City to City Collaboration for Zero-Carbon Society in FY2023
Zero Carbon Society Development Support Project by Introduction of Carbon Management System and Decarbonization Technologies under city to city cooperation between Danang and Yokohama

Final Report

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CARBON FREE CONSULTING CORPORATION

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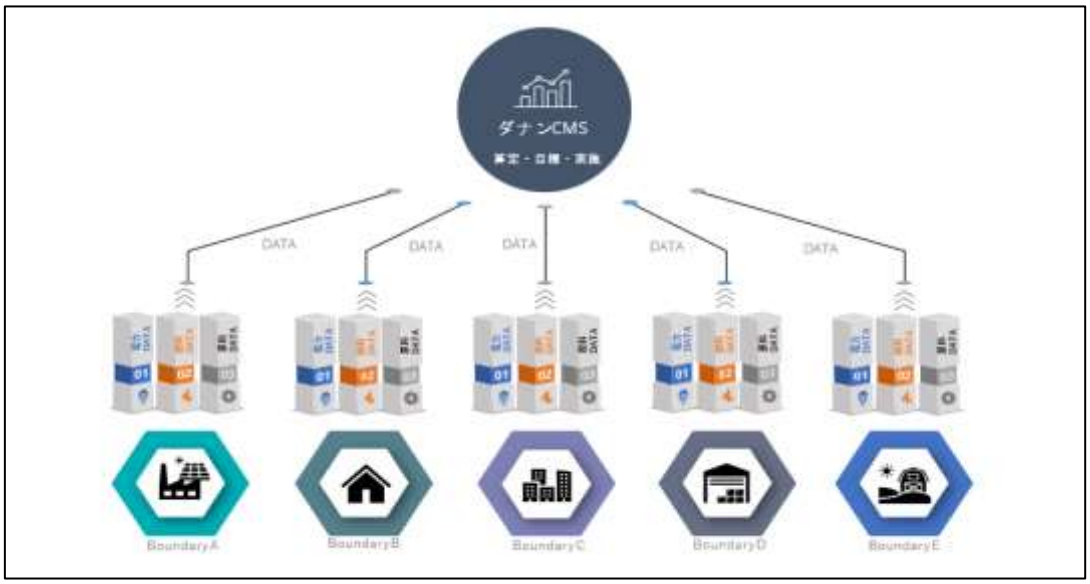
List of Abbreviations

abbreviation	formal name	Japanese translation
BAU	Business As Usual	ビーエーユー
CEA	Country Environmental Assessment	国別環境分析
CFP	Carbon Footprint	カーボンフットプリント
COP	Conference of the Parties	締約国会議
CMS	Carbon Management System	炭素管理制度
DHPIZA	Danang Hi-Tech Park and Industrial Zones Authority	ダナン工業団地管理委員会
DOIT	Department of Industry and Trade	商工局
DONRE.	Department of Natural Resources and Environment	天然資源環境局
ETS	Emissions Trading System	排出権取引制度
GHG	Greenhouse Gas	温室効果ガス
IGES	Institute for Global Environmental Strategies	地球環境戦略研究機関
Intergovernmental Panel on Climate Change	Intergovernmental Panel on Climate Change	国連気候変動パネル
MONRE	Ministry of Natural Resources and Environment	天然資源環境省
MPI	Ministry of Planning and Investment	計画投資省
NDC	Nationally Determined Contribution	国が決定する貢献
PDP	Power Development Plan	電力開発計画
PMSM	Permanent Magnet Synchronous Motor	永久磁石同期モータ
PPA	Power Purchase Agreement	電力購入契約
music video	Photovoltaic	太陽光
SBT	Science Based Targets	科学的根拠に基づく目標
TCFD	Task force on Climate-related Financial Disclosure	気候関連財務情報開示タスクフォース
VGGS	Vietnam Green Growth Strategy	ベトナム・グリーン成長戦略
YUSA	Yokohama Urban Solution Alliance	ユサ

1. Business Overview

1-1 Purpose of the Project

Located on the coast of central Vietnam, Da Nang City is one of the major cities supporting the Vietnamese economy as an important logistics hub. Since Vietnam and other maritime economies are vulnerable to the effects of climate change, Da Nang City is also actively working on climate change countermeasures. Yokohama City signed a technical cooperation agreement with Da Nang City in 2013 and has conducted many cooperative projects based on its knowledge and experience. Especially, from 2020 to 2022, Yokohama implemented the "Commissioned Intercity Cooperation Project for Realization of a Decarbonized Society" (hereinafter referred to as "Phase 1 Project"), contributing to the formulation of Da Nang's climate change action plan and its declaration of decarbonization.



Source: Prepared by CFC

Figure 1: Image of CMS

Based on the friendly and cooperative relationship between Da Nang and Yokohama, this project, as a continuation of the Phase 1 project, will investigate the feasibility of introducing a new Carbon

Management System (CMS) and decarbonization technologies with the aim of building a decarbonized society in Da Nang, the project will propose concrete measures for the introduction of a new carbon management system (CMS) and decarbonization technologies. In Phase 1, the project supported the development of a master plan for the environment and climate change sector in general, such as a 10-year environmental plan that will lead to decarbonization in Da Nang City. This Phase 2 will focus on decarbonization among climate change measures and will support the establishment of a new comprehensive carbon management system, as shown in the diagram. In order to make this system work, this project supports introduction of related technologies such as GHG emissions calculation tool (web), energy management systems, renewable energy technologies, and energy-saving technologies. Based on the results of Phase 1, Hoa Khanh Industrial Park, which houses many Japanese manufacturers in Da Nang, will be positioned as a model case for an eco-industrial park.

1-2 Project Description

1-2-1 Support for Establishment of Carbon Management System (CMS) in Da Nang City

In the first year of the project, a literature review and interviews with government agencies will be conducted to identify issues for the design of the CMS; in the second year, a draft system will be developed and a simulation for decarbonization, including GHG emissions accounting, will be conducted at companies in Da Nang City. In the third year, based on the lessons learned from the simulations, the CMS will be integrated into the 10-Year Environmental Plan and existing systems, and the structure, system and calculation tools are further shaped. The steps are as follows.

Status quo research

- Conduct a literature review on the current status of CMS in the Vietnamese government and the city of Da Nang.

- To understand the current situation through interviews with government officials and private companies.
- Analyze the results of the survey and consider issues and measures to address them.

Institutional design

- Prepare a draft of the GHG emissions management system and draft manual and guidelines for Da Nang City. A GHG emissions calculation tool is developed as a part of IT technologies to visualize GHG emissions.
- Conduct training and workshops on carbon management systems for Da Nang city government officials and private companies.
- In Da Nang City, with the cooperation of government agencies and the private sector, collect GHG emissions data, calculate them, and simulate the reporting system.
- Carbon footprint calculations of specific products will be performed at pilot factories to identify major emission sources and propose specific measures to address them.

Institutional integration

- Based on the simulation results, a draft GHG emissions management system and a draft manual/guideline for Da Nang City will be revised.
- Propose a GHG emissions management system with the manual/guidelines and GHG emissions calculation tools to Da Nang City after confirming its consistency with the existing system of the Vietnamese government.
- Conduct training and workshops for Da Nang city government officials and private sector personnel to support CMS capacity building.

1-2-2 Hoa Khanh Industrial Park Renewable Energy Installation Support

Regarding the introduction of decarbonization technologies, a feasibility study will be conducted to determine the feasibility of

introducing renewable energy in the Hoa Khanh Industrial Park. The basic steps are as follows.

Survey on supply and demand potential in the factory complex (solar power and energy demand)

- Organize the status of and plans for the introduction of solar power generation in the industrial park.
- Sorting out potential for new installation
- Method of interconnection of solar power generation (reverse power flow possible or only for private consumption) ⇒Confirm with EVN
- Estimation of solar power generation
- Sorting out demand for solar installation sites
- Sorting out the supply-demand balance (is there a surplus of solar power or not enough?)

Study the feasibility of energy flexibility using distribution lines

- Organize methods for energy flexibility (organize methods that are possible under the system and methods that may be possible in the future).
- Organize where there is a surplus of solar power and where there is a shortage (where will be electricity sharing, areal or multi-facility?)
- Study of supply-demand balance in the case of energy interchange

Business feasibility of energy interchange *If energy interchange is systematically possible (including cases where it will become possible in the future

- Business feasibility of simple on-site consumption at individual facilities without energy integration (on-site PPA)
- Business feasibility of installing on-site PPA + storage batteries at individual facilities (when there is excess solar power)
- Business feasibility in the case of energy interchange
- Comparison of business feasibility in the above, and consideration of policy for introducing renewable energy in industrial parks.

1-2-3 Introduction of other decarbonization technologies

A feasibility study is also conducted on the technologies as follows including candidate technologies in phase 1 project.

a. IT technology for visualizing GHG emissions
b. Technologies for efficient wastewater treatment

IT technology for visualizing GHG emissions

In general, the automatic GHG emissions calculation tool is a system whereby GHG emissions are automatically calculated by entering the amount of activity (monetary value, weight, etc.). The tool contributes to reduce the time and effort required for calculation by the companies. The calculation formulas and emission factors will be developed as part of the institutional support of this project. By incorporating these formulas and emission factors into the calculation tool, it will be possible to calculate supply chain emissions and product-level GHG emissions for offices and factories in Da Nang City.

Technologies for efficient wastewater treatment

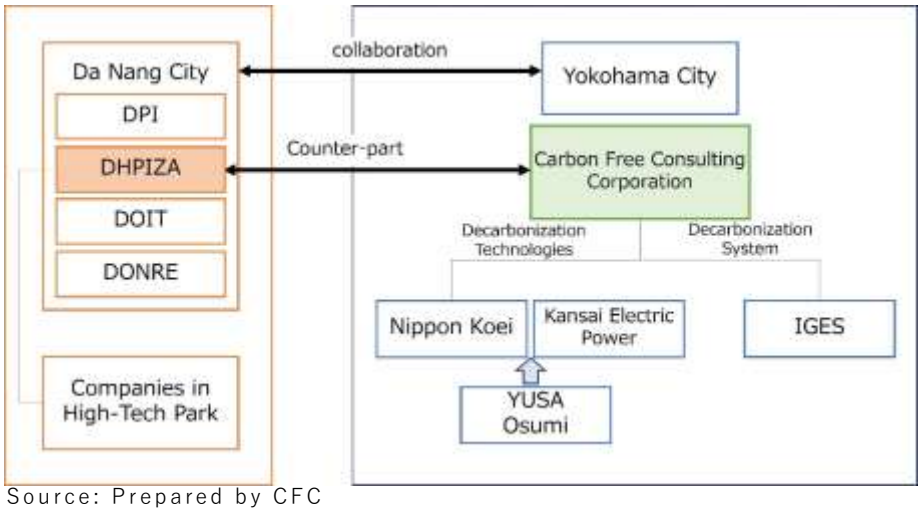
Sewage wastewater treatment consumes electricity in its treatment process, and the introduction of high-efficiency equipment can bring about a reduction in electricity use, thereby reducing GHG emissions from wastewater treatment facilities. In particular, when biological treatment methods are used, a large amount of electricity is used to supply oxygen to the reaction tanks, which can be expected to increase efficiency.

1-3 Project Implementation Structure

As shown in the figure below, the project will be implemented based on the inter-city partnership between Da Nang City and Yokohama City, and Carbon Free Consulting, Inc. will be responsible for overall coordination. For the decarbonization system, Carbon Free Consulting,

together with the Institute for Global Environmental Strategies (IGES), will conduct research and support the establishment of a carbon management system in Da Nang City and Hoa Khanh Industrial Park. In the area of decarbonization technology, Nippon Koei will take advantage of its superior knowledge in the field of urban development and, together with Kansai Electric Power Company, will be in charge of planning a project to convert Hoa Khanh Industrial Park to a renewable energy source and conducting a study for the commercialization of JCM. Yokohama Urban Solution Alliance (YUSA) and Osumi Corporation will provide on-site support for the study of decarbonization technologies and play a central role in matching between Japanese and Vietnamese companies.

On the Danang City side, the Danang Hi-Tech Park Management Committee will be the counterpart of the project. However, the establishment of the carbon management system is led by the Department of Natural Resources and Environment, while the local departments of the line ministries (Department of Industry and Trade, Department of Construction, etc.) are in charge of this project. In addition, since the Department of Industry and Trade is in charge of electricity policy, it is necessary to cooperate with these Departments in conducting the research project.



Source: Prepared by CFC

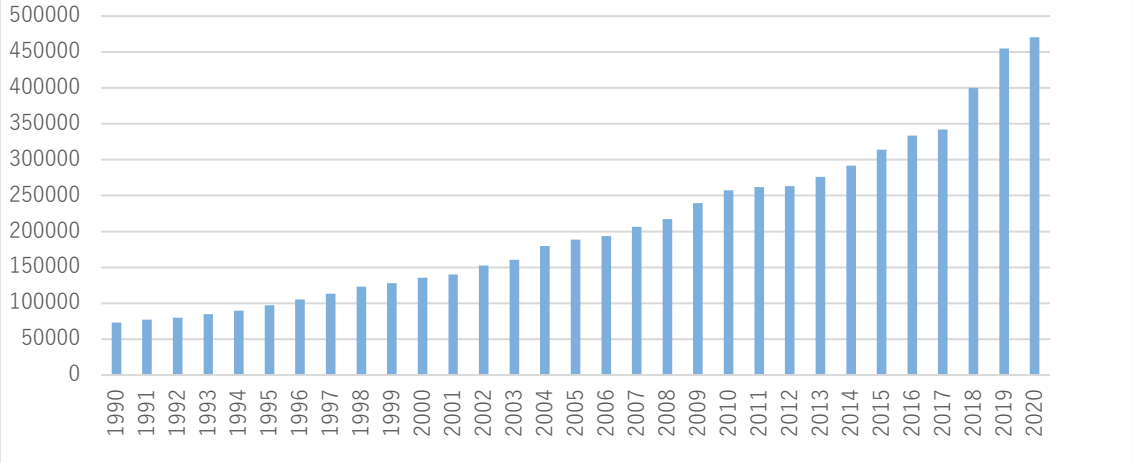
Figure 2: Implementation structure

2. Activities

2-1 Current Status of Decarbonization

2-1-1 GHG Emissions

GHG emissions in Vietnam have been increasing year by year on the back of robust economic growth, exceeding 400 million t-CO2 in 2019 and reaching about 470 million t-CO2 in 2020, which is equivalent to about 1% of total global emissions. Compared to other Southeast Asian countries, this is comparable to Thailand's 430 million t-CO2 and less than Indonesia's 980 million t-CO2, but greater than Malaysia's 300 million t-CO2 and the Philippines' 220 million t-CO2. The GHG emissions of Da Nang City are estimated to be 5,557,000 t-CO2, taking into account the population size of Da Nang City, given that the per capita GHG emissions in Vietnam (2020) are 4.9 t-CO2.

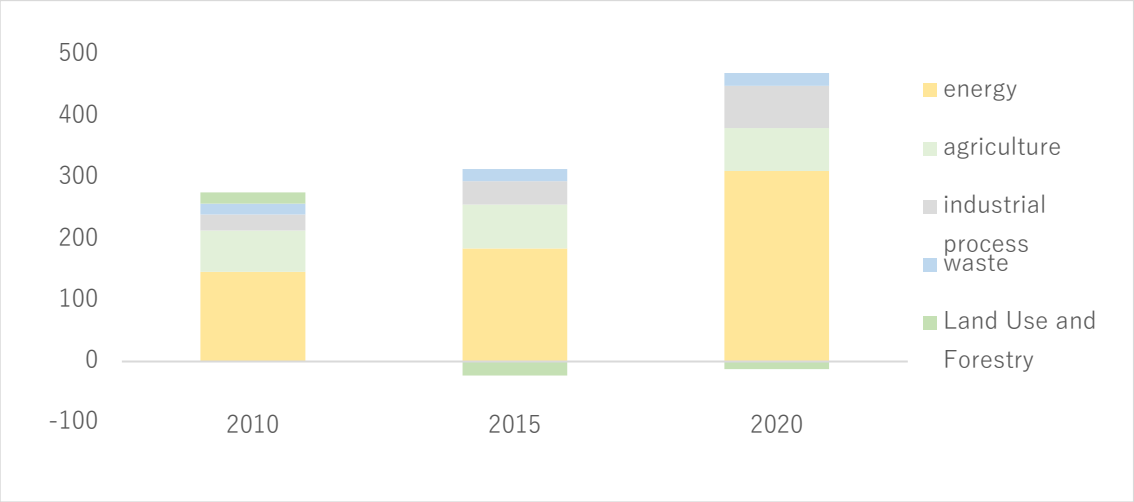


Unit: 1,000 t-CO2
Source: prepared by CFC from World Bank World Development Indicators database

Figure 3 Transition of GHG emissions

Looking at Vietnam's GHG emissions by sector, emissions from the energy sector stand out as the largest, at 67.8% of the total. This is followed by the agriculture sector at 15.3% and industrial processes at 15%. The waste sector accounts for less than 5%. The land use and

forest sector, at -2.7%, absorbs more than it emits. In particular, emissions from the energy sector and industrial processes are increasing year by year, more than doubling in the 10 years from 2010 to 2020. This is thought to be due to the fact that industrialization is progressing along with Vietnam's economic growth.



