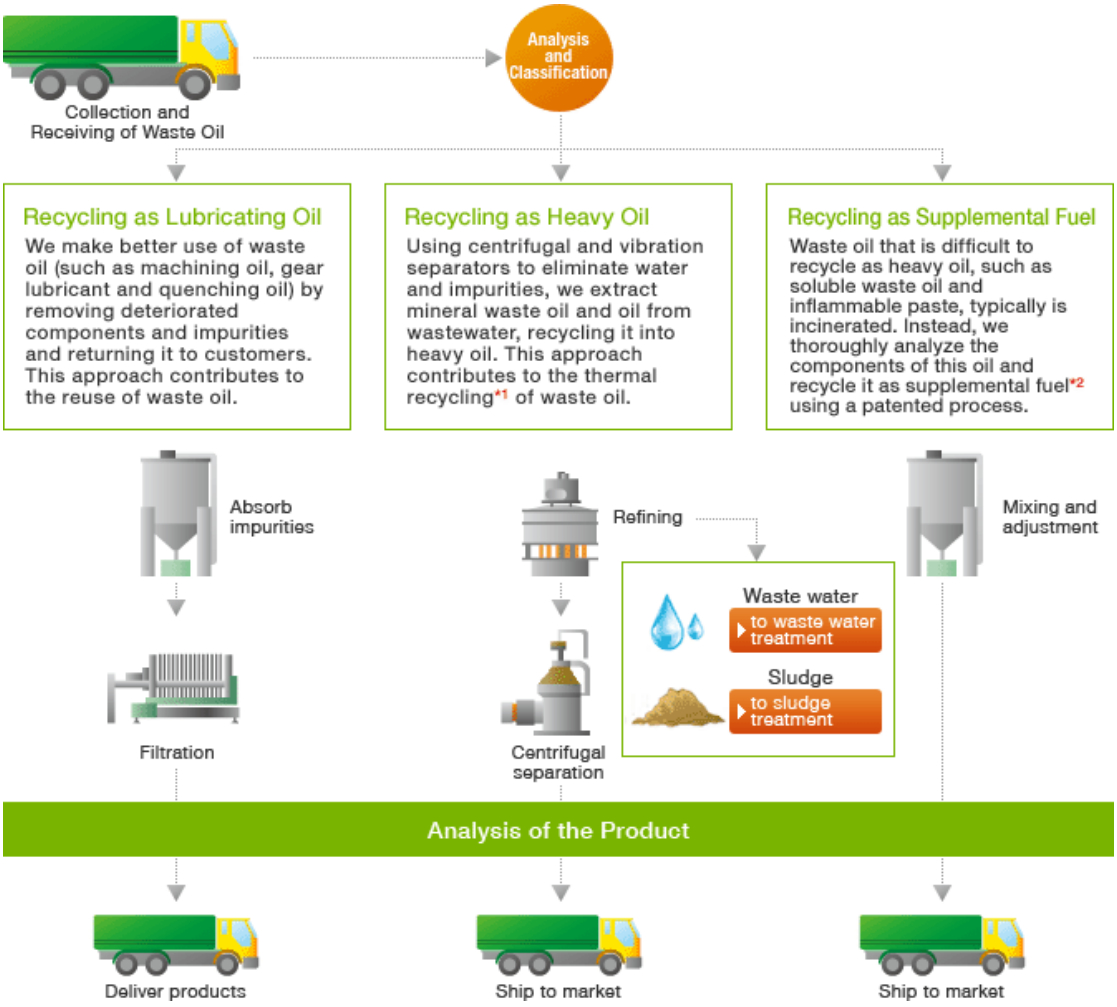


Figure 2.2.1.3: Flow of waste oil treatment and recycling at Daiseki

(Source: Daiseki's website[23])

(3) Results of the 2021 survey and target of this year's survey

In the FY2021 survey, interviews with local cement companies revealed a high level of interest in the use of waste and liquid waste as raw fuel and potential demand for alternative fuels. However, the survey also found that companies are hesitant to introduce systems using waste and liquid waste because of the lack of national standards and guidelines on the use of cement as raw fuel. In the industrial parks surveyed (Nam Cau Kien Industrial Park and DEEP C Industrial Zones), information on the amount of waste oil, waste solvents and other hazardous wastes was unavailable, as individual factories outsource the disposal of hazardous wastes through direct contracts with licensed companies. The amount of waste oil and sludge from the industrial estate was also limited, and the amount of waste oil discharged by the tenant companies interviewed was also small. Therefore, in this year's survey, a decision was made to expand the survey target beyond Hai Phong to the entire northern region, and to focus on companies that could be expected to emit a large amount of waste oil and waste solvents, in addition to surveys on cement plants.

Vietnam introduced the Extended Producer Responsibility (EPR) policy tool in the amended Law on Environmental Protection of 2020 (Articles 54 and 55), and Article 78 of the Decree (Decree No. 08/2022/ND-CP), which serves as the law's enforcement regulations and stipulate items to be recycled, including lubricating oil. Daiseki has a definitive technological advantage as recycling lubricating oil (recycled lubricating oil and heavy oil) is the company’s main business in Japan (Figure 2.2.1.3), and therefore, a decision was made to continue the survey from fiscal 2021 into fiscal 2022.

In light of the above, this year's survey had a more specific focus on liquid wastes, such as waste lubricants and solvents, with studies conducted on the actual conditions of recycled heavy oil and its conversion into alternative fuels for cement companies.

2.2.2. Study targets and methods

In addition to Hai Phong, this study covered the entire northern region of Vietnam, including the suburbs of Hanoi, in order to investigate a wide range of potential projects. In fiscal 2021, the survey was mainly conducted remotely due to the inability to travel to the areas because of COVID-19, which limited the information that could be collected locally. However, with travel opening up this year, two field surveys were carried out to collect information.

In addition to the team's own travel to the area to conduct surveys, information was collected with the cooperation of experts from An Chuan - IEC Environmental and Energy Services Joint Stock Company (AIC), which manages an intermediate waste treatment company in Vietnam, and Hanoi University of Science and Technology.

(1) Survey on legal systems

Information on Vietnam’s legal system was examined in relation to the conversion of liquid waste and sludge into raw fuel and EPR, with high priority assigned to relevant laws and regulations on hazardous waste, etc.

[Survey method]

Information was collected from interviews with the Ministry and Department of Natural Resources and Environment (MONRE and DONRE), the Japanese Embassy in Vietnam, JICA Vietnam, industrial parks, cement manufacturing companies, research institutions and local authorities, as well as from websites and other online sources.

(2) Survey on waste disposal

A survey was also conducted on general industrial waste, but this year it focused on waste oil, liquid waste and other types of hazardous waste, and investigated local treatment needs, actual treatment conditions, emission volumes, composition and types of waste, and other areas.

[Survey method]

Interviews and surveys were conducted on the amount of waste generated and treated, treatment methods and actual conditions, and actual conditions of use with visits to the Hai Phong Economic Zone Authority (HEZA), Department of Natural Resources and Environment (DONRE), government research institutions, solid waste treatment companies, hazardous waste treatment companies, waste generation companies, cement companies, and other groups.

(3) Survey on the use of alternative raw materials and fuels at cement plants

Interviews and surveys were conducted twice in 2022 (1 to 5 August and 30 October to 4 November) on the actual use of waste materials, needs and issues with three cement companies in northern Vietnam and one cement company in central Vietnam.

[Survey method]

Visits and interviews with cement companies.

2.2.3. First field survey

2.2.3.1. Summary

From Sunday, 31 July to Saturday, 6 August 2022, the team conducted interviews and inspections at cement plants, waste treatment companies and relevant administrative bodies in order to ascertain the actual status and conditions of introducing the process of converting liquid and solid waste into raw fuel, local needs, relevant regulations and other issues.

Date	Destination	Business activities
1 Aug	URENCO Hai Phong Composting Centre	Collection and disposal of general and medical waste
1 Aug	Cement company A	Manufacture and sale of cement
2 Aug	Hai Phong Economic Zone Authority (HEZA)	Administrative organisation
2 Aug	Department of Natural Resources and Environment (DONRE)	Administrative organisation
2 Aug	Department of Foreign Affairs (DOFA)	Administrative organisation
2 Aug	Waste management company A	Companies licensed to collect and dispose of hazardous waste
3 Aug	Cement company B	Manufacture and sale of cement
4 Aug	Department of Legal Affairs, Ministry of Natural Resources and Environment (MONRE/DOLA)	Administrative organisation
4 Aug	Vietnam Environment Administration, Ministry of Natural Resources and Environment (MONRE/VEA/WAMA)	Administrative organisation
4 Aug	Cement company C	Manufacture and sale of cement
5 Aug	Vietnam National Cement Association (VNCA)	Association of cement companies
5 Aug	Vietnam Institute for Building Materials (VIBM)	Research institute under the Ministry of Construction

2.2.3.2. Survey

Visit and consultation with URNCO Hai Phong Composting Centre

- URENCO Hai Phong is contracted by the People's Committee to collect, dispose and recycle general waste from four districts in Hai Phong. The centre also collects medical waste.
- Since 2016, the company has been running a composting business with support from the Kitakyushu City Environment Bureau, which includes the dispatch of experts. The composting business, including waste sorting, is running smoothly.
- The Law on Environmental Protection of 2020 includes targets to require the public to separate waste by 2024, so Hai Phong wants to focus on increasing the amount of organic waste collected by this time. Currently, waste is separated at businesses that generate large amounts of organic waste (e.g., restaurants, hotels, markets), and improvements are being made. Activities to raise awareness are also continuing to be implemented for households and residential complexes.
- Organic waste received at the centre is further sorted and then composted on the premises. Currently, 10% (about 100 tonnes/day) of the approximately 1,000 tonnes/day of municipal solid waste in Hai Phong is composted, while the remaining 90% is mostly disposed of in landfills. In the future, the aim is to increase the proportion of composted waste to between 15% and 20%.
- The compost produced is blended with chemical fertiliser (NPK) and sold. As a state-owned company, URENCO is more concerned with public interest than its own profits.
- If Daiseki is able to develop business in this area, there is interest in what waste can be converted into raw cement fuel, effectively using the dry waste that is currently dumped into landfills after

separation and extending the life of the landfill sites.

- Hai Phong currently has two landfill sites (Trang Cat and Dinh Vu). The People's Committee is also building a new preliminary landfill site, which, once completed, will be handed over to URENCO to be managed and operated.
- Hai Phong has plans to develop a waste incineration and power generation project, but this is still in the planning stages.

Meeting with centre staff

Food waste sorting machine

Storage space for pre-processed food waste

Compost pit

Fig. 2.2.3.2.1. Images of meetings and inspections with URENCO Hai Phong

<u>Plant inspection and discussions with Cement company A</u>

- The plant is an older design, so thermal efficiency improvements are needed. The company plans to invest in equipment in the future, focusing on improving production efficiency. Currently, priority is placed on upgrading the pre-heaters, and alternative fuels will be considered only after this work is completed.
- There is an expectation that, when using alternative fuels, there will be a reduction in CO2 emissions at the same time as costs are reduced by replacing coal. In terms of quantity, it is expected that more solid alternative raw fuels will be collected than liquids.
- When introducing alternative fuels, capital investment must be made to modify temporary combustion furnaces, but solid alternative fuels such as waste plastics need to be uniform in size, so

liquid fuels may have an advantage.

- As waste oil generated in-house is waste, it can no longer be reused within the company and is outsourced for processing, and then resold by that business. If Daiseki were to start a business, it would be able to reuse the waste oil on its own premises and gain a price advantage.
- Co-firing solid waste as an alternative fuel is not a problem as long as the emissions standards are met, but a license for hazardous waste treatment would need to be obtained. When using alternative raw fuels, it is important to find a way to reduce costs and secure quantities.

Discussions with Hai Phong City (HEZA, DONRE, DOFA and Waste management company A)

[HEZA]

- HEZA manages all industrial park clusters in Vietnam.
- Sludge generated in each industrial estate is classified as hazardous waste. Therefore, a hazardous waste license must be obtained to handle it. This sludge contains high levels of heavy metals, which poses challenges in terms of treatment methods.
- In order to use waste oil as an alternative fuel in cement plants, waste oil properties and exhaust gas parameters must be considered.

[DONRE]

- There are no legal issues regarding the sale of recycled oil. Users are consulted on business feasibility.
- When assessing hazardous waste licenses, technology and processes are also subject to review.
- With specific requests, DONRE can provide information that is available. However, while they possess information on industrial waste, there is no data on the calorific value of municipal waste.
- DONRE has data on waste oil and liquid waste collected in Hai Phong and will respond if they receive a list of requests.
- Hazardous waste can be brought into the city from outside if it is in the permit area that has been obtained.
- Sludge is not being recycled and is posing a challenge.
- The possibility of implementing a waste-to-energy project was suggested as an area to be examined at the Communist Party Committee in 2020.

[Waste management company A]

- Currently we collect, recycle and process mainly waste plastic. The volume of municipal waste is also increasing, which is an issue. After collection, waste plastic is made into resin pellets and sold. Collected sludge and waste oil are incinerated in an incinerator.
- After listening to Daiseki's explanation, the company understood how difficult it is for a single cement company to build a recycling chain, and the need to link the functions of collection, intermediate treatment and utilisation.
- The company is interested in waste-to-energy and believe that this will be essential in the future.

Fig. 2.2.3.2.2. Meeting with Hai Phong city officials

Inspection visit to Waste management company A

- This company is a hazardous waste collection, transport and treatment operator, licensed by MONRE for the entire northern region. The company receives approximately 1,000 tonnes/month of industrial and hazardous waste from the surrounding industrial parks. They handle mostly solid waste and a small amount of liquid waste.
- After receiving industrial waste, recyclable plastics and paper are sorted manually. Plastic is processed into plastic pellets and sold. Paper is sold to recycled paper suppliers.
- Other combustible waste that cannot be recycled is simply incinerated (approx. 2 tonnes/hour) together with waste oil and sludge in several incinerators of different sizes.
- Acid, alkali and other toxic effluents are treated chemically or by microbiological treatment in different tanks depending on their composition, and under flocculation, sedimentation and dehydration processes. After treatment, the effluent is adjusted to standards commensurate with the effluent treatment standards of the centralised effluent treatment plant in the industrial park and discharged. After dehydration, the coagulated sludge is incinerated.
- The incinerated ash is solidified into blocks for private consumption.

Inspection and discussion with Cement company B

- This company owns limestone, silica stone and clay mines. The company's strength lies in the fact that it owns and operates its own transport facilities, from receiving raw materials to shipping. Natural gypsum is imported and chemical gypsum is accepted in Vietnam.
- The company is licensed to treat hazardous waste. The company accepts footwear and textile waste, waste oil, household waste and other industrial waste as fuel substitutes. Footwear and textile waste is fed directly into the pre-heater, but as there is no chlorine bypass, waste plastics with high chlorine content are avoided as much as possible. The expansion of the existing system of feeding footwear and textile waste is currently under consideration.
- Waste is mainly received from the vicinity of the factory, but is also accepted from the entire northern region. No waste is accepted from the south. Tires are not used as they are not collected.
- The only waste oil used is waste lubricating oil generated on site. Most of the waste oil is processed

by existing companies and resold to third parties. Waste oil is currently not collected from external sources as it contains harmful PCBs. It may be difficult for cement factories to obtain licenses for waste oil as they are not considered to have the capacity to process waste oil.

- Emission standards are almost the same as in Japan, but automatic monitoring equipment that constantly transmits data to authorities will need to be installed from 2025.
- Group companies have CO2 emission reduction targets, necessitating consideration of both CO2 emission reduction and costs in the future.
- When using liquid alternative fuels, capital investment, including for safety, is required. A survey is needed to find out if the company can process liquid fuels because of legal compliance issues, both in terms of composition and equipment. The company would like this point to be investigated and considered.

Discussions with the Ministry of Natural Resources and Environment (DOLA, VEA/WAMA)

[DOLA]

- Vietnam is deeply interested in the proposed project as it aims to be zero carbon by 2050.
- Three of Daiseki's business areas (sludge, wastewater and waste oil) have been defined as recycling targets. But respective recycling standards are not yet available and are currently being developed by MONRE.
- When recycling collected industrial waste, there are rules stating that if there are no applicable standards in Vietnam, the standards of developed countries can be applied. In this case, a meeting should be held with the VEA to discuss details of what standards can be applied.
- Sludge and waste oil are legally treated in the same way, even if they are used for different purposes, such as fuel or raw material.
- In order to use fly ash or sludge as an alternative raw fuel for cement, it is necessary to obtain a permit from the Ministry of Construction. Industrial effluents are also treated in the same way as sludge.
- Vietnam's Extended Producer Responsibility (EPR) sets out two obligations for producers and importers. They have the option of collecting and recycling recyclable products and packaging (containers) or, for products that are difficult to recycle, donating to the Vietnam Environment Protection Fund (VEPF) for their disposal.
- The EPR stipulates post-sale collection and recycling methods and rates for lubricant manufacturing companies; for lubricants, 15% of the product is recycled through two methods. In Vietnam, there are few facilities to collect and effectively recycle waste oil, with most incinerated after collection, so Daiseki's collection and recycling of waste oil is expected to make a significant contribution to EPR in Vietnam.

[VEA/WAMA]

- In Vietnam, the Law on Environmental Protection came into force in 2005 and various notifications and regulations on waste treatment and recycling have been issued; the amended Law on Environmental Protection of 2014 includes provisions on waste treatment in rotary kilns in the regulations on industrial waste treatment. Furthermore, the revised Law on Environmental Protection,

which came into force in 2020, also included items recommending the recovery and recycling of waste.

- In order to recycle hazardous waste, each cement plant is required to obtain a treatment license from MONRE. To apply for a license, an environmental protection plan must be prepared and submitted to MONRE. A total of 117 operators have so far obtained hazardous waste treatment licenses, including three cement companies.
- It is understood that due to the geographical location of the licensed cement plants and the source of the waste, cement plants are less competitive than existing hazardous waste treatment operators in terms of hazardous waste recovery costs. Therefore, it is important for cement companies to work with hazardous waste treatment operators to promote recycling projects at cement plants.
- MONRE has issued a notification about a rule that the scope of collection is not restricted in order to encourage and expand hazardous waste recycling in cement plants, but provincial People's Committees have the right to determine the actual scope of collection. Therefore, to help cement plants to collect waste from other provinces, VEA provides support for submission of the necessary documents to provincial People's Committees for approval.
- If each cement plant uses hazardous waste as an alternative fuel, it must understand what abatement components affect clinker quality. In other words, not all wastes can be used as alternative raw fuel.
- With regard to intermediate treatment, if Daiseki were to collect and recycle waste oil to produce a suitable product for delivery to a cement plant, they would have to obtain a hazardous waste treatment license, but the cement plant using the product would not have to obtain a license.
- The hazardous waste collection and treatment license specifies the type of waste to be used as raw materials, etc. If the alternative fuel is mainly liquid fuel, various criteria need to be identified, such as the type of recycling equipment and technology used, and whether the recycled oil meets Vietnamese standards.
- Recycled products must be thoroughly treated until harmful components have been removed and then handed over to the next contractor. However, if toxic components, such as benzene, are decomposed at high temperatures, such as in cement kilns, they can be used as fuel. These standards differ depending on the manufacturing industry (e.g., cement plants and glass plants).
- For substances containing heavy metals, such as fly ash and slag, national technical standards on hazardous waste have been established. For waste oil, there are only national technical standards on waste oil recycling. There are different standards for exhaust gases from heating processes.
- The process for obtaining a hazardous waste treatment license is as follows: formulate an environmental protection plan for approval → create an environmental impact report for approval by MONRE → submit the necessary documents to MONRE for licensing. MONRE's Evaluation Committee conducts the assessment on the volume handled under the license, which includes reviews on all machinery and equipment.
- The process of obtaining a license generally takes about one year. The most time-consuming aspect of the process is the preparation of the environmental plan to be submitted to the People's Committee, which takes several months after MONRE receives all the documents and issues the permit.
- The project falls under rank 1 of the Environmental Impact Assessment (EIA) and will also require

an environmental license.

- There are currently no intermediate treatment companies in Vietnam that specialise in liquid waste like Daiseki.

Meeting with DOLA

Meeting with VEA/WAMA

Fig. 2.2.3.2.3. Meetings with the Ministry of Natural Resources and Environment.

Inspection and discussion with Cement company C

- The use of alternative raw fuels for cement is being actively promoted and the volume of waste handled is increasing. Textile waste is used as an alternative fuel. In order to increase the effectiveness of recycling, the company aims to recover and recycle not only fibre waste but also various other wastes in the future.
- Sludge is also recovered and used as an alternative raw material, as well as fly ash and chemical gypsum.
- Recycled oil can be used in cement plants, but the company needs to consider whether there are price advantages.
- Footwear and textile waste are purchased from several suppliers (intermediate processors) and brought in from all over the northern region. Waste plastics such as nylon are purchased separately from an intermediate processor and mixed with footwear and textile waste before being fed into the pre-heater. As waste plastics contain a high chlorine content, they are set and controlled in specified quantities.
- The company is familiar with chlorine bypass equipment, but has not yet introduced this system because the chlorine concentration is still low.

Vietnam Cement Association (VNCA)

- Vietnam has 56 cement plants across the country, two-thirds of which are members of the Vietnam Cement Association. The Vietnam Cement Association can act as a bridge between the Vietnamese Government and municipalities and provinces.
- Vietnam's cement production capacity is approximately 100 million tonnes/year; in 2021, this figure stood at 107 million tonnes. Coal consumption is 10 million tonnes/year and clay consumption is 20 million tonnes/year. As can be seen from these figures, if quality alternative raw fuels were available,

a number of cement plants would be willing to use them. Among raw fuels, the price of coal is very high compared to the price of clay.

- The Vietnamese government has a strong interest in two types of waste (municipal solid waste and industrial waste from chemical plants, fertiliser plants, etc.).
- There is a great deal of interest in cement raw fuel conversion, but this has not been possible in Vietnam due to a variety of difficulties and challenges. VNCA has participated in many workshops and seminars on sludge recovery and recycling in Vietnam, but it has not yet been realised.
- Currently, many companies collect and recycle waste oil, but they are not able to recycle it effectively. It is understood that they have not yet contributed to environmental protection. In addition, many industrial waste treatment businesses in Vietnam are small-scale businesses.
- In Vietnam, wastewater and sludge treatment is a challenge and treatment facilities are small.
- Transport costs and distances should also be considered, as many cement companies are located far from industrial parks. VNCA agrees that locally licensed companies should be involved in collection.
- Information needs to be provided on the specifications of treated recycled oil and recycled raw materials so that cement plants understand them. VNCA would also like to be informed about the effects in Japan (e.g., reduced energy use). Once these are understood, Vietnam would like to introduce them extensively.
- Some companies have developed technical proposals on waste oil recovery in the past, but no company has proposed three types of recycling: sludge, waste oil and wastewater. This is the first project of its kind in Vietnam, so there may be many problems, but VNCA strongly agrees with the aims of the project. In order for the project to proceed smoothly, VNCA would like to actively introduce the project when discussing it with cement plants in the cities and provinces.
- VNCA can provide support for discussions with authorities when applying for new projects. VNCA can be contacted if additional data is required.

Figure 2.2.3.2.4: Meeting with the Vietnam Cement Association.

Vietnam Institute for Building Materials (VIBM)

- VIBM is a research institute belonging to Vietnam’s Ministry of Construction, which also studies policies and standards on cement production and waste recycling in the cement industry, and reports

to and advises the government on research findings.

- VIBM has exchanged views with cement factories in Vietnam, and the recycling of solid fuels and raw materials has attracted the attention of the industry. Cement factories have also inquired about what technologies and equipment should be introduced.
- The Vietnam Construction Materials Development Strategy was formulated in 2020, which includes a section on the use of solid fuels in cement plants in waste treatment and recycling. The Vietnamese government has also instructed relevant ministries and agencies, in addition to the Ministry of Construction, to research and fast-track the use of waste as solid fuel for cement.
- Waste such as electronic components, footwear and textile waste is effectively treated, but the highest costs in terms of treatment are transport costs. In the past, waste was received in cooperation with intermediate treatment companies, but recently more and more waste are being delivered directly from the source to cement plants.
- Demand for municipal waste has increased recently. There is a high level of interest in the possibility of utilising municipal solid waste and recycling it as fuel. Due to the low calorific value and high organic content of municipal solid waste, effective treatment technologies are not yet available.
- Statistical data on waste oil is available, but it seems to be inaccurate as many contractors do not participate in surveys even if they are surveyed. Waste oil is a hazardous waste and therefore cannot be handled without a license. There are three cement companies that possess hazardous waste licenses, one of which holds a license for waste oil treatment. The company in question collects expired chemicals and impure waste oil and mixes it with other wastes.
- More cement plants are likely to apply for licenses in the future, but the administrative procedures to apply for a license are time-consuming. In order to apply, a number of issues have to be resolved, such as economic benefits. Japan and Vietnam's industrial structures are also different, so it is better to proceed with the project while adapting to the actual market situation.
- The most important point is to secure the source and volume of waste emissions. If the volume cannot be secured, the business will not be viable. There are no concerns in terms of technology, as Japanese environmental technology is excellent.
- VIBM has a close working relationship with cement companies because they work with many cement plants to develop new raw materials. VIBM also studies strategies and policies, so if any data is required, the team should contact them. Alternatively, if the team has information on new technologies or new fuels to be introduced in cement plants instead, VIBM requested that data be shared with them.
- VIBM also provides technical support to cement plants in obtaining permits for the introduction of new equipment and alternative fuels. In addition to research and development work, VIBM also provides consulting services in cooperation with many cement plants and would like to provide support. The institute has a history of developing new technologies in cooperation with the Japanese cement industry, and would like to introduce various technologies in cooperation with their Japanese partners.

Meeting with VIBM VIBM entrance

Fig. 2.2.3.2.5. Visit to VIBM

2.2.4. Second field survey

2.2.4.1. Summary

From 30 October to 4 November 2022, the team conducted interviews and site visits to cement plants, relevant administrative organisations and waste disposal companies to investigate the actual situation and issues at the source in order to understand the size of the market for raw waste materials.