Unit: 1 million t-CO2
Source: Prepared by CFC from Climate Watch 2024 data.

Figure 4 Sector-specific GHG emissions

2-1-2 Risks of Climate Change

Vietnam is positioned as one of the most vulnerable countries in the world to climate change, and the risks of climate change associated with such increased GHG emissions are significant. For example, it is ranked 127th out of 182 countries in the Notre Dame Global Adaptability Index, ranking as a country with low adaptive capacity. It is also ranked 13th out of 180 countries in the Germanwatch Global Risk Index, placing it as a high-risk country. This is largely due to geographical factors, as most of Vietnam's land borders the coast and the country has many river deltas, making it vulnerable to the effects of sea level rise. In addition, in some places, aridity and water shortages are becoming more severe, and river erosion and landslides are frequent. With regard to forests, there is an increase in forest fires and the impact

of heavy rains and strong winds on ecosystems. In particular, there are concerns about serious impacts on agriculture and fisheries and reduced productivity, and the costs of countermeasures are increasing. According to the World Bank's Country Environmental Assessment (CEA), losses due to climate change have already occurred and are estimated to have reached US$10 billion in 2020 alone.

2-1-3 Policies on Climate Change

To address these climate change risks that Vietnam faces, the Vietnamese government has developed a policy to combat climate change and has embarked on full-scale measures to combat climate change. A major impetus for this was the revised Nationally Determined Contribution (NDC) submitted in 2020 prior to the 26th Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC), which was held in Glasgow in 2021. In order to realize this NDC, the Ministry of Natural Resources and Environment (MONRE: Ministry of Natural Resources and Environment) is taking the lead in implementing various programs. In October 2021, the Ministry of Planning and Investment (MPI) took the lead in adopting a new Vietnam Green Growth Strategy (VGGS), which aims to balance climate change measures and economic growth. The VGGS aims to balance climate change measures and economic growth.

NDC

The Vietnamese government's NDC was first drafted in 2015 (INDC: Intended Nationally Determined Contribution); in 2020, a full-fledged NDC2020 was developed based on that draft and submitted to the UN Framework Convention on Climate Change. At COP26 in 2021, the Vietnamese government declared, among other things, that it would make strong efforts to reduce GHG emissions with the support of the international community and its own resources to achieve the net zero goal by 2050, based on the NDC2020. Subsequently, under the direction of the Prime Minister, MONRE took the lead in formulating the current NDC2022 after reviewing the 2020 NDC.

Its main contents consist of target sectors, types of GHGs, period covered, methodology, GHG emission reduction targets, climate change adaptation measures, potential synergies, NDC implementation, and challenges in NDC implementation. The target sectors are energy, agriculture, land use and forestry, waste, and industrial processes; GHGs are considered to be seven gases by the UN, but here, based on the feasibility of the calculation, they are four types: carbon dioxide (CO2), methane (CH4), dinitrogen monoxide (N2O), and hydrofluorocarbons (HFCs) CO2.

The GHG emission reduction targets are more ambitious than those of NDC2020: GHG emission reduction targets are divided into two categories: unconditional contributions to be made by the Vietnamese government from its own budget and conditional contributions to be made with aid funding from the international community. Of these, the unconditional contribution has increased 1.8-fold, from 9% to 15.8%. Conditional contributions also increased 1.6-fold, from 27% to 43.5%.

Table 1: Overview of NDC 2022

(data) item	Contents
GHG Emission Reduction Targets	By 2030, compared to BAU (business as usual), in the target sector※1 , reduce the unconditional contribution※2 by 15.8% and the conditional contribution※3 by 43.5%. *1Sectors covered: energy, agriculture, land use/forestry, waste, industrial processes *2Unconditional contribution: Contribution made with the budget of the Vietnamese government *3Conditional contributions: Contributions funded by the international community

Climate change adaptation measures	-Update climate change trends, future projections, and risk analysis. -Update the implementation status and results of climate change adaptation measures. -Update existing and future economic and non-economic losses and damages. -Contribute to climate change adaptation measures, including implementation of the Economic and Social Development Plan 2021-2030, the National Climate Change Strategy towards 2050, and the National Strategy on Natural Disaster Prevention.
Possibility of synergistic effects	-Maximize synergies and minimize negative effects of GHG reduction measures, climate change adaptation measures, and economic and social development.

Source: Compiled by CFC from Government of Vietnam Nationally Determined Contribution (NDC) (Updated in 2022)

VGGS

The Vietnamese government's Green Growth Strategy was approved by the Prime Minister's Decision (Decision 1658/QD-TTg) in 2021. Aiming to balance climate action and economic growth, the strategy sets out basic policies such as economic restructuring through innovative growth models and increased competitiveness, sustainable development, people-centered growth, modern organization and governance, and active investment in advanced technologies such as DX and infrastructure. As shown in the table below, specific targets on decarbonization are linked to economic growth and are positioned as one of the key policies for building a decarbonized society.

Table 2 VGGS configuration

Item	Contents
Target	-Reduce GHG emissions per GDP by at least 15%

	from 2014 levels by 2030. -Reduce GHG emissions per GDP by at least 30% from 2014 levels by 2050. *Other goals include reductions in energy consumption per GDP, energy, waste and the UN Human Development Index.
Strategic Directions	-Fundamental Direction: Strive to rebuild the economy through innovative growth models, reduced GHG emissions, digital technology, sustainable infrastructure, and green lifestyles. -Developing the adaptive capacity of key industries and sectors: improving the effectiveness and efficiency of energy use, developing modern agriculture, clean and sustainable farming, limiting the mass waste sector, developing sustainable transportation and irrigation infrastructure, and promoting smart and sustainable urbanization.
Tasks and Solutions	To realize the goals and strategic directions set forth here, the mission and response measures of the responsible ministries will be defined. * Sets out the missions of the Ministry of Planning and Investment, Ministry of Finance, Ministry of Natural Resources and Environment, Ministry of Industry and Trade, Ministry of Agriculture and Rural Development, Ministry of Transport, Ministry of Construction, Ministry of Science and Technology, Ministry of Education and Training, Ministry of Health, Ministry of Culture, Sports and Tourism, Ministry of Labor, Wound and Social Relations, Central Bank and Ministry of Information and Communication. It provides for the ministries to formulate and implement policies, conduct communication and awareness-raising activities, train human resources and develop green professions, as well as financial expenditure and research and development for this purpose.

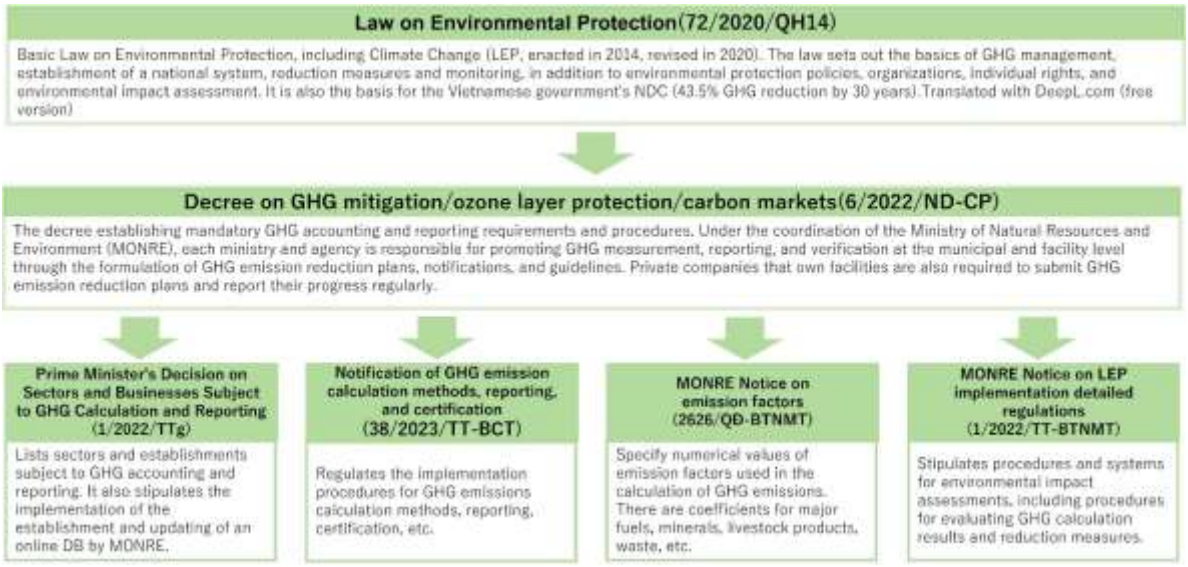
Implementing agency	-A Green Growth National Steering Committee will be established to direct the implementation of this Strategy and will be chaired by the Ministry of Planning and Investment. -The Ministry of Planning and Investment, the Ministry of Finance, and other relevant ministries will be responsible for implementation. -The Ministry of Planning and Investment will monitor, evaluate, and report on the Strategy.

Source: Prepared by CFC based on Decision 1658/QD-TTg of the Prime Minister of the Government of Vietnam.

2-2 Decarbonization System

2-2-1 Outline of Legal System

The Vietnamese government's efforts to combat climate change are supported by various legal systems, including the Law on Environmental Protection, as well as various decrees, decisions, and notifications.



Source: Prepared by CFC

Figure 5 Legislation on GHG calculation

The current Law on Environmental Protection (amended Law on Environmental Protection (72/2020/QH14_2020.11.17)), enacted after revisions in 2015 and 2020 to address climate change, serves as the basic law on climate change measures, defining its objectives, basic policies, rights and obligations, and organization. Immediately below it is the Decree on GHG Mitigation/Ozone Layer Protection/Carbon Market (6/2022/ND-CP_2022.01.07) to embody the revised Environmental Protection Law, which defines the basic management system and structure for GHG emissions. In addition, there are various notifications and decisions under the Decree, which make the Environmental Protection Act and Decree more concrete. The Prime Minister's Decision (1/2022/TTg) on GHG accounting and reporting specifies the sectors and businesses subject to GHG accounting and reporting. In addition, there are notifications from the respective ministries in charge of the implementation of GHG emissions management. For example, the Ministry of Industry and Trade's Circular (38/2023/TT-BCT) stipulates how to calculate GHG emissions in sectors managed by the Ministry of Industry and Trade. However, this Circular has only been published for the Ministry of Industry and Trade and the Ministry of Natural Resources and Environment, and those for other ministries are still in the process of being prepared. The MONRE Decision on Emission Factors (2626/QĐ-BTNMT) defines the emission factors required for the calculation of GHG emissions for each sector covered, including industry, main energy sources, production and disposal. And the MONRE Circular (1/2022/TT-BTNMT) on the Detailed Regulations for the Implementation of the Revised Law on Environmental Protection specifically provides for the analysis, assessment, reporting, and certification of climate change and GHG impacts and risks. Thus, the Vietnamese government has enacted and announced a series of laws and regulations on climate change measures to improve the system and structure.

Revised environmental protection law

The Law on Environmental Protection, originally enacted in 1994, initially focused primarily on nature conservation and environmental impact assessment. However, it was amended in 2015 considering discussions on the Paris Agreement on the Framework Convention on Climate Change, and further amended as a legal basis to support the domestic implementation of the NDC to be submitted by the Vietnamese Government in 2020.

The Law is the basic law on climate change measures in Vietnam, and it defines the objectives, organization, and rights and obligations of the people in the fight against climate change. While there are a wide range of provisions on climate change, it is important to note that a climate change component has been incorporated into the national environmental protection plan. Especially, in Chapter 3, Article 23, climate change scenarios are positioned as the basis for national environmental protection plans. It is also important to note that in Chapter 4, Article 27, climate change impacts are included in the content of environmental assessments.

The reduction of GHG emissions is specified in Chapter 7, Climate Change Adaptation Measures (Articles 90-96). Article 91 sets out the basics of GHG emission reductions, and in addition to paragraph 2 a) to develop roadmaps and methodologies, and b) to conduct inventorying, accounting, reporting, and assessment at the national, sectoral, field, and internal levels, it also stipulates d) to develop a national carbon market. Paragraph 4 of the same stipulates the role of the Ministry of Natural Resources and Environment, including the compilation of a country-wide GHG inventory report under its primary responsibility. Article 94 provides for a national database on climate change, which is to include information on GHG emissions, their impact on economic and social activities, and reductions in GHG emissions. Thus, the Environmental Protection Law is the most fundamental legal basis for climate change and GHG emissions reduction.

Decree on GHG emission reduction and ozone layer protection (Decree No. 6)

Decree No. 6 was enacted to embody the revised Environmental Protection Law, and with regard to GHG emissions reduction, it specifies the identification of organizations that are obligated to reduce and report, basic principles and objectives of reduction, methods of reduction and reporting, allocation and trading of GHG emissions, certification bodies, and development of domestic carbon markets. Of particular importance is the identification of organizations that are obligated to reduce GHG emissions and the establishment of specific GHG emissions management implementation systems and procedures. Article 5, the details of which are discussed below, stipulates that the Prime Minister shall designate the sectors and organizations that are obligated to reduce GHG emissions, and that the Ministry of Industry and Trade, Ministry of Transportation, Ministry of Agriculture and Rural Development, Ministry of Natural Resources and Environment, and Ministry of Construction shall oversee efforts in their respective sectors. Article 6 also defines the role of the local People's Committees and stipulates that they shall direct the relevant specialized agencies and review the energy consumption of the sectors and institutions concerned every two years. Article 7 defines the role of the relevant ministries and the Ministry of Natural Resources and Environment and the procedures for managing GHG emissions. These provisions require organizations that are obligated to reduce GHG emissions to identify and inventory their own GHG emissions and reduce emissions under the supervision of the responsible ministry.

Prime minister's decision on sectors and businesses subject to GHG calculation and reporting

Following Decree 6, which stipulates that the Prime Minister shall designate sectors and organizations with GHG emission reduction and reporting obligations, this Prime Minister's Decision (1/2022/TTg) lists the specific sectors and the names of companies covered in all 63 provinces of Vietnam. The sectors subject to GHG accounting and

reporting are energy, transportation, construction, industrial processes, agriculture, forestry, land use, and waste, Energy, Transportation, Construction, Industrial Processes, Agriculture/Forestry/Land Use, and Waste, with the following subsections for each sector. Energy, industrial processes, agriculture, forestry, and land use, and waste are the same areas covered in the NDC, indicating that the GHG accounting and reporting is consistent with the NDC.

The Prime Minister's Decision also specifically lists the facilities and establishments that are subject to GHG emissions accounting and reporting, in order from north to south, with a total of 1,912 entities enumerated. The breakdown is 1,662 for energy, 70 for transportation, 104 for construction, and 76 for waste, with the overwhelming majority of establishments related to energy. As for Da Nang City, there were 19 energy-related establishments, none in transportation, 3 in construction, and 1 in waste, reflecting the fact that tourism is a major industry in the city rather than manufacturing. In addition, 15 of the 19 energy-related companies in Da Nang are in Hoa Khanh Industrial Park, the pilot site of the project. As for industrial processes and agriculture, forestry, and land use, there is no list at this time, and it has not been determined how the target business sites will be identified.

Table 3 Areas with GHG accounting and reporting obligations

target area	
1. Energy	Energy Production
	energy consumption
	coal
	Petroleum and Natural Gas
2. Transportation	Energy consumption in transportation
3. Construction	Energy Consumption in Construction
	Material Production

4. Industrial process	Chemical Manufacturing
	metalworking
	electronics industry
	Manufacture of ozone-depleting products
	Manufacture of other industrial products
5. Agriculture, forestry and land use	agriculture
	Forestry and Land Use Change
	farming
	Energy consumption in agriculture, forestry and fisheries
	Other emissions in agriculture
6. Waste	Landfill waste
	Bio-waste treatment
	Incineration of waste
	Wastewater Treatment

Source: Prepared by CFC based on PM Decision 1/2022/TTg

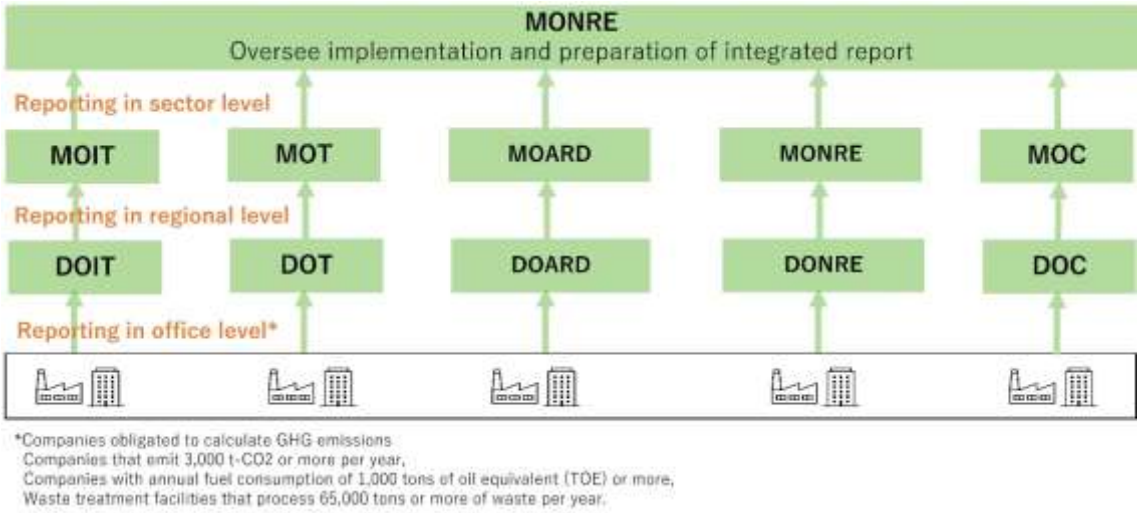
MONRE Notice on LEP implementation detailed regulations

The MONRE Circular on the Enforcement Bylaws of the Revised Environmental Protection Law embodies the law with respect to addressing climate change and specifies how to recognize, assess, and certify GHG impacts and risks. Chapter 2 (Articles 4-8) of the Circular specifies the types of information, assessment items, and processes to be used for the assessment of climate change impacts, vulnerability, risk, loss, and damage. The information used in this assessment includes temperature, rainfall, severe climatic events, sea level rise, etc. This information is to be collected and analyzed, and the impacts on the economy and society are to be assessed and reported. In addition, Chapter 3 (Articles 9-14) provides for the certification of the evaluations conducted in Chapter 2. This certification is carried out by a Certification Committee established

by the ministry in charge, whose members include representatives of the ministry in charge, representatives of the Ministry of Natural Resources and Environment, and representatives and experts from other relevant ministries. The certification committee verifies the appropriateness and accuracy of the assessment, which includes the appropriateness of GHG emissions information and data, as well as the conformity of calculation methods and emission factors, to ensure the quality of GHG emissions calculation.

2-2-2 Implementation Structure

The carbon management system in Vietnam is specifically defined by Decree No. 6, following the basic provisions of the revised Law on Environmental Protection. The decree stipulates that each ministry and agency is responsible for measuring, reporting, and verifying GHG emissions, and sets up a process whereby each ministry and agency compiles data from the establishments under its jurisdiction and reports it to the Ministry of Natural Resources and Environment, which then calculates and analyzes GHG emissions for the entire government and prepares a consolidated report for the government.



Source: Prepared by CFC

Figure 6 CMS Implementation Structure

In compiling GHG-related data for the areas under their jurisdiction, ministries and agencies will first collect information at the regional level, such as province or city. Private companies with facilities or establishments designated by the Prime Minister's decision will calculate GHG emissions and submit their reduction plans and progress to the specialized agency (department in charge) of the local People's Committee. The departments in charge of the region will scrutinize the information collected and submit it to the central ministries. In the case of GHGs in the energy sector in Da Nang, factories and businesses in the city will calculate their own GHG emissions and report them to the Da Nang City Department of Industry and Trade. The Department will compile the reported GHG-related data and report it to the central Ministry of Industry and Trade. The Ministry of Industry and Trade compiles the data collected from each region and submits it to the Ministry of Natural Resources and Environment. In addition, the Ministry of Natural Resources and Environment, as the lead agency for the government-wide carbon management system, is also responsible for formulating and implementing GHG emission reduction plans, issuing notices and guidelines, and facilitating the measurement, reporting, and verification of GHG emissions at the center and in each region.

2-2-3 Calculation of Greenhouse Gases

Specific methodologies for GHG calculation are stipulated in each ministry's notification on GHG emission calculation methods, reporting, and certification. However, among the notifications of each ministry, only the Ministry of Industry and Trade (38/2023/TT-BCT) and the Ministry of Natural Resources and Environment (17/2022/TT-BTNMT) have already been published, while the other notifications are currently under preparation. The emission factors required for the calculation are specified in the MONRE Circular on Emission Factors (2626/QĐ-BTNMT). However, while energy- and electricity-related factors exist, product-level factors are not yet available and should be enhanced in the future.

GHG emissions calculation method

GHG emissions in Vietnam are calculated for each of six sectors: energy, transportation, construction, industrial processes, agriculture/forestry/land use, and waste. The method of calculating GHG emissions and reductions for energy and industrial processes is stipulated in the Ministry of Industry and Trade Circular, and the principles of adequacy, uniformity, transparency, accuracy, and comparability must be met in the calculation. The process then involves collecting activity data, selecting appropriate emission factors, and taking into account uncertainties in the calculation. The formula is as follows: GHG emissions are calculated by multiplying the activity amount by the emission factor.

$$KNK_{i,t} = \Sigma_t \ AD_{i,t} * EF_{i,t}$$

KNK: GHG emissions
AD: Activity
EF: Emission factor

The method for calculating GHG emissions in the waste sector is stipulated in a notification from the Ministry of Natural Resources and Environment, and, as with the calculation of GHG emissions from energy and industrial processes, the process involves collecting activity data, selecting appropriate emission factors, and taking uncertainties into account. While several calculation formula patterns are provided, such as the case where waste is reused/recycled or a gasoline-powered vehicle is converted to an electric vehicle, specific formulas for how to calculate the emission reductions are not provided.

$$ER_{WR} = ER_{WRPj} + ER_{WRIj}$$

ER_{WR} : GHG emission reductions
ER_{WRPj} : Emission reductions from reusing waste
ER_{WRIj} : Emission reductions from recycling waste instead of incineration or landfill

GHG emission factor

As mentioned in the formula above, emission factors are required to calculate GHG emissions, and the emission factors applicable to Vietnam are listed in the MONRE Decision (2626/QĐ-BTNMT). The decision has 312 emission factors in the energy, industrial process and product use, agriculture/forestry/land use, and waste sectors.

In the energy sector, GHG emission factors are set for fuel combustion and refining: for GHGs, by CO2, CH4, and N2O; for industries, by energy, manufacturing, domestic aviation, land transportation, marine transportation, trade, civil service, and agriculture, forestry, and fisheries categories. For example, the combustion of anthracite coal in the energy industry is 98,300 kg-CO2 for carbon dioxide and 1 kg-CH4 for methane per terajoule of heat value.

For industrial processes and product use, emission factors are set for the production of specific raw materials such as clinker production and calcium oxide production in the mineral, chemical, and metal industries. For example, the CO2 emissions for calcium oxide production is 0.75 t-CO2 per ton of production.

For agriculture, forestry, and land use, emission factors are set separately for breeding, land, and other. Most of the emission factors are related to animal husbandry, and emission factors are set for each type of livestock. For example, for dairy cows, the emission factor for methane from feed digestion per cow per year is 78 kg-CH4, and for beef cattle, it is 54 kg-CH4. In the case of land, emission factors are set per surface forest biomass or cultivated area of land, with a CO2 emission factor of 20 t-C of carbon per hectare of cultivated area per year. In addition, emission factors for other categories, such as biomass combustion, are set.

For waste, emission factors are specified for solid waste landfill, biological solid waste treatment, incineration, and sewage effluent treatment. The emission factor for methane gas generation in sewage treatment is 0.60 kg-CH4 per 1kgBOD.

Various GHG emission factors have been established for different

sectors in this MONRE Decision, but in many cases the rationale for how these emission factors were established is not specified. In addition, the emission factor for the combustion of plastic waste is 100%, which includes some emission factors that are difficult to interpret as emission factors, and these points should be kept in mind.

GHG emissions projections

NDC calculates future GHG emissions projections using the guidelines of the United Nations Intergovernmental Panel on Climate Change (IPCC) and Vietnam's national statistics as its methodology. The IPCC guidelines referred to here are the IPCC Guidelines for National GHG Inventories established in 1996 and the IPCC Good Practice Guidelines established in 2000, both of which measure and calculate sectoral GHG emissions from national statistical data and estimate them from the economic scale.

Table 4 GHG emissions calculation method in NDC

GHG emissions and data calculation method	-IPCC Guidelines -National Statistical Yearbook, National Socio-Economic Development Plan, Sector Activity Data on GHG Reductions
Application criteria	100-year Global Warming Potential -CO2=1 -CH4=25 -N2O=298 -HFCs=124-14,800

Source: Prepared by CFC based on PM Decision 1/2022/TTg

2-3 Decarbonization Technology

2-3-1 Outline of the Survey

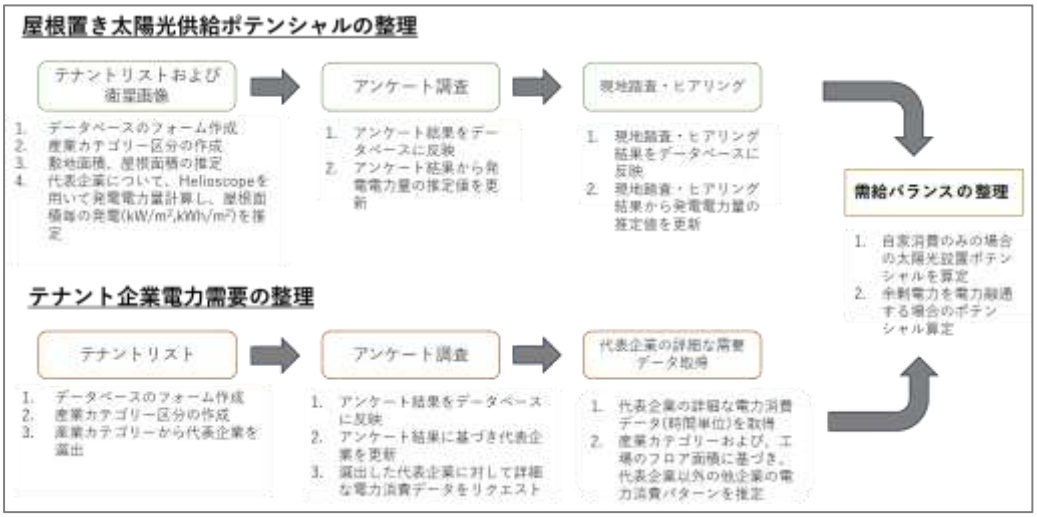
Purpose of the Survey

In this year's study, a basic survey was conducted to understand

the potential in the industrial park for the introduction of roof-mounted photovoltaic power generation in the Hoa Khanh Industrial Park. The scale of supply from the introduction of roof-mounted photovoltaic power generation was compared to the scale of demand based on the amount of electricity used by the companies, and the existence of surplus power was sorted out. Based on this information, the plan for the next fiscal year is to reverse the flow of surplus power into the industrial park's power distribution network, and to study a new mechanism for flexible power distribution among the resident companies. Through this, we aim to maximize the potential of the roof-mounted photovoltaic power generation system in the Hoa Khanh Industrial Park.

Method of investigation

In this study, we first organized the roof-mounted solar supply potential and then the electricity demand of tenant companies, as



described below.

Source: Compiled by Nippon Koei

Figure 7: Survey implementation flow

① Understanding the supply potential from the introduction of rooftop photovoltaic generation

In order to determine the scale of rooftop solar power installation, we conducted a solar power generation simulation on an estimated

roof area based on Google Earth satellite imagery, and calculated the scale and amount of power generated. In addition, the estimated scale of power generation was verified through a questionnaire survey, site visits, and on-site interviews.

② Organize electricity demand of tenant companies

Representative companies were selected based on the list of industrial park tenant companies and their respective industry categories, questionnaires were conducted, and detailed electricity consumption data were obtained. Based on these data, we estimated the overall electricity consumption of the tenant companies in the industrial park.

2-3-2 Roof-mounted PV Potential Study

This study was conducted to determine the status and potential of photovoltaic power generation in the Hoa Khanh Industrial Park. Google Earth satellite imagery was used to collect basic data such as PV installation status, uninstalled roof area, and site area. Satellite imagery was used to estimate the status and potential of PV installation in the entire industrial park, and then field surveys were conducted to confirm the actual status of representative locations. The satellite images were available as of May 2023.

In estimating the potential, the amount of electricity generated was predicted using Helioscope, a software program for studying photovoltaic power generation, based on the roof area estimated from satellite images.

Satellite imagery to confirm the introduction of solar power generation in the industrial park

① Estimation of roof area

There are approximately 190 companies in the Hoa Khanh Industrial Park. Of these, 25 companies had roof areas of 10,000 m2 or more. The largest enterprise with the largest roof area was approximately 62,000 m^2 . The total roof area was approximately 966,000 m^2 .

Table 5 Estimated Roof Area in Hoa Khanh Industrial Park

屋根面積（m2）			テナント数
0	～	5,000	74
5,000	～	10,000	30
10,000	～	15,000	7
15,000	～	20,000	7
20,000	～	25,000	5
25,000	～	30,000	1
30,000	～	35,000	2
35,000	～	40,000	0
40,000	～	45,000	1
45,000	～	50,000	0
50,000	～	55,000	0
55,000	～	60,000	1
60,000	～	65,000	1
位置未特定/計測不能等			57
計			186

Source: Compiled by Nippon Koei

② Photovoltaic installation status

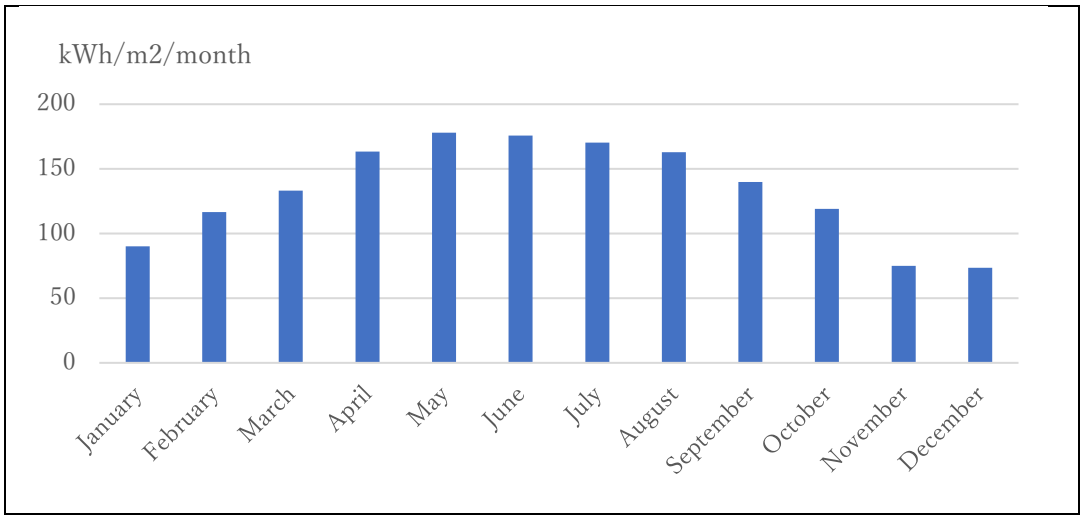
In the Hoa Khanh Industrial Park, 25 companies have already installed photovoltaic systems, with a total installed capacity of approximately 20,000 kWp.

Source: Compiled by Nippon Koei based on Google Earth

Figure 8: Photovoltaic installation status

③ Estimation of solar radiation

The annual solar radiation at Hoa Khanh Industrial Park was approximately 1765 kWh/m2 . The month with the highest solar radiation was May, at about 178 kWh/m2 , and the month with the lowest solar radiation was December, at about 74 kWh/m2 .