Date	Organisations visited	Business/activity
30 Oct	DONRE (Department of Natural Resources and Environment), Khanh Binh province	Administrative organisation
30 Oct	Cement company D	Manufacture and sale of cement
31 Oct	Waste management company B	Hazardous waste collection and disposal services
31 Oct	Manufacturing company A	Manufacture and sale of automotive and household appliance parts
1 Nov	Manufacturing company B	Manufacture and sale of electronic components
1 Nov	Manufacturing company C	Manufacture and sale of lubricants
2 Nov	Manufacturing company D	Manufacture and sale of lubricants
2 Nov	Cement company A	Manufacture and sale of cement
3 Nov	Manufacturing company E	Manufacture and sale of liquid containers
3 Nov	Viet Nam Institute for Building Materials (VIBM)	Research institute under the Ministry of Construction
4 Nov	Manufacturing company F	Manufacture and sale of transport equipment

2.2.4.2. Surveys

Discussions with DONRE (Department of Natural Resources and Environment), Khanh Binh province

- Six cement plants are located in Khanh Binh province, due to the availability of good quality limestone. (Three plants only crush clinker, while three others are in full operation, including clinker production).
- One of the three plants in operation reuses waste oil generated in the plant.
- The national policy on promoting the use of alternative raw materials and fuels has fallen down to the provincial level, with two management hierarchies in provincial measures, one by the provincial People's Committee and the other by DONRE.
- Currently, there is one operator in Khanh Binh province that has introduced German equipment for intermediate treatment of general waste (household waste), but initial investment is high and business profitability is questionable. In addition, some household waste is landfilled after accepted and sorted. Authorities are focusing on the business continuity of waste treatment operators.
- As there are no operators holding hazardous waste disposal licenses in Khanh Binh province, the waste is transported out to operators with licenses located outside the province.
- There are disputes with residents over cement companies, which the authorities handle in a timely manner.
- Pre-treated solid waste (ordinary industrial waste) can be transported into the province from other provinces.
- Hazardous waste can be used within the scope of the EIA for cement recycling as long as the company holds a co-processing license.
- Even if the intermediate treatment company possesses a hazardous waste license, the EIA of the cement plant needs to be changed if alternative fuels derived from hazardous waste will be used by the cement plant.
- DONRE understands the data from the source of the waste in terms of waste generation, as companies are required to report this information to DONRE once a year.
- The law requires waste to be segregated by 2024, but this is expected to be difficult to achieve.

Fig. 2.2.4.2.1. Meeting with DONRE, Khanh Binh province

Inspection and discussion with Cement company D

- No alternative fuels such as waste plastic is in use yet, as alternative fuel input facilities are currently being installed. Permit for a pilot operation has been obtained.
- The company wants to achieve a 10% to 15% rate of use for alternative fuels by 2023. In the future, they want to increase the use of waste-derived raw fuels to 25%.
- The company plans to obtain a permit from DONRE in November for the use of solid waste.
- No alternative raw materials have been used, but fly ash is being used in the clinker crushing plant.
- The company is always looking for competitive alternative fuels, and would like information on the prices, available quantities and calorific values of alternative fuels from Daiseki.
- Coal mills are in operation at hours when electricity costs are low, and a suggestion was made to reduce electricity consumption in the coal mills by using alternative liquid fuels.

Fig. 2.2.4.2.2. Inspection visit at Cement company D

Inspection and discussion with Waste management company B

- Waste management company B is a former state-owned company and one of hazardous waste treatment operators in Hai Phong.
- After privatisation, it took three years for the company to obtain a hazardous waste disposal license from MONRE (throughout Vietnam). All waste oil is hazardous waste, which is assigned a code for each type and managed accordingly.
- To obtain a hazardous waste disposal license, an environmental impact plan must be submitted. If equipment other than the technology listed in the Environmental Impact Assessment (EIA) will be installed, the EIA must be revised.
- If the current capacity is exceeded when installing new machinery and equipment, a new license application must be submitted.
- Collected waste oil is incinerated (in-house) after dehydration. A permit has been obtained from MONRE to discharge wastewater into rivers after treatment.
- The company is also commissioned by Hai Phong to handle oil leakage accidents and other incidents. After collection, the waste oil is incinerated.
- There are no companies in Vietnam that collect and sell waste liquid with high oil content. Waste oil

can only be passed to licensed processors. A fine of VND 90 million is imposed on companies transferring waste oil to non-licensed operators.

- Hazardous waste may be sold if treated with proper technology.
- Oily water and rags are incinerated, while waste plastic with oil attached is sold after washing. Drums are also cleaned and may be sold as recycled drums or returned to the source.
- Auxiliary fuel is purchased for incinerators.
- When building a new recycling plant, it is advisable to consult the district-level People's Committee → DONRE → municipal People's Committee → MONRE.
- For technical aspects of obtaining a permit, it is advisable to consult the Centre for the Promotion of Science and Technology.

Meeting with company

Incinerator

Oil-water separation and wastewater treatment facilities

Hazardous waste carrier

Figure 2.2.4.2.3. Scene of meeting and inspection with Waste management company B

Discussions with Manufacturing company A

- The lubricating oil for equipment is changed every two years, which generates waste oil, but in small quantities.
- Waste oil is generated by plating processors and other companies, but investment licenses for plating businesses in Vietnam are subject to strict screening. The level of difficulty is thought to vary between

industrial parks. Japanese plating processors have indeed entered the market, but most have extensive wastewater treatment facilities and do not produce toxic components in their own factories.

- A certain number of motorcycle parts manufacturers are entering Vietnam as part of a trend of moving away from China.
- At this company's factory, waste oil is sent to a treatment company to be processed for a fee.
- There was no choice in the treatment operator as the management company specified the treatment operator when the company moved into the industrial park.
- The company sells corrugated cardboard, vinyl, pure wood pallets, iron, and other components.
- Now it may be cheaper to make products in Japan due to the weak yen (importing parts).
- The government may suddenly change laws and regulations, such as suddenly withdrawing preferential taxation.
- The company generates waste plastic and other materials for packaging, so they are interested in disposal methods and disposal companies. They assume that waste plastic will be generated on the customer side and hope to be able to recycle it.
- The plant was designed to be load-bearing when it was built so that rooftop solar PV panels can be installed in the future. The company would eventually like to consider installing them. Rooftop solar PV equipment is also meant to shield heat, so they expect to save electricity in air-conditioning and other areas.

Fig. 2.2.4.2.4. Meeting at Manufacturing company A

Inspection and discussion with Manufacturing company B

- The waste currently generated is ordinary industrial waste (cardboard, string, etc.).
- The hazardous waste generated is wastewater from cleaning printed circuit boards.
- Wastewater is placed in drums and outsourced to a licensed hazardous waste treatment operator. The company does not know if the waste is recycled by the treatment operator after the treatment is outsourced. They heard that the waste is discharged into rivers after treatment.

- A small amount of waste oil is also handled by the same treatment company.
- The company is planning to obtain UL 2799 certification[28] and plans to reduce landfill disposal by promoting “Zero Waste”.
- Hazardous waste (stored according to waste code) and waste for sale/ordinary industrial waste are stored separately in separate yards.
- The company plans to install solar PV equipment in its building next year.

Meeting with company　　Hazardous waste site

Fig. 2.2.4.2.5. Meeting at Manufacturing company B and hazardous waste site

Discussions with Manufacturing company C

- The company processes and sells lubricants. Lubricants are sold via distributors or directly to manufacturers and their agents. There are no large-scale specialised shops like Autobacs in Vietnam, and most of the lubricants are used by dealers or maintenance shops in the city.
- Japanese car and motorcycle manufacturers in Vietnam are thought to be mainly assemblers, while Vietnamese car and motorcycle manufacturers manufacture engines. Therefore, machine oil is believed to come from parts suppliers, etc.
- Although in small quantities, waste oil from the factory is stored in drums and outsourced to a collection company. Clean oil is treated internally.
- The company is keeping a close eye on whether the EPR will give us instructions on where waste is to be disposed of in the future. Currently, they are unable to determine what happens beyond collection.
- Some waste oil is sold to industrial waste treatment companies, as long as it is passed to a licensed hazardous waste operator.
- Each industrial park seems to refer different waste disposal operators.
- The EPR was enacted in January 2023, and the company is considering what needs to be prepared for the 2024 revision.
- There are cases of OEM products being supplied on an OEM basis and sold as other companies’ branded oil; even for OEM products, the manufacturer is clearly marked on the container in Vietnam, so it seems

[28] UL 2799 certification: Environmental performance verification procedures for zero-landfill waste. https://japan.ul.com/wp-content/uploads/sites/27/2021/11/再生プラスチック.pdf

relatively easy to identify them, but it is unclear how the 15% mandated by the EPR is to be defined.

- The company assumes that they need to invest in the Vietnam Environmental Protection Fund (VEPF) and a third recycling organisation will use the funds to recycle the waste oil, but does not think it is realistic for manufacturers to collect and recycle the waste oil themselves.
- The company is not talking specifically to MONRE and EPR at this stage.
- They are also concerned about recycling packaging containers.
- The factory was established in 2014, but dust and other particles fly in from neighbouring factories and adhere to the office windowpanes and cannot be washed away. Therefore, capital investment in, for example, the installation of solar PV equipment installation would be unsuitable.

Discussions with Manufacturing company D

- The company processes and sells lubricants and metalworking oils.
- If recycled heavy oil and alternative fuels for cement are likely to be included in EPR measures, a scheme could be created to collect waste lubricating oil and set up a recycling loop with a Japanese intermediate treatment company such as Daiseki in between. In this case, it would be important to secure a retailer for the recycled fuel oil.
- As a manufacturer, the company does not know much about the treatment of waste oil discharged from car repair shops in the city. It is likely that both dealers and repair shops sell waste oil to oil collectors.
- There are 117 hazardous waste license holders in Vietnam. Six to seven of these are located in Hai Phong.
- The company has heard that waste oil from any manufacturer is acceptable as long as the amount of waste oil collected is 15% of the manufacturer's sales volume, as stipulated by the EPR.
- They are concerned that container recycling does not include lubricant containers in the EPR.

Discussions with Cement company A

- This is a second visit following the August 2022 survey. The results of the previous survey were shared.
- Capital investment is underway to improve production efficiency. The company considered installing burners for alternative fuels, but have decided against it due to the rising price of alternative fuels.
- No alternative fuels are currently used at the plant, but fly ash is used as an alternative raw material.
- If alternative solid fuels are used, the company is considering installing an external temporary incineration facility.
- The cement market is overly competitive in terms of inexpensive cement.
- The company’s current priority is to complete capital investments to improve productivity. After that, the company plans to start working on capital investment for alternative fuel inputs.
- Regulations stipulate that hazardous waste cannot be handled within five kilometres of historical heritage sites, tourist attractions, and other locations. The company’s plant differs from other cement plants in that it is located close to historical heritage sites, and therefore must include environmental considerations in its plans and operations. As it stands, it is expected to be difficult to obtain an EIA when applying for a hazardous waste license. Therefore, the company believes that environmental measures must be taken, for example, by fully automating processes. However, it is likely to be less challenging in terms of administration if liquid alternative fuels are used instead of solid alternative

fuels.

- The company attempted to import waste tires from Australia, but could not do so because they are treated as waste.

Inspection and discussion with Manufacturing company E

- The company manufactures and sells containers for liquids.
- Waste oil and solvents are only produced in-house to the extent that waste paint is produced. The company also pays a processing fee to drain oil from presses and reduction gears, and passes the waste oil to a local waste disposal business.
- The main customers for liquid containers are companies that produce small batches of solvents. The company also sells products to paint manufacturers. Customer also include Japanese paint manufacturers, mostly building paint.
- The company has heard that customers are concerned if waste collectors and other companies are licensed.
- Due to stiffer competition for employees, it was difficult to recruit employees in larger industrial parks due to more competition. Therefore, the factory was set up in a local industrial park that is not foreign-owned. The advantage of a local industrial park is the comparatively low cost of land. The disadvantage is that there are frequent power outages.

Discussions with the Vietnam Institute for Building Materials (VIBM)

- This is a second visit following the August 2022 survey. The results of the previous survey were shared.
- In many cases, cement plants in Vietnam collect waste and throw it directly into temporary incineration furnaces.
- VIBM would like to promote the use of household waste in cement plants, but household waste is not separated in Vietnam and impurities such as dry cell batteries are mixed in.
- VIBM wants to promote the use of industrial waste and waste oil, but there has been no progress in this area because product standards for recycled alternative raw materials and fuels have not been established.
- With regard to whether or not there are regulations on waste materials used in cement plants in Japan, the team explained that there are basically no regulations on waste materials at the receiving end as long as they meet the plant's emission standards, cement product standards and the regulations of the license they have obtained. In Vietnam, it is difficult to obtain understanding in this regard and there is a strong tendency to impose restrictions on alternative raw materials and fuels on the receiving end.
- The removal of repellent components is an effective way to reuse more waste in cement plants, but only one cement plant in the south has established chlorine bypass facilities to remove repellent components, according to the report.
- VIBM has been commissioned by the Ministry of Construction to prepare guidelines for the use of municipal solid waste (to be promulgated in 2023), which will be submitted by the end of this year.
- As the cement industry is a very important function for waste utilisation in Vietnam, the VIBM suggested that if the guidelines were to stipulate this, it would be practical to strictly control product and emission standards, etc., rather than narrowing acceptance on the waste side.

- It is possible for VIBM to act as a consultant to the project in the course of the project and should be consulted.
- When using alternative fuels derived from waste, cement plants need to have (1) a license to use alternative fuels, and if (2) alternative fuels derived hazardous waste will be used, a license for hazardous waste is required.
- As there are currently no product standards for liquid alternative fuels derived from hazardous waste, standards based on Japan's experience can be proposed to MONRE and, if certified, can be used by cement plants without a hazardous waste license.

Fig. 2.2.4.2.6. Meeting at VIBM

Discussions with Manufacturing company F

- Waste solvents for painting are outsourced for disposal, but it is unclear how they are disposed of after outsourcing.
- The treatment of paint waste and sludge is outsourced to specialised treatment companies.
- No information can be disclosed externally regarding treatment operators or treatment conditions.
- The factory is not aware of conditions for waste engine oil, etc., but the waste engine oil from forklifts and other equipment used in the factory is outsourced to a contractor for treatment.
- The factory is not aware of conditions regarding the treatment of waste engine oil at dealers, and only the sales department is aware of the situation.
- The factory has not started any measures for legal compliance with the EPR. The sales department may handle the EPR for lubricating oil, but the production department is only responsible for the waste generated in its own factory.
- Painting (gas) lines and melting furnaces (electricity) are energy intensive. The company is interested in energy saving, including ideas for reducing the amount of electricity used in these areas.
- The company's wastewater treatment plant treats wastewater according to Class A standards. Part of the wastewater is used in intermediate water. Some wastewater is discharged and in some cases treatment is outsourced.

2.2.5. Collection and organisation of local information

2.2.5.1. Cement companies in Vietnam

According to the Vietnam Cement Association (VNCA), Vietnam has a domestic cement production capacity of approximately 107 million tonnes and is also the world's largest cement exporter.

The largest cement enterprise in Vietnam is the Vietnam Cement Industry Corporation (VICEM), which has 10 plants around the country with a production capacity of 20 million tonnes per year of clinker and 27 million tonnes per year of cement. The first modern cement factory in Vietnam was established in Hai Phong 120 years ago. VICEM took over that factory as its Hai Phong plant and built a cement industry museum on its site in January 2021 to introduce the history of the cement industry and cement production technology in Vietnam.

In terms of foreign cement companies, Siam City Cement of Thailand has acquired Holcim Cement as a local subsidiary to manufacture and sell cement. Japan’s Taiheiyo Cement Corporation and Mitsubishi Ube Cement Corporation have a stake in Nghi Son Cement, which is in operation.

Fig. 2.2.5.1.1. Distribution of integrated cement manufacturing plants in Vietnam.
(Source: CemNet.com)

In recent years, due to the rising price of coal and the need to address global warming, the Vietnamese government has instructed the cement industry to be more proactive in the use of alternative fuels by 2030. Specifically, the Prime Minister's Decree (Decision No. 1266/QD-TTg) issued in 2020, “Development

Strategy of Vietnam's Construction Materials in the Period of 2021-2030, with a Vision toward 2050", specified that 15% of all fuels used in cement clinker production should be replaced with alternative fuels from 2021 to 2030. The strategy also stipulates that 15% of all fuels used in cement clinker production must be replaced with alternative fuels, with the aim of replacing up to 30% of all fuels with alternative fuels derived from waste such as municipal, agricultural and industrial waste between 2031 and 2050 (Annex 1 summarises the abstract of Decision No. 1266/QD-TTg).

In addition to soaring fuel prices and other factors, rapid economic development has led to urbanisation and a growing concentration of the population in urban areas, causing a variety of environmental pollution problems, such as a shortage of landfills for domestic waste, foul odours and soil contamination. The urbanisation rate in Vietnam is expected to be 37% in 2020 and continue to rise by 2050.

With the promulgation of the Prime Minister's Decree, cement companies are considering the use of alternative fuels derived from waste and are investing in equipment. According to data from VNCA, co-processing licenses have already been issued to Hon Chong Cement, Thanh Cong Cement, Nghi Son Cement, and VICEM Ha Tien Cement by the Vietnam Environment Administration (VEA) under MONRE.

VIBM has also been instructed by the Ministry of Construction to prepare guidelines on the use of domestic waste in cement plants, which are expected to be promulgated in early 2023.

2.2.5.2. Industries with high expectations for the discharge and demand of waste oil, solvents, etc.

In considering business feasibility, the first field study focused on checking legal requirements and surveying the current status of cement plants for potential future users. The second field study focused on the status of generation and treatment of waste oil, waste liquid and solid waste as raw materials for alternative raw fuels, with particular focus on waste oil and waste liquid that could be used as raw materials for recycled heavy oil and alternative liquid fuels. Interviews were conducted during visits with the manufacturers listed in the table below (Table 2.2.5.2.1).

Table 2.2.5.2.1. Waste generators visited in this year's survey

No.	Location	Business	Waste generation process
1	Hai Phong city	Manufacturing	Manufacture and sale of automotive and household appliance parts
2	Hai Phong city	Manufacturing	Manufacture and sale of electronic components
3	Hai Phong city	Manufacturing	Manufacture and sale of lubricants
4	Hai Phong city	Manufacturing	Manufacture and sale of lubricants
5	Hung Yen province	Manufacturing	Manufacture and sale of liquid containers
6	Vinh Phuc province	Manufacturing	Manufacture and sale of transport equipment

The interviews revealed that while some companies are interested in the EPR direction that will be enforced in the future and container recycling by association, many of the companies visited did not have information on waste disposal after collection by the collection contractors. This seems to be partly due to

the fact that the management companies of the industrial estates in which they are located specify or introduce collection and disposal companies, so they are not familiar with the companies used.

Information was also received on the fact that high quality waste oil is filtered and recycled as raw material for liquid fuels and reused as lubricating oil for agricultural tractors and ships, while low grade waste oil is used as fuel and even lower grade waste oil is used as an alternative fuel. The study team was also able to confirm the fact that waste oil collected by some processors has been turned over to other processors after passing through intermediate traders. In order for Daiseki to obtain waste oil, they can either (1) obtain it from existing intermediate traders in each region or (2) obtain it directly from large-scale operators (source of emissions). In (2), Daiseki would be competing with existing licensed hazardous waste operators who collect waste oil from those companies.

In order to gauge the business potential of recycling waste oil and other materials, it is necessary to visit more manufacturers and focus on wastes that can be used as feedstock for recycled fuel oil and liquid alternative fuels, and to confirm the size of the feedstock that could be secured. However, many companies were particularly reluctant to disclose information on hazardous wastes, and when approached for visits and interviews, often refused. Therefore, in the future, efforts will be made to collect information on the amount and types of hazardous waste being disposed of that are known in Hai Phong and other provinces in northern Vietnam, and interviews will be conducted with large intermediate traders and other large-scale operators that have hazardous waste disposal licenses. With regard to operators, the study team plans to focus the target to below manufacturers (Table 2.2.5.2.2) located in northern Vietnam (suburbs of Hanoi and Hai Phong) and take the opportunity to visit and interview them.

With regard to demand, the study team will continue to focus on cement plants, but also explore opportunities to visit secondary refining and lime manufacturing industries based on the survey.

Table 2.2.5.2.2: Processing plants likely to generate raw material wastes

Expected waste generation process
Metal surface treatment and various types of coating
Manufacture of electronic components
Cutting operations
Casting and machining
Manufacture of electronic components
Transport equipment and component manufacturing
Manufacture of pharmaceuticals

2.2.5.3. Laws and regulations on the collection, transport and disposal of hazardous waste

Vietnam’s legal system is based on the Constitution, promulgated by the National Assembly, which enacts laws. The Cabinet determines how to implement laws by issuing decrees, and ministries and agencies specify administrative procedures and internal guidelines by issuing ministerial decrees, or circulars to implement laws and decrees in accordance with the Cabinet's instructions (Fig. 2.2.5.3.1).

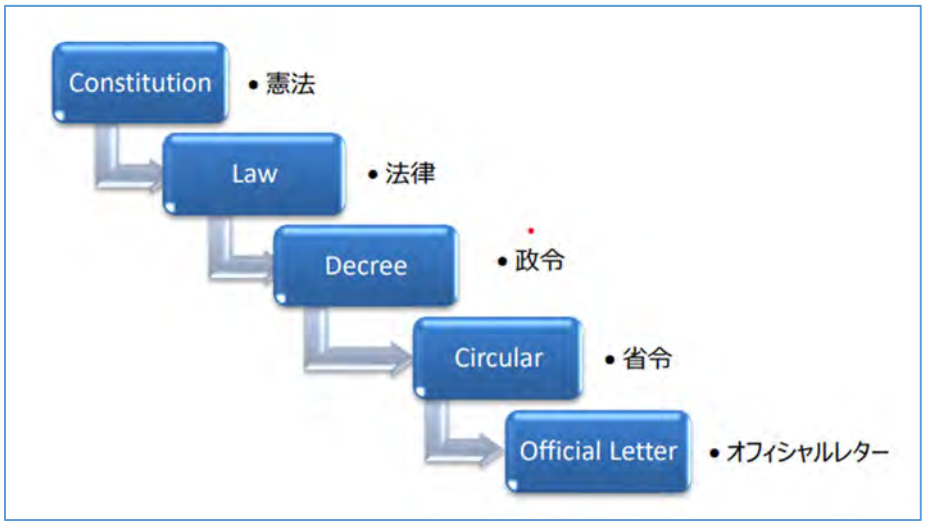


Figure 2.2.5.3.1 Legal system in Viet Nam (Source: Japan External Trade Organisation (JETRO)[29])

The Basic Law on Environmental Protection, including waste management, was enacted in 1993 and entered into force in 1994. It was subsequently amended for the first time in 2003 and for the second time in 2014, before the Parliament passed the Law on Environmental Protection (Law No. 72/2020/QH14) in November 2020, which amended the previous law (2014 Environment Protection Law) and came into force in January 2022. The amended Law on Environmental Protection incorporates concepts such as the circular economy (Article 142) and extended producer responsibility (Article 54).

In addition, whereas previously investment projects were classified according to their size, capacity and type of product, business or service and required an environmental impact assessment (EIA), the revised law now also takes into account the location of the project. In addition to the existing requirements, densely populated areas, areas with water sources and natural heritages are now considered and classified, and investment projects are now categorised as class I to IV in view of the risk of adverse effects on the environment. Projects with the highest risk of adverse environmental impacts are categorised as class I, followed by II, III and IV, which are classified as lower risk. Based on this classification, Articles 28 to 30 of the relevant amended law provide for a Preliminary Environmental Impact Assessment (PEIA), an Environmental Impact Assessment (EIA), an Environmental Impact Assessment Report (EIAR) and an Environmental License. In this context, operations handling hazardous waste are categorised as class I and are required to conduct a PEIA from the beginning of 2020.

The PEIA is a new measure introduced in the amended law, which considers and clarifies key environmental issues during preliminary feasibility studies and investment project proposal applications. Projects classified as Investment Project I must submit basic information on environmental impacts to the competent authorities separately from the EIA. Each investment project is subject to a PEIA or EIA, depending on its classification, and the EIAR is assessed and approved by MONRE or the provincial

[29] Japan External Trade Organisation (JETRO): https://www.jetro.go.jp/ext_images/_Reports/02/2018/fb58bdd9f9dd9980/vn201807.pdf

People's Committee.

The amended law consolidates and amends the previously separate licensing and approval contents into an integrated environmental permit system, allowing for a single application for an integrated environmental permit to be submitted to only one authority, depending on the type and characteristics of the project or facility. Other new provisions include environmental audits and greenhouse gas emission quotas, as well as a domestic carbon market. In addition to the MONRE and the provincial People's Committees, a number of different ministries are involved in environmental administration (Figure 2.2.5.3.2).

Fig. 2.2.5.3.2. Correlation diagram of environmental administration in Vietnam
(Source: Created by VEA's website[30])

With the amendment of the Law on Environmental Protection (Law No. 72/2020/QH14), subordinate laws and regulations, such as Decree No. 08/2022/ND-CP and Circular No. 02/2022/TT-BTNMT, were also amended, in which waste is defined as municipal solid waste (domestic waste), general solid industrial waste and hazardous waste (Figure 2.2.5.3.3).

Hazardous waste is defined as waste that is toxic, radioactive, infectious, flammable, explosive, corrosive, toxic or otherwise hazardous, and includes fluorescent lamps, waste lubricants, batteries, storage batteries, and containers for lubricants, chemicals, paints and inks generated in business and service activities. The regulations stipulate management under strict regulations, from classification to storage, transport and treatment. In particular, only licensed hazardous waste operators are permitted to handle the transport and treatment of hazardous waste.

[30] Vietnam Environment Administration (VEA): http://vea.gov.vn/sites/en/Pages/detail.aspx?$id=245

Fig. 2.2.5.3.3. Classification of waste in Vietnam (Source: Law No. 72/2020/QH14, Decree No. 08/2022/ND-CP, Circular No. 02/2022/TT-BTNMT)

According to VEA data[31], 119 facilities in Vietnam held hazardous waste treatment licenses as of July 2020. There are 60 facilities in the northern region, mainly in Hanoi, 6 in the central region, 53 in the southern region, mainly in Ho Chi Minh City, and seven hazardous waste treatment facilities in Hai Phong (Table 2.2.5.3.1).