Source: Compiled by Nippon Koei using Helioscope

Figure 9: Trends in solar radiation around the Hoa Khanh Industrial Park

Estimation of electricity production from roof-mounted solar power using Helioscope

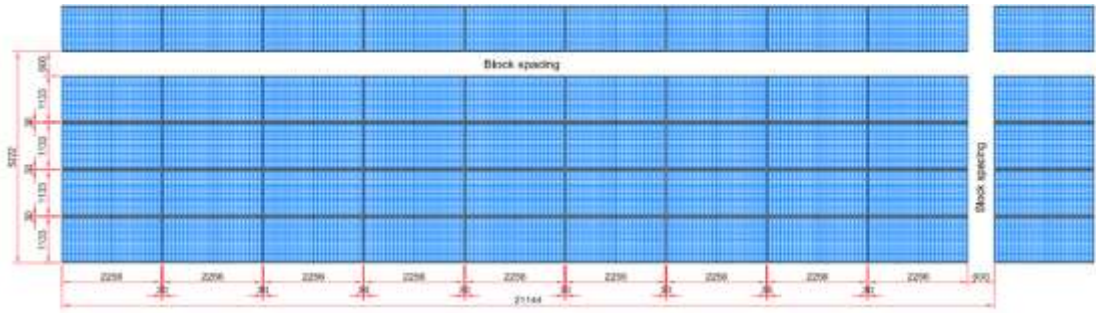
In this study, a model for the installation of solar panels on the roof of a factory in the Hoa Khanh Industrial Park was created using Helioscope, a software program that simulates the placement of solar panels and the amount of electricity generated, depending on the shape and orientation of the roof and the amount of solar radiation.

① Solar panel installation model

In creating the installation model for each factory, information such as roof area, orientation, tilt angle, and presence of shielding was assumed based on satellite imagery. The following generalized model was created for panel type, size, and placement spacing, etc., and

applied to each factory roof. Regarding the condition of the roof to be installed, roof size, roof direction, and shielding (skylights, trees, etc.) were estimated based on satellite imagery. The height of the factory was assumed to be 8 to 12 meters, depending on the width of the factory, and the slope of the roof was assumed to be 10 degrees. The solar panels would be installed along the direction and angle of the factory roof.

Solar panel installation model



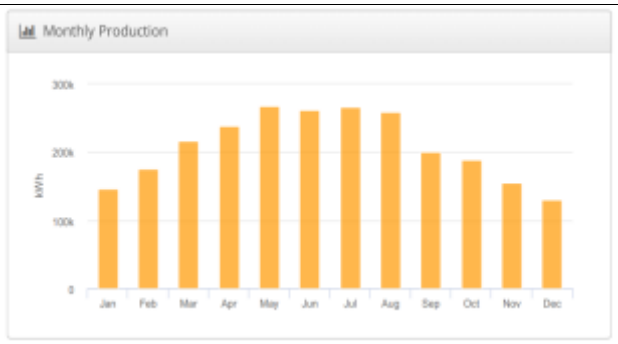
- Typical PV model is LR5-72HBD-535M						- Typical array		
+ PV dimension: LxWxT (mm)	2256 x	1133	x	35		+ Number of row in an array	4	
+ Maximum power: P_{max}		535	(W)			+ Number of column in an array	9	
+ Open circuit voltage: V_{oc}		49.35	(V)			+ Total panel in an array	36	
+ Short circuit current: I_{sc}		13.78	(A)			+ Number of panel in a string	18	
+ Voltage at maximum power: V_{mp}		41.5	(V)			+ Number of string in an array	2	
+ Current at maximum power: I_{mp}		12.9	(A)			+ Module spacing	30	(mm)
						+ Array spacing	600	(mm)
						+ Length of an array	21.144	(m)
						+ Width of an array	5.222	(m)
						+ Area of an array	110.41	(m2)
						+ Power of an array	19.26	kWp)
						+ Voltage of a string	888.3	(DCV)

Source: Compiled by Nippon Koei using Helioscope

Figure 10: Trends in solar radiation around the Hoa Khanh Industrial Park

Helioscope calculations were performed for five representative companies in the industrial park based on the above settings. An example of the results of the power generation calculation is shown below. As a result, 3,732 solar panels were placed on a roof area of 15,874.4 m^2 , resulting in a power generation scale (DC) of 1,996.6 kWp. Based on these results, the roof-mounted solar potential of each tenant company was estimated by roof area ratio.

Table 6: Example of calculated results of power generation for companies in Hoa Khanh Industrial Park



Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Area 4	99%	99%	99%	99%	99%	99%	99%	99%	98%	98%	98%	98%
Area 3	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Area 2	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Area 1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	100%
Area 6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Area 5	98%	98%	99%	99%	99%	99%	99%	99%	98%	98%	98%	98%
Solar Access, weighted by kWp	99.0%	99.1%	99.2%	99.2%	99.2%	99.3%	99.2%	99.2%	99.0%	99.0%	99.0%	98.9%
AC Power (kWh)	146,109.7	176,127.7	217,058.4	238,204.4	267,252.9	262,669.8	266,245.1	259,383.2	199,830.5	188,265.2	154,513.6	130,827.6

Solar access: Incident solar energy with shielding divided by incident solar energy without shielding

Source: Compiled by Nippon Koei using Helioscope

Confirmation of solar potential based on surveys and site visits

The potential for solar power generation in the industrial park, which was estimated using satellite imagery, was revised and updated based on the results of a questionnaire survey and site visits.

① Questionnaire survey

The questionnaire was distributed to 51 companies in the Hoa Khanh Industrial Park, and responses received from all 51 companies. The questionnaire included the following items. Based on the results of the questionnaire, we assessed the solar potential of each company by ascertaining their willingness to introduce solar power generation and their specific needs.

- Questions regarding willingness to introduce solar power generation and track record of introducing solar power generation
- Questions regarding the basic condition of the facility and the

use of the building and roof
- Questions regarding the status of plant operation and electricity consumption

② Field inspection

On-site inspections were conducted at some of the companies in the Hoa Khanh Industrial Park. The following items were surveyed, and interviews were conducted with the persons in charge to confirm their intention to introduce the system.

- Plant Location
- Building is being expanded or renovated (compared to satellite imagery).
- Are nearby facilities being demolished or newly constructed?
- Building/roof condition
- Is the building in shadow and will it affect solar power generation?
- Parking lots, etc. where PV can be installed
- Linkage point with industrial park power distribution network
- Potential sites for installing battery storage systems (if required)
- Other

Based on the results of the field visits, the satellite-imagery-derived PV potential was revised and updated. A list of the 13 companies that conducted the site visits and a checklist of the site visit are shown below.

Table 7: List of companies surveyed in Hoa Khanh Industrial Park

企業	業種	日系/ベトナム企業
企業A	小型DCモーターの生産	日系企業
企業B	スポーツ用品の製造	日系企業
企業C	テープとロールの生産と加工	日系企業
企業D	木製フレームの生産と加工	日系企業
企業E	紙とカートンパッケージの生産	ベトナム企業
企業F	カートンパッケージの生産	ベトナム企業
企業G	車用の各種フィルター生産	ベトナム企業
企業H	動物用飼料生産	ベトナム企業
企業I	織物の生産	ベトナム企業
企業J	セメントの生産	ベトナム企業
企業K	包装商品用ラベル印刷	ベトナム企業
企業L	動物用飼料生産	ベトナム企業
企業M	FRP合成プラスチック製品製造	日系企業

Table 8 Example of field inspection check sheet

Name of Tenants	General	Diference between Satelite image and current situation	Evaluation of the potential for utilization of Rooftop	Evaluation of the potential for utilization of Car Park	Other findings	Interview
Tenant A	Nationallity: Vietnam Manufacturing industry: Production of ceramic tiles Industry Category: 5.Ceramics and Earth and Stone Products Manufacturing Land area: 60000 m2 Floor area: 25000 m2 Nos of building: 4 Facility ownership: Tenant Existing PV: No Potential PV: 1620 kWp Energy consumption: 774.750 kWh/month PV installation plan: 100.000 kWp Purposes: Reduce electricity cost Rooftop limitations: Yes, Administrative procedures are quite complicated Other limitations: No	- The building is being expanded or renovated. - Surrounding facilities are being demolished or newly constructed. - If the facility name has been changed, it needs to be confirmed.	- The condition of the building's aging (significantly aged, / unable to confirm, etc.) - Solar power generation is installed on the roof. - Shading issue	- Parking space for *** vehicles - The building is in the shadow, and power generation cannot be expected, etc.	- Connection point (high voltage, low voltage, method of pulling in, location of pulling in) - The situation of the shading objects for solar radiation (with shading objects, without) - Constructability of solar panels (no issues, with issues) - Candidate locations for installing the energy storage system (if necessary)	Confirmation/ additional Questionnaire items) ① The use of the building and the way electricity is used, operation manner ② Future power demand outlook ③ The location where installation is assumed ④ Recognized issues (constructability, capacity of structure, design, etc.) ⑤ Needs for solar power generation (RE100, reduction of electricity charges, etc.)
	Result of Site visit	A：no changed B：changed	A：as assumed B：some restrictions	A：potentially available B：some restrictions	A：no issue B：some issues	

Source: Compiled by Nippon Koei

③ Results of confirming the solar potential after the questionnaire and site visit

Based on the results of the questionnaire survey and the site visits, the potential of each company to install roof-mounted photovoltaic power generation was reassessed. In particular, there is a need to revise the results of the desk-based estimation of PV potential in the following points identified through the survey.

- The questionnaire and on-site interviews revealed that a certain percentage of tenants have no intention of installing roof-mounted solar panels. Of the 51 companies surveyed, 22 did not intend to install solar panels, only 9 said they did, and the rest did not respond. The main reasons for not intending to install solar panels were a lack of budget to cover the initial investment costs for roof-mounted solar panels and a lack of awareness of the need to use renewable energy. There were also cases where the respondents had considered installing roof-mounted solar panels at one time, but decided against it due to changes in government regulations on the introduction of roof-mounted solar panels.
- On the other hand, the results of the site inspection revealed that there were buildings with aging roof structures that were not suitable for panel installation, even though there was an intention to install the panels. Of the 13 companies surveyed, there were 5 companies with aging roof structures. The companies said that their location near the coast makes them susceptible to salt damage, and for this reason, roofing materials are generally replaced every 5 to 10 years in the area. There were also companies that had the intention to install solar panels, but were unable to do so due to insufficient load-bearing capacity of the roof structure.

2-3-3 Demand Survey in Industrial Parks

In order to understand the supply-demand balance at each company in the industrial park, there is a method to obtain actual electricity consumption data from each company regarding the scale of demand. However, obtaining data from all of the approximately 190 tenant companies in the park and confirming the situation on site would

require a great deal of time and effort, and it would not be practical to conduct the survey within the time frame of the study. Therefore, this survey employed a method of selecting representative companies and estimating the overall situation based on them. The specific method of selecting representative firms and estimating the electricity consumption of each firm are shown below.

① Electricity consumption classification

Tenant firms were divided by industry category into large, medium, and small industry groups in terms of electricity consumption. Companies in the same industrial category were assumed to have similar electricity consumption scale and pattern. In estimating the scale of electricity consumption by industry category, we referred to the domestic energy intensity data by industry[1] (calculated by dividing the crude oil equivalent of annual energy consumption by shipment value), which was organized by the Energy Conservation Center, Japan.

② Selection of representative tenants

Select representative tenant firms from the industrial categories that occupy a relatively large number of industrial parks. In order to estimate the scale of demand for all companies occupying the industrial park as much as possible, companies are selected not only from tenants with high electricity consumption, but also from tenants with electricity consumption of about small to medium. In addition, companies with large potential for roof-mounted photovoltaic power generation were also taken into account.

③ Obtaining demand curves

Demand curve data (actual hourly electricity consumption data) is obtained from the selected representative tenants. This was used to identify trends in electricity demand for each industrial group.

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[1] https://www.shindan-net.jp/factory_data/

④ Typical demand curve setup

Based on the data obtained, representative demand curves were estimated for each of the large, medium, and small groups, and power consumption and consumption patterns per factory floor area were developed.

⑤ Estimated scale of electricity consumption and demand curve for each tenant company

The scale of electricity consumption and demand curves for each tenant company were estimated based on the electricity consumption per factory floor area set in ④ and the factory floor area.

Table 9: Organization of industry categories and selection of representative firms

	産業カテゴリー	原単位 KL/出荷金額（億円/年）	テナント数	平均太陽光ポテンシャル(kWp)
電力消費量大	2.洗濯・利用・美容・入浴サービス	200	2	140
	1.鉱山、採石、砂利採取	137	3	328
	5.窯業・土石製品製造業	109	6	506
	4.石油・石炭製品の製造	97	1	388
	8.鉄鋼業	96	26	253
	11.宅配外食産業	96	0	-
	3.繊維産業	91	13	476
	7.化学工業	84	11	250
	6.非鉄金属製造業	80	0	-
	9.電子部品、デバイス、電子回路の製造	73	5	149
電力消費量中	12.プラスチック製品製造業	67	17	417
	10.ゴム製品製造業	58	1	-
	14.飲料、タバコ、飼料の製造	56	5	471
	22.汎用機械器具製造業	54	3	1,675
	17.電気機械器具製造業	52	4	115
	13.金属製品製造業	51	20	566
	15.食品製造業	48	6	532
	16.木材及び木製品製造業	40	9	413
	21.輸送用機械器具製造業	36	3	587
電力消費量小	19.印刷関連産業	34	3	150
	23.事務用機械器具製造業	32	4	540
	18.パルプ、紙及び紙加工製造業	31	14	413
	20.生産用機械器具製造業	26	13	748
	24.家具・建具製造業	23	4	224

入居テナント数の多い産業カテゴリーから代表企業を選出

太陽光発電ポテンシャルの大きい産業カテゴリーから選出

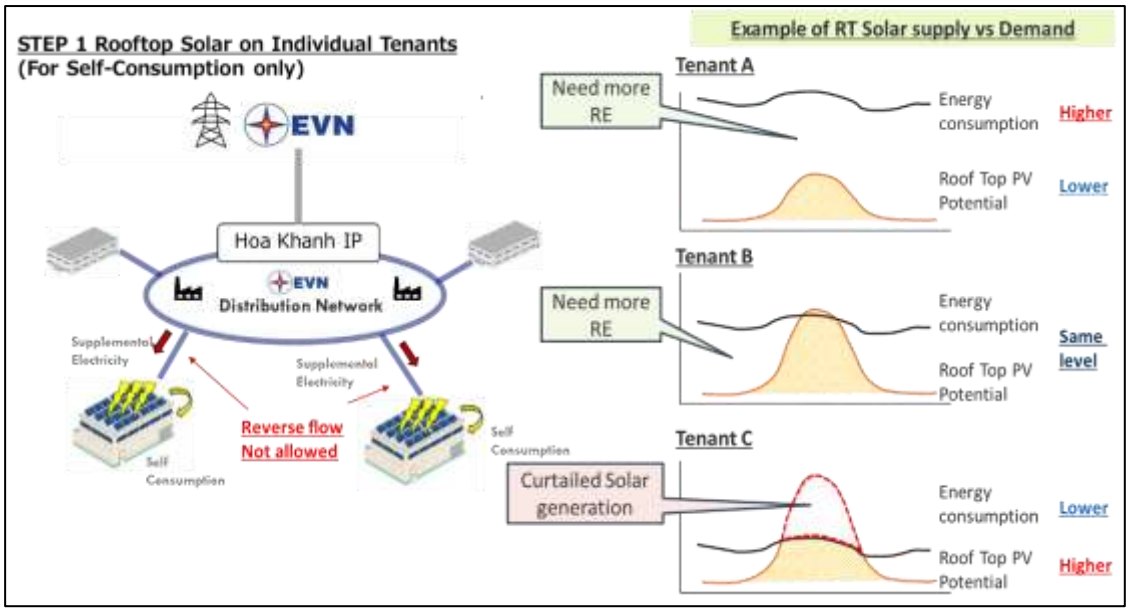
Source: Compiled by Nippon Koei

As a result of the above arrangement, a total of 25 representative

companies, including 5 Japanese companies, were selected from companies in each of the categories of large, medium, and small electricity consumption, and their electricity consumption performance data was collected. At the end of the first year of the survey, we had received electricity consumption data from one Japanese-affiliated company, and we changed our plan for collecting data from the other 24 companies to the second year of the survey.