[31] VEA [2020/07/26]: List of Hazardous Waste Disposal Facilities: http://vea.gov.vn/detail?$id=910

Table 2.2.5.3.1: Number of licensed hazardous waste treatment companies in Vietnam

(Source: the VEA Hazardous Waste Disposal Facility List[31])

As of 26 July 2020

Region	Administrative district	Number of permits granted (including changes and adjustments in progress)
North	Bac Ninh Province	8
	Hai Duong Province	4
	Hai Phong City	7
	Hanoi	14
	Hoa Binh Province	1
	Hung Yen Province	6
	Nam Dinh Province	3
	Nghe An Province	2
	Quang Ninh Province	1
	Thai Nguyen Province	5
	Thanh Hoa Province	4
	Vinh Phuc Province	5
	Northern total	60
Central	Binh Dinh Province	2
	Ha Tinh Province	2
	Quang Ngai Province	1
	Thua Thien Hue Province	1
	Central total	6
South	An Giang Province	1
	Ba Ria Vung Tau Province	3
	Binh Duong Province	7
	Binh Phuoc Province	3
	Dong Nai Province	6
	Ho Chi Minh City	17
	Khanh Hoa Province	3
	Long An Province	9
	Tay Ninh Province	4
	Southern total	53
Total		119

According to data obtained separately from Hai Phong during this survey, there were four hazardous waste treatment companies in the city. Subsequent checks with VEA data showed that there were seven companies (Table 2.2.5.3.2) Of the seven companies, one handles only medical waste, while the others handle only hazardous waste (Table 2.2.5.3.2).

Table 2.2.5.3.2: Number of hazardous waste treatment businesses identified in and near Hai Phong (Source: Hai Phong City)

Location	Number of hazardous waste companies
Hai Phong City	7
Bac Ninh Province	2
Phu Tho Province	1
Hai Duong Province	1
Total	11

As mentioned earlier, there are uncertainties in the handling of liquid alternative fuels derived from hazardous waste when they are used in cement plants, partly because many are simply incinerated by operators with hazardous waste treatment licenses. Consideration was given to delivery methods for processing hazardous waste at licensed hazardous waste treatment operators to produce alternative raw fuels for delivery to cement plants.

The following three methods are possible (Figure 2.2.5.3.4).

(1) When delivered as a product, the product needs to comply with Vietnam's national technical standards (QCVN) or with the quality standards of developed countries (G7 countries including Japan). If there is no applicable standard in the existing QCVN, a new QCVN for liquid alternative fuels should be proposed to MONRE for verification. In this case, it is assumed that it will take some time until the relevant QCVN is established, but once the demonstration is approved by MONRE, the cement plant side will not need to obtain a hazardous waste license.

(2) If the waste is delivered as hazardous waste, the cement plant does not need to comply with the QCVN, but the cement plant will need to obtain a co-processing license. As mentioned above, the VNCA document states that four plants have already obtained co-processing licenses, but the team's research indicates that five cement plants in the north are currently known to have such licenses. At the current rate, it is expected that around 10 cement plants will have licenses in two or three years, so this option is presumed to be the most realistic.

(3) In this option, permission would be obtained from MONRE to introduce trial products on a trial basis for the purpose of demonstrating how waste can be utilised, and then conduct a demonstration project to obtain data to be reflected in MONRE's QCVN on waste oil recycling (QCVN56: 2013/BTNMT).

(*) Co-processing licenses are issued by MONRE in the same way as hazardous waste licenses. It

authorises the handling of hazardous waste, based on the assumption that hazardous waste is handled in cement plants. Therefore, it is more limited in scope than the waste handling codes that can be obtained by hazardous waste operators and does not come with a hazardous waste collection and transport license.

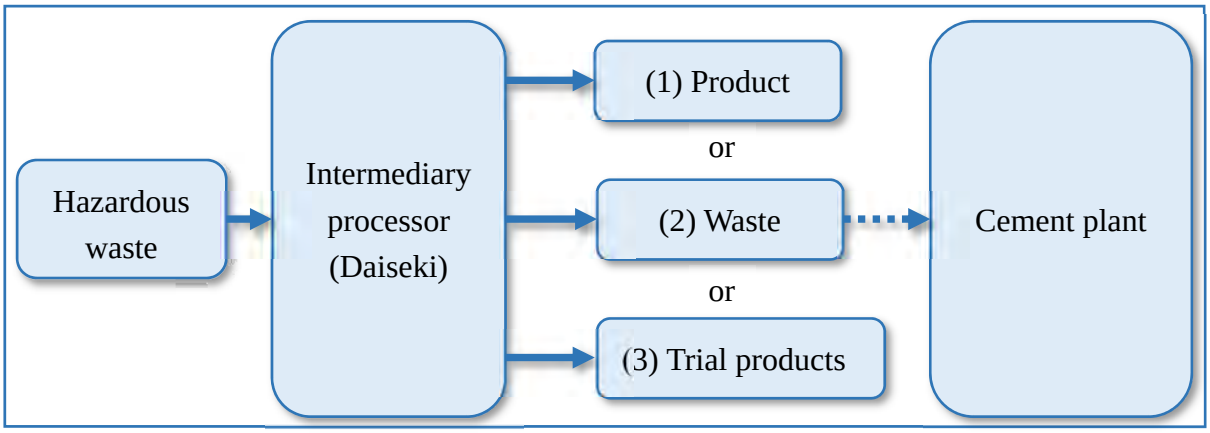


Fig. 2.2.5.3.4. Options for the delivery of alternative fuels derived from hazardous waste

2.2.5.4. Commercialisation process and milestones

The processes, milestones and precautions for foreign companies entering the hazardous waste treatment business in Vietnam are summarised based on information obtained from local hazardous waste treatment companies (Figure 2.2.5.3.5).

Sectors in which foreign companies are prohibited from investing, i.e., the negative list or conditional investment sectors, are stipulated in Law No. 03/2022/QH15, and investment projects related to the "transport and treatment of hazardous waste" are classified as conditional investment sectors.

Normally, when starting a project, it is necessary to compile a management plan including the amount of investment, charter capital, business description, investment location, recruitment plan, environmental measures, project design, construction, and other factors based on marketability. However, as hazardous waste treatment projects are classified as Investment Project I, a PEIA must also be conducted, with basic information submitted on the risks of environmental impacts during the preliminary project feasibility study and investment registration application period, etc.

The general administrative procedure is to apply for the issuance of an Investment Registration Certificate (IRC) and an Enterprise Registration Certificate (ERC). After obtaining the IRC, the ERC will be obtained in the initial stage. According to Decree 31/2021/ND-CP, the Investment Registration Certificate is issued by the Department of Planning and Investment or the Management Committee of the Industrial Park, Export Processing Zone, High-tech Zone or Special Economic Zone, while the Enterprise Registration Certificate is issued by the Business Registration Office under the Department of Investment Planning of the province or city directly under the Central Government according to Decree 01/2021/ND-CP.

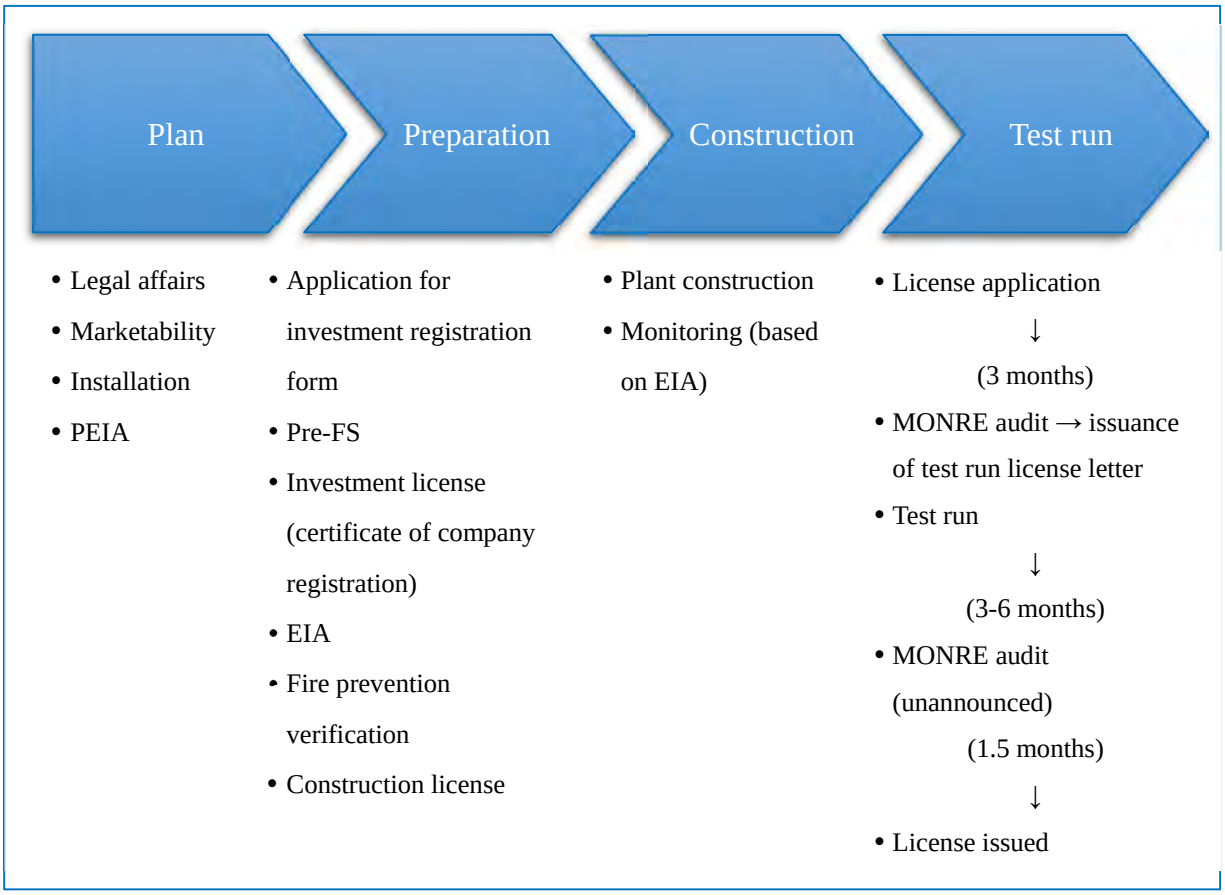


Fig. 2.2.5.3.5. Anticipated processes and milestones for commercialisation

The introduction of waste treatment facilities must be positioned in the urban plan of each province (planning period of around five years). In other words, investment projects that are not included in the urban plan will not be reviewed, although they may be added to the existing plan even if they are still in the urban planning period. However, this is worth noting when considering the location of facilities. In the case of waste treatment facilities, there are a limited number of industrial parks where investment is permitted. This should also be noted, as it is estimated that the number of industrial parks where investment is permitted is even more limited in the case of hazardous waste treatment facilities.

There are three possible measures: (1) building on a site where an investment permit has already been granted, (2) acquiring an existing similar plant in a hazardous waste treatment investment permit area, or (3) changing the land title of a different site to that for a hazardous waste treatment facility. Difficulty is assumed to increase in the order (1) < (2) < (3).

2.2.5.5. Licensed hazardous waste generation and treatment companies in Hai Phong

When considering the feasibility of projects, the most important issue is the potential to guarantee the availability of sufficient raw materials. Statistical figures on the scale of generation of raw material wastes, especially hazardous wastes, were investigated, but unfortunately no appropriate secondary information could be obtained. The study team requested statistical information from Hai Phong, which are summarised

in Table 2.2.5.5.1.

However, the 16 hazardous waste generating enterprises and 5,063 tonnes/year generated were estimated to be considerably less than realistic figures, and information on waste categories was also limited. As the city does not have jurisdiction over hazardous waste, this information must be confirmed with MONRE, which has jurisdiction over this area. It is also necessary to confirm the actual amount and shape of the waste through direct visits and interviews with waste generating companies and to continuously accumulate data. In addition, there is a need to confirm the packaging of the waste handled by hazardous waste treatment license holders for reference when transporting the waste after the project has started, so storage sites and packaging must be observed and confirmed, whenever possible.

Table 2.2.5.5.1. Main sources of hazardous waste in Hai Phong

(Source: Hai Phong City)

	Source	Amount	Unit
1	Electronic component manufacturer A	1,510	t/year
2	Electronic component manufacturer B	86	t/year
3	Electronic component manufacturer C	70	t/year
4	Shoe manufacturer A	54	t/year
5	Shoe manufacturer B	170	t/year
6	Precision equipment manufacturer A	51	t/year
7	Lubricants manufacturer A	326	t/year
8	Machinery manufacturer A	186	t/year
9	Machinery manufacturer B	134	t/year
10	Machinery manufacturer C	132	t/year
11	Plastics manufacturer A	96	t/year
12	Machine parts manufacturer A	609	t/year
13	Machine parts manufacturer B	347	t/year
14	Machine parts manufacturer C	230	t/year
15	Metal parts manufacturer A	732	t/year
16	Thermal power plant A	330	t/year
	Total	5,063	t/year

The raw materials can be collected either directly from the source or from existing hazardous waste treatment businesses. Therefore, Hai Phong was also requested to provide information on hazardous waste treatment companies in the city and its suburbs. As already shown in Tables 2.2.5.3.1 and 2.2.5.3.2, confirmation was obtained that there are seven hazardous waste treatment companies in Hai Phong. Confirmation was made with DONRE in Hai Phong that each hazardous waste treatment contractor reports annually on the documentation and quantities of waste treated, so data is available, but this information cannot be disclosed. Therefore, the only way to obtain information would be to visit individual companies and conduct interviews.

In addition, Hai Phong also provided data on solid waste generation and actual examples of waste generation and treatment in the city. This information is summarised in Tables 2.2.5.5.2. and 2.2.5.5.3. respectively, which estimate that the quantity of waste generated in Hai Phong is actually higher than the applicable quantity. This data indicates that the most common waste generated from a single site is fly ash from power plants. Fly ash is used as an alternative raw material in cement plants and is found to be used

as a raw material for bricks, as can be seen in Table 2.2.5.5.3. “Examples of waste and treatment in Hai Phong”. During the next visit to the cement factory, the use of fly ash should also be checked.

Table 2.2.5.5.2. Waste generation in Hai Phong (2021)

(Source: Hai Phong City)

Item		Amount	Unit
(i) Municipal waste (domestic waste)		1,000	t/day
(ii) Construction waste		200	t/day
(iii) Total general industrial waste		4,949	t/day
	Not yet recycled	695	t/day
	Achieved portion recycled	89	t/day
	Waste gypsum	977	t/day
	Ash and slag	3,188	t/day
Total (i)+ (ii)+ (ii)		6,149	t/day

Table 2.2.5.5.3. Examples of waste and treatment in Hai Phong

(Source: Hai Phong City)

Type of waste	Main sources	Waste		Amount	Unit	Waste disposal situation	Processed amount	Unit	Remarks
General industrial waste	Plaster manufacturers	Waste gypsum	Generated	977	t/day	Reused by gypsum manufacturer	1,600	t/day	Bac Ninh Province
			Inventory	623	t/day				
		Ash & slag		38	t/day	Treated by one processor	38	t/day	
	Thermal power stations	Ash & slag		4,200	t/day	Treated by five processors	3,150	t/day	Brick manufacturing, etc.
							400,000	T	Unprocessed stock
Hazardous waste	Unspecified	Waste oil		58	t/day	Licensed operator(s)	57	t/day	
							1	t/day	Stored at source

2.2.5.6. Lubricant EPRs in accordance with the Environmental Protection Act

The promotion of the circular economy has become a global trend over the past few years. In Japan, the establishment of the Japan Partnership for Circular Economy in March 2021 by the Ministry of the Environment, Ministry of Economy, Trade and Industry and Keidanren has accelerated this trend. In Vietnam, Article 138 of Decree No. 08/2022/ND-CP stipulates the circular economy and provides guidance on its promotion. In this context, an attempt is being made to directly promote the circular economy by establishing an Extended Producer Responsibility (EPR) ecosystem. Since lubricating oil is included in the EPR and there has been strong interest expressed by the Vietnamese government in this area, Daiseki saw this as an opportunity to develop the recycling of lubricating oil and the conversion of lubricating oil into recycled fuel oil, which are its main products in Japan. Thus, the survey team examined

whether these methods could be positioned in Vietnam's EPR.

The EPR in Vietnam requires producers and importers of products to comply with Article 55 of Decree 54, which stipulates recycling rates and recycling methods for waste products. The specific mechanism stipulates that producers must either recycle voluntarily, work with recyclers or outsource recycling to licensed treatment companies (which can also be combined), or donate (0.1% of sales) to the Vietnam Environmental Protection Fund (VEPF). The VEPF is managed by the Vietnam EPR Office, established by MONRE and the National EPR Council, and is envisaged to be used, among other things, to cover the costs of recycling items that fall under the EPR (Fig. 2.2.5.6.1).

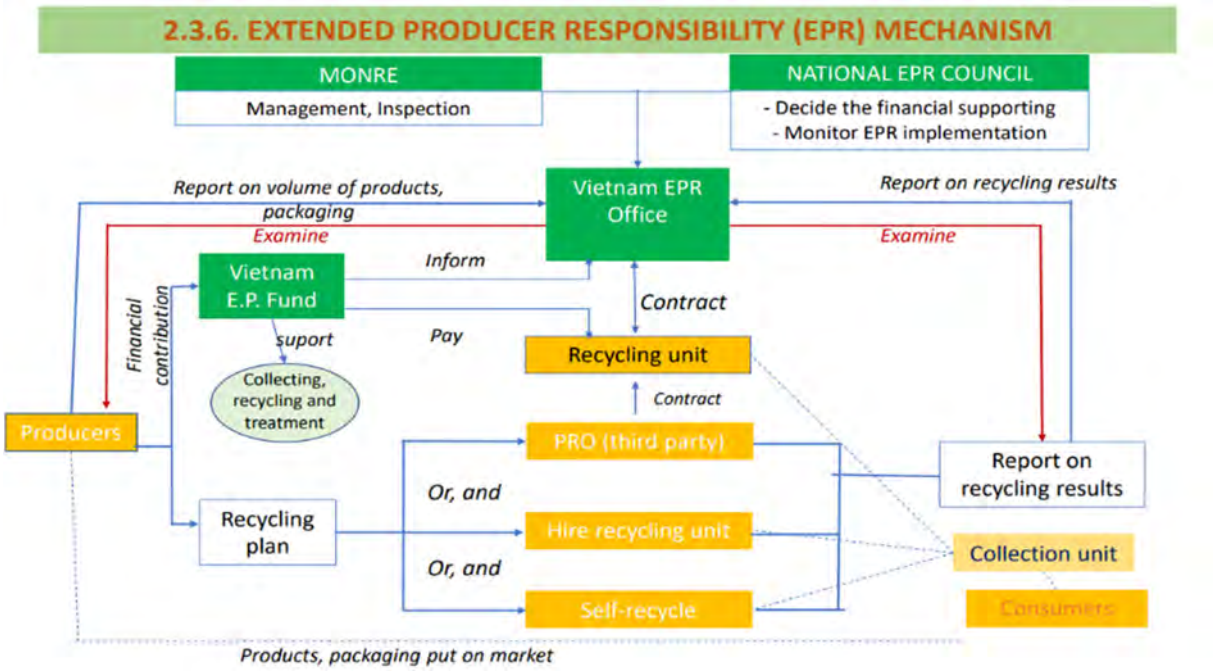


Fig. 2.2.5.6.1. EPR mechanism in Vietnam.
(Source: Department of Legal Affairs, MONRE)

The EPR roadmap defines the quantities to be achieved in the first three years after entry into force in January 2024, with a target recycling rate of 15% of production in the case of lubricating oil EPRs. The roadmap also specifies "distillation and refining" or "fractional distillation of waste oil" as recycling methods (Table 2.2.5.6.1).

In Europe and the United States, there are some cases of recycling into lubricating oil base oil through distillation, but this has not been implemented in Japan, partly because it is not economically rational due to the large energy consumption and scale of the facilities and business. Daiseki's domestic fuel oil recycling is a more realistic method because it consumes less energy, has a higher recovery rate, and can convert waste into fuel. Therefore, it is necessary to present the results in Japan and other information to MONRE in order to encourage them to position recycled fuel oil conversion as one of the recycling methods for lubricant EPRs.

Table 2.2.5.6.1. Waste lubricants specified in 1EPR (Source: Department of Legal Affairs, MONRE)

TT (1)	Product subgroup (2)	Product list (3)	Recycling rate for the first 3 years (4)	Mandatory recycling specifications (recovery of at least 40% of volume of product and packaging materials collected for recycling in accordance with the mandatory recycling rate) (5)
C. OIL (LUBRICANT)				
17	C.1. Lubricants for engines	C.1.1 Engine oil	15%	Selected recycling solution: 1. Distillation of base oil or other oils. 2. Fractional oil recovery distillation.

Article 85(5) of the Decree requires the National EPR Committee to approve the Decree and report to MONRE on the use and management of funds paid by producers and importers of products to the VEPF, which was expected to be delivered in December 2022. However, as of the end of January 2023, the Decree has not been promulgated and is expected to be delayed for some time. In addition, prior to the issuance, a public hearing on the ministerial ordinance was held on 7 November 2022, mainly by universities, and it appears that the hearing was also conducted sequentially with waste treatment companies and others.

One issue with lubricant EPRs at present is that, while the focus is on the recycling of waste lubricants, it appears that recovery is not taken into account. In terms of means, lubricant producers have no incentive to collect and dispose of waste lubricant, as they do not discharge waste lubricant from their own operations, and it is not easy to collect only waste lubricant from their own products. It is also unclear whether it is possible to recycle and treat 15% of the waste oil produced for a 1% share of sales (treatment costs). As discharge, collection and treatment are left to market principles, there is concern that the system is not structured in such a way that waste oil can easily be collected by lubricant producers or by the recycling operators commissioned by VEPR, as waste oil flows to companies with lower prices (e.g., simple incineration treatment). Ideally, the introduction of hazardous waste manifests should be linked to EPRs to make it easier for waste oil to be collected by designated contractors, but the simultaneous introduction of multiple systems is likely to cause confusion and is therefore considered premature.

2.2.6. Feasibility and potential for future development

(1) Summary

The cost of cement production is rising rapidly, partly due to the rising price of coal and other factors. As a result, interest in alternative fuels is very high, and the use of cutting waste and textile waste generated during footwear production in cement plants is rapidly spreading and becoming difficult to acquire. As the demand for alternative fuels is expected to increase in the future, the cement plants visited and interviewed are considering expanding the range of wastes that can be used as alternative fuels, and showed strong interest in the use of hazardous wastes such as waste oil. The Vietnamese government has also encouraged this trend with the Prime Minister's Decree (Decision No. 1266/QD-TTg), which provides guidance on promoting the

use of alternative fuels in cement plants.

In addition, Vietnam's economy is growing rapidly and the population is continuing to increase, especially in large cities. As a result, the disposal of sewage sludge and municipal solid waste has become a challenge for local authorities. Therefore, in order to solve these problems by utilising the functions of cement plants, the Vietnamese government prepared guidelines on converting municipal solid waste into alternative cement fuels, which are expected to be promulgated in early 2023.

Expectations for waste recycling in Vietnam’s cement industry are high, and the cement industry appears strongly motivated to actively utilise waste from the perspective of cost reduction, among other things.

(2) Challenges

The results of the study showed that interest in and demand for alternative fuels is high. However, the study also identified issues that need to be resolved in order to promote the use and commercialisation of alternative fuels.

Although it is of paramount importance to understand the expected volume of waste materials to be used as raw materials and their quality when considering a project, there is still insufficient information available, so it is necessary to continue to investigate primary and secondary information on the size of the waste market and the status of its generation.

To promote the use of hazardous wastes such as waste oil by cement companies, it is necessary to create an environment in which users can use hazardous wastes or alternative fuels derived from hazardous wastes with confidence by clarifying whether hazardous waste treated through intermediate treatment is still classified as hazardous waste or is a product. For example, by creating a new national standard such as the QCVN for alternative fuels and classifying those that comply with the standard as “products” even if they are hazardous waste or processed products derived from hazardous waste, users would not need a hazardous waste treatment license or a co-processing license, which would help promote the recycling of hazardous waste.

The EPR also stipulates a target recycling rate for waste lubricants and containers, which is one measure to promote the use of waste. However, there are many unclear aspects, such as who the target producers are, how to calculate the recovery rate and how to evaluate it, and it appears that definitions and mechanisms need to be developed to a level where they can actually be operationalised.

The use of municipal solid waste in cement plants, an area in which the Vietnamese government is interested, has not been widely used in Japan, and there are issues such as chlorine and other repellent components in cement production that need to be addressed, such as how to ensure that households separate their waste and how to remove repellent components in cement facilities.

(3) Direction of the study in 2023

It is necessary to continue to examine the situation of waste oil and liquid waste generated, with an emphasis on waste oil and liquid waste as raw materials for the production of recycled heavy oil and alternative fuels, mainly in the northern region of Vietnam, and to ascertain the scale of the market. Specifically, priority will be given to identifying and interviewing Daiseki's domestic business partners that

have expanded into Vietnam, large waste generators in Vietnam and local hazardous waste treatment businesses to collect data to determine the feasibility of commercialisation.

This survey did not identify any businesses producing recycled oil or alternative fuels from waste oil or liquid waste. In addition, as EPR is at the stage where regulations and rules are being fleshed out and clarified, an approach to position recycled fuel oil conversion as a lubricating oil EPR method will be considered. To this end, the study will confirm unclear or ambiguous regulations and present treatment methods and performance in Japan, and encourage the authorities to position recycled fuel oil as a product.

As mentioned above, VIBM is preparing “Guidelines on Pre-treatment and Co-processing of Municipal Solid Waste in Clinker Production” on behalf of the Ministry of Construction, and is also interested in preparing guidelines on the conversion of waste oil and liquid waste into raw fuel for cement, for which it has requested cooperation. We would like to share the knowledge of Japan (Daiseki) and other countries and cooperate in the preparation of guidelines to promote the use of waste. According to the NCA, the promotion of waste utilisation in Vietnam’s cement industry requires the implementation of clearer and more positive incentives. The study team would like to further strengthen cooperation with relevant organisations with a view to lobbying from this perspective.

In light of cases in Japan, it would be essential to monitor the quality control of cement as a product and the off-gases emitted in the manufacturing process, rather than setting strict regulations on the raw fuel delivered to cement plants, in order to promote the use of waste.

While laws and regulations are not yet in place, it may be safe to expand business possibilities with the development of small-scale pilot projects to reflect the experience and concepts developed in Japan, visualise and solve problems and demonstrate the feasibility of the project as a model, in cooperation with government measures such as the EPR and co-processing guidelines. Therefore, the team would like to continue the feasibility study with a view to the possibility of implementing pilot projects utilising subsidies.