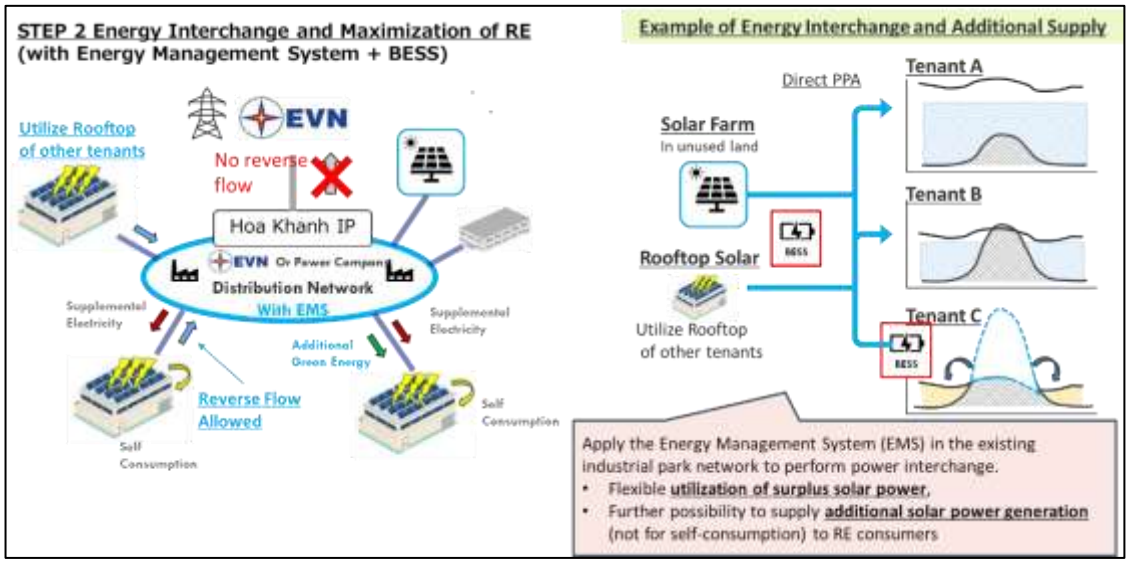
2-3-4 Organizing the Supply-demand Balance in an Industrial Park

In organizing the supply-demand balance in the industrial park, the potential for electricity flexibility was sorted according to each tenant's demand and solar power generation potential.



Source: Compiled by Nippon Koei

Figure 11: Tenant classification in Step 1



Source: Compiled by Nippon Koei

Figure 12: Diagram of energy flexibility in Step 2

As for the typology of each tenant, as shown in Figure Step 1, when solar power is installed for each current individual tenant, Tenant A is the tenant with high demand for solar power, Tenant B is the tenant whose demand and power generation are at the same level, and Tenant C is the tenant with surplus power generation relative to demand. As shown in Figure Step 2, the characteristics of each tenant type are utilized to maximize the use of solar power generation in the industrial park by supplying the surplus power of Tenant C to Tenant B or A.

The table shows the results of the above typology based on the electricity demand and power generation of the companies whose electricity usage could be ascertained through on-site surveys and questionnaires during the first year of the study. Eight tenants can be evaluated, and four of these tenants can be expected to have a surplus of solar power generation. If we assume that the tenants in the field survey are able to accommodate electricity, the total peak electricity consumption and the potential of solar power generation are almost the same, which means that there is a possibility of accommodating electricity. In the next fiscal year, as these electricity

usage volumes are being sorted out, the typology of the entire industrial park and the potential for energy flexibility will be examined.

Table 10: Examples of tenant typologies for field survey

No.	企業	業種	業種	フロア面積	電力需要量	想定ピーク電力※	太陽光規模既設	太陽光規模ポテンシャ	タイプ分け	備考
				m2	kWh/Month	kW	kWp	kWp		
1	企業A	小型DCモーターの生産	20. 生産用機械器具製造業	74,748	3,047,073	14,107	2,969	6,213	テナントA	需要大
2	企業B	スポーツ用品の製造	22.汎用機械器具製造業	52,519	1,847,032	8,551	—	8,048	テナントB	屋根強度に課題あり
3	企業C	テープとロールの生産と加工	3.繊維産業	5,500	66,000	306	1,180	—	テナントC	発電量大
4	企業D	木製フレームの生産と加工	16.木材及び木製品製造業	5,500	140,319	650	—	792	テナントC	発電量大
5	企業E	紙とカートンパッケージ生産	18.パルプ、紙及び上加工製造業	25,000	1,186,948	5,495	—	2,728	テナントA	需要大
6	企業F	カートンパッケージの生産	18.パルプ、紙及び上加工製造業	20,646	—	—	—	1,202	—	—
7	企業G	車用の各種フィルター生産	—	3,969	13,113	61	—	554	テナントC	発電量大
8	企業H	動物用飼料生産	14. 飲料、タバコ、飼料の製造	—	—	—	—	—	—	—
9	企業I	織物の生産	3.繊維産業	66,592	1,093,679	5,063	—	8,670	テナントC	発電量大
10	企業J	セメントの生産	1.鉱山、採石、砂利採取	—	477,273	2,210	—	457	テナントA	需要大
11	企業K	包装商品用ラベル印刷	19.印刷関連産業	2,823	—	—	—	5,134	—	—
12	企業L	動物用飼料生産	14. 飲料、タバコ、飼料の製造	—	—	—	—	—	—	—
13	企業M	FRP合成プラスチック製品製造	12.プラスチック製品製造業	—	—	—	—	—	—	—
参考に、各テナントの値を合計した場合⇒						36,442	4,149	33,798		
※想定電力ピークは、負荷率30%とした参考値を示す。今後の電力需要量のデータにより精査する。										

Source: Compiled by Nippon Koei

2-4 Other Decarbonization Technologies

In FY2023, as mentioned above, photovoltaic power generation equipment was positioned as the main technology, but in the course of the survey, Da Nang City expressed a need for calculation tools, IT technology was also considered. In addition, other needs were identified, such as power saving in wastewater treatment, so we identified candidate facilities and equipment on the Japanese side. The details are described in the next chapter, but (1) a calculation

tool from Carbon Free Consulting, Inc. as IT technology for GHG visualization, (2) turbo blowers and U-PEC scum removal equipment from Shin Maywa Industries, Ltd. and BW water quality improvement equipment from TKK Evolution, Inc. as technology to improve wastewater treatment efficiency, etc. were identified.

2-5 Other Events, etc.

In FY2023, in addition to the above activities, various reports and presentations were made: in November 2023, at the Business Matching Seminar of the 12th Asia Smart City Conference hosted by the City of Yokohama, an overview of the project regarding GHG emissions calculation was reported; in January 2024, at the 12th Danang Urban Development Forum , we reported on this inter-city collaboration project. On that occasion, training on GHG emissions accounting was also conducted for Da Nang city government officials and private sector employees (details are described in the main results of this project). In addition, monthly reports and debriefing sessions were conducted.

3. Results

In FY2023, the project achieved both institutional and technical results for building a decarbonized society in Da Nang City. The main institutional outcomes included a survey of the institutional and actual conditions related to decarbonization schemes in general, and an understanding of the challenges and specific needs related to CMS among the decarbonization schemes. In addition, as part of the support for the implementation of the carbon management system, training was provided to Da Nang city government agencies and private companies for GHG emissions calculation, which contributed to capacity building. With regard to decarbonization technologies, a site visit to Hoa Khanh Industrial Park allowed us to collect specific electricity data and to identify decarbonization needs other than solar power generation.

3-1 Identifying Issues and Needs in CMS Implementation

With regard to the decarbonization system, in order to understand the feasibility of introducing the CMS proposed in this project, we surveyed the existing decarbonization system of the Vietnamese government and the city of Da Nang in general, and identified issues to be addressed in introducing a Japanese CMS. To begin with, the Vietnamese government's policy on decarbonization schemes can be traced back to the 2015 Paris Agreement. The government at that time revised the Law on Environmental Protection as a response to the Paris Agreement and decided to introduce a GHG emission control system as part of its climate change measures. Various decrees, notifications, and decisions were then developed to put this revised Environmental Protection Law into practice. Among them, Decree No. 6 on GHG mitigation, ozone layer protection, and carbon markets is closely related to CMS, and stipulates GHG emission management methods, procedures, and systems as the basic matters of the GHG emission management system in Vietnam. The method of calculating GHG emissions is to be defined in the Circular of the ministry in

charge, and the method of calculation is defined for energy and industrial processes. 300+ emission factors are set in the MONRE Decision on emission factors for GHG emissions calculation. The system is also being developed under this legal system, and under Decree No. 6, the Ministry of Natural Resources and Environment has established a system for overall coordination First, individual establishments calculate their GHG emissions and report them to the respective local administrative authorities. Local administrative bodies compile the data for the facilities and establishments under their jurisdiction and report it to the central ministries. The central ministries have established a system whereby each ministry submits data to the Ministry of Natural Resources and Environment, which then compiles the overall GHG emissions of Vietnam and prepares a consolidated report. Thus, the results of the survey on the legal and institutional aspects showed that Vietnam already has a legal system for GHG management, and that basic matters such as systems and processes have been established.

However, interviews with government agencies and companies that manage GHG emissions revealed that these systems and frameworks are not always fully functional. As the reason for this, those involved uniformly stated that there is a lack of specific implementation guidelines and manuals. Essentially, the CMS is a system for calculating GHG emissions, determining the current status, setting reduction targets and implementing specific emission reduction measures, and for each management target, a GHG emissions calculation method and the emission factors required for the calculation are in place. At the organizational level, GHG emissions are calculated by multiplying the amount of activities in the supply chain by an emission factor. At the product level, GHG emissions are calculated by multiplying the amount of input in each process during the product life cycle by an emission factor. However, while Vietnam's GHG emission control system has basic requirements, such as who is responsible for what process, there is still room for improvement in the formulas and emission factors required for actual calculations. As mentioned above, the formulas are to be defined in the

notifications of each ministry and agency. Currently, however, only the methodologies for the energy and industrial process sectors prescribed by the Ministry of Industry and Trade and the waste sector prescribed by the Ministry of Natural Resources and Environment are in existence. Furthermore, the only specific calculation formulas that are clearly defined in those notifications are those related to electricity use and fuel combustion. For the others, the formulas are either not clearly specified or, even if they are, as in the examples below, they simply add up different emission reductions and are not specific formulas for calculating emissions, making it difficult to calculate emissions.

$$ER_{WR} = ER_{WRPj} + ER_{WRIj}$$

ER_{WR} : GHG emission reductions

ER_{WRPj} : Emission reductions from reusing waste

ER_{WRIj} : Emission reductions from recycling waste instead of incineration or landfill

More than 300 data sets for emission factors have been established in a notification from the Ministry of Natural Resources and Environment. Some of the emission factors are equivalent to those used in Japan and internationally, such as those for electricity use and fuel combustion, but others, such as the methane emission factor per dairy cow, have no clear basis for their calculation. In addition, the emission factor for the combustion of plastic waste is 100%, which is difficult to interpret as an original emission factor, and there is much room for improvement. In addition, the emission factors for raw materials and products required for calculating indirect GHG emissions in a company's supply chain and carbon footprint (CFP) are extremely limited. As a result, when each company tries to calculate GHG emissions at the facility or office level, GHG emissions associated with the use of electricity or specific fuels can be calculated, but other indirect emissions and CFPs are almost impossible to determine. Thus, the current legal system is still in the process of being developed, and it is in resolving these issues that

there is a need for assistance from Japan's knowledge and experience. In FY2024, based on the results of this study, we plan to formulate manuals and guidelines for CMS in general and GHG calculation, and provide training to administrative agencies and private companies in Da Nang City.

In relation to the CMS, there were also expectations for the establishment of a carbon credit market and rule setting, mainly from the private sector in Da Nang City. With regard to the carbon credit market, Chapter 2 of Decree No. 6 stipulates that an emissions trading system and a market for the sale of carbon credits will be piloted by 2025 and fully established by 2027. Even at present, voluntary international credits are already traded in Viet Nam, and carbon credits from rice cultivation are purchased by international organizations for USD 5 per t-CO2. The participants of the CMS training program expressed that once the rules for carbon credit exchanges, creation, sales, and utilization are clarified, they will be able to actively engage in decarbonization efforts, and will be able to use carbon credits to contribute to the development of the country. To begin with, as seen in the discussion of the GHG Protocol, some participants argue that carbon credits discourage companies' efforts to reduce supply chain emissions. On the other hand, some argue that they have the effect of promoting decarbonization efforts by providing sales profits to farmers and forestry workers, as in the case of agricultural credits and afforestation credits. In Japan, except for some credits, these credits are not a means of reducing Scope 1-3 emissions as defined by the GHG Protocol. However, as concluded in the Paris Agreement Article 6 Consultation, high-quality credits with a clear rationale should be recognized for their effectiveness in reducing GHG emissions, and they can be expected to stimulate the decarbonization efforts of Da Nang City.

3-2 CMS Calculation Training

In FY2023, the CMS calculation training was conducted for administrative agencies and private companies in Da Nang City,

starting from the background concepts of CMS to specific GHG emissions calculation, in order to improve the basic skills required for CMS implementation and to raise awareness about CMS. The training was held in parallel with the 12th Urban Development Forum organized by Yokohama City and Da Nang City, and was hosted by the Da Nang Department of Industry and Trade (DOIT), with 35 participants including DOIT officials, officials from the Department of Natural Resources and Environment (DONRE), officials from Danang Hi-Tech Park and Industrial Zones Authority (DHPIZA), and employees from private companies in Da Nang City.

Table 11: Training themes

Update of Vietnam's Policy Requirement to Implement NDC and Net Zero Target~The Role of Localities and Business Facilities~ Dr. Luong Quang Huy Division Head Mitigation and Ozone Layer Protection, Department of Climate Change Viet Nam Ministry of Natural Resources and Environment Mr. Koji Fukuda Chief Advisor Japan International Cooperation Agency (JICA), NDC Implementation Support TA (SPI-NDC), MONRE
Global Trends of Decarbonization for Net Zero Ms. Junko Akagi Research Manager Institute for Global Environmental Strategies
Carbon Management System - how to calculate GHG emissions in a supply chain and Carbon Footprint of products Tsuyoshi Kiyohara Ph. Executive Vice President Carbon Free Consulting Corporation

Source: Prepared by CFC

The training was conducted under three themes, the first of which was "Policy Update on the Implementation of NDC and Net Zero Targets in Vietnam," with presentations from the Vietnamese Ministry of Natural Resources and Environment and JICA experts on the progress of the Vietnamese government's net zero targets. This helped to promote participants' understanding of the Vietnamese government's decarbonization efforts and why it is important to develop guidelines, manuals, etc. for GHG accounting and improve the capacity of government agencies and private sector officials to operate the system. The second theme was "International Trends of Decarbonization Toward Net Zero," in which IGES explained the trends of decarbonization in the international community. It pointed out that international green transformation (GX) has become an irreversible trend, and that the calculation of Scope 1-3 emissions as defined by the GHG Protocol and the calculation and visualization of carbon footprints at the product level are also important as corporate strategies. The third theme was "How to calculate GHG emissions in the supply chain and carbon footprint," and the lecture covered actual calculation methods from CFC. At the organizational level, he explained how to calculate Scope 1-3 using examples, and at the product level, he taught how to calculate carbon footprint using the same examples.

Through these lectures, we were able to promote participants' understanding of the background and current status of CMS, as well as specific calculation methods. Many of the participants expressed that their understanding of CMS had improved as a result of this training, and many were positive about taking more time and trying many more examples, with regard to calculation methods. Based on the feedback from Da Nang City, we plan to increase the number and duration of training sessions in FY2024.

3-3 Needs and Potential for JCM in Decarbonization Technologies

3-3-1 Solar Power Generation Facilities

The study on photovoltaic power generation facilities consists of three steps: in the first step, the potential for electricity supply and demand in the Hoa Khanh Industrial Park is organized; in the second step, the potential for electricity flexibility using the power distribution network is studied; and in the third step, the feasibility of electricity flexibility is examined. Of these, in FY2023, we conducted a survey on the feasibility of introducing solar power generation facilities in the industrial park, narrowed down the companies targeted for introduction, and were able to begin acquiring electricity consumption data. In this survey, we first collected basic data on facility information such as electricity consumption and roof area from companies occupying the industrial park, and then conducted a questionnaire survey of 51 companies out of 157 companies on the list of companies occupying the industrial park, narrowing down the list to those companies that have high electricity demand and can introduce solar power generation facilities in terms of facilities. As a result, 25 companies wishing to install roof-mounted solar power generation facilities were targeted, and we were able to obtain actual electricity consumption data for one of these companies. The remaining 24 companies are scheduled to receive the data in FY2024. With regard to electricity flexibility, tenants in the industrial park were classified based on their electricity demand and solar power generation potential into three categories: tenants with high demand for solar power (Tenant A), tenants with the same level of demand and power generation (Tenant B), and tenants with a surplus of power generation relative to demand (Tenant C). Based on the survey results of 51 companies surveyed in FY2023, at least 4 tenants were found to have excess electricity generated by solar power, and will continue to be scrutinized as strong candidates for the installation of solar power generation facilities.