In addition, in order to deepen the understanding of cement companies, waste intermediate treatment companies and relevant government departments on the project, it would be effective to invite them to Japan to see first-hand and exchange ideas and information on the use of alternative fuels and technologies at Daiseki's facilities and cement plants. The study team would like to explore such opportunities.

2.3. Study on the introduction of energy-efficient and high-efficiency equipment

2.3.1. Background and purpose

Dhowa Technos Co., Ltd. participated in a study under the city-to-city collaboration programme between Kitakyushu and Hai Phong in fiscal 2019, and has been preparing to apply for a subsidy under the JCM model project scheme with Vietnam-Italy Steel (VIS), a steel manufacturing company in which Kyoei Steel Ltd. holds an approximately 70% stake, to install a 'high-efficiency blower + high-voltage inverter' system. In the fiscal 2019 survey, actual measurements of VIS's dust collection equipment were carried out on site. Based on these measurements, a new blower was designed by Murakami MFG. Co., Ltd., and calculations were performed on energy consumption and other factors, under the assumption that operations were controlled with a high-voltage inverter produced by Yaskawa Automation & Drives Corp. The study found that if a 'high-efficiency blower + high-voltage inverter' system was installed in the existing dust collection facility with two fans, an energy saving effect of 3,604,800 kWh/year and a GHG emission reduction effect of 2,939 tCO_2/year could be expected.

A high-voltage transformer was required to install the equipment, so the application was expected to be submitted only after the updating work was completed. However, the COVID-19 pandemic delayed construction work on the transformer, forcing the application to be postponed. Plans to increase the production capacity of the steelmaking plant at VIS were put forward, in addition to considerations on the construction of an additional steel rolling mill. However, with an increase in the facility's production capacity, the study had to be revised, as the proposed facility would have to be changed and calculations on GHG emission reductions and other benefits would have to be reworked. With the resumption of field work this year and the prospect of completing work on the transformer and the production expansion plan, a field survey was conducted with the aim of understanding conditions at the site and to redo the necessary calculations to prepare the application for the JCM model project in 2023.

Furthermore, in Vietnam, large energy-consuming companies above a certain size are required to submit regular reports on their energy use to the Ministry of Industry and Trade (MOIT). In Hai Phong, the Department of Industry and Trade (DOIT) is responsible for audits. Due to high energy prices around the world, energy efficiency has become an urgent issue for these large energy-consuming enterprises. The DOIT requested that an energy audit be conducted for these companies to propose appropriate energy-saving equipment and to investigate the possibility of developing a JCM model project. Therefore, in this survey, the request from DOIT was taken as an opportunity to identify new projects for the introduction of energy-saving and high-efficiency equipment in addition to VIS, to narrow down high-priority projects from a long list of large energy-consuming companies, conduct on-site surveys, and consider applying for subsidies under the JCM model project scheme for highly feasible projects.

2.3.2. Large blower + inverter survey

(1) Field survey

This project is based on the installation of a large blower and high-voltage inverter at VIS (steelmaking plant). After the previous survey, VIS revealed plans for the installation of a high-voltage transformer and an increase in production at its steel plant. This field survey was conducted on the basis of these points and local

conditions to examine installation requirements for the blower and other equipment.

A summary of the field survey is as follows.

Objective

- To obtain information necessary to apply for subsidies under the JCM model project scheme
- To conduct interviews on VIS’s capital investment plans
- To investigate specifications and CO2 emissions (electricity consumption) in existing facilities through on-site surveys
- To submit revised quotations based on equipment improvements following updates to the transformer

Details

- Confirmation of VIS's intention to apply for JCM model project
- On-site survey on specifications and operational status of existing facilities

Schedule

- Tuesday, 15 November to Wednesday, 16 November 2022

Existing equipment to be updated

- Blower (590,000 M3) x 2 units
- Existing blower drive motors x 2 units
  1400KW 6.6KV 50HZ 920rpm

(2) Overview of installed equipment

The findings of this field survey are as follows.

<u>Production plan and equipment operating hours</u>

Currently, operations are being carried out with a target of around 73 t/h. The transformer was upgraded in October 2022, which has been effective in improving productivity per unit of time. The latest production rate averaged 82.2 t/h, with a maximum of 88 t/h. At present, the existing facilities are sufficient to meet the above productivity targets.

The future production plan in line with facility expansion is as follows.

In 2022, 320,000 t (estimated) 5,635 h, 56 t/h
In 2023, 477,000t (planned) 6,356h, 75 t/h
In 2024, 505,000t (planned) 6,381h, 79 t/h
In 2025, 545,000t (planned) 6,553h, 83 t/h
In 2026, 600,000t (planned) 7,242h, 82 t/h

Air flow control method

The motor side uses fluid coupling (a type of clutch that transmits rotational movement via fluid). Fluid couplings are used approximately twice a day.

Flows related to air flow control in existing installations is shown in figure 2.3.2.1. The maximum value for the canopy hood damper in the diagram is 20% to 30% open. If the temperature does not rise, the canopy hood damper is used to maintain a maximum value of 20%. The emergency damper is used to fully open the flow path when high temperatures (100°C to 120°C) are reached (ON/OFF control).

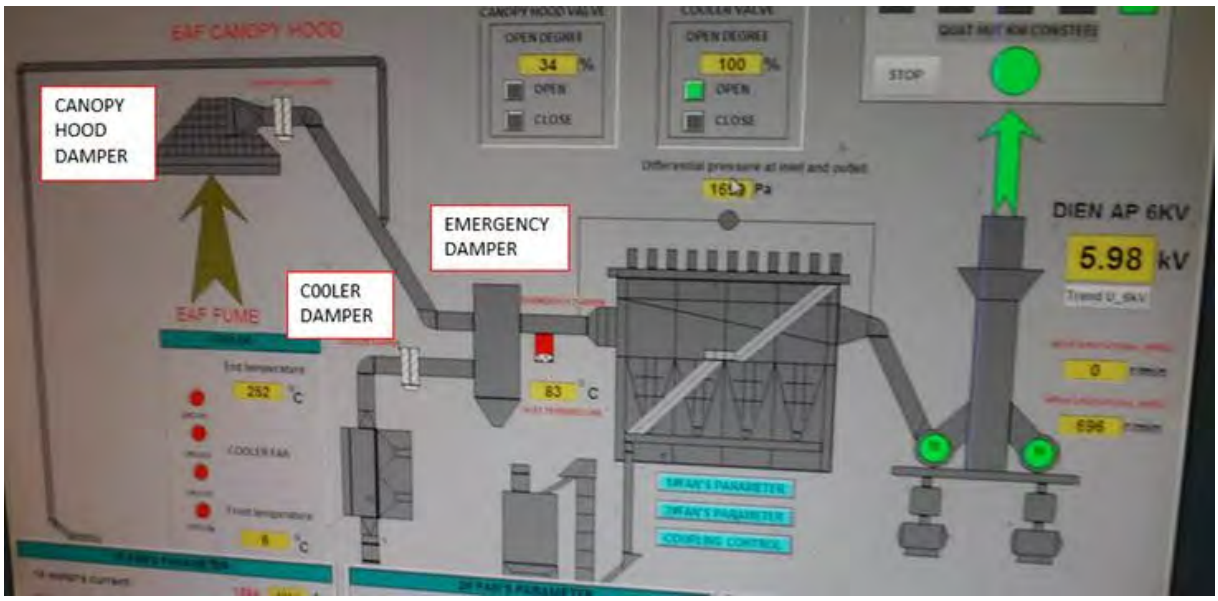


Fig. 2.3.2.1. Manufacturing system monitoring screen

Driving patterns

Operation are divided into two patterns: daytime and night-time. The speed of the motor is controlled so that the current value is around 130 A during the day and 110 to 115 A at night. The degree of control is done when the temperature rises.

Pressure loss in bag filters

There is no particular pressure loss in the bag filters and they are backwashed regularly. About 5,600 bag filters are stored in 32 rooms. They are cleaned at approximately four-minute intervals.

Relationship between production and airflow

The transformer was updated in October 2022 and has been effective in improving productivity per unit of time. The most recent production rate averaged 82.2 t/h.

Maintenance of fluid fittings

The manufacturer of the existing equipment (Chinese company) is out of business, so fluid fittings are not available and VIS does not have spare parts.

Frequency of blower bearing replacement

Bearings are replaced after 20,000 hours (two to three years). Spare bearings are available.

Cost for equipment investment

After the survey team presented the quotation and asked VIS to review it, the possibility of installing equipment was confirmed, if the application to the JCM model project is approved, partly due to the depreciation of the yen. Based on the on-site discussions, the survey team and VIS confirmed that the quotation would be reviewed, revised and shared again with VIS. Both parties also confirmed that the revised quotation would be used as the basis for further discussions at VIS to secure the budget.

Decisions on the JCM model project application

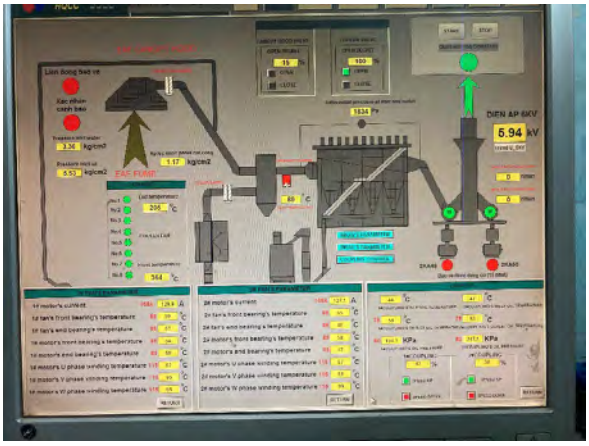
VIS responded positively to investing in equipment, not only because of the energy-saving benefits, but also because of concerns in acquiring spare parts for fluid fittings in their existing system and the inability to access after-sales services from the Chinese manufacturer (which has gone out of business). However, it was confirmed that a final decision would be made by the end of 2022, after reviewing the revised quotation.

Existing blower and motor section

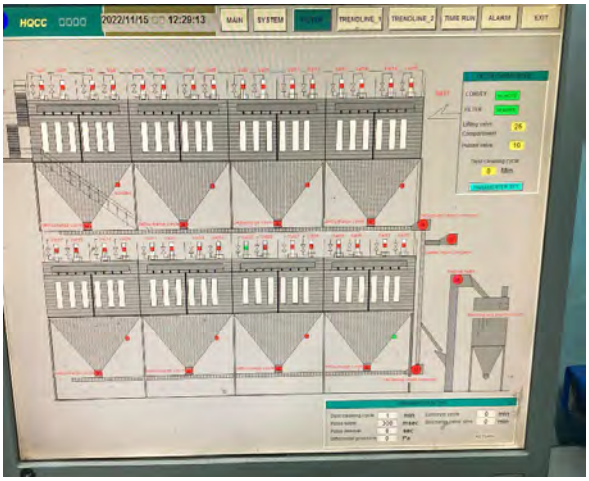
Equipment covered by this survey (side view)

Existing fabric filters

Equipment covered by this survey
(rear exterior view)



Existing DCS screen (entire dust collector)



Existing DCS screen (bug filter)

Field survey (motor section)

Field survey (check against existing drawings)

Field survey
(checking existing blower duct section)

Field survey
(checking electrical room)

Figure 2.3.2.2. Field survey

Based on the results of the field survey, it was decided that the new specification would be to increase airflow by approximately 1.7% with the introduction of a new blower and inverter, compared to the existing blower specification, and to study energy savings with the inverter.

Table 2.3.2.1. Large blower specifications proposed for VIS

SPECIFICATION OF FAN

	Existing fan		New Fan	
Capacity (m3/h)	590,000	⇒	600,000	1．7% UP （Usually 410,000(m3/h)）
TOTAL PRESSURE （kPa）	5.70	⇒	5.90	3．4% UP（Usually Max 3.4(kPa)）
Air Temp （℃）	85	⇒	85	
Suction Gas Density (kg/m3)	1.0	⇒	0.982	1.2×(273+20)/(273+85)＝0.982
Shaft Power （kW）	?	⇒	1,250	(at85℃)
Motor （kW）	1,400	⇒	1,500	(40℃運転考慮)
Rated Speed (min^{-1})	920	⇒	985	

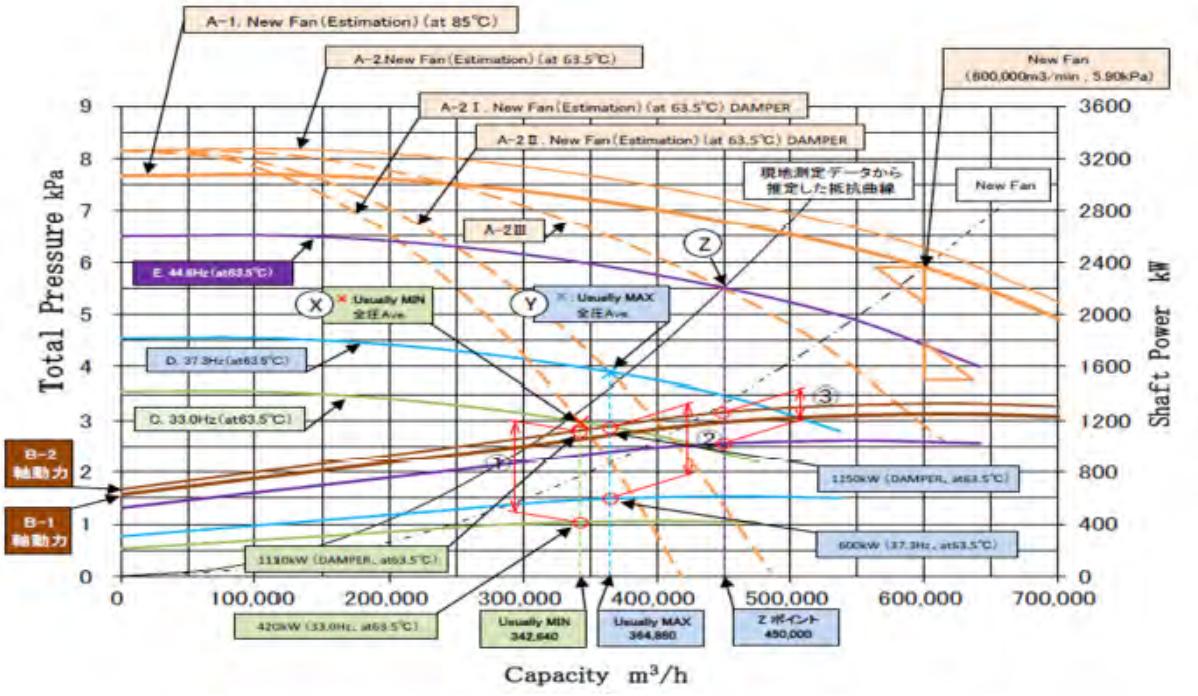


Figure 2.3.2.3. Performance curves for large blowers proposed for VIS

(3) GHG reduction benefits

Assuming that the proposed equipment is installed in VIS, the GHG reduction benefits were determined based on the energy saving effects. Assumptions are as follows.

- The evaluation assumes that even if inverters are introduced, damper control will also be performed in the same way as the existing control method (combined use of speed change and damper adjustment at fluid coupling). If the damper control method is exactly the same, the energy saving effect is only the difference in mechanical loss between the inverter and the fluid coupling.
- As there is no data on existing fluid couplings, the calculation is based on data from a Japanese manufacturer.
- In practice, if there is a difference between the efficiency of the old and new fans, the difference will also affect the amount of energy saved. However, this is omitted here as there is no documentation available on existing fans.

Table 2.3.2.2. Average value of available data on large blowers

Usually MAX				Usually MIN			
Fan Flowrate (m3/h)	Total Pressure (kPa)	SPEED (min-1)	Shaft Power (kW)	Fan Flowrate (m3/h)	Total Pressure (kPa)	SPEED (min-1)	Shaft Power (kW)
364,876	3.891	741	974	342,641	2.959	598	700

1) Amount of energy saved

(2) Usually MIN

- Ratio of fan speed to the rated speed of the existing fan 920 (min-1): 598/920 x 100 = 65%
- Mechanical loss of fluid couplings (refer to fluid coupling manufacturer's data): 14.6%
- Mechanical loss of inverter: 5 %
- Difference between mechanical loss of inverter and fluid coupling: 14.6% - 5% = 9.6%
- Energy saved by inverter compared to existing 700 kW: 700 kW x 9.6% = 67 kW/unit

(2) Usually MAX

- Ratio of fan speed to the existing fan speed rating of 920 (min-1): 741/920 x 100 = 80.5%
- Mechanical loss of fluid couplings (refer to fluid coupling manufacturer's data): 12.8%
- Mechanical loss of inverter: 5 %
- Difference between mechanical loss of inverter and fluid coupling: 12.8% - 5% = 7.8%
- Energy saved by inverter compared to existing 974 kW: 974 kW x 7.8% = 76 kW/unit

Assuming that the equipment is in operation for 190 days and 21.4 hours per day, the annual energy savings in each case are as follows.

(1) Usually MIN

67 (kW) x 21.4 (h/day) x 190 (day/year) = 272,422 (kWh/year/unit)

(2) Usually MAX

76 (kW) x 21.4 (h/day) x 190 (days/year) = 309,016 (kWh/year/unit)

2) Amount of energy saved

Assuming a unit cost of electricity (average electricity bill per day) of 6.77 yen/kWh, the amount of energy saved would be as follows.

(1) Usually MIN

272,422 (kWh/year) × 6.77 (yen/kWh) = 1,844,297 (yen/year/unit)

(2) Usually MAX

272,422 (kWh/year) × 6.77 (yen/kWh) = 2,401,054 (yen/year/unit)

3) CO2 reduction effect

Electricity intensity in Vietnam is 0.8041 (tCO2/MWh), according to the "FY 2022 Table of Electricity CO2 Emission Factors (tCO2/MWh) for the JCM Model Project" by the Ministry of the Environment. Therefore, the CO_2 reduction effect is as follows.

① Usually MIN

272.422 (MW/year) x 0.8041 (tCO2/MWh) = 219 (tCO2/year/unit)

② Usually MAX

309.016 (MW/year) x 0.8041 (tCO2/MWh) = 248 (tCO2/year/unit)

4) Summary

With the installation of two large blowers in the VIS factory, energy savings and CO_2 emission reductions in each case are both shown as the effect of two blowers.

Table 2.3.2.3. Energy savings and CO_2 reductions associated with equipment upgrades

	Amount of energy saved (per unit)	Amount of energy saved (per two units)	CO_2 reductions (per two units)
Usually MIN	67kW	JPY 3.69 million/year	438 tonnes/year
Usually MAX	76kW	JPY 4.8 million/year	497 tonnes/year

(4) Cost effectiveness

In the 2022 open call guidelines for the JCM model project, the method used to calculate the cost effectiveness of the subsidy in relation to the total GHG emission reductions is shown by the following formula.

GHG reduction cost effectiveness [yen/ tCO2 eq] = subsidy amount [yen] ÷ total GHG emission reductions [tCO2 eq].

As confirmed in the same document 'Annex 3 Classification of similar technologies: Results of adoption in each partner country', this would be the first project in Vietnam, and therefore would qualify for a 50% subsidy. Based on the estimated amount, if the cost-effectiveness criterion is less than JPY 4,000/tonne when the amount to be subsidised is divided by CO2 emission reductions, the requirements for applying for the

JCM model project will be met.

The estimated amount of the proposed equipment is currently being examined, and an assessment will be conducted as soon as the results are known, after which a system to apply for the JCM model project subsidy will be put in place.

(5) Preparation for application for the JCM model project subsidy

Based on the positive responses to investment form VIS at the end of 2022, a decision was made to start preparing to apply for a subsidy under the JCM model project scheme. In line with this year's application guidelines, the team and VIS decided to confirm the timetable for application and to start preparing the application documents.

In terms of the implementation structure, it was agreed that an international consortium would be formed by Dhowa Technos and VIS, with Murakami MFG. Co., Ltd. and Yaskawa Automation & Drives Corp. supplying the relevant equipment.

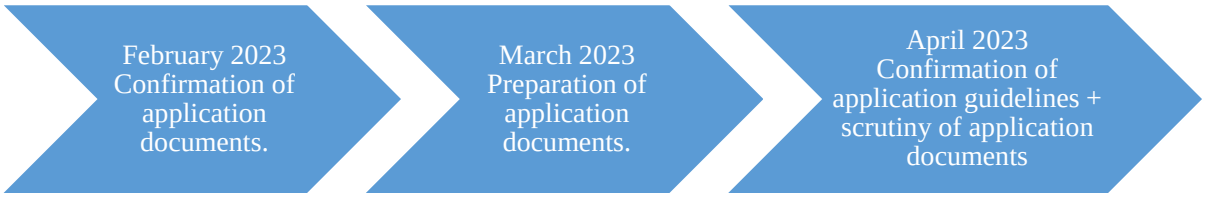


Figure2.3.2.4. Image of the timetable for applying for the JCM model project.

In addition to the above, it is highly likely that a proposal for a Measurement, Reporting and Verification (MRV) methodology will also be required for the JCM application, as there were no similar projects in the list of adopted projects. Therefore, with the aim of providing additional material for the MRV methodology, a local market survey on the equipment covered by this project was also conducted with the cooperation of staff from the Vietnam National Productivity Institute (VNPI), who also have a network with local manufacturing companies.

As large equipment is usually incorporated into the design of a plant, it is not possible to conduct a comprehensive check on the market, as is the case with commercial products such as air-conditioning equipment for residential use, for example. The survey found that it is difficult to generalise about methods of controlling airflow and other factors, and that even though high-voltage inverters are recognised for their effectiveness in saving energy, those on site consider it difficult to invest in this type of equipment due to price. The survey found that reference emissions could be set on the basis of ‘VIS's conventional air volume control method + no high-voltage inverter’.

2.3.3. Survey on the introduction of energy-saving equipment for large energy-consuming enterprises

(1) Field survey

Prior to the field survey, a shortlist of survey targets was drawn up based on a long list of large-scale businesses consuming energy above a certain size (157 businesses in total), obtained from the Hai Phong Department of Industry and Trade (DOIT). In addition to energy consumption rank, requirements for selection included the possibility of introducing 'large-scale blowers + high-voltage inverters'. The survey team narrowed down the list from 157 companies to five, and confirmed with Hai Phong's Department of Foreign Affairs about the possibility of visiting these companies. The team visited Thanh Phuong Casting Mechanical Company Limited, one of the five companies during the field survey to conduct a factory inspection and interviews.

Thanh Phuong Casting Mechanical Company Limited (hereafter 'Thanh Phuong'), a casting manufacturer with its own electric furnace, produces manhole and water meter castings for Japan from scrap iron collected from within Vietnam. Thanh Phuong has two plants: its older plant produces castings that require manual labour, while the new plant produces fabricated metal products (relatively small parts). The equipment itself was manufactured in 2017 and the new plant opened in 2019.

During the field survey, the team visited both the old and new plants, accompanied by the factory manager as the director was not available, and interviewed the factory manager in the company reception room afterwards. The company was interested in energy efficiency and conservation due to high monthly electricity bills and were expecting the survey team to offer advice in this area.

The field survey identified the following points.

- All dust collector and blower equipment is made in China.
- Dust collection equipment is mainly operated at night when electricity costs are lower.
- The motors are star-delta starter. Inverters are not currently installed.
- They question whether the inverter is suitable for the plant in question, as the inverter they installed broke down soon afterwards.
- The equipment was relatively new, so the company did not appear to want to invest in equipment immediately.
- The company had no equipment with the high voltage required by the survey team and the motor capacity was small, so even if equipment was installed, it was unlikely that it would qualify for a subsidy under the JCM model project scheme.
- Performing maintenance on existing equipment before updating the equipment could results in energy savings.

The team introduced the company to the JCM model project scheme and suggested that they upgrade the inverter, dust collector, and blower, but the differences between the survey team's proposal and local needs led to the conclusion that it would be difficult to formulate a JCM model project at Thanh Phuong.

業種：製造業　　主要加工：鋳造　　地域：Hai Phong市

社名		
	THANH PHUONG CASTING MECHANICAL COMPANY LIMITED	
	ベトナム語	CÔNG TY TNHH CƠ KHÍ ĐÚC THÀNH PHƯƠNG
	略名	THANH PHUONG

弊社は「継続的な発展のために信頼・品質・納期を心掛ける」という考えに基づき、日々努力しております。最新技術を用い、日本の基準を満たした弊社の製品は、取引先より高く評価されております。

主要製品

No	主要製品	No	主要製品
1	マンホールカバー	5	
2	工業用各種機械	6	
3	工業用ガス台	7	
4	水道メーター用カバー	8	

加工分類

No	加工分類	No	加工分類
1	鋳造金型製造（設計）	5	ロストワックス
2	鋳造金型製造（製作）	6	フライス加工
3	鋳造（ダクタイル鋳鉄）	7	研磨
4	鋳造（鋳鋼）	8	

主要設備

機械種別	型式	台数	メーカー	製造国
破壊試験機		01		イギリス
光学顕微鏡		01		イギリス
スペクトラムアナライザ		01		ドイツ
フラン砂鋳造鋳型ライン		01	Omega	イギリス
樹脂金型製造ライン	縦型	14		ベトナム
ショットブラスト機	縦型	04		中国
中間周波数の炉	ハイスピード	06		中国

会社概要

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		TEL	0225-387-4574		FAX	0225-377-3745	
	工場	住所	Village 7 Kien Bai, Thuy Nguyen, Hai Phong				
		TEL	0225-387-4574		FAX	0225-377-3745	
	担当者	氏名	Mr. Nguyen Van Quynh		役職	Vice Director	
		TEL	0982-854-256		Email	nguyenquynhducthanhphuong@gmail.com	
		氏名	Ms. Tran Tinh		役職	General Accounting	
		TEL	0904-135-767		Email	trantinh769@gmail.com	
	言語	英語	○	日本語		その他	
概要	設立年	2001年	従業員数	100名	工場面積	22,000m2	
	資本金	5,000,000 USD	年商	4,000,000 USD	生産能力	300 トン/月	
	取扱素材	FC, FCD			稼働率	100%	
	素材調達先	Thai Nguyen Steel			最低発注数		

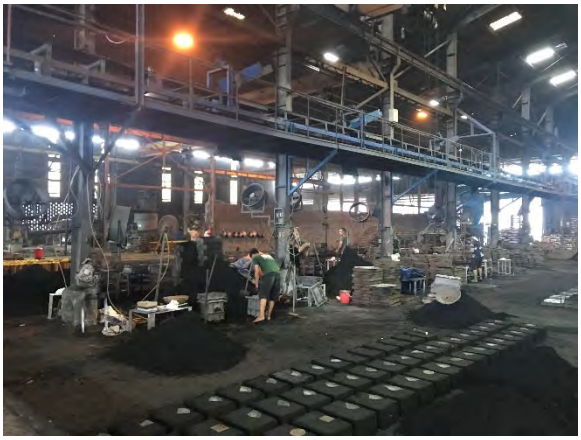
主要顧客	日本	30%	ドイツ	20%	資本形態	国営		%
	韓国	20%	ベトナム企業	30%		民間	ベトナム	100%
標準規格	ISO	9001:2008	DIN	JIS	5S			%
								%
輸出入	輸出国	日本、ドイツ、韓国、ギリシャ			輸出品	水道メーター用カバー、工業用ガス台、マンホールカバー		
	輸入国	中国、英国			輸入品	機械設備		

Figure 2.3.3.1.　Profile of Thanh Phuong

Source: 'Excellent Vietnamese Companies in Northern and Central Vietnam (12th edition)', JETRO, September 2021

https://www.jetro.go.jp/ext_images/world/asia/vn/company/pdf/nm2021.pdf

View of the new plant



View of the old plant

Blowers at the new plant

Interviews at Thanh Phuong

Figure 2.3.3.2. Inspection visits and meetings at Thanh Phuong

2.3.4. Hai Phong City's energy efficiency and conservation-related policies

The survey team visited Hai Phong's Department of Foreign Affairs and interviewed officials from the department, as well as the Department of Commerce and Industry about the city’s energy efficiency and conservation policy and local conditions.

- Under the Energy Conservation Law, the Energy Management Department of the Department of Commerce and Industry oversees enterprises with high levels of energy consumption. The list is updated annually and information is released in official forums.

- In the past, the city organised energy efficiency and conservation seminars for businesses, but has not done so in recent years due to COVID-19. Seminars are not organised every year; only when a budget is available.
- The city's energy efficiency and conservation centre used to be independent, but has been integrated into an organisation affiliated with the Department of Industry and Trade.

The field visit found that the city is in the position of managing national laws, regulations and policies and is not implementing its own initiatives. In addition, given that energy efficiency seminars are held irregularly and that the energy efficiency centre, which was seen as the key to promoting energy efficiency, is no longer in existence, it was unclear how the city will take measures to achieve carbon neutrality in the future.

The team also asked for reasons on why requests for introductions to companies to identify potential new projects had been turned down across the board prior to the field survey. Hai Phong replied that, as production levels fell in many manufacturing industries due to the country's overall economic recession, local companies may have declined the team's request to visit because they may have found it difficult to invest even with a new proposal. Another reason given was that the time for coordination was too short.

If there is an opportunity for the next survey, the survey team can submit a request as soon as possible to avoid this situation. On the other hand, if Hai Phong aims to become carbon neutral, it may be necessary to consider the development of an environment where companies in the city are forced into a position where they need, or are encouraged, to take energy-saving measures without being influenced by the economy. As there is no solution to this point in any city, including Kitakyushu, it was suggested that participation in events and learning opportunities through city-to-city networks could help.

Hai Phong Department of Foreign Affairs

Members of the survey team and Hai Phong city officials (second and third from left)

Figure 2.3.4.1. Meetings with the Department of Foreign Affairs and Department of Industry and Trade of Hai Phong City

2.4. Sharing know-how and studies on decarbonisation in Hai Phong

A workshop was held online to report on the results of the study conducted this year to city departments and local authorities in Hai Phong and organisations that had offered their cooperation with the study, and to exchange ideas on studies for the following year.

2.4.1. Support for the formulation of a Green Growth Action Plan for Hai Phong

The Ministry of Planning and Investment (MPI) of Vietnam formulated the National Green Growth Action Plan for 2021 – 2030 period (Decision 882/QD-TTg 2022) in July 2022 based on the National Green Growth Strategy for the 2021 – 2030 period, with a vision by 2050 (Decision No. 1658/QD-TTg, 2021). With the promulgation of the Plan, each province and city, including Haiphong, is required to formulate within one year (by July 2023) an action plan (GGAP) to implement the National Green Growth Action Plan. In Haiphong City, the Department of Planning and Investment (DPI) will lead the formulation of the plan, and all relevant departments will provide inputs.

As Kitakyushu has a history of jointly preparing Hai Phong City's Green Growth Promotion Plan in cooperation with Hai Phong as part of the FY2014's city-to-city collaboration programme, DPI requested Kitakyushu's cooperation in the formulation of the GGAP this time as well. In this initiative, through a meeting with DPI, we confirmed the status of the preparation of the GGAP and its policies and exchanged opinions on what kind of support Kitakyushu can provide.

2.4.1.2. Meeting with the Department of Planning and Investment

Date/Time: 14:00-15:00, 14th February 2023
Location: Department of Foreign Affairs (DOFA) of Hai Phong
Participants:
DPI: Scientific, Cultural and Social Affairs Department (1 person) and Overseas Economic Affairs Department (1 person)
DOFA: 2 persons

<u>Status of formulation of the Green Growth Action Plan (GGAP)</u>

- (Kitakyushu) Kitakyushu City has a history of cooperation with Hai Phong in the formulation of the previous GGAP. I heard that Hai Phong is also planning to create a GGAP following the formulation of the national GGAP, and I would like to ask about the status of the formulation of the GGAP and whether there is anything that Kitakyushu can do to cooperate with Hai Phong.
- (DPI) The Vietnamese government issued a National GGAP (Decision 882/QD-TTg 2022) in July 2022. In response to the government's instructions, Hai Phong will be creating its GGAP. DPI is preparing the plan under the direction of the People's Committee. For the preparation of Hai Phong's GGAP, Hai Phong has decided to establish an Advisory Committee and is currently in the process of preparing to establish this committee. The Advisory Committee for GGAP will prepare the draft GGAP based on the National GGAP in cooperation with relevant departments of Hai Phong. Currently, opinions are being collected with the relevant departments.

- (DPI) Hai Phong's GGAP is divided into 14 themes.
- (Kitakyushu) When is the project scheduled for completion?
- (DPI) The Advisory Committee is scheduled to finish setting up this month, and then will begin preparing it in March or April. The National GGAP issued in July 2022 states that each province/city must prepare its GGAP within one year, so the preparation must be completed before July 2023. The previous national GGAPs from 2014 to 2020 had a lot of general content. The current GGAP however has many detailed items, so we expect it to take more time than the previous one.
- (Kitakyushu) How much of the GGAP will be unique to the province/city? For example, are the 14 themes the same as the National GGAP?
- (DPI) The National GGAP is divided into 18 themes, 57 groups, and 134 projects. Hai Phong has selected 14 themes on its own.
- (Kitakyushu) Kitakyushu has created a Kitakyushu City Action Plan for Global Warming Countermeasures and a Kitakyushu Green Growth Strategy. It sets four pillars: decarbonization of energies, promotion of innovation, transformation of lifestyle, and adaptation to climate change. Of these, the Green Growth Strategy was formulated focusing on two areas, energy and innovation. Which of the 14 themes is Hai Phong particularly focusing on?
- (DPI) Waste management and air quality improvement are important, and I think these two have something in common with Kitakyushu City. Other issues include improving the management capacity of local governments, policy making, strengthening international cooperation, human resource development, and logistics.
- (Kitakyushu) Waste management and air quality improvement are so important in Kitakyushu City Action Plan for Global Warming Countermeasures that the city has created a section on waste management alone. As for specific initiatives, the plan for waste management focuses on sorting, recycling, utilization of biomass plastics, and waste power generation for plastic countermeasures.
- (DPI) Besides waste management and air quality improvement, what else can Kitakyushu support?
- (Kitakyushu) I think the feasibility study currently underway in Hai Phong could be considered as one of the support. Or, for example, if there is a lack of concrete ideas in preparing a plan, Kitakyushu can share its planning ideas.
- (DPI) I will communicate to the People's Committee as we move forward with the preparation of the GGAP.
- (IGES) I understand that the GGAP has both aspects of an economic growth and environmental protection, but will the plan be heavily focused on the economy? For example, to what extent will decarbonization be part of the plan?
- (DPI) We aim to balance economic growth and environmental protection. Hai Phong is creating a GGAP based on economic growth; DPI is attracting investment, but also aims to attract environmentally friendly companies.
- (IGES) I know that the plans that each department has are tied to each department, but is the GGAP positioned in parallel with them or above them?
- (DPI) If it is science and technology related, we need to gather input from the Department of Science and Technology; if it is agriculture-related, we need to gather inputs from the Department of

Agriculture and Rural Development (DARD).

- (Kitakyushu) I will share the Kitakyushu City Action Plan for Global Warming Countermeasures and Kitakyushu Green Growth Strategy, albeit in Japanese so that you can translate it for reference.
- (DPI) Decarbonization is an area that no one has had experience with so far, so we are having trouble figuring out how to make it work.
- (DPI) The Chairman of the Advisory Committee of Hai Phong GGAP will be the Vice Chairman of Hai Phong People's Committee, the Vice Chairman will be the Director General of DPI, and the Director General of each department will also participate in the Advisory Committee. Districts and communes will also participate. The Advisory Committee is scheduled to meet once a year. Instructions for digital transformation are also coming down from the national government.

Figure 2.4.1.1. Meeting with the Department of Planning and Investment (DPI) and the Department of Foreign Affairs (DOFA)

2.4.1.2 Tentatively proposed structure of GGAP

During the meeting with DPI, the proposed structure of Haiphong's GGAP, which was shared with us by DPI, included the following major items:

- Establish and complete institutions and policies related to green growth goals; improve management effectiveness and efficiency
- Improve communication, education, and awareness
- Human resource development and green jobs
- Secure financial resources and promote investment in green growth
- Science, technology, and innovation
- International partnerships and cooperation
- Transportation and logistics services
- Waste management
- Air quality management
- Green, sustainable consumption

2.4.1.3. Kitakyushu City's Response (Sharing of relevant materials)

Based on the meeting with DPI, Kitakyushu sent (through DOFA) to DPI the Japanese version of the

"Kitakyushu City Global Warming Countermeasures Plan" (formulated in August 2021) and "Kitakyushu City Green Growth Strategy" (formulated in February 2022) and their respective English summary versions.

2.4.2. Studies on DX issues and needs and sharing know-how

In this study, interviews were conducted with local authorities in Hai Phong, industrial parks, factories and other organisations to acquire information about digital transformation (DX) issues and needs. Detailed feedback showed interest on issues in improving the efficiency of inspections on the immense sites of industrial parks and wide-area monitoring of Lan Ha Bay after it gets added to the World Heritage site of Ha Long Bay. Currently, inspections and countermeasures for both are being conducted manually. These processes are inefficient, so a proposal was formulated for the development of a system with sensors and monitoring cameras operated by small PV systems and storage batteries installed at inspection points that transmit data via WiFi. Refer to section “2.1.4.3 Potential for business development and technical cooperation” for more information about this proposal.

2.4.3. AIM scenario analysis and identification of definitive projects in collaboration with JPRSI

Several government-subsidised projects are being simultaneously implemented through city-to-city cooperation between Hai Phong and Kitakyushu, in addition to the city-to-city collaboration programme itself. MOEJ-related projects, such as a support project in fiscal 2021 on building institutions to encourage the widespread use and development of exceptional decarbonisation and low-carbon technologies in developing countries (hereinafter, the “AIM project”), and the operation and management of the Japan Platform for Redesign: Sustainable Infrastructure (hereinafter, the “JPRSI project”) both have strong links with the city-to-city collaboration programme. It is critical that a complementary approach is taken to connect these related projects and avoid duplication. Accordingly, this section describes the ways in which this study has been linked to these projects, and how collaboration can help identify specific projects in the future.

2.4.3.1. Links with the AIM scenario analysis for Hai Phong

The Asia-Pacific Integrated Model (AIM) is a large-scale simulation model jointly developed with the National Institute for Environmental Studies (NIES), Kyoto University, Mizuho Research & Technologies and other organisations, in cooperation with several research institutes in the Asia-Pacific region, that functions as a tool for policy deliberations focused on reducing GHGs and avoiding climate change impacts.[32]

Since 2015, capacity building programmes on AIM scenario analysis, workshops, and scenarios analyses have been conducted for Hai Phong through the AIM project. In 2016, a low-carbon scenario was developed to reduce GHG emissions by 14% by 2030 compared to BAU, using 2013 as the base year. As the Prime Minister’s Decision No. 2068/2015/QD-TTg incorporated a 25% reduction in GHG emissions by 2030 and a 45% reduction by 2050 compared to a BAU scenario, Hai Phong’s low-carbon scenario was subsequently updated in 2020 to include a scenario to reduce GHG emissions by 45% by 2050, in line with national targets.

Following Prime Minister Pham Minh Chin’s announcement at COP26 in 2021 of the country’s aim to achieve carbon neutrality by 2050, a draft decarbonisation scenario for Hai Phong was developed this year

[32] Asia-Pacific Integrated Assessment Model (AIM): https://www-iam.nies.go.jp/aim/index_j.html

on the premise of net zero by 2050. The draft scenario was presented at an AIM workshop held in Hai Phong on 14 February 2023, where discussions were held with the participation of relevant city departments. A collection of technical case studies was also developed and presented for the 29 projects in the five action areas used in the scenario analysis in order to provide city departments with an image of how the decarbonisation scenario could be implemented. Also included in the technical case study collection are specific examples of actions that are being examined in this study, i.e., converting waste into raw cement fuel and the installation of high-efficiency equipment at factories. Not yet complete, the 2050 decarbonisation scenario is expected to be updated and discussed further so it can be reflected in measures aiming at net zero by 2050, and thus, be instrumental in the decarbonisation of Hai Phong.

Adopted as a three-year programme in 2021, this study has a history of refining proposed technologies and study targets with a particular focus on energy savings and energy supply systems in factories with high potential for reducing GHG emissions in the industrial sector, which has the highest proportion of GHG emissions, using the analytical results from the 2020 updated AIM scenario. The city-to-city collaboration programme and the AIM project have been closely linked in this context, with feedback going in both directions contributing to efforts to implement scenarios.

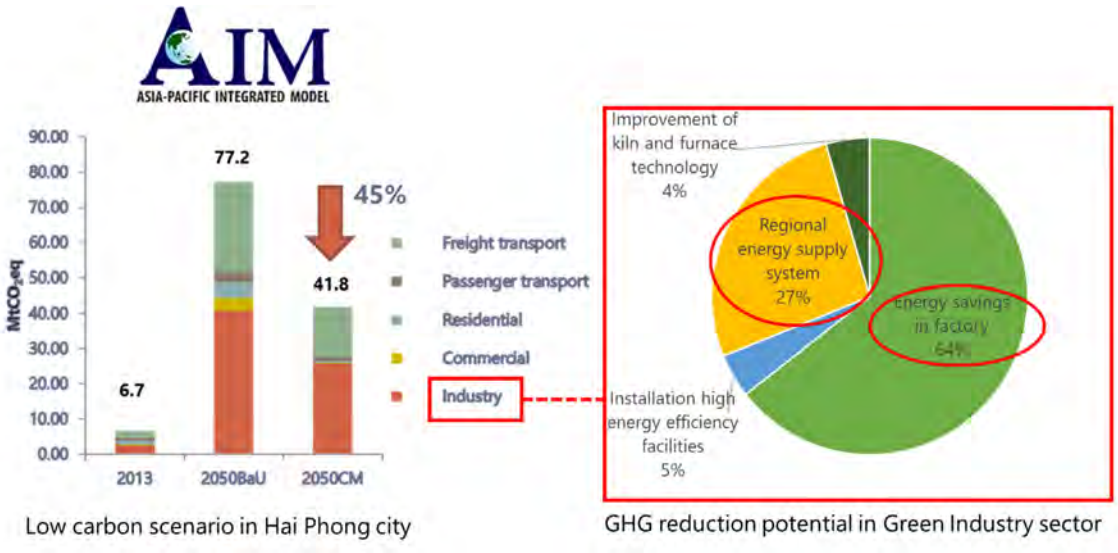


Fig. 2.4.3.1.1. AIM low-carbon scenario for Hai Phong (left) updated in 2020 and breakdown of the highest GHG emissions industrial sector (right) (Source: Compiled from FY 2020 report[33])

2.4.3.2. Collaboration with JPRSI for Hai Phong

The Japan Platform for Redesign: Sustainable Infrastructure (JPRSI) is a platform for public-private partnership set up by MOEJ in September 2020 to provide comprehensive support to Japanese companies engaged in the development of environmental infrastructure overseas. As of December 2022, 471 companies are registered on the platform.[34]

[33] FY 2020 Commissioned report on support for building institutions to encourage the widespread use and development of exceptional decarbonisation and low-carbon technologies in developing countries
[34] Japan Platform for Environmentally Sustainable Infrastructure (JPRSI): https://www.jprsi.go.jp/

Three task forces have been launched under the JPRSI to provide additional benefits to members. One such group is the Task Force on Industrial Parks and Districts, which aims to introduce members to advanced environmental initiatives being promoted in industrial parks and districts (e.g., zero-carbon development of districts) and to encourage members to take part in such activities. Initiatives that are the focus of studies in projects adopted by the city-to-city collaboration programme, in particular, are expected to meet a wide variety of environmental needs and offer opportunities that local companies in participating cities alone cannot fulfil. Therefore, one of the aims of these types of projects is to pay forward opportunities to a wide range of members.

This year, the task force examined ways to provide information to members about advanced environmental initiatives focusing on Hai Phong. This has culminated in arrangements to organise an online seminar for JPRSI members in 8th March 2023 “Environmental Technology Needs and Opportunities in Hai Phong City, Vietnam” (tentative title).

The organisation of this seminar has been planned and coordinated under this study in collaboration with the JPRSI Secretariat. In more specific terms, networks with and information on related organisations and companies in Hai Phong that have been built up through the city-to-city collaboration program have been offered to assist in coordinating this seminar.

The draft agenda for the seminar (as of February 2023) is shown in Table 2.4.3.2.1. Case studies will present information on local needs and opportunities for introducing environmental infrastructure, with a focus on environmentally friendly industrial parks in Hai Phong that aim to acquire the status of an Eco-Industrial Park, which are being promoted by UNIDO and Vietnam’s Ministry of Planning and Investment. Case studies are expected to be presented by the Science Technology Development and Innovation Centre (ISC) of Hai Phong and two industrial parks.

The seminar is expected to be instrumental in helping a wide range of JPRSI members learn about Hai Phong and contribute to promoting eco-industrial parks in the city through business matching opportunities for environmental infrastructure. If a promising low-carbon project is identified through business matching, this project may support a feasibility study.

Table 2.4.3.2.1. Draft agenda for the JPRSI online seminar, “Environmental Technology Needs and Opportunities in Hai Phong City, Vietnam” (tentative title)

Draft agenda	Speakers (Tentative)
1. Opening remarks	MOEJ
2. City-to-City Collaboration between Kitakyushu and Hai Phong	Kitakyushu City
3. Environmental Infrastructure Needs and Opportunities in Hai Phong City	Science Technology Development and Innovation Centre (ISC)
4. Initiatives for Eco-Industrial Parks and environmental infrastructure and needs (case study 1)	Nam Cau Kien Industrial Park (NCK)
5. Initiatives for Eco-Industrial Parks and environmental infrastructure and needs (case study 2)	DEEP C Industrial Zones (DEEP C)
6. Q&A	
7. Announcement from the secretariat (about business matching)	JPRSI Secretariat
8. Closing remarks	MOEJ

3. Workshops, International Conferences and Other Meetings

3.1. Workshop with Hai Phong

An online workshop was held to report on the results of the study conducted this fiscal year to city departments and local authorities in Hai Phong and other relevant organisations that cooperated with the study, and to exchange ideas on studies in the upcoming year.

Date and time: Friday, 9 December 2022 11:00-13:15 (JST)
Location: Online (Zoom)
Languages: Japanese, Vietnamese (continuous interpretation)
Participants: 31

Hai Phong City	• Department of Foreign Affairs (DOFA): Nguyen Thi Bich Dung, Nguyen Minh Trang • Department of Industry and Trade (DOIT): Vinh • Department of Natural Resources and Environment (DONRE): Hoang Ha • Cat Ba Archipelago Biosphere Reserve Management Board: Nguyen Thuy Lien • Science Technology Development and Innovation Center (ISC): Nguen Dinh Vinh、Do Thi Nhung、Trung Tam
Cooperating organisations in Vietnam	• DEEP C Industrial Zones: Trang Thi Hanh Dung, Hiro Tsuchiya, Eiichi Yumoto • VietNam Institute for Building Materials (VIBM): Luu Thi Hong, Trinh Thi Cham • An Chuan – IEC Energy and Environmental Services Joint Stock Company (AIC): Dang Van Sy • Hanoi University of Science and Technology: Van Dinh Son Tho • Ngoc Long Solar: Nguen Van Thuong, Dang Xuan Thanh
Study team	• Kitakyushu City: Muto, Nagahara • Daiseki Co., Ltd.: Kusano • Dhowa Technos Co., Ltd.: Watanabe • AZUSA SE&E Co., Ltd.: Sugie • IGUAZU Corporation: Kumada • IGES: Akagi, Hibino (MC), Horizono, Maehata
Observers	• Embassy of Japan in Vietnam: Hiroi • Ministry of the Environment, Japan: Kamimura
Interpreter	Vu Hoang Anh

I. Study on use of energy derived from waste liquid and solid waste (Daiseki Co., Ltd.: Kusano) (Annex 2)

A field survey was conducted on the feasibility of a project using liquid and solid waste as an alternative fuel for cement calcination and a project to treat waste lubricating oil. Field visits and interviews were conducted with cement plants, waste oil emitters, hazardous waste processors, government agencies, research institutes and other organisations. The survey found that cement plants have a strong interest in introducing alternative fuels and demand is growing for such fuels due to soaring coal prices. In line with revisions to the Law on Environmental Protection, waste lubricating oil is now covered under extended producer responsibilities (EPR). However, there are a number of unknowns, as it has not been fully institutionalised. Next year's study will explore this topic in more depth.

II. Study on the introduction of energy-efficient and high-efficiency equipment (Dhowa Technos Co., Ltd.: Watanabe) (Annex 2)

A field survey was conducted on a project to replace large, existing blowers in a steel manufacturing plant at Vietnam Italy Steel (VIS) with high-efficiency equipment. Existing equipment was measured and redesigned so that equipment could be installed to match the scale of production, as VIS plans to further expand production in the future. The survey found that the company is on track and will start preparations to apply for the JCM Model Project subsidy programme, due to open in April 2023. A field visit was also conducted at the Thanh Phuong Casting Mechanical Company Ltd.'s factory, a cast metal manufacturer with an electric furnace, to investigate the potential for updating the factory's dust collector and inverter. However, a decision was made that, due to the small size of the facility, it would not be a suitable applicant for the JCM Model Project subsidy programme.

III. Study on installation of PV + regenerative storage batteries on Cat Ba Island (IGUAZU Corporation: Kumada) (Annex 2)

A study was conducted, examining the feasibility of introducing technology to regenerate lead-acid batteries in Hai Phong from a wide range of perspectives. As a result of the study, a decision was made to conduct a demonstration project on a small-scale, combination used PV panel and regenerative storage battery unit with people living in the floating village around Cat Ba Island. Other ideas considered included applying for a project on roof-top PV systems with regenerative storage batteries as a JCM Model Project, a battery regenerative service together with a telecom company, a rental service for electric forklifts in industrial parks, a project to convert electricity from electric carts on Cat Ba Island to renewable energy, and a wide-area monitoring system for off-grid areas targeting Lan Ha Bay and industrial parks. Next year's study will explore these topics in more depth.

IV. Q&A

<u>Comments from the head of the Science Technology Development and Innovation Centre (ISC)</u>

- ISC plays a role in introducing Hai Phong to companies with the latest scientific technologies. ISC

has already collaborated with several companies in Kitakyushu City to introduce technologies to companies in Hai Phong. The presentations by the three companies today all have potential to help improve current conditions and contribute to development in Hai Phong.

- Dhowa Technos's study targeted cement and steel production plants. However, we would like to know if there is potential to deploy technologies to other types of plants. There are likely a number of interested companies, but subsidies would allow more companies to apply this technology due to the large investment required.
- The survey by Daiseki mentioned footwear scrap. Is there potential to apply this technology outside of cement plants? What hazardous gases, such as dioxins, would be emitted during combustion, and how are they treated?
- We understand the technology presented by IGUAZU because of meetings at ISC on PV panels and regenerative batteries. If this system could be developed for Hai Phong, it would help protect the environment. Lan Ha Bay on Cat Ba Island is an important resource for Hai Phong. Even though the technology is environmentally friendly, a detailed study would be required before it could be deployed on a wide scale. It may be difficult to obtain capital investment, as fishers have little money, so the introduction of this technology would be more feasible with the application of subsidies. If there is potential to acquire a subsidy, ISC would be interested in actively helping expand this in the bay area. Iguazu's presentation also touched upon a study on regenerative batteries for telecom companies. How would you proceed with expanding this locally?
- Thank you for the meaningful information on technologies presented at today's workshop. We would appreciate another opportunity to meet like this and would like to extend our support to future initiatives in any way we can.