3-3-2 Water and Wastewater Treatment Facilities, Air conditioning

This project has so far focused on the introduction of photovoltaic power generation equipment, but it has become clear that there are also local needs in areas such as water and wastewater treatment. This is one of the results of this study, and in FY2024, based on such local needs, we plan to conduct a study on Japanese technology in this field for developing JCM.

In the FY2023 survey, Da Nang City indicated that in addition to solar power generation facilities, there is a need for decarbonization in water and wastewater treatment facilities, and that they would like to consider support from the Japanese side, such as high-efficiency equipment. Hoa Khanh Industrial Park is aiming to be registered as an eco-industrial park and has a centralized wastewater treatment facility with a treatment capacity of 5,000 m3 per day, and is trying to reduce CO2 emissions by reducing water and electricity consumption. In the Son Tra area of Da Nang City, there is a concentration of fish processing plants, and since a lot of electricity and water are used for wastewater treatment from the fish and meat processing plants, there is a need to improve the efficiency of this process. A feasibility study on a project to improve the water quality of wastewater treatment was conducted jointly by a Japanese company and Osaka University as part of the 2014 Asian Water Environment Improvement Model Project. The results of the study indicated that wastewater quality and treatment costs could be improved by installing water treatment equipment using polyvinyl alcohol in existing wastewater treatment facilities. While reducing electricity and water consumption is necessary to achieve decarbonization in wastewater treatment, we will continue to study decarbonization in wastewater treatment while utilizing the results of the previous studies.

With regard to such wastewater treatment technologies, high-efficiency equipment from Japanese companies has already been installed in sewage treatment plants in Japan and Southeast Asia, and we believe that it can fully contribute to the decarbonization of Da Nang City. For example, ShinMaywa Industries' turbo blower is an

aeration blower that combines air bearing, high-efficiency impeller, and high-efficiency motor technologies, and has four characteristics: energy saving, maintenance saving, space saving, and low noise. Among these features, the energy-saving air bearing (airfoil bearing) is a simple design that does not use lubricating oil, is maintenance-free, and has a semi-permanent life because it is non-contact. In addition, the high-efficiency motor technology employs a permanent magnet synchronous motor (PMSM), which, in combination with the air-foil bearing technology, enables operation at 40,000 min-1 or higher. These technologies enable this turbo blower to reduce power consumption by more than 20% compared to ordinary blowers.

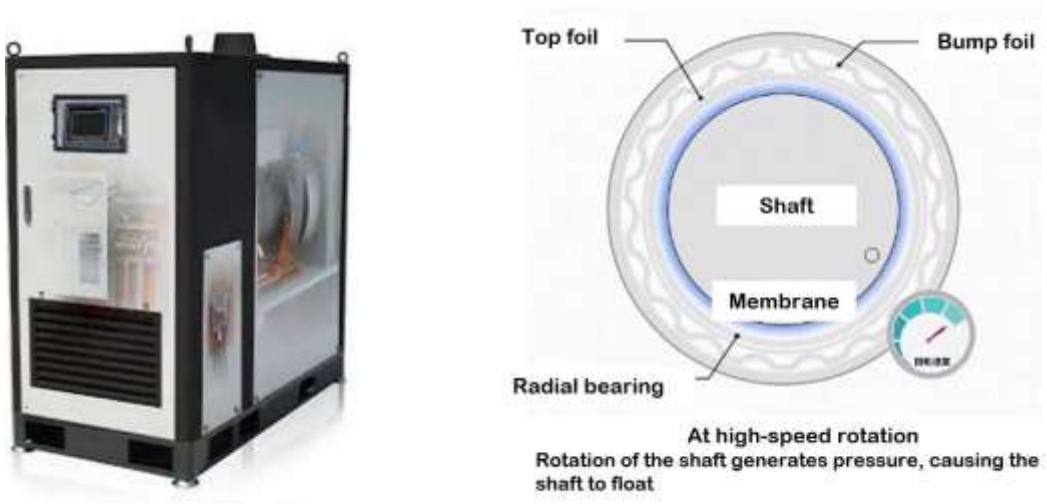


Figure 13: High efficiency turbo blower

Utsunomiya Industries' decarbonization technology is also a device that efficiently collects oily sludge (scum) generated in the sewage treatment process. In this device, a scum induction mechanism controls the upward flow generated in the tank to ensure a rectification zone, a scum peeling device uses air (bubbles) to peel off scum adhering to the walls and pipe skimmer, and a surface flow acceleration device accelerates the flow velocity to push the scum into the pipe skimmer. Installation of this device in the sedimentation

basin of a sewage treatment plant will improve the treatment capacity of the facility, prolong the life of the facility, and reduce power consumption. In particular, the system can reliably treat scum in 10 minutes per day, reducing electricity consumption by up to 1/20. Such highly efficient energy-saving technology has the potential to contribute to the decarbonization of Da Nang City, as it reduces CO2 emissions by reducing electricity and water consumption.

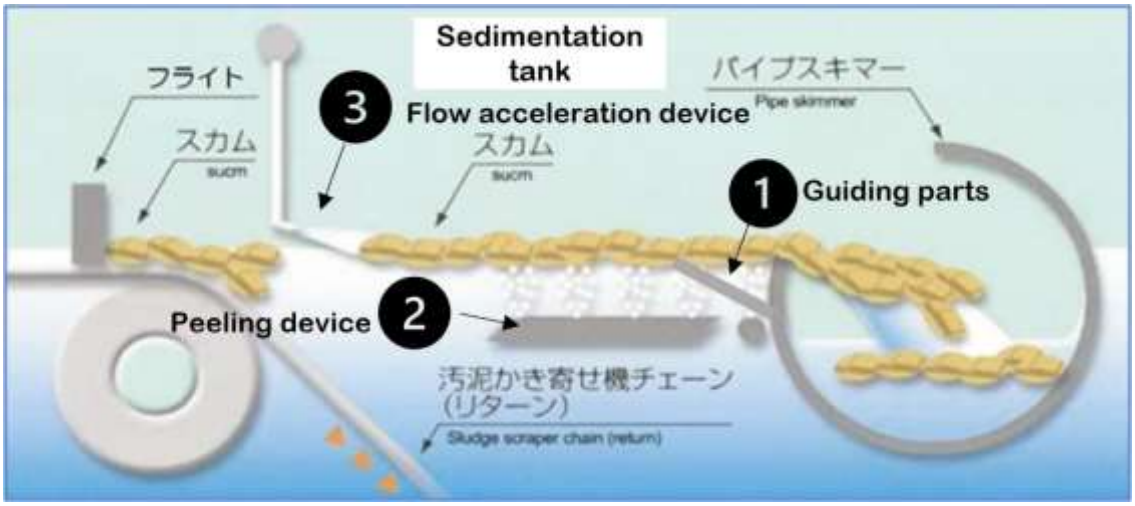


Figure 14: High efficiency scum collection device

Da Nang City also expressed interest in technology to improve water distribution efficiency, which has been deteriorating due to the aging of water pipes. A company in Yokohama has a technology to improve the efficiency of water supply by removing rust and water stains that adhere to water pipes due to age-related deterioration. Water that has passed through this device turns red rust adhering to the inside of water pipes into black rust, which coats the surface of the pipes and serves to protect them. At the same time, water that has passed through this device has the effect of removing water stains, which are mainly composed of calcium and other substances, and can improve the flow rate of water. When water distribution pipes become blocked, power consumption of pumps increases, but by using this water quality improvement device, the blockage condition of water distribution pipes can be improved and power consumption can be reduced.

Figure 15: Water quality improvement device

Furthermore, this technology can be applied to air conditioning of buildings. In buildings and other structures, cooling water is produced by circulating water through cooling towers, and by improving the efficiency of these cooling towers, power savings can be achieved. The cooling tower's water distribution pipes have a problem in that water stains such as calcium adhere to them over time, reducing their cooling efficiency. However, by installing the device to remove the water stains, the cooling tower can be operated in a power-saving manner.

3-3-3 IT technologies for visualizing the GHG emissions

In addition to the JCM candidate projects mentioned above, private companies in Da Nang City showed particularly strong interest in the GHG emissions calculation tool. According to a notice from the Vietnamese government, private companies including those in Da Nang City are required to calculate and report GHG emissions at their offices and factories by March 2025, but no specific implementation

method has been defined, and interest in calculation tools is growing from the perspective of improving operational efficiency.

As mentioned above, various companies in Japan have developed and deployed calculation tools. In FY2023, we identified these IT tools and selected Carbon Free Consulting's calculation tool as one of the candidates. This calculation tool is characterized by the fact that it can be used by introducing an original database for each company. For example, when a manufacturer company calculates GHG emissions in its supply chain, a database including emission factors for raw materials purchased by the company, emission factors for transportation, etc. can be installed in advance in this calculation tool. The user enters the amount of the relevant activity in the tool, and the GHG emissions are automatically calculated.

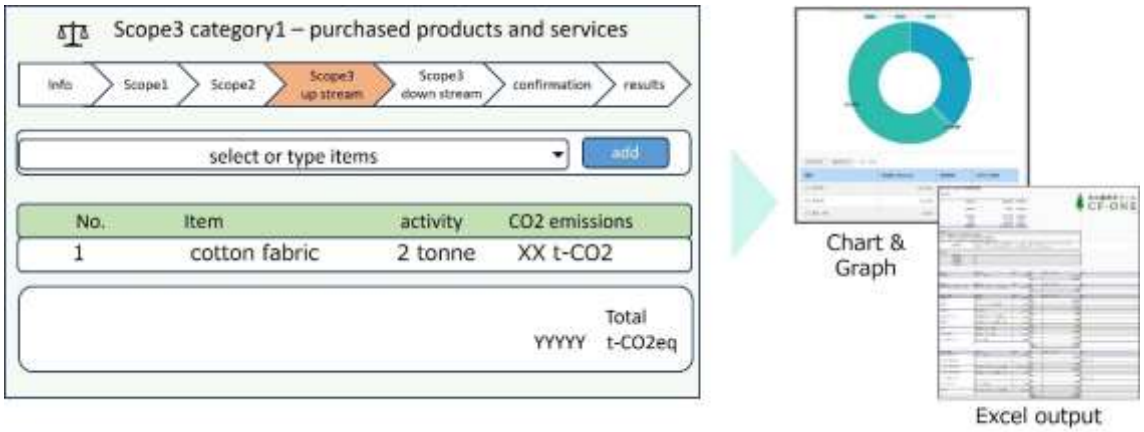


Figure 16: GHG emissions calculation tool

Thus, while the tool allows detailed settings according to the actual raw materials handled by a company, more emission factors need to be installed if the tool is to accommodate a larger number of companies. However, as this year's survey revealed, only over 300 emission factors have been installed for major sectors at this time. If manuals and guidelines for calculation methods and emission factors are developed under this project, many companies will be able to use the tool. In addition, since this tool is a web-based tool, it can be

used by multiple users simultaneously as long as they have access to the Internet, and there is no need to install it. Thus, we believe that this tool is versatile enough to be used by more companies and personnel, and can contribute to the promotion of GHG emissions visualization by companies and data aggregation at administrative agencies and central ministries in Da Nang City. 2024, we are planning to prepare a draft manual and guidelines in the establishment of a decarbonization system, and we will While coordinating the movement, we would like to investigate the feasibility of meeting the needs for such a calculation tool.

4. Lessons Learned from the Project

While the above results were obtained as a result of the study on decarbonization schemes and technologies in the first year of this project, the following lessons were also learned. All of these were identified during interviews with practitioners working on climate change measures on the ground in Da Nang City, and will be applied to activities in FY2024 and beyond.

4-1 Development of Specific Guidance in the Decarbonization System

The first lesson learned regarding the decarbonization system is the importance of having specific guidance in place to put the CMS into practice. Initially, desk research and literature review of the Vietnamese government's legislation related to the overall decarbonization system revealed that there are systems and processes in place to manage GHG emissions in various legal forms, including laws, decrees, notifications, and decisions. However, based on the existence of these legal systems, we conducted interviews with staff of Da Nang city government agencies and employees of companies in the city, who are the actual people in the field, and found that most of them understood the existence and content of laws and decrees, but did not know how to put them into practice and were waiting for the government guidance to be issued. One factory representative stated that they knew that they had to calculate the GHG emissions of each business site by the end of 2025 and report it to the responsible department in Da Nang City, but that they could not do so even if they wanted to because the data to be collected and the calculation formula were not specifically defined. Thus, even though the legal system is being developed at the central government level, there is an urgent need to develop manuals and guidelines that can actually be used by those in charge in the field.

The second lesson learned is the need to develop guidance on GHG management systems and at the same time provide training using

such guidance to improve the skills of those in charge. While there is certainly much room for improvement in the current legal system, there are some cases, such as gasoline combustion, for which formulas and emission factors have been established and GHG emissions can be calculated. However, there were many cases where the notifications defining such calculation formulas and emission factors were difficult to understand and therefore not well understood by those in charge in the field. Therefore, once manuals and guidelines are developed, it would be necessary to provide training for those in charge in the field using these manuals and guidelines. In addition, although the Da Nang City Department of Natural Resources and Environment is supposed to provide this kind of technical support, the staff interviewed stated that they themselves were not sufficiently prepared to provide assistance to the private sector because they had not received specific instructions or guidance from the central government. They stated that they were unable to do so. Given that city government officials are also responsible for verifying the results of GHG emissions calculations reported by private companies and controlling the quality of these calculations, it is also necessary to provide training for government officials and improve their capacity.

The third lesson learned is the importance of having a good understanding of the administrative structure of Da Nang City and the cooperation of the actual authorities. The project will conduct a study to introduce carbon management systems and decarbonization technologies, and will support the development of relevant plans and guidance, as well as human resource development. In the Vietnamese government, the departments in charge of climate change measures, including decarbonization, are diverse, with the Ministry of Natural Resources and Environment leading the central ministries, and the Ministry of Industry and Trade, Ministry of Transport, Ministry of Agriculture and Rural Development, and Ministry of Construction designated as the responsible ministries. In Da Nang City, in addition to the local departments of these ministries, namely the Department of Natural Resources and Environment, the Department of Industry

and Trade, the Department of Transportation, the Department of Agriculture and Rural Development, and the Department of Construction, Danang Hi-Tech Park and Industrial Zones Authority is also responsible for promoting ecological conversion and decarbonization in the industrial parks. Since Hoa Khanh Industrial Park was selected as the pilot project site, the Hi-Tech Park Management Committee, which has the authority to manage the companies occupying the industrial park, was the counterpart in this project, but the Committee does not have specific authority to manage GHG emissions, and it was the regional departments of the line ministries that issued instructions and guidance to the various establishments. In such a complex situation of numerous administrative agencies, it is essential to determine which agency has the most authority and to obtain the cooperation of those agencies.

4-2 Policy Constraints and Local Needs for Decarbonization Technologies

The first lesson learned regarding decarbonization technology is that the need for decarbonization technology is not always well understood on the ground where decarbonization efforts are being made. Questionnaires and on-site interviews were conducted with the enterprises occupying the Hoa Khanh Industrial Park this time, but 22 of the 51 enterprises surveyed had no intention of introducing the system. Reasons given included a lack of budget to cover initial investment costs and a lack of awareness of the need to use renewable energy.

This reluctance is not limited to Vietnam, but is also seen among Japanese companies. To counter this phenomenon, it is important to first raise awareness of climate change risks. In doing so, it is necessary not only to raise awareness, but also to demonstrate that addressing climate change risks will bring benefits to companies. Some companies are sensitive to the general risks of climate change and are willing to act. However, most are more concerned about the impact on sales and costs, and for such companies, the decision to

take climate change action is largely dependent on their relationships with customers and suppliers, and the intentions of shareholders and other investors. Therefore, in introducing solar power generation facilities, it is necessary to show in concrete terms how the introducing company can gain an advantage in its relationships with customers, business partners, and investors. In this regard, in Japan, customers are increasingly requesting products with lower CO2 emissions, and this is due to the Scope 1-3 concept defined by the GHG Protocol. In particular, in order to reduce Scope 3 GHG emissions (indirect emissions other than electricity use in the supply chain), large companies are increasingly asking their trading partners to reduce CO2 emissions in the manufacture of the products and services they purchase. Some companies are increasing their sales by advertising that their products have low CO2 emissions. In addition, investors, including financial institutions that are proactive in climate change measures, are increasingly using the climate change measures of companies as a basis for investment decisions and demanding that companies disclose climate change-related risks. The TCFD is a movement to require companies to disclose their climate change-related risks. Some companies and organizations are increasingly requiring that their products and services meet internationally recognized reduction targets (SBT: Science Based Targets) as a condition of procurement. Furthermore, if the emissions trading system is fully implemented by 2027, as stipulated in Decree No. 6 of the Vietnamese government, a price will be set on CO2 in the emissions trading market, which will directly lead to cost reductions for companies in reducing CO2 emissions. Thus, in order to introduce decarbonization technologies, it is important to concretely demonstrate the benefits of CO2 reduction and raise corporate awareness of climate change risks. This project will raise the awareness of private companies in Da Nang City through the formulation of manuals and guidelines on CMS and training opportunities.