<u>Responses to comments</u>

- Typically, cement is fired at 1450 ^{o}C, so it is unlikely that dioxins will be generated. Alternative fuels use existing waste materials and footwear scrap is already currently in use. The purpose of this study was to examine the potential for supplying other types of liquid fuel produced from waste plastics, waste oil and waste solvents. (Daiseki)
- At the moment, it is unclear whether small-scale, stand-alone power units will be too expensive for people living on the water. However, there may be ways around purchasing equipment in one lump sum, such as by leasing or renting. While there is a need to look for subsidies, we must also consider how this technology can be self-sustaining, as the project will not be sustainable if it is not viable without subsidies. The subsidy from the Japanese government under consideration at this point is the JCM scheme, so we need to consider how to prepare to apply by setting up an implementation system in a way that fits with the JCM scheme. (IGUAZU)
- Information on the price of PV panels and battery sets will be provided at a later date. (ISC)
- If we can make connections with interested telecom companies, a small, temporary plant will be built first where batteries can be recovered and tested. Telecom companies may also have concerns, so we would ask them to assess the feasibility of the project through testing. If the test results are positive, we can envision developing a joint venture with a Vietnamese company. (IGUAZU)

V. General comments

- Over the past two years of studies, local conditions and business opportunities have come to light. One of the objectives of the city-to-city collaboration programme is the move to connect projects to the JCM with the use of subsidies. We would like to offer our support for the development of projects that can lead to JCM projects. We will continue to promote projects in specific ways that are beneficial to both our cities in the next fiscal year. We request your continued cooperation in this effort. (Kitakyushu)
- A number of affiliated departments from Hai Phong participated in today's workshop. DOFA will continue to work on promoting this cooperative relationship with Kitakyushu. Three companies shared the results from the studies conducted this fiscal year and their plans going forward. We would like to work as a bridge between both cities so that studies can continue to be smoothly implemented in the upcoming fiscal year. We would like you to send us the profiles of the companies and technologies later on so that we can introduce the technologies we heard about today to as many companies in Hai Phong as possible. We will work with the Department of Science and Technology to introduce the technologies to a number of companies in the city. We would also like to consult with DOIT to identify potential companies that could be targeted for the technologies talked about today, in addition to cement and steel production plants. We would also like to organize business matching opportunities through the ISC. We look forward to your continued cooperation. (DOFA)

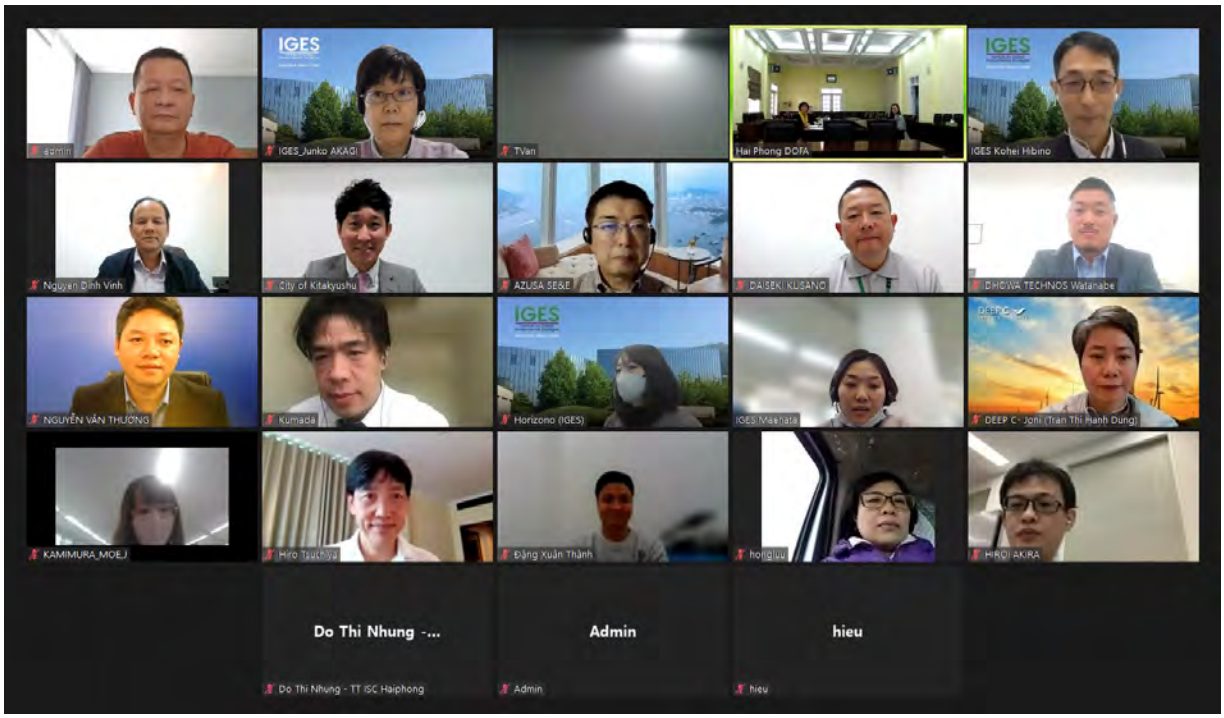


Fig. 3.1.1. Group photo during the workshop with Hai Phong

3.2. Presentations at MOEJ-designated meetings (international conferences)

There were no specific opportunities to present the results of this study at MOEJ-designated international conferences this year.

3.3. Presentations at MOEJ-designated meetings (related to the city-to-city collaboration programme)

A briefing on the outcomes of the projects adopted in this fiscal year's city-to-city collaboration programme was to be presented at an online exhibition at the "Zero Carbon City International Forum 2023", organised by MOEJ (held on 1 March 2023).[35] Two versions of the report have been prepared and submitted in Japanese and English according to a prescribed form by the Secretariat (Appendix 3).

[35] "Zero Carbon City International Forum 2023": https://www.iges.or.jp/jp/events/20230301

Annex

Prime Minister of Vietnam: Decision No. 1266/QD-TTg (Summary)

Name: Development Strategy of Vietnam's Construction Materials in the Period of 2021-2030, with a Vision toward 2050
Date approved: 18 August 2020 (in effect from 1 January 2021)
Summary: Development strategy for construction materials in Vietnam from 2021 to 2030, with a vision to 2050

◇ Vision

a. Development of an efficient and sustainable building materials industry to meet basic domestic demand and gradual increase in imports to contribute to socio-economic growth and development.
b. Early approaches and application of scientific, technological and operational achievements, especially in the Fourth Industrial Revolution.
c. Efficient use of natural resources and thorough conservation of energy, raw materials and fuel.
d. Minimising environmental impacts during mining and processing of minerals for building materials and in the process of producing construction materials.
e. Promotion and encouragement of all economic sectors to invest in and develop the building materials industry.
f. Allocation of a network of construction material production facilities throughout Vietnam in line with the natural and social conditions of each region.

⇩

○Promotion of scientific and technological research and applications

Conduct research and development of new products and technologies, and use of waste as raw materials and alternative fuels; reduce energy consumption; improve productivity and quality of building materials.

◇Implementing bodies:

1. Ministry of Construction	Formulates plans to implement strategies and guide dissemination to localities.
2. Ministry of Natural Resources and Environment	Coordinates with the Ministry of Construction on key responsibilities in examining environmental criteria in the production and development of minerals. Implements regulations on environmental protection and provides guidance on the installation of online environmental monitoring systems in manufacturing plants.
3. Ministry of Industry and Trade	Directs the collection, management and recycling of industrial waste (ash, thermal power plants, metallurgy, slag, chemicals, mineral mines, etc.)
4. Ministry of Transport	Coordinates with the Ministry of Construction on the use of construction materials in road construction.
5. Ministry of Science and Technology	Assumes prime responsibility for and coordinates with ministries, agencies, branches and local authorities in organising the implementation of scientific and technological research tasks at the national level on the production of building materials.
6. Ministry of Planning and Investment	Assumes prime responsibility for and coordinates with the Ministry of Finance, Ministry of Construction and relevant agencies in proposing the introduction of investment projects to the government on the production of construction materials using industrial, municipal and

	agricultural waste. Projects to construct power plants using raw materials, alternative fuels and waste heat from factories producing construction materials will be eligible for support and preferential policies.
7. Ministry of Finance	Proposes support mechanisms and policies to competent authorities to encourage corporate investment in advanced technologies and equipment for power generation systems using waste heat in order to promote energy efficiency.
8. Professional building materials-related associations	Proposes solutions and policies to national governing organisations and bodies on technology, environmental protection and trade.
9. People's Committees in provinces and centrally-managed cities	Formulates plans, schemes and strategies for the development of building materials in areas. Also approves investments in construction material projects in areas in accordance with regulations.
10. Investors and manufacturing companies	Endeavours to conduct research on and apply science and technology, conserve energy, maximise the use of industrial, municipal and agricultural waste, reduce consumption of raw materials and fuels, and minimise emissions of pollutants.

◇Specific goals for each phase (1) (from Appendix)

Cement industry (1)

1. Period between 2021 and 2030

a) Investment:

- Investments shall only be made in new cement clinker production plants with a clinker line capacity of at least 5,000 tonnes/day and in power generation systems that use waste heat.
- By 2025, cement plants currently in operation with clinker production capacities of less than 2,500 tonnes/day must invest in technologies to improve productivity and quality.
- The average rate of use of clinker in cement production for the entire industry shall be set at 65%, with cement additives a minimum of 35%.
- By 2025, the total designed capacity of cement plants must not exceed 125 million tonnes/year and 150 million tonnes/year by 2030.

b) Technology:

- Advanced technologies with high degrees of automation shall be used and information technology applied to production to achieve the following technical standards:
  - ✧ Heat consumption: ≤730 kcal/kg clinker;
  - ✧ Power consumption: ≤ 90 kWh/tonne clinker;
  - ✧ Power consumption: ≤ 65 kWh/tonne clinker.
- Emission requirements for investment lines:
  - ✧ CO_2: ≤ 650 kg/tonne cement;
  - ✧ SO_2: ≤ 200 mg/Nm^3;
  - ✧ NO_2: ≤ 800 mg/Nm^3;
  - ✧ Dust: ≤ 30 mg/Nm^3.
- Emission requirements for new investment lines:
  - ✧ CO_2: ≤ 650 kg/tonne cement;
  - ✧ SO_2: ≤ 100 mg/Nm^3;
  - ✧ NO_2: ≤ 400 mg/Nm^3;
  - ✧ Dust: ≤ 20 mg/ Nm^3.
- By the end of 2025, all cement production lines with a production capacity of 2,500 tonnes/day or more must install and operate power generation systems using waste

heat.

- At least 20% fly ash or other industrial waste must be used as alternative raw materials and as an additive in cement production by 2025, and 30% by 2030.
- Up to 15% of total fuel used to produce cement clinker must be alternative fuels.

c) Development and use of natural resources:

- Industrial, agricultural, construction and household waste shall be maximised for use as raw materials, fuels, and additives in cement manufacturing processes.

d) Environmental protection:

- Cement production facilities must possess equipment to monitor dust concentrations at waste sources and connect these devices online with local environmental management agencies.

◇Specific goals for each phase (2) (from Appendix)

Cement industry (2)

2. Period between 2031 and 2050

b) Technology:

- The average rate of clinker use in cement production across the industry shall be set at 60%, with at least 40% of cement additives.
- Achievement of the following technical standards:
  - ✧ Heat energy consumption: ≤ 700 kcal/kg clinker;
  - ✧ Power consumption: ≤ 80 kWh/tonne cement.
- Emission requirements:
  - ✧ CO_2 content: ≤ 550 kg/tonne cement;
  - ✧ SO_2 content: ≤ 100 mg/Nm^3;
  - ✧ NO_2 content: ≤ 400 mg/Nm^3;
  - ✧ Dust content: ≤ 20 mg/Nm^3.
- At least 60% of production lines shall use fly ash or other industrial waste as alternatives to clay materials.
- At least 30% of fly ash, slag, or other industrial waste shall be used as additives in cement production.
- Up to 30% of all fuels used to produce cement clinker shall be replaced with alternative fuels, such as household, agricultural and industrial waste.
- Clinker and cement exports shall not exceed 20% of the total design capacity.

◇Specific goals for each phase (3) (from Appendix)

Cement industry

1. Period between 2021 and 2030

a) Investment:

- Restrictions shall be in place for new investments in ceramic tile production facilities.
- Fuels produced through coal gasification shall be completely replaced with clean, environmentally friendly fuels, such as LPG and CNG.
- By 2025, the total design capacity of plants producing ceramic tiles shall not exceed 850 million m^2/year, and 950 million m^2/year by 2030.
- Achievement of the following technical standards:
  + Heat energy consumption: ≤ 700 kcal/kg clinker;
  + Power consumption: ≤ 80 kWh/tonne cement.
- Emission standards:
  + CO_2 content: ≤ 550 kg/tonne cement;
  + SO_2 content: ≤ 100 mg/Nm^3;
  + NO_2 content: ≤ 400 mg/Nm^3;
  + Dust content: ≤ 20 mg/Nm^3.

2. Period between 2031 and 2050

- No coal gas shall be used as fuel.

Other provisions are in place for paving stones, sanitary ware, glass, lime, brick (provisions to replace 50% of natural raw fuels with alternatives by 2030 and reduce heat consumption and CO_2 emissions from 20% to 30% by 2050), other building materials, roofing materials, sand, aggregates and concrete.

Công việc uỷ thác dự án liên hết giữa các thành phố nhằm thực hiện xây dựng xã hội giảm phát thải CO2 năm 2022
（Dự án thúc đẩy xây dựng các khu công nghiệp sinh thái hướng tới cắt giảm phát thải CO2 tại TP Hải Phòng, Việt Nam）

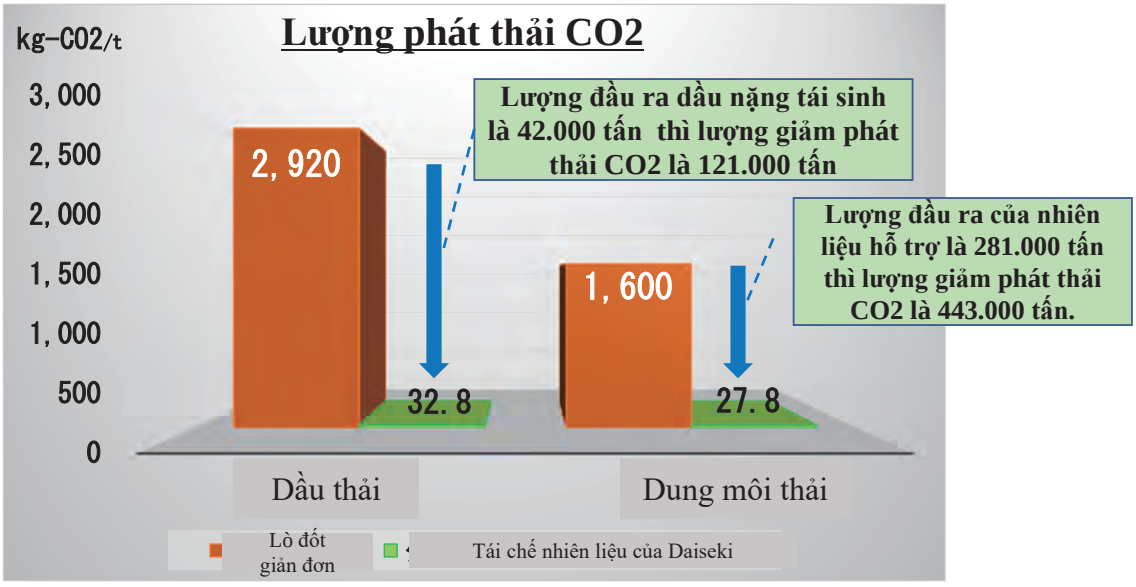
Khảo sát sử dụng năng lượng thu hồi từ chất thải dạng lỏng và chất thải rắn

Tháng 12 năm 2022

Công ty Daiseki
Iguazu Corporation
Viện nghiên cứu chiến lược môi trường toàn cầu
Thành phố Kitakyushu
Thành phố Hải Phòng

Các hoạt động của Daiseki trong nước

Cắt giảm lượng phát thải CO2 bằng việc cung cấp nhiên liệu tái chế



Bằng việc sản xuất và bán nhiên liệu thay thế tại Việt Nam có thể góp phần cắt giảm phát thải CO2

Nghiên cứu hình thành dự án

- Nhiên liệu thay thế than đá dung trong lò nung Xi măng
- Tái sinh dầu nặng từ dầu bôi trơn thải

Nhiên liệu thay thế than đá dung trong lò nung xi măng

Đã làm việc với các tổ chức nhà nước, các đơn vị liên quan đến ngành xi măng

HEZA,DONRE,DOFA(TP Hải phòng)

MONRE Cục Pháp chế

MONRE Cục quản lý rác thải Tổng cục môi trường
（VEA・WAMA）

・Chỉ có 3 nhà máy xi măng sở hữu giấy phép xử lý rác thải nguy hại （tính đến tháng 8）
・Do giá nhiên liệu ngày càng tăng cao nên các nhà máy xi măng đang tiến hành chuẩn bị xin cấp giấy phép xử lý rác thải.
・MONRE ban hành quy định không giới hạn phạm vi thu gom rác thải nguy hại giữa các địa phương.
・Thực tế khi tiếp nhận rác thải từ bên ngoài phạm vi tỉnh cần có sự cho phép của Uỷ ban nhân dân
・Các nhà máy xi măng đang có ý định sử dụng rác thải nguy hại làm nhiên liệu, tuy nhiên cần thiết phải khảo sát xem có ảnh hưởng tới môi trường và thành phần của xi măng hay không

Đang khảo sát nhiên liệu dùng trong các nhà máy xi măng trong bối cảnh giá nhiên liệu ngày một tăng cao. Phía các cơ quan tổ chức nhà nước cũng đang thúc đẩy sử dụng rác thải trong các nhà máy xi măng.

株式会社 ダイセキ

Nhiên liệu thay thế than đá trong lò nung Xi măng

Đã làm việc với các tổ chức nhà nước, các đơn vị liên quan đến ngành xi măng

Hiệp hội xi măng Việt Nam（VNCA）

Viện nghiên cứu vật liệu xây dựng Việt Nam（VIBM）

・Xác nhận về tính cần thiết sử dụng nhiên liệu thay thế trong bối cảnh than đá đang dần một tăng cao
・Cần quan tâm tới việc sử dụng rác thải trong nhà máy xi măng, đặc biệt là xử lý bùn thải trong hệ thống thoát nước và xử lý rác thải đô thị.
・Có sự quan ngại về ảnh hưởng tới thành phần xi măng do tang cường sử dụng rác thải, có mong muốn hợp tác về mặt thiết bị (engineering)
・Liên quan tới rác thải sinh hoạt,hiện đang được chính phủ giao nhiệm vụ xây dựng bản hướng dẫn sử dụng nhiên liệu thay thế trong các nhà máy xi măng (dự kiến ban hành vào đầu năm 2023)

Mặt khác, cũng có mong muốn thúc đẩy việc sử dụng rác thải đô thị làm nhiên liệu trong nhà máy xi măng để kéo dài tuổi thọ của các bãi chôn lấp.

Nhiên liệu thay thế than đá trong lò nung Xi măng

Tình trạng sử dụng nhiên liệu thay thế trong nhà máy xi măng

Nhà máy xi măng A

Nhà máy xi măng B

・Thực tế có nhiều nhà máy xi măng vẫn chưa hoàn toàn sử dụng nhiên liệu thay thế,vẫn còn phụ thuộc và than đá.
・Một phần trong đó sử dụng các loại rác thải thải ra ra nhà máy sản xuất giày dép, vải sợi…là nhiên liệu.
（Nhà máy A：120.000 t/năm、nhà máy B：3.000 t/năm）※ Nhà máy A sử dụng cả Nylon thải
・Chủ yếu các loại rác thải rắn không chứa Clo được xem là đối tượng sử dụng.
・Ngay cả tại các nhà máy cho đến nay chưa sử dụng nhiên liệu thay thế cũng đang nghiên cứu cải tiến thiết bị để bắt đầu sử dụng.

株式会社 ダイセキ

Nhiên liệu thay thế than đá trong lò nung Xi măng - BẢN TÓM TẮT

○ Nội dung đã nắm bắt được

・Giá sản xuất xi măng tăng cao do giá than đá có xu hướng ngày một tăng
・Vì giá các loại rác thải từ ngành sản xuất giày dép và vải sợi có xu hướng tăng cao trở nên khó thu gom nên việc mở rộng đối tượng rác thải để sử dụng làm nhiên liệu thay thế là yêu cầu được đặt ra.
・Để sử dụng rác thải nguy hại như dầu thải làm nhiên liệu thay thế, các nhà máy xi măng cần phải xin được giấy phép xử lý rác thải nguy hại.
・Trong chất thải nguy hại, nếu xây dựng mới các quy chuẩn quốc gia chẳng hạn như QCVN…để biến thành “sản phẩm” theo quy chuẩn đó thì đơn vị sử dụng không cần thiết phải có giấy phép xử lý.
・Về phía cơ quan nhà nước cũng có mong muốn xử lý cả rác thải sinh hoạt để sử dụng cho các nhà máy xi măng.

○Các việc cần triển khai trong thời gian tới

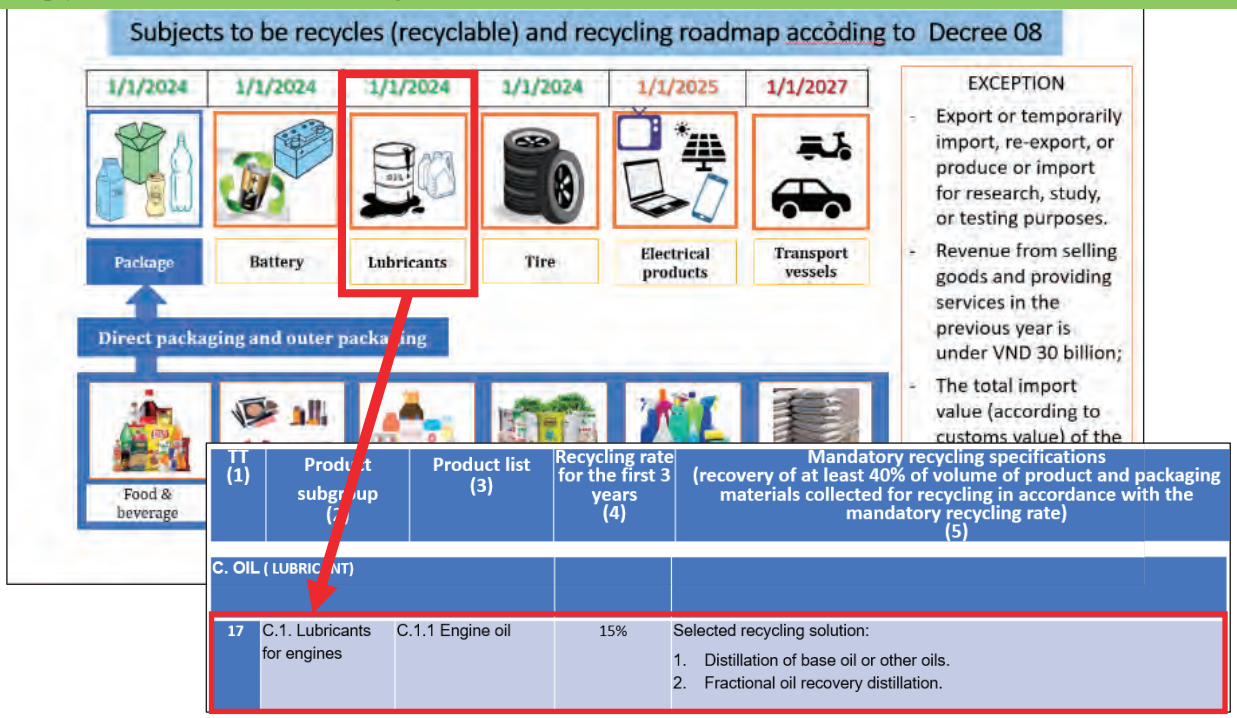
・Xác định và đảm bảo nguyên liệu dùng để sản xuất nhiên liệu thay thế
・Xác nhận các sử dụng một cách hợp pháp nhiên liệu đã sản xuất ra
・Nghiên cứu thiết bị để xử lý rác thải, sử dụng là nhiên liệu thay thế

Annex 2

Tái sinh dầu nặng từ dầu bôi trơn thải

Bên chịu trách nhiệm mở rộng sản xuất（EPR）

Luật Bảo vệ Môi trường mới của Việt Nam (số 72/2020/QH14) có hiệu lực từ ngày 01 tháng 01 năm 2020, trở thành quy định thi hành luật này.Nghị định số 08/2022/NĐ-CP được ban hành và có hiệu lực vào ngày 10 tháng 11. Trong đó quy định “Trách nhiệm mở rộng của nhà sản xuất” đối với dầu nhờn.



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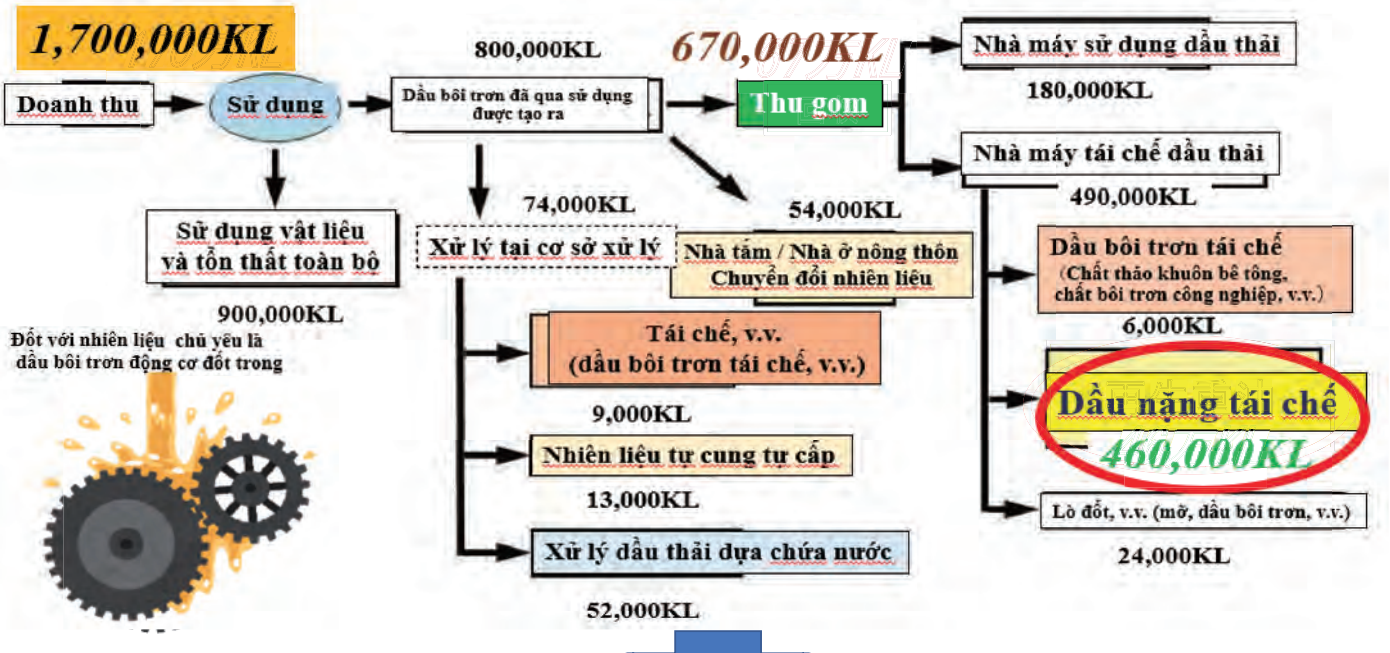
Tái sinh dầu nặng từ dầu bôi trơn thải

Chu trình nguyên liệu dầu nhớt tại Nhật Bản

Tại Nhật Bản, 70% dầu bôi trơn thu gom được tái chế dưới dạng dầu nặng tái chế.



Phương pháp tái chế dầu nhớt thải ở Việt Nam không được chấp nhận?

Tái sinh dầu nặng từ dầu bôi trơn thải

Tình trạng tái chế dầu thải

Nhà máy C tiến hành xử lý thiêu đốt

Nhà máy D xử lý thu gom dầu thải của tàu thuyền

- Dầu thải thu được loại nào đều được sử dụng làm nhiên đốt.
- Cũng có trường hợp không áp dụng phương pháp sử dụng phù hợp mang lại hiệu quả nhiệt cao mà chỉ đơn thuần là sử dụng làm nhiên liệu đốt.
- Bằng cách chuyển đổi dầu thải thành một sản phẩm tiêu chuẩn, có thể sử dụng lại dầu này với hiệu suất nhiệt tốt.

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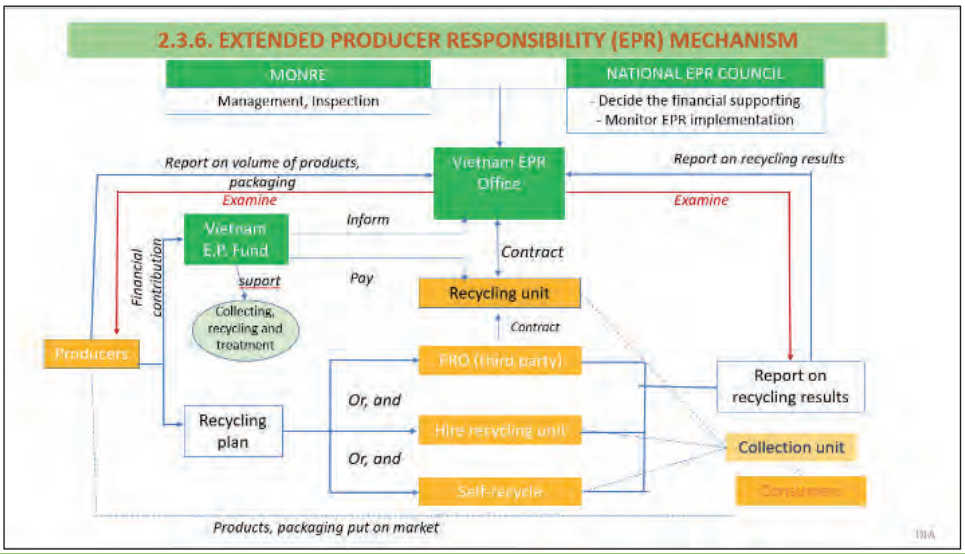
Tái sinh dầu nặng từ dầu bôi trơn thải

Hiệu quả về trách nhiệm mở rộng của nhà sản xuất (EPR)



Đang nhìn thấy các vấn đề cùng với các doanh nghiệp hiện vẫn còn nhiều nội dung chưa rõ ràng

Các nhà sản xuất đang nhắm tới tối tượng là ai?
- Tỷ lệ thu hồi được tính như thế nào?
- Ai đánh giá và đánh giá như thế nào?

- Số lượng được thu hồi theo trọng lượng hay thể tích?
- Làm thế nào tôi có thể thu thập được?

Cần có các biện pháp để việc tái chế không chỉ là hình thức giản đơn

Tái sinh dầu nặng từ dầu bôi trơn thải
Bản tóm tắt

○Nội dung đã nắm bắt được

・Dầu thải trở thành rác thải nguy hại và chỉ có thể được bán cho công ty xử lý được cấp phép.

・Các đơn vị xử lý chỉ sử dụng dầu thải làm nhiên liệu hỗ trợ cho quá trình đốt nên nhiệt lượng không được sử dụng hiệu quả

・Có nhiều điểm chưa rõ ràng trong EPR và cần phải xác nhận chi tiết.
(Có thông tin buổi họp thảo luận về các quy định chi tiết sẽ được tổ chức và quy định dự kiến được xây dựng trong năm nay)

○ Các hạng mục cần triển khai thời gian tới

・Đảm bảo nguồn nguyên liệu có thể tái chế thành dầu nặng
・Đảm bảo nơi sử dụng dầu nặng tái chế
・Hướng tới mục tiêu biến chất thải thành "sản phẩm" bằng cách tái chế dầu thải thành dầu nặng
・Hướng tới mục tiêu bổ sung dầu nặng tái chế vào phương pháp EPR

株式会社 ダイセキ

Kế hoạch khảo sát trong năm tới

○Nhiên liệu thay thế than đá dùng trong lò nung Xi măng

・Tập trung điều tra nhằm mục đích nắm được quy mô thị trường rác thải sử dụng làm nhiên liệu để có thể xác nhận đầy đủ nhu cầu sử dụng nhiên liệu thay thế trong nhà máy xi măng.

○ Các hoạt động cụ thể

・Dự kiến lựa chọn các doanh nghiệp dự kiến có phát sinh rác thải từ hoạt động kinh doanh tại Nhật Bản và tiến hành hỏi đáp trao đổi thông tin
・Lựa chọn các doanh nghiệp và tiến hành hỏi đáp trao đổi thông tin bằng danh sách các doanh nghiệp hiện JETRO và các đơn vị khảo sát nắm giữ.
・Ước tính lượng phát thải từ danh sách các chủ nguồn thải CTNH tại TP Hải Phòng
. Thu hẹp các công ty dự kiến sẽ phát thải và tiến hành các cuộc khảo sát và phỏng vấn tại hiện trường
・Dựa trên những cơ sở trên giả định quy mô kinh doanh, xem xét kỹ lưỡng tính khả thi thực hiện dự án.

Đề nghị TP Hải Phòng cung cấp thông tin các doanh nghiệp có phát sinh dầu thải và dung dịch thải dạng lỏng

Hội thảo báo cáo về Chương trình hợp tác giữa thành phố với thành phố năm 2022 vì xã hội không carbon giữa thành phố Hải Phòng và thành phố Kitakyushu

DHOWA TECHNOS CO., LTD

Tóm tắt dự án tại VIS

・Đơn vị sử dụng：VIS （Vietnam Italy Steel）
・Tên dự án: Làm mới hệ thống hút bụi và thiết bị điện hiện có・Thời gian đặt hàng: khoảng tháng 6 năm 2023
・Quy mô số tiền: PR30000

・Thông số kỹ thuật sản phẩm hiện có: Cả quạt gió và linh kiện điện đều do nhà sản xuất Trung Quốc sản xuất.
(Thông số động cơ: 1400kW, 6kV, 158A, 50Hz, 992r/min)
Số lượng: 2 chiếc

・Quạt gió: Quạt hiệu suất cao được sản xuất bởi Murakami Manufacturing Co., Ltd.
・Thiết bị điện: Động cơ điện YAD và biến tần cao áp
・Thiết bị giám sát

Điểm mấu chốt của dự án này là sử dụng tiền hỗ trợ thiết bị JCM để giảm chi phí đầu tư vốn cho người sử dụng.

THÔNG TIN KHÁI QUÁT VỀ VIS

(1) Tên gọi: Công ty Cổ phần Thép Việt Ý
(2) Vị trí: Tỉnh Hưng Yên, Việt Nam
(3) Người đại diện: Nguyễn Thanh Hà (TGĐ)
(4) Lĩnh vực kinh doanh: Sản xuất và mua bán các sản phẩm thép (thép thanh, thép cuộn) và bán thành phẩm
(5) Vốn điều lệ: 738,3 tỷ đồng Việt Nam (3.544 triệu yên)
(6) Thành lập: 2002
(7) Cổ đông lớn và tỷ lệ đầu tư: Công ty TNHH Thép Kyoei 65,0%, Công ty Cổ phần Thương mại Thái Hưng 20,00%
(8) Năng lực sản xuất: Luyện thép 450.000 tấn/năm (Nhà máy Hải Phòng) , Cán 300.000 tấn/năm (Nhà máy Hưng Yên）

共英製鋼、海外増産
カナダ・ベトナム 350億円投資
圧延ライン
ガス供給
品に5年間

Xây dựng nhà máy cán mới với vốn đầu tư khoảng 9,1 tỷ Yên
Lập kế hoạch mở rộng quy mô sản xuất

(Nguồn: ngày 24 tháng 1 năm 2022 Nikkan Kogyo Shimbun）

NỘI DUNG KHẢO SÁT THỰC TẾ

＜Mục đích＞

- Tiếp nhận thông tin cần thiết về xin phê duyệt tiền hỗ trợ thiết bị theo dự án JCM
- Hỏi đáp về kế hoạch đầu tư vốn của bên sử dụng
- Hỏi đáp các thông số kỹ thuật và lượng khí thải CO2 (tiêu thụ điện năng) của các cơ sở hiện có thông qua khảo sát thực địa

· Gửi báo giá sửa đổi dựa trên việc nâng cấp cơ sở vật chất sau khi nâng cấp máy biến áp

＜Nội dung khảo sát＞

- Khảo sát tại hiện trường cùng với nhân viên kỹ thuật IGES và Murakami

· Liên hệ với VIS để xác nhận ý định của họ về đơn xin trợ cấp thiết bị JCM và thực hiện khảo sát thực tế các thông số kỹ thuật bên máy.

＜Lịch trình khảo sát＞

Ngày 15 tháng 11 (thứ Ba) đến ngày 16 tháng 11 (thứ Tư), năm 2022

NỘI DUNG KHẢO SÁT THỰC TẾ

Cổng chính của VIS

Các thiết bị là đối tượng khảo sát (hình ảnh bên ngoài chụp trực diện)
Quạt thông gió (590,000M3) x 2 máy
2 động cơ để điều khiển quạt hiện có
1400KW 6.6KV 50Hz 920rpm

DHOWA TECHNOS

NỘI DUNG KHẢO SÁT THỰC TẾ

Phần quạt và động cơ hiện có

Các thiết bị là đối tượng khảo sát (hình ảnh bên ngoài chụp trực diện)

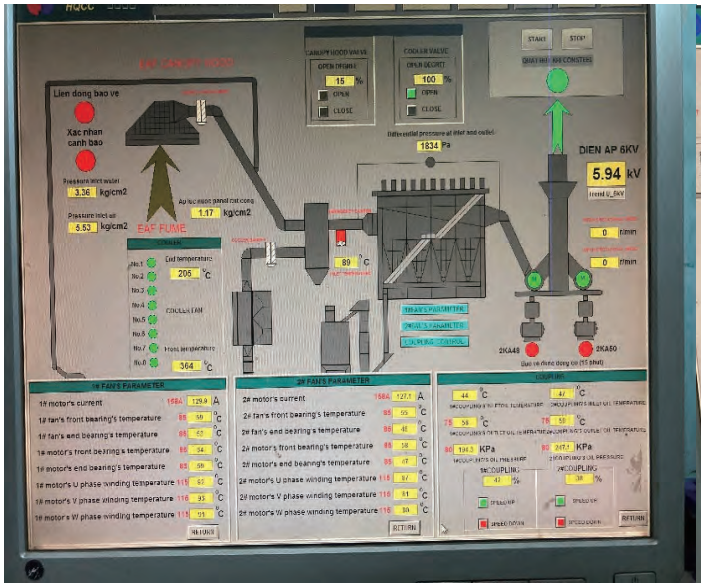
DHOWA TECHNOS

NỘI DUNG KHẢO SÁT THỰC TẾ

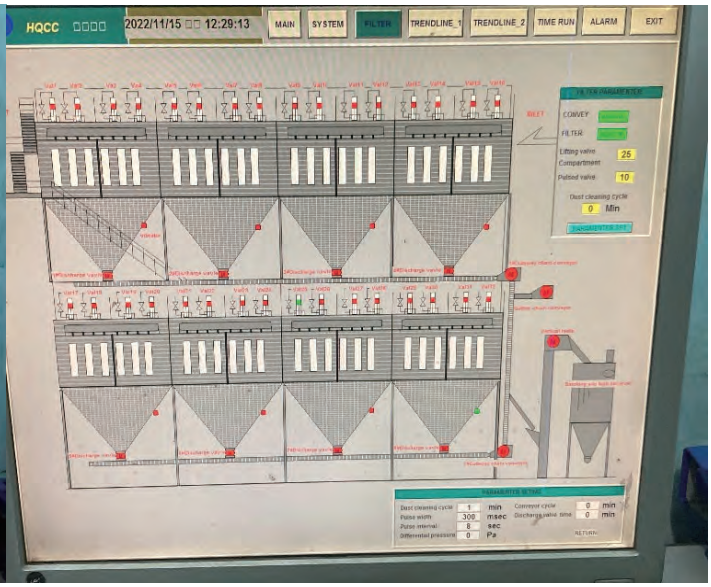
Túi lọc hiện có

Hình ảnh các thiết bị khảo sát (nhìn từ phía sau)

NỘI DUNG KHẢO SÁT THỰC TẾ



Màn hình DCS hiện có (toàn bộ bộ thu bụi)



Màn hình DCS hiện có (bộ lọc túi)

NỘI DUNG KHẢO SÁT THỰC TẾ

Khảo sát hiện trường (phần động cơ)

Khảo sát hiện trường (đối chiếu với bản vẽ hiện có)

NỘI DUNG KHẢO SÁT THỰC TẾ

Khảo sát hiện trường (kiểm tra ống dẫn quạt hiện có)

Khảo sát hiện trường (xác nhận phòng điện)

NỘI DUNG KHẢO SÁT THỰC TẾ

＜Hạng mục đã nắm bắt được＞

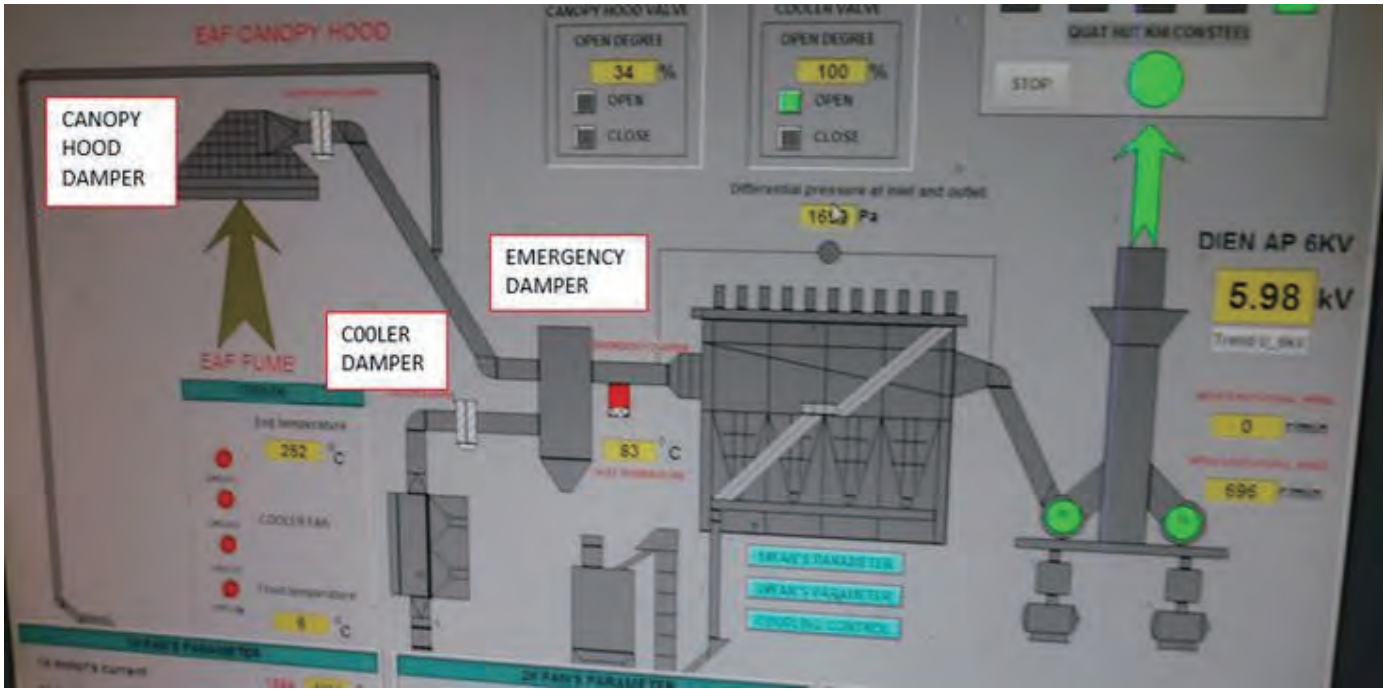
▪ Kế hoạch sản xuất trong thời gian tới tại VIS và ước lượng thời gian vận hành thiết bị
Năm 2022: 320.000T (ước tính) 5,635H 56T / 1H
Năm 2023: 477.000T (đã lên kế hoạch) 6.356H 75T / 1H
Năm 2024: 505.000T (kế hoạch) 6.381h 79T / 1H
Năm 2025: 545.000T (đã lên kế hoạch) 82t/1h

* Hiện tại đang xem xét vận hành với mục tiêu khoảng 73t/1h.
Máy biến áp đã được nâng cấp từ tháng 10 năm 2022 và đang hoạt động hiệu quả.
Trung bình gần đây là 82,2t/1h
Gần đây Max là 88t/1h

*Hiện tại cơ sở vật chất hiện có đã đáp ứng được năng suất trên.

DHOWA TECHNOS

NỘI DUNG KHẢO SÁT THỰC TẾ



DHOWA TECHNOS

NỘI DUNG KHẢO SÁT THỰC TẾ

＜Hạng mục đã nắm bắt được＞

1. Có thể cung cấp cho đoàn khảo sát biết phương pháp điều khiển lượng không khí và kiểu vận hành trong quá trình vận hành không?

【VIS trả lời】→ Sử dụng khớp nối lưu động ở phía động cơ, được sử dụng khoảng hai lần một ngày.
Khi khí gas bị rò rỉ, khớp nối này được sử dụng để giảm số vòng quay và khói thải ra. (Đặc biệt, sử dụng khớp nối này vào ban ngày để giảm khói thải)

CANOPY HOOD DAMPER tối đa là 20-30%. Nếu nhiệt độ không tăng, giữ nguyên sử dụng ở mức 20%.
EMERGENCY DAMPER với điều khiển BẬT/TẮT, tối đa 100-120°C.

2）Mô hình vận hành

【VIS trả lời 】→ Điều khiển tốc độ động cơ sao cho giá trị hiện tại khoảng 130A vào ban ngày và điều khiển tốc độ động cơ sao cho giá trị hiện tại khoảng 110-115A vào ban đêm. So với số liệu năm 2020, giá trị hiện tại đã tăng lên, nhưng điều này là do chất lượng phế liệu đã kém đi nên lượng bụi tăng lên và lượng bụi thu được cũng tăng lên.

Hai mô hình hoạt động: ban ngày và ban đêm
Như đã mô tả ở trên, không có mẫu cụ thể nào vì quá trình điều khiển chỉ được thực hiện khi nhiệt độ tăng.

NỘI DUNG KHẢO SÁT THỰC TẾ

＜Hạng mục đã nắm bắt được＞

2. Phạm vi tổn thất áp suất (Pa) của bộ lọc túi được sử dụng là bao nhiêu?

[VIS trả lời] → Không có. Rửa ngược thường xuyên.
Bộ lọc túi bao gồm 32 buồng và có 5600 bộ lọc.

5376 ÷ 32 = 168 / 1 đơn vị
8 giây x 32 phòng = 256 giây (tần suất dọn dẹp khoảng 4 phút)

3. Hãy cho biết mối quan hệ giữa khối lượng sản xuất và khối lượng không khí.

【VIS trả lời 】→Máy biến áp đã được nâng cấp từ tháng 10 năm 2022 và có hiệu lực. Trung bình gần đây là 82,2t/1h
Thể tích không khí thay đổi khi thời gian hoạt động tăng hoặc giảm.

4. Về bảo trì khớp nối lưu động:

【VIS trả lời】→ Thay vòng bi sau mỗi 20.000 giờ (2-3 năm).
" Không có khớp nối lưu động dự phòng, có vòng bi dự phòng.

5. Tần suất thay thế vòng bi quạt gió

【VIS trả lời 】→ Thay vòng bi sau mỗi 20.000 giờ (2-3 năm). Có sẵn vòng bi dự phòng.

Về tình trạng sử dụng ngân sách và chi phí của VIS

＜ Ngày 15 tháng 11 năm 2022 Đã gửi báo giá sửa đổi tại thời điểm khảo sát VIS ＞

※Trả lời vào 15/11/2022

1. Về giá của bản báo giá (bảng báo giá Dowa Technos số DT20-009A)

【VIS trả lời】→Ấn tượng không có nhiều so với những gì nhóm khảo nghe được từ người tiền nhiệm của công ty - Phó chủ tịch Oda.

Ngoài ra hiện đồng Yên đang yếu, nên nếu có thể xin được trợ cấp JCM có khả năng triển khai dự án.

Tiếp theo là câu hỏi suy nghĩ gì về hiệu quả chi phí sau khi xem xét chi phí vận hành? → Ông Hirata từ Công ty sản xuất Murakami giải thích. Gửi lại bảng hiệu quả chi phí cho VIS xem xét, tham khảo ở mức 20-30% hoạt động của van điều tiết.

2. Tình hình xin ngân sách cho VIS

【VIS trả lời 】→VIS đã hoàn tất đề xuất Kyoei Steel cung cấp ngân sách thiết bị cho năm 2024. Về số tiền, nhóm khảo sát đã báo cáo số tiền mà ông Hayashi đã được nghe từ ông Oda trước đây. Dựa trên số tiền DT20-009A, Kyoei Steel và ông Hayashi đã tiến hành thảo luận. Sau đó, nhóm khảo sát sẽ tiếp nhận phản hồi về mức ngân sách và gửi báo giá hoàn thiện cho VIS. Với số tiền đó, nhóm thực hiện sự án sẽ đăng ký JCM.

3. Tình trạng chuẩn bị hồ sơ đăng ký JCM cho VIS

【VIS trả lời 】→Đã xác nhận. Tham khảo tài liệu Excel riêng.

4. Phản hồi của Kyoei Steel trước dự án JCM của VIS...

【VIS trả lời 】→Kết quả tác động ngân sách của Kyoei Steel sẽ được thông tin vào tháng 12. Tại thị trường Việt Nam, tình hình sản xuất không ổn định do tiếp tục phải cắt giảm sản lượng. (Kể từ ngày 15 tháng 11 năm 2022) Đó không phải là một phản ứng tiêu cực, nhưng...

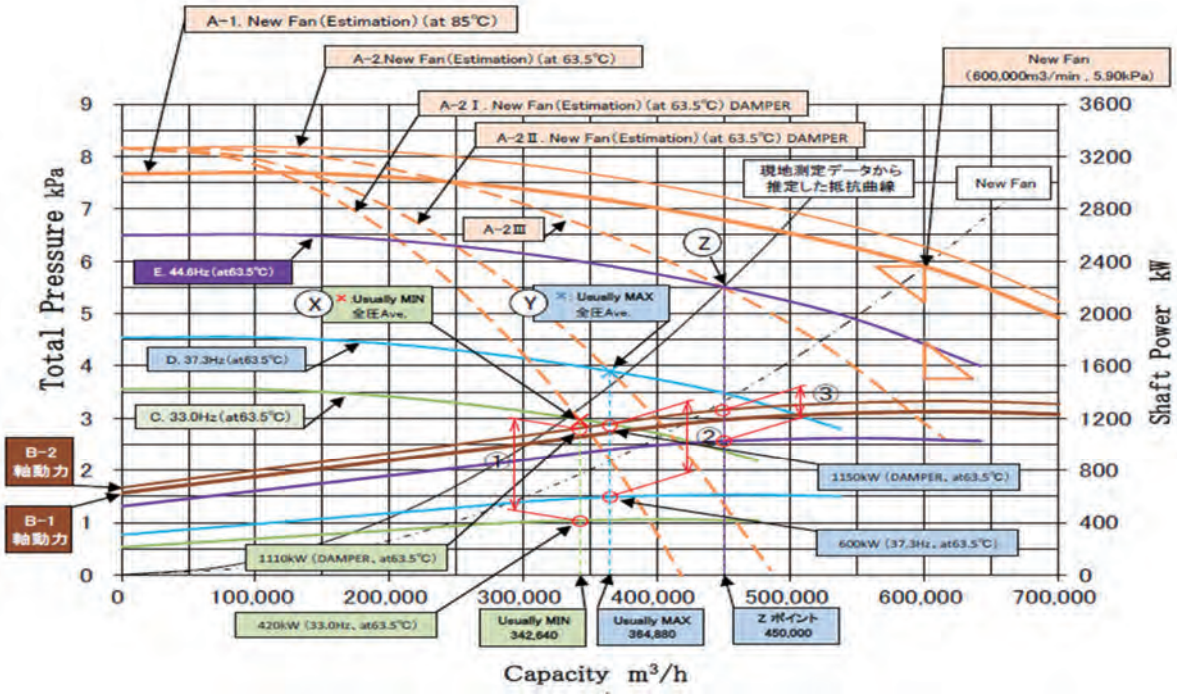
Nội dung đề xuất thông số kỹ thuật quạt thông gió kiểu mới

1. Quy cách mới: Tiến hành quyết định cách thức vận hành mới có khả năng nâng vòng quay lên khoảng 1,7% bằng biến tần hiện có. Quy cách mới này được biểu thị như bảng dưới đây:

SPECIFICATION OF FAN

	Existing fan		New Fan	
Capacity (m3/h)	590,000	⇒	600,000	1．7% UP （Usually 410,000(m3/h)）
TOTAL PRESSURE （kPa）	5.70	⇒	5.90	3．4% UP（Usually Max 3.4(kPa)）
Air Temp （℃）	85	⇒	85	
Suction Gas Density (kg/m3)	1.0	⇒	0.982	1.2×(273+20)/(273+85)=0.982
Shaft Power （kW）	?	⇒	1,250	(at85℃)
Motor （kW）	1,400	⇒	1,500	Xem xét hoạt động ở 40 độ C
Rated Speed (min^{-1})	920	⇒	985	

Nội dung đề xuất thông số kỹ thuật quạt thông gió kiểu mới



Nhằm mục đích xin phê duyệt cho dự án hỗ trợ thiết bị vào năm tới

① Xác nhận (nội bộ) 9.2022

② Xác nhận (GEC) 10.2022

③ Xác nhận (VIS) 10.2022

④ Khảo sát thực tế 11.2022

⑤ Chuẩn bị hồ sơ 3.2023

⑥ Nộp hồ sơ 4.2023

※インターネットを利用した電子申請

※4月頭に説明会

Đến thăm nhà máy đúc

Nội dung khảo sát

Thời gian đến khảo sát: 16 tháng 11 năm 2022 10:00-12:00
Thành phần: Mr.Akagi từ IGES, Mr.Hirata từ Công ty sản xuất Murakami, Mr.Usui, Mr.Watanabe
Người cung cấp thông tin: Ông Nguyễn Văn Quỳnh (PGĐ)
Thông tin khái quát về nhà máy đúc:
Thành lập: 2001 Vốn: 5.000.000 USD Doanh thu: 4.000.000 USD
Số lượng nhân viên: khoảng 100 người
Hoạt động kinh doanh: Sản phẩm đúc, sản phẩm gia công kim loại (nguyên liệu là sắt vụn tái chế)
Năng lực sản xuất: 4.000 tấn/tháng (nhà máy cũ), 600 tấn/tháng (nhà máy mới)

Quạt thông gió túi lọc hiện có (cả áp suất thấp và công suất thấp)

Đã hoàn thành được chứng nhận ISO9001

Đến thăm nhà máy Đúc

Nội dung khảo sát

Nhà máy sản xuất sản phẩm đúc sở hữu một lò điện. Chuyên đúc nắp hố ga, nắp cống, nắp đồng hồ nước từ phế liệu kim loại thu gom từ Việt Nam và xuất khẩu sang Nhật.
Có hai nhà máy, nhà máy cũ sản xuất các sản phẩm đúc đòi hỏi công việc thủ công và nhà máy mới sản xuất các sản phẩm gia công kim loại (các bộ phận tương đối nhỏ).
Nhà máy quan tâm đến việc tiết kiệm năng lượng vì tiền điện hàng tháng của nhà máy ngày càng cao. Tất cả các thiết bị hút bụi và thiết bị quạt thông gió đều được sản xuất tại Trung Quốc.
Động cơ khởi động trực tiếp với khởi động Δ. Nhà máy hiện không lắp biến tần. Nhà máy đã cân nhắc việc gắn biến tần, nhưng bụi quá nhiều khiến biến tần dễ bị hư hỏng. Đã giới thiệu mô hình dự án JCM và đề xuất nâng cấp biến tần + hút bụi + quạt gió. Thiết bị hiện có được sản xuất vào năm 2017 và nhà máy mới được thành lập vào năm 2019. Hoạt động của máy hút bụi chủ yếu hoạt động vào ban đêm là thời điểm giá tiền điện thấp.