The second lesson learned regarding the introduction of decarbonization technologies, similar to the lesson learned in the

decarbonization program, is the importance of understanding the characteristics of Vietnam and the administrative structure of Da Nang City, where the government has strong licensing authority, and of obtaining the cooperation of the actual authority. As mentioned earlier, since Hoa Khanh Industrial Park was selected as the pilot project site for this project, the Hi-Tech Park Management Committee was used as the counterpart, but the Vietnamese government's regulation on the introduction of roof-mounted solar power is under the jurisdiction of the Ministry of Industry and Trade, and the decision-making authority for both the policy decision and the submission of electricity consumption data for the entire industrial park was held by the Da Nang City Department of Industry and Trade. In the survey, some companies indicated that they did not wish to install solar power generation facilities because of the changes in the national regulation on the introduction of roof-mounted solar power, and the involvement of the agency responsible for national policy and policy making is extremely important in order to support the introduction of decarbonization technologies in the project. It was also found that since there is no law or government ordinance governing the installation of stand-alone PV facilities, it is necessary to wait for the government to announce its policy in order to install such facilities in the industrial parks. This is a characteristic of Vietnam, where the government has strong licensing authority, and the involvement of an agency with actual authority is essential for smooth licensing acquisition. Based on these lessons learned, from FY2024 onward, the involvement of the Department of Industry and Trade, which has primary jurisdiction over renewable energy including solar power generation facilities, will be strengthened.

5. Upcoming Events

Based on the results and lessons learned in FY2023, the project will proceed in FY2024 and beyond according to the following work process The work will continue to be carried out with decarbonization systems and decarbonization technologies as the two pillars of the Project. The specific way forward for each is described below.

Table 12 Work process

Source: Prepared by CFC

5-1 Decarbonization System

In FY2023, a study of the legal system and the institutional framework was conducted to understand the current situation in Da Nang City with regard to the decarbonization system, and in FY2024, a draft manual and guidelines will be prepared to enable the setting of GHG emission reduction targets and monitoring of progress required for the CMS. In preparing these manuals and guidelines, reference will be made to Japanese and international initiatives, and emphasis will be placed on making them usable in practice by the administrative agencies and private sector personnel in Da Nang City.

In order for a company to determine its GHG emissions, it must first collect GHG emissions data, which can be done in several ways. One is an aggregation method that uses data from representative cases, such as electricity and fuel, and calculates emissions by sector based on their economic scale, and NDC uses this method. The other is the method of accumulating the activities of companies and organizations, as described in the Corporate Guidance of the GHG Protocol. In this method, individual companies and organizations divide GHG emissions in their supply chains into Scope 1 (direct emissions), Scope 2 (indirect emissions from the use of electricity, etc.), and Scope 3 (other indirect emissions), and calculate their respective CO2 emissions. There are two methods for calculating GHG emissions in this accumulation method. One method uses primary data obtained from actual measurements of specific activities in a company's supply chain. The other method uses data from sources other than the company's supply chain, such as GHG emission factors (data from emission factor databases). In this case, GHG emissions are calculated by multiplying the amount of emissions from the source activity by the emission factor. This method is also used to calculate product-level GHG emissions, and the GHG emissions calculated here are essential information for the introduction of decarbonization technologies. This manual/guideline clarifies the advantages and disadvantages of these methods and is designed to be used by practitioners for actual calculations.

Once the draft manual and guidelines are prepared, a pilot project will be implemented with the cooperation of Da Nang City administrative agencies and private companies. In the pilot project, data will be collected from specific factories, etc., GHG emissions will be calculated, and the results will be reported to the Da Nang City government. Through this pilot project, institutional issues will be identified, and efforts will be made to revise the manual and guidelines. In 2025, the manual and guidelines will be completed and integrated into the existing system of Da Nang City.

5-2 Decarbonization Technology

With regard to decarbonization technologies, the study focuses on the introduction of photovoltaic power generation facilities and is being carried out in three steps: 1) sorting out the supply and demand potential, 2) studying the potential for energy flexibility, and 3) analyzing the feasibility of energy supply and demand. In FY2023, we conducted a study of electricity supply and demand in the Hoa Khanh Industrial Park and examined the potential of solar power generation. In FY2024, in addition to this, a study of the supply-demand balance will be conducted. A study on electricity flexibility will also be carried out. As for the solar power business, although there is a policy to promote rooftop solar power in the 8th National Power Development Plan (PDP8), the plan is still being fleshed out on a regional basis. Since the resident companies are also considering the pros and cons of installing solar power generation equipment while keeping a close eye on specific future policies, this point will be confirmed in future surveys.

In addition to solar power generation, the 2023 status survey informed us that there are other needs for decarbonization in water and wastewater treatment, and we plan to conduct a needs assessment of these needs in FY2024. As mentioned earlier, the Hoa Khanh Industrial Park has a centralized wastewater treatment plant with a capacity of 5,000 m3 per day, and there is a need to improve efficiency through energy-saving equipment. The Son Tra area also has a concentration of fish processing plants, and there is a need to improve the efficiency of wastewater treatment. Further needs are found in improving water distribution efficiency by rehabilitating distribution pipes. For these needs, there are high-efficiency blowers, efficient sludge recovery equipment and a water pipe rehabilitation device from Japanese companies. In the next fiscal year and beyond, we will examine the feasibility of introducing Japanese equipment and devices to these water treatment facilities, and work to promote the introduction of decarbonization technologies in the water treatment sector. Based on the results, we also plan to commercialize these

technologies as JCM projects.

In addition to the study of such JCM projects, the feasibility of introducing IT tools for GHG emissions visualization will be investigated. In conjunction with the design of the system and the formulation of manuals and guidelines as part of the establishment of a decarbonization system, the introduction of GHG emissions calculation tools will enable the staff in the field to effectively and efficiently calculate and report on GHG emissions. The company intends to introduce the tool in Da Nang City in FY2025.

Appendix

Document 1: CMS Calculation Training Materials

CARBON FREE CONSULTING

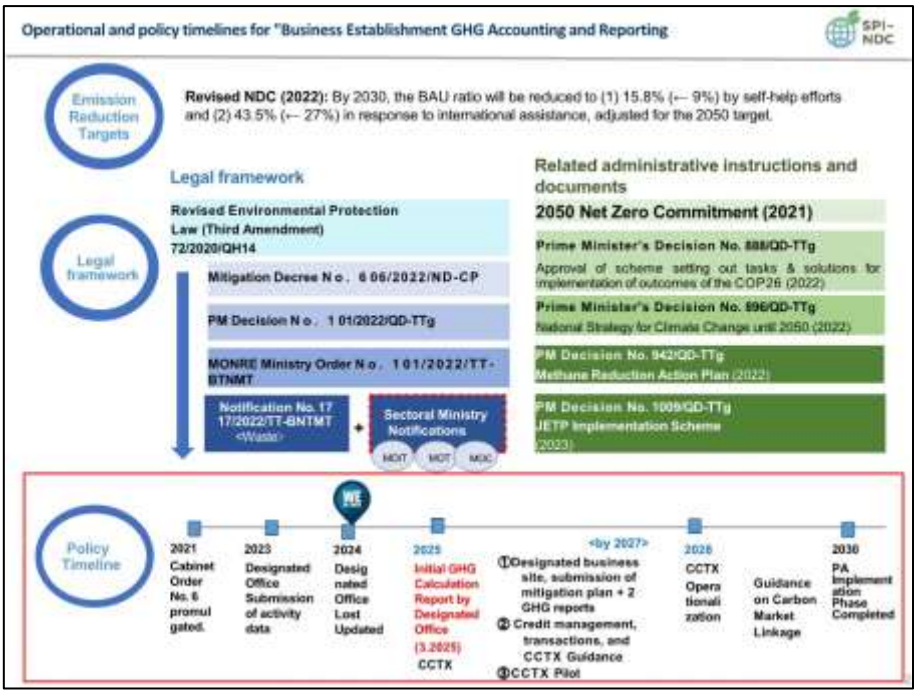
IGES Institute for Global Environmental Strategies

Training Program on Carbon Management System

Hosted by Carbon Free Consulting Corporation (CFC), Institute for Global Environmental Strategies (IGES)
Date: 15th January 2024
Venue: Rm No.1 on the 2nd floor, Danang City Administrative Centre
Language: Vietnamese/Japanese （consecutive interpreting）
URL: https://us06web.zoom.us/j/83618067912?pwd=en1ffBseUNLlcs4WjDcz0QX4fRGCOJ.1

Time	
13:30 -	**Registration** **A brief explanation of Yokohama - Da Nang City to City Collaboration Project phase 2** Tsuyoshi Kiyohara Ph.D. Executive Vice President Carbon Free Consulting Corporation
13:45 -14:05	**Update of Viet Nam's Policy Requirement to Implement NDC and Net Zero Target ~ The Role of Localities and Business Facilities~** Dr. Luong Quang Huy Division Head Mitigation and Ozone Layer Protection, Department of Climate Change Viet Nam Ministry of Natural Resources and Environment Mr. Koji Fukuda Chief Advisor Japan International Cooperation Agency (JICA) NDC Implementation Support TA (SPI-NDC) | MONRE
14:05 -14:55	**Global Trends of Decarbonization for Net Zero** Ms. Junko Akagi Research Manager Institute for Global Environmental Strategies
14:55 -15:15	**Carbon Management System - how to calculate GHG emissions in a supply chain and Carbon Footprint of products** Tsuyoshi Kiyohara Ph.D. Executive Vice President Carbon Free Consulting Corporation
15:15	**End of Program**

Update of Viet Nam's Policy Requirement to Implement NDC and Net Zero Target-The Role of Localities and Business Facilities-



Operation of "GHG Accounting and Reporting at Business Establishments" and its Implications for Local Governments

SPI-NDC

corporate side
Prime Minister's decision No. 1
Designated office

Role: By the time of business GHG calculation and reporting submission actions leading up to

- Calculation of GHG emissions per business site using FY2024 activity data and submission by March 2025 (biennial reporting thereafter)
- Methodologies are **based on the Ministry's Circulars and Technical Guidance** specified for each business sector.

- Waste 17/2022/TT-BTNMT

- Energy 38/2023/TT-BCT

- Other Major Sectors (Transportation, AFOLU, Construction)

(Facilities Division) is awaiting the formulation of the Ministry's notification.

- Emission factors are based on a list of factors updated annually by MONRE.
- Reporting format: GHG electronic reporting by MONRE System Preparation

Local Government / Department in Charge

Role: Administrative response after report submission (GHG report content check and administrative procedures)

- **Report checking system/staffing**
  Projects within the jurisdiction submitted by March 2025
  Checking of GHG reports
- **Intragovernmental Reporting Procedures**
  Reporting to provincial/municipal people's boards and the central government
  →Overall coordination by the central government
- **Prior learning about electronic payment procedures**
  Electronic reporting and payment procedures in the system
  +
- **Provincial and urban bounces for updating the list of establishments**
  Understanding the dynamics of companies within Dali (especially DEUs)

3

Challenges and Opportunities in the Design and Operation of the "Business Site GHG Accounting and Reporting

SPI-NDC

- The Vietnamese government's introduction of a GHG accounting and reporting system for business establishments and its attempt to computerize the system is a new approach to GHG emissions management.
  The project is still in its infancy, but it is a pioneering effort in Southeast Asia, following Singapore.
- Japan also operates a similar system under the Law Concerning the Measures to Cope with Global Warming (Calculation Reporting and Publication System) and an electronic system, EEGS. It is important to learn from the know-how of other countries' examples and actual operation, and to design the system according to the domestic context.
- All prior countries with similar systems experienced incremental improvements. A developmental approach that does not seek perfection from the beginning, but starts simply, works through the reporting cycle, and gradually improves and refines the system is needed in Vietnam.

GHG Reporting System Issues	✓ **Issuance of Ministry Circulars as** Basis for Sectoral GHG Calculations **+ Calculation Support Tools (Guidelines and Manuals)** ✓ Linkages between schemes (e.g., energy consumption reporting) ✓ Alignment with corporate ESG reporting requirements (reduced reporting burden) ✓ Handling (disclosure) of reporting results, etc.	✓ Operational Pilot ✓ Fulfillment of calculation support tools ✓ Inter-institutional cooperation ✓ policy reform
Challenges of system computerization	✓ Timing of each ministry's notification as the basis for GHG calculation ✓ Establish operational conditions for the electronic system: establish hardware/implementation system for the system by the Vietnamese government (secure servers, personnel and resources) ✓ Information Management/Security, Confidentiality	✓ Vietnamese government actions (notification, implementation system) and information management
Establishing the capacity needed to operate the system	✓ GHG calculation method acquisition needs by target companies and establishments ✓ GHG Reporting Appraisals and Checking Capacity Improvement Needs by Local Government Officials and Departments in Charge	✓ Training sis turning a film, novel, etc. into a tempo ✓ Help Desk 8

Strengthening of business sites' GHG calculation capacity through NDC implementation support
(JICA SPI-NDC)

Targeted, Hands-on GHG/ER Quantification Training for Selected Business Sectors

Kick-off Seminar (NDC/Net Zero) → Business Leaders' Forum → Sector-focused Training (Facility GHG emissions on-site calculation/mitigation planning)

All biz sectors
180 Participants

CEOs and Managers
67 Participants

Cement
50 Facilities
96 Participants

Food & Beverage
194 Facilities
226 Participants

Waste
76 Facilities
304 Participants

Paper &Pulp
69 Facilities
275 Participants

Textile
282 Participants

2021 | **2022**.6.30 | 10.27 | 12.14-15 | **2023**.3.15 | 4.18 | 7.17 | 11.8

- **Pilot GHG quantification** with selected facilities (Cement, Waste, Paper&Pulp)

- Observed **high learning demand** for biz facilities, **interaction** among participating facilities
- **Uptake** from international trends, progressive companies' case studies for each biz sector

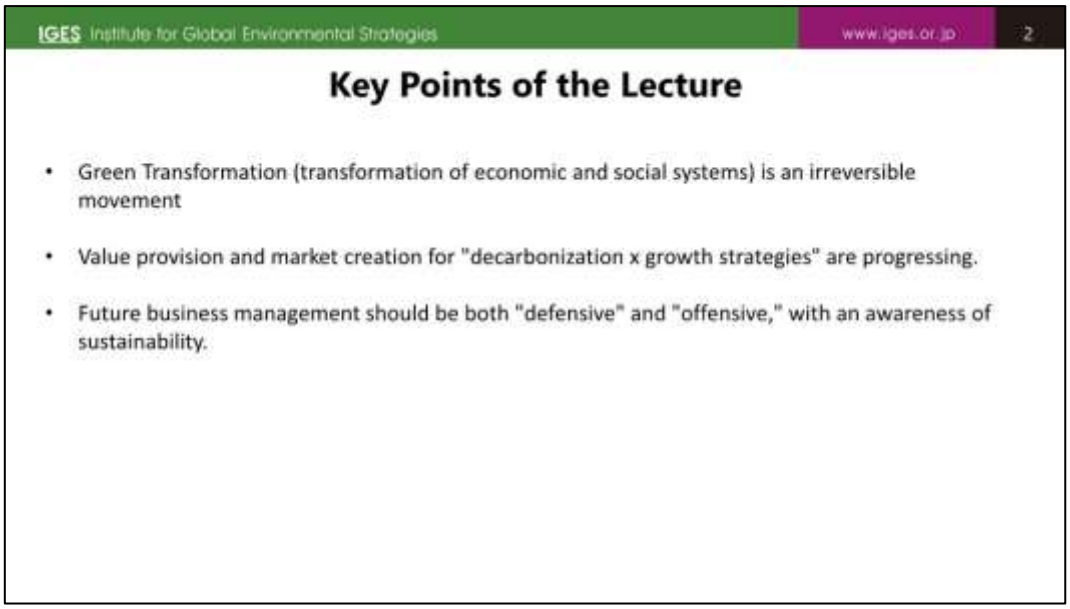
Alignment with key policies in mitigation plan

Task	Activities (2022-2030)	
1. innovation in strategy, policy, MP and planning	■ Review of financial and fiscal measures including green credits ■ Introduction of carbon tax ■ Domestic Carbon Market ■ Credit Transaction Regulations pertaining to Article 6 ■ GGS A/P Formulation ■ Net Zero Mainstreaming Guidance to Major Plans	■ NCCS2 ■ Methane Emissions A/P ■ NDC-ISP ■ NDC Revision 2 ■ Offshore Wind Research ■ Green procurement, etc.
2. energy and industrial transformation	■ PDP8 ■ Energy Transition A/P(2021-30) ■ Study on elimination of gasoline and diesel vehicles by 2040 ■ **New industry development (offshore wind, ammonia fuel, electric/hydrogen fuel, SMR, storage technology)** ■ consumer energy conservation	■ EV Promotion ■ **Renewable energy promotion measures (revenue mechanism, microgrid, electricity load regulation)** ■ CCS ■ Methane Event Survey
3. transportation and construction	■ Promote modal shift (BTR, MRT (Hanoi, HCM)/Metro, Monorail (HCM)) ■ EV charging stations at high speeds ■ ZEB	■ Urban Greening Assessment ■ GG Urban Planning 26 Pilot, et al.
4. lulucf	■ Methane Reduction Plan ■ Expansion of forest absorption	■ Reforestation and carbon stock savings ■ Blue carbon survey, etc.
5. natural resource management	■ Final disposal site gas recovery ■ compost ■ WTE	■ Energy recovery including plastic. ■ Waste and wastewater-derived methane surveys, etc.
6. climate change adaptation	■ NAP revision ■ M&E Regulations ■ Coastal Disaster Prevention Infrastructure ■ NBS ■ Enhanced weather observation and forecasting	■ SLR Forecast ■ Urban Adaptation Model Analysis ■ Mekong Delta Adaptation Program ■ Central Plateau/Low-income housing enhancement ■ Northern flood control, etc.
7. scientific research, CB and awareness raising	■ Low Carbon Technology Survey ■ Science and technology programs that take into account net-zero ■ Sectoral emission factor development, etc.	
Just Transition	■ Consideration of Just Transition suitable for Vietnam's climate	
9. climate diplomacy	■ Diplomatic Activities to Establish Vietnam's Position in the Multilateral Environment,	

TRÂN TRỌNG CẢM ƠN!