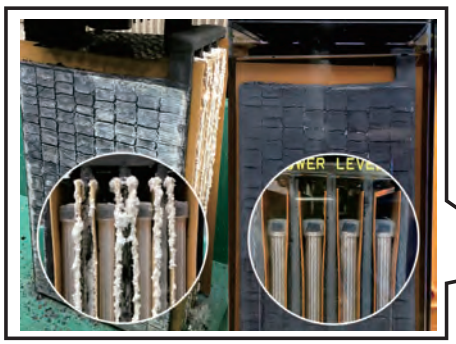
【NHẬN XÉT ĐÁNH GIÁ】
Do giám đốc đi vắng nên đoàn đã có cuộc họp với người phụ trách vận hành nhà máy nhưng người phụ trách bày tỏ chỉ muốn giảm tiền điện (tiết kiệm năng lượng) chứ chưa có ý thức cao trong việc giảm CO2. Hầu hết các động cơ là điện áp thấp, 15KW, 37KW, 55KW được sản xuất tại Trung Quốc và không có thiết bị điện áp cao. Trên lò điện cũng không có thiết bị thông gió, được vận hành bằng quạt thông gió áp suất thấp 55KW và 37KW. Từ những yếu tố trên cho thấy ngay cả khi áp dụng JCM, chi phí dự án thấp và hiệu quả giảm GHG không được kỳ vọng.

KHẢO SÁT ÁP DỤNG "PHÁT ĐIỆN MẶT TRỜI + PIN TÁI SINH" TẠI ĐẢO CÁT BÀ
(Hội thảo và khảo sát hiện trường)

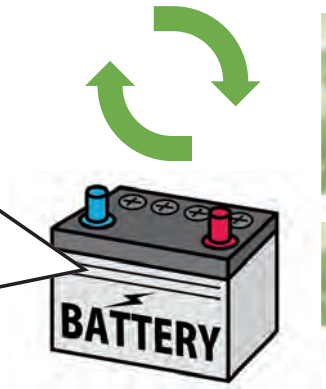
Ngày 09/12/2022

IGUAZU Corporation
Idemitsu Energy Solutions
Shin-ei Electronic Measuring Co., Ltd.
Institute for Global Environmental Strategies
Kitakyushu City
Hai Phong City

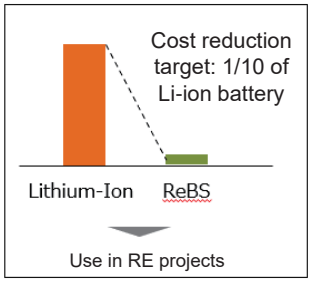
Ý TƯỞNG KHẢO SÁT



https://www.motta.tech/about



http://www.sotolab.co.jp/



Giảm chi phí nhờ vào phục hồi tái sinh ắc quy

+

Lưu trữ năng lượng tái tạo

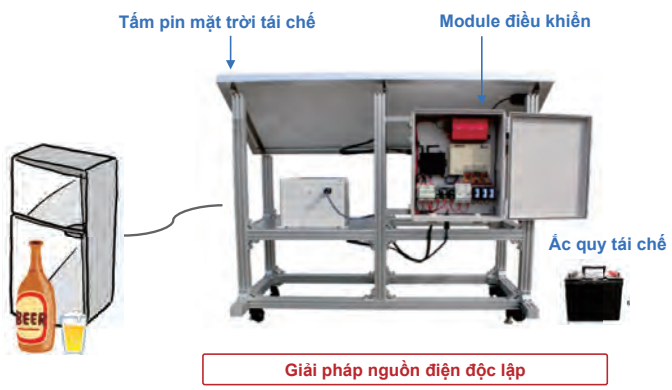
- Nhu cầu tái sinh ắc quy của các cơ sở sử dụng nhiều ắc quy
- Nhu cầu sử dụng năng lượng tại các khu vực chưa có điện lưới (đảo Cát Bà)
- Khả năng áp dụng dự án JCM nhờ áp dụng phát điện mặt trời + hệ thống ắc quy lưu trữ

KHÁI QUÁT CUỘC KHẢO SÁT

【Lịch trình】Từ ngày 23 tháng 10 (chủ nhật) đến 29 tháng 10 (thứ 7) năm 2022
【Thành viên】IGUAZU（Kumada）、SOLAR ENERGY SOLUTIONS （Ominato), Shin-ei Electronic Measuring Co.,Ltd （Kubota）、IGES（Hibino）、Phiên dịch（Anh）

LỊCH TRÌNH	HOẠT ĐỘNG KHẢO SÁT
24/10	• Làm việc với Kanematsu KGK Việt Nam • Thị sát và trao đổi làm việc tại KCN Nam Cầu Kiền
25/10	• Thị sát vịnh Lan Hạ • Làm việc với Uỷ ban nhân dân huyện Cát Hải • Làm việc với Uỷ ban nhân dân thị trấn Cát Hải • Thị sát và làm việc tại KCN DEEP C
26/10	• Thị sát và làm việc tại công ty Ắc quy Tia Sáng • Làm việc với ban quản lý di sản quần đảo Cát Bà • Làm việc với Sở ngoại vụ Hải Phòng
27/10	• Làm việc với khách sạn The Tray Hotel • Làm việc với công ty Ngoc Long Solar • Ăn trưa và làm việc với Sở ngoại vụ Hải Phòng • Làm việc với trung tâm đổi mới sáng tạo khoa học công nghệ sở Khoa học công nghệ thành phố Hải Phòng

HỆ THỐNG PIN MẶT TRỜI VÀ ẮC QUY CỠ NHỎ



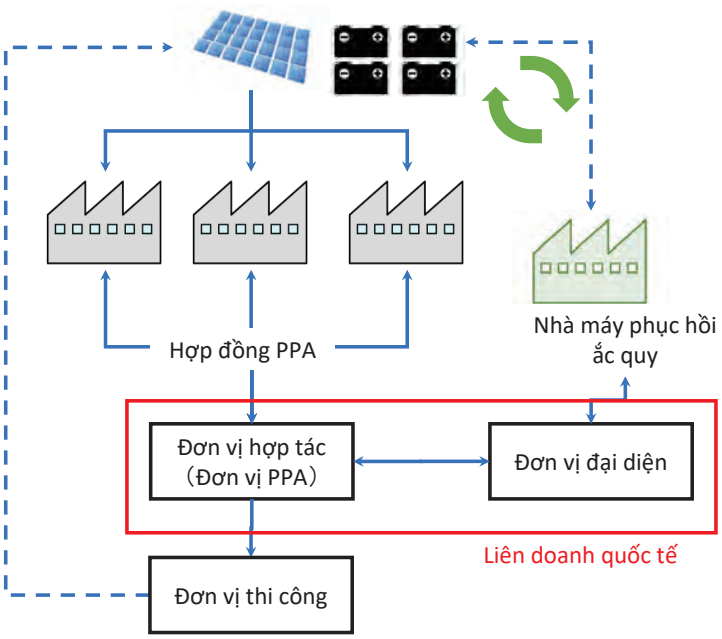
【Kết quả khảo sát】

- Liên quan đến việc đề cử công nhận di sản thiên nhiên thế giới của vịnh Lan Hạ, vì nhiều hộ nuôi trồng thuỷ sản sẽ được di chuyển tới nơi có điện lưới nên các hộ sống ở nơi không có điện lưới sẽ trở nên giới hạn.
- Tuy nhiên, một phần của khu vực chưa có điện lưới vẫn còn tồn tại nên vẫn có nhu cầu sử dụng điện mặt trời và ắc quy.
- Nếu tham khảo giá điện, ngay cả trong thành phố vẫn còn dư địa áp dụng phát điện mặt trời và sử dụng hệ thống ắc quy lưu trữ.

【Kế hoạch trong thời gian tới】

- Trong năm tới sẽ áp dụng thử nghiệm một bộ thiết bị quy mô nhỏ bao gồm tấm pin mặt trời, ắc quy và bộ chuyển đổi inverter tại Cát Bà.
- Trong năm tới sẽ thu thập phản hồi của người sử dụng, dữ liệu nghiên cứu tính khả thi mở rộng, thúc đẩy việc áp dụng rộng rãi.

DỰ ÁN JCM ÁP DỤNG PIN MẶT TRỜI + ẮC QUY



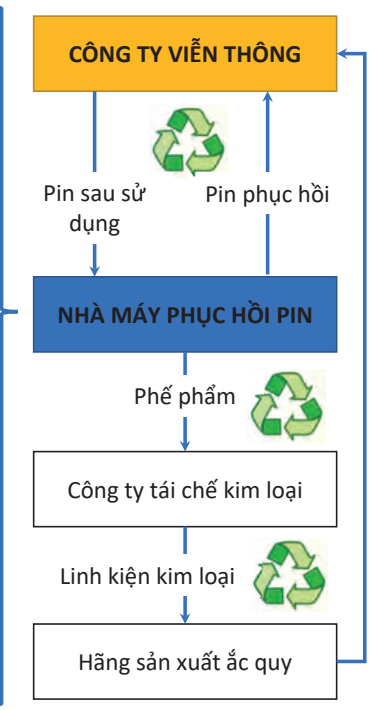
【Kết quả khảo sát】

- Làm việc với đơn vị thi công lắp đặt điện mặt trời, xác nhận có khả năng thực hiện dự án PPA nhờ phát điện mặt trời đặt trên mái của các nhà máy.
- Xác nhận có thể sử dụng ắc quy, tấm pin mặt trời sản xuất nội địa.
- Có khả năng áp dụng dự án JCM bằng lắp đặt tấm pin mặt trời + bộ lưu điện + ắc quy trên mái với đối tượng là các nhà máy hoạt động cả thời gian ban đêm.

【Kế hoạch trong thời gian tới】

- Trong năm tới sẽ lựa chọn đơn vị PPA, đơn vị thi công và các nhà máy đối tượng, khảo sát tính khả thi thực hiện.
- Nghiên cứu về đơn vị đại diện, cơ chế thực hiện.
- Nghiên cứu về phương pháp luận JCM của dự án phát điện mặt trời và ắc quy bao gồm cả ắc quy phục hồi.

HOẠT ĐỘNG PHỤC HỒI TÁI SINH PIN TẠI CÔNG TY VIỄN THÔNG



【Kết quả khảo sát】

- Tại các công ty viễn thông đang thải ra một lượng lớn ắc quy được sử dụng làm ắc quy tại các trạm viễn thông.
- Có khả năng triển khai đồng thời tại Việt Nam mô hình phục hồi ắc quy với đối tượng là các công ty viễn thông giống mô hình hiện đang triển khai ở Myanmar, Thái Lan…
- Nếu có nhà máy phục hồi tái sinh ắc quy với đối tượng chính là các công ty viễn thông thì sẽ dễ triển khai việc phục hồi ắc quy cho cả các dự án khác.

【Kế hoạch trong thời gian tới】

- Trong năm tới sẽ tiến hành làm việc với các công ty viễn thông, nghiên cứu tính khả thi hoạt động phục hồi tái sinh ắc quy.
- Tiến hành nghiên cứu địa điểm, quy mô, công ty tái chế kim loại và cơ chế liên kết với các hãng sản xuất ắc quy khi xây dựng nhà máy phục hồi tái sinh ắc quy tại đây.

CHO THUÊ XE NÂNG ĐIỆN

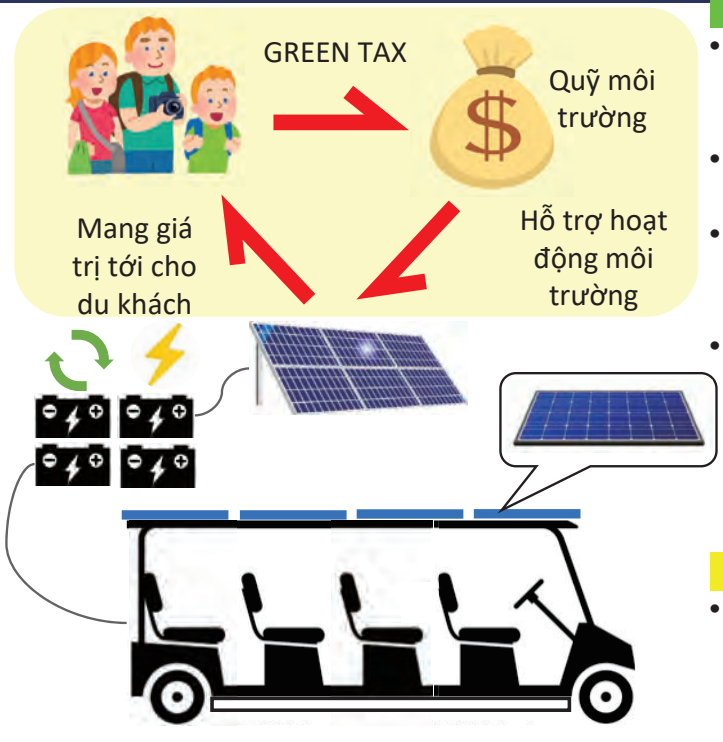
【Kết quả khảo sát】

- Có khả năng triển khai song song dự án phục hồi tái sinh ắc quy dùng trong xe nâng điện (xe forklift) như dự án đã được thực hiện tại Nhật.
- Vì xe nâng điện được sử dụng nhiều ở các nhà máy có vốn nước ngoài nên có thể kì vọng vào nhu cầu phục hồi ắc quy.
- Hoạt động cung cấp dịch vụ cho thuê xe nâng điện, phục hồi ắc quy tại các nhà xưởng thuê.

【Kế hoạch trong thời gian tới】

- Trong năm tới sẽ khảo sát nhu cầu sử dụng xe nâng điện thuê với đối tượng là các KCN sở hữu nhà xưởng cho thuê.
- Sẽ khảo sát về nhu cầu sử dụng pin phục hồi tái sinh của xe nâng điện trọng tâm tại các nhà máy có vốn nước ngoài.

NĂNG LƯỢNG TÁI TẠO CHO XE ĐIỆN



【Kết quả khảo sát】

- Căn cứ theo kế hoạch xây dựng Đảo Xanh (Green Island) tại Cát Bà, đến năm 2025 sẽ giới hạn các xe ô tô chạy bằng Diezen, xăng vào đảo.
- Hiện tại có 140 xe điện đang vận hành và dự kiến sẽ gia tăng trong thời gian tới.
- Đang suy nghĩ lắp tấm pin năng lượng mặt trời lên trên mái xe và từng bước hướng tới triển khai sử dụng năng lượng tái tạo
- Hiện tại giá vé vận chuyển còn rẻ (10,000 VND) nên cùng với việc tăng giá vận chuyển khi đăng ký đề xuất công nhận di sản thiên nhiên thế giới với UNESCO, đang suy nghĩ tới việc áp dụng thuế môi trường, bổ sung tài chính vào các dự án môi trường như này.

【Kế hoạch trong thời gian tới】

- Làm việc với Sở du lịch, Sở giao thông, ban quản lý di sản quần đảo Cát Bà…, nghiên cứu áp dụng triển khai dự án xe điện tại Cát Bà và áp dụng thuế môi trường trong khuôn khổ kế hoạch xây dựng Cát Bà Xanh.

KIỂM TRA GIÁM SÁT KHU VỰC RỘNG LỚN CHƯA CÓ LƯỚI ĐIỆN

【Kết quả khảo sát】

- Nếu vịnh Lan Hạ được UNESCO công nhận là di sản thiên nhiên thế giới cần thiết phải tăng cường các biện pháp kiểm soát phạm vị rộng lớn như rác thải đại dương, xây dựng các đối sách về môi trường…
- Vì các khu công nghiệp sở hữu mặt bằng diện tích lớn nên bố trí nhân lực để tiến hành kiểm tra và giám sát…
- Có thể kiểm soát phạm vi rộng lớn với chi phí thấp bằng sử dụng sensor, thiết bị Camera giám sát chạy bằng ắc quy và truyền dẫn dữ liệu bằng Wifi…ngay cả ở những nơi không có hệ thống điện lưới.

【Kế hoạch trong thời gian tới】

- Trong năm tới tiến hành khảo sát nhu cầu giám sát các khu vực phạm vi rộng lớn tại vịnh Lan Hạ, nghiên cứu cách thức giám sát từ xa…
- Tiến hành trao đổi hỏi đáp thông tin với các khu công nghiệp, nắm bắt được nhu cầu kiểm tra, giám sát các khu vực có phạm vi rộng lớn và nghiên cứu các cách thực hiện.

ベトナム・ハイフォン市−北九州市に関する都市間連携

ハイフォン市と北九州市は、2009年に「友好協力協定」を締結後、主に上下水道分野の技術交流や文化・経済交流を行ってきた。さらに、2014年には「姉妹都市協定」を締結し、廃棄物部分野、低炭素技術分野等も含め包括的な連携に発展してきた。特に、2014年には「ハイフォン市グリーン成長推進計画」を共同で作成し、そこで特定された15のパイロットプロジェクトの具体化に取り組んできている。

ベトナム・ハイフォン市−北九州市に関する都市間連携

【体制図】

【写真】

JCM設備補助事業への申請を予定している大型送風機と現地調査の様子

【事業活動・成果】

活動

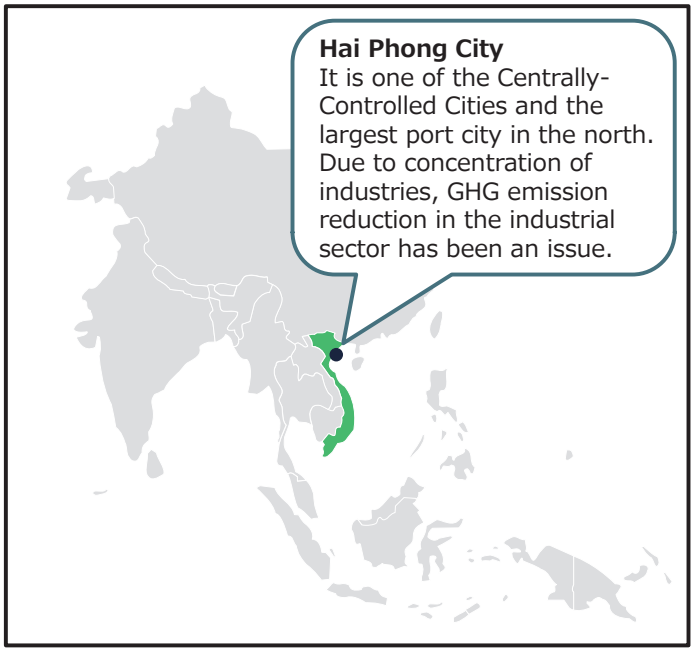
- 現地調査の実施
  - 太陽光発電導入調査（10月）
  - 廃液・固形廃棄物エネルギー利用調査（8月、11月）
  - 省エネ・高効率設備導入調査（11月）
- 現地とのワークショップの開催（12月）

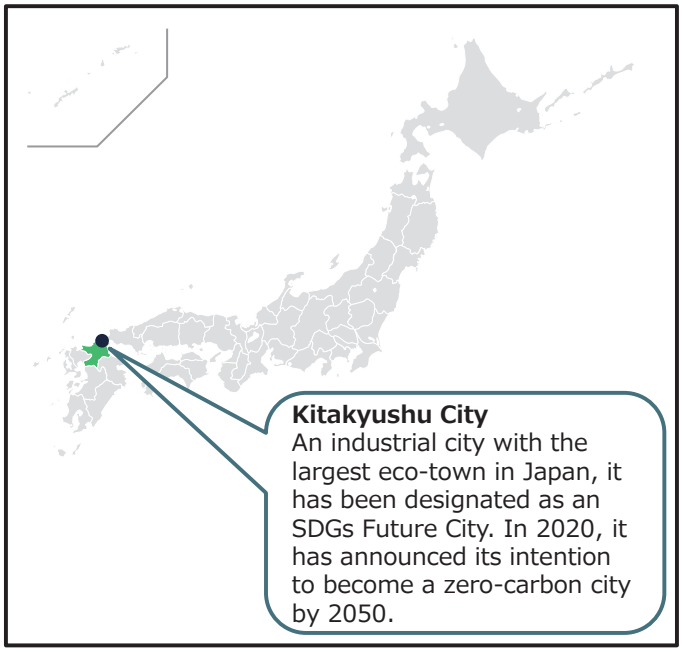
成果及び今後の展開

- カットバ島周辺の水上生活者の現状、ニーズを把握できた。今後は、ランハ湾における水上生活居住区に、再生太陽光発電モジュールと再生バッテリを組み合わせた小規模発電ユニットを試験的に導入し、テストする。
- 廃棄物固形燃料、液体燃料ともにセメント工場で石炭代替燃料としてのニーズが高いことが分かった。
- 大型送風機＋インバーターの設備更新案件について、JCM設備補助事業への申請要件を把握できた。今後は、JCM設備補助事業の令和5年度公募に向けて申請準備を行う。

City-to-city collaboration between Hai Phong City and Kitakyushu City

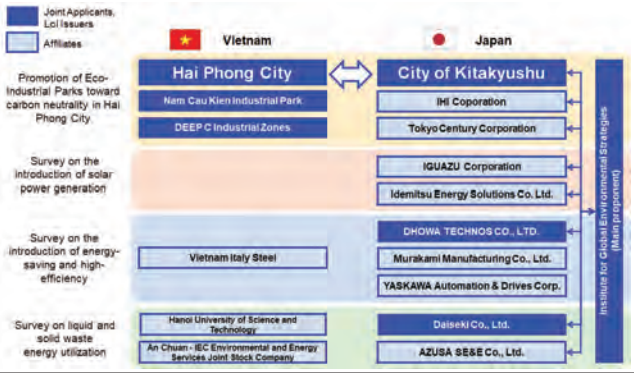
Hai Phong City and Kitakyushu City have signed the Friendship, Cooperation Agreement in 2009, and since then, two cities have engaged in technological exchange mainly in the field of water supply and sewerage as well as cultural and economic exchanges. Furthermore, in 2014, the two cities concluded an agreement regarding Sister-Cities Friendship and Cooperation Relations, which has developed into a comprehensive collaboration that includes the fields of waste management and low-carbon technology. In particular, in 2014, the two cities jointly developed the Green Growth Promotion Plan of Hai Phong and have been working on the materialization of the 15 pilot projects identified in the plan.





City-to-city collaboration between Hai Phong City and Kitakyushu City

Structure



Photos

A large industrial blower that is scheduled to be applied for the JCM Model Project and a site survey

Activities and tentative results

Activities

- Field survey
  - Solar power system survey (October)
  - Liquid & solid waste energy recovery survey (August & November)
  - Energy saving & high-efficiency equipment survey (November)
- Reporting workshop (December)

Tentative results and next steps

- The survey enabled to understand the current situation and needs of floating villagers around Cat Ba Island. Next fiscal year, a small-scale power generation units combining reuse solar modules and regenerative batteries will be installed and tested on a trial basis in one of the floating villagers in Lan Ha Bay.
- Both waste solid fuel and liquid fuel were found to be in high demand as coal substitutes in cement plants.
- The requirements for applying for the JCM Model Project have been identified for the large industrial blower + inverter. Necessary preparations for applications to the FY2023 JCM Model Project will be conducted.

FY2022 City-to-City Collaboration for Zero-Carbon Society
(Promotion of Eco-Industrial Parks Toward Carbon Neutrality in Hai Phong City, Vietnam)
Commission Report
March 2023

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