Thank you for your attention.


Global Trend of Decarbonization Toward Net Zero
Global Trends of Decarbonization for Net Zero
Junko Akagi
IGES Kitakyushu Urban Center
research manager
Intercity Cooperation Project for Realization of Decarbonized Society (Da Nang City and Yokohama City)
Online training Monday, January 15, 2024
IGES
Institute for Global Environmental Strategies


IGES Institute for Global Environmental Strategies
www.iges.or.jp
2
Key Points of the Lecture
• Green Transformation (transformation of economic and social systems) is an irreversible movement
• Value provision and market creation for "decarbonization x growth strategies" are progressing.
• Future business management should be both "defensive" and "offensive," with an awareness of sustainability.

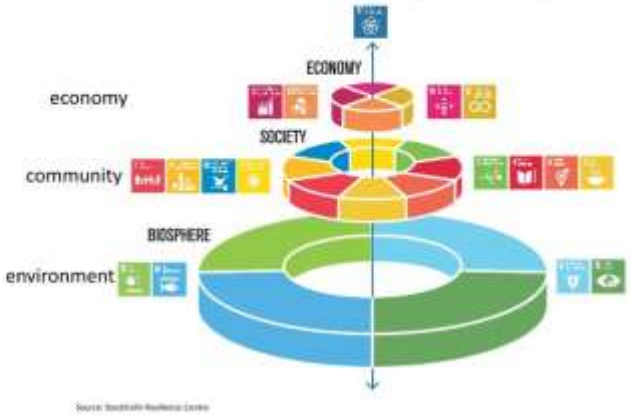
An era in which economic and social systems need to be reformed

- Green transformation
- Transformation to use as little fossil fuels as possible and to use clean energy and the activities aimed at achieving this
- The goal is to "achieve carbon neutrality" x "strengthen industrial competitiveness

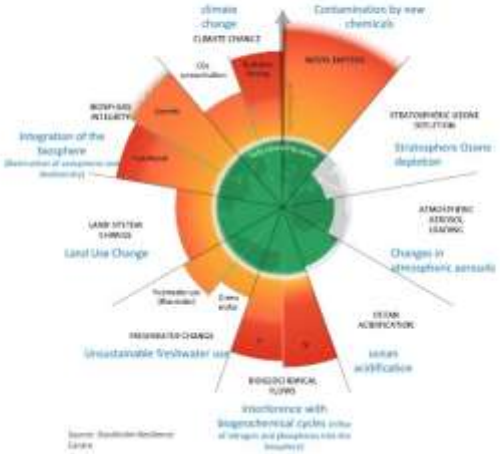
Carbon neutrality means balancing greenhouse gas emissions and absorption

Healthy economic activity is only possible with a healthy environment.

Environment > Society > Economy



As it is now, exceeding the "limits of the earth"



- Planetary Boundaries
  - ✓ The concept that "there are boundaries of the global environment that must not be crossed in order for humans to survive sustainably on the Earth.
  - ✓ Assessed by 9 items (left chart)
- Climate change indicators (CO_2 concentrations, radiative forcing) are already in the danger zone

Climate change is the biggest risk factor

- More than 1,200 experts from the World Economic Forum (WEF) network responded
- In the medium to long term, the biggest risk is "failure to combat climate change" (unchanged for the last 10 years)

Sustainability trend accelerates from around 2015

Paris Agreement (1985) × fund shift

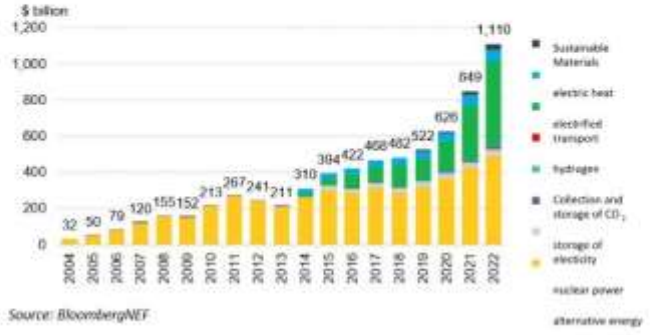
- International Framework to Combat Climate Change after 2020, adopted in 2015. Countries around the world will work towards achieving the following goals.
- Limit temperature rise to "less than 1.5° C"[※] compared to pre-industrial times.
- Aim for virtually zero greenhouse gas emissions by 2050
- Aim to halve greenhouse gas emissions by 2030

- In 2006, the United Nations proposed the Principles for Responsible Investment (PRI) for institutional investors to incorporate ESG (Environmental, Social and Corporate Governance) into their investment process.
- Accelerated divestment from fossil fuels investment (divestment)
- Strengthening the encouragement of companies from investors and financial institutions to decarbonize (Engagement + Transition Financing)

Increased investment in clean energy

In 2022, total global investment reaches $1.1 trillion, on par with support for fossil fuels

Low-carbon energy investment



Source: BloombergNEF

From 2020, "Carbon Neutral Siege."

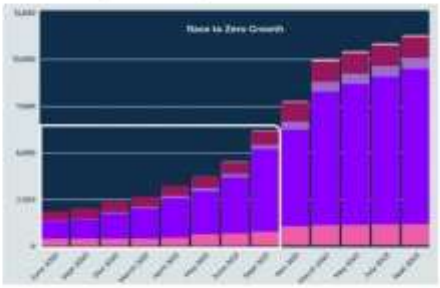
Status of national carbon neutrality declaration

2023年5月：158ヶ国

カーボンニュートラル宣言状況（国・地域数）	CO2排出量に占める割合
2050年までのカーボンニュートラル：147ヵ国	(80.2%)
2060年までのカーボンニュートラル：156ヵ国	(82.2%)
2070年までのカーボンニュートラル：158ヵ国	(89.5%)

Non-governmental actors participating in Race to Zero

In September 2022, 11,309 organizations participated,
Of these, 80% are companies and financial institutions



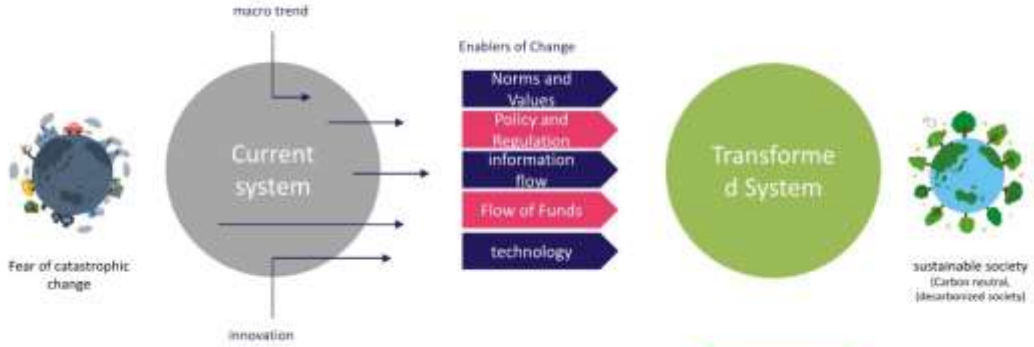
*Non-government actors: companies, financial institutions, cities, academic institutions, investors, etc.

Decarbonization x Growth Strategy

Success or failure of decarbonization efforts directly affects the competitiveness of companies and nations

United States of America	EU	Japan
• Inflation Control Act (August 2022): approx. 50 trillion yen in government support • Ensure predictability with 10-year commitment to government support • Measures to promote investment in a manner proportional to production volume, in addition to initial investment support	• Europe Green Deal: Public and private investment of approx. 140 trillion yen • Effective use of EU-ETS (Emissions Trading Scheme), etc. • Announced a bill to increase investment in the region (e.g., a goal of over 40% self-sufficiency in key technologies in the region).	• GX Promotion Basic Law (July 2023): Over 150 trillion yen investment by public and private sectors • Strengthening Transition Finance • Development of emissions trading schemes • Embodiment of the government's 20 trillion yen investment promotion measures
Greenhouse Gas Emission Reduction Targets		
• 2030: 50-52% reduction (compared to 2005) • 2050: Carbon neutral	• 2030: 55% reduction (compared to 1990) • 2050: Carbon neutral	• 2030: 46% reduction (compared to FY2013) • 2050: Carbon neutral

Transformation of economic and social systems is an irreversible movement



A vision of the future envisioned by a group of Japanese companies

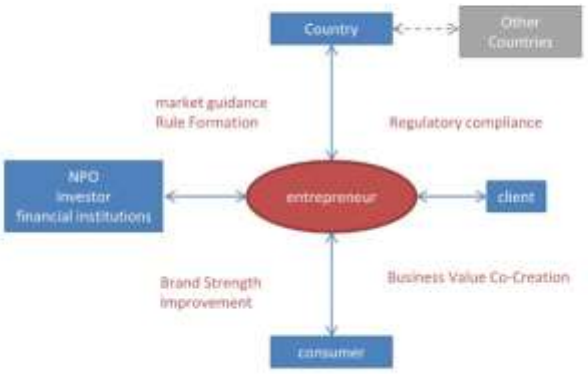
A society where organizations, people, businesses, and products/services that practice "Earn + Decarbonize" are valued.

GX League

Exercise with 101 companies participating voluntarily (2022)

Nearly 600 companies participate in the GX League

Era of "co-creating" a market where value is evaluated in terms of "carbon



Emissions per organization
- Assessing emissions associated with organizational activities
- Regulatory compliance and sustainability information disclosure
- GHG Protocol (Scope 1, 2)

Overall supply chain (SC) emissions
- Assessing emissions associated with SC-wide activities
- Regulatory compliance and sustainability information disclosure
- GHG Protocol (Scope 1-3)

Emissions per unit of product or service
- Evaluate emissions per unit product or service
- Regulatory compliance, appeal to consumers and business partners
- Carbon Footprint/LCA

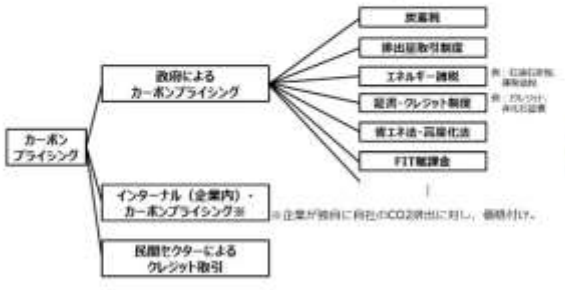
Reduction contribution of products and services
- Evaluate effectiveness per unit product or service
- Appeal to consumers and business partners
- WBCSD Guidelines

Reduction per project (PJ)
- Evaluate reductions associated with PJ implementation
- Regulatory compliance, appeal to consumers and business partners
- Guidelines for J-Credit, JCM, and other schemes

carbon pricing

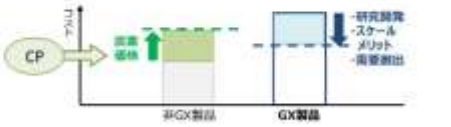
A policy approach that puts a price on CO_2 (carbon) emitted by companies and other entities, thereby changing the behavior of emitters.

Classification of Carbon Pricing



Eliminate carbon leakage

Appeal to consumers and business partners



Global Carbon Pricing Implementation Status

Covers 23% of global GHG emissions as of 2023

Implemented at the national level 39

Implemented at local level 33

Means of evaluating the organization's efforts

Supply chain emissions = Scope 1 emissions + Scope 2 emissions + Scope 3 emissions

Scope1：事業者自らによる温室効果ガスの直接排出(燃料の燃焼、工業プロセス)
Scope2：他社から供給された電気、熱・蒸気の使用に伴う間接排出
Scope3：Scope1、Scope2以外の間接排出(事業者の活動に関連する他社の排出)

Brand owners begin to reduce "Scope 3" emissions

Cooperative reductions among companies or sourcing from companies with low emissions?

Toyota requests parts suppliers to reduce emissions by 3% in 2009
Decarbonization in the supply chain

Japan Construction Industry Association
Reduction of CO_2 emissions during the construction phase

Fast Retailing (UNIQLO)
Supply Chain Emissions Reduction Initiatives

Honda, 50-year CO_2 zero across its entire procurement network
Requested 4% annual reduction

Demands on main component manufacturers

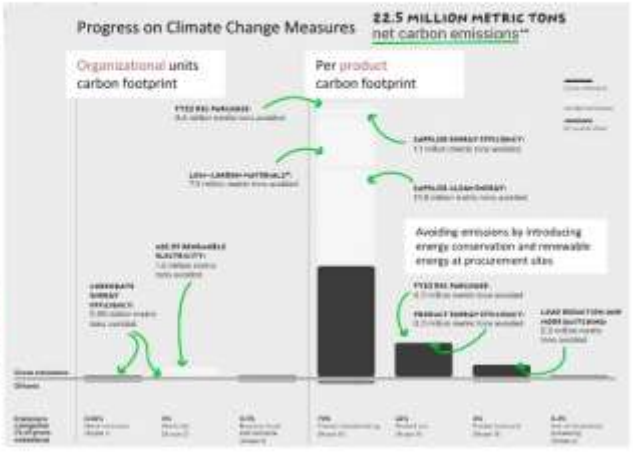
solution (esp. to a problem)
- Electrification of cars
- renewable electricity

Sources: Nikkei Electronics Edition, Nikkei Sekeha Shimbun Electronic Edition, "Voluntary Action Plan for the Environment in the Construction Industry, Version 7, FY2022-2024.

Source: Nikkei ESG

Apple also works with suppliers to reduce Scope 3 emissions

Climate change, resources, and smarter chemistry initiatives



Source: Apple "2022 Environmental Progress Report"

Means of evaluating the value of products and services

Carbon Footprint (CFP) = CO_2 emissions from raw material procurement to disposal

Appealing to consumers for value with CFP

Appealing to business partners for value with CFP

The world's largest general chemical manufacturer

Evaluation of all products (approx. 45,000 items) completed (2020)


BASF

We create chemistry

News Release

BASF、全製品のカーボンフットプリントを算出

In the future, pharmaceuticals will also be used.

Europe's Carbon Border Adjustment Mechanism (CBAM)

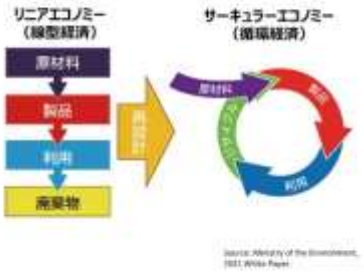
- A mechanism to charge for certain imports with high emissions in order to prevent carbon leakage (outflow of industry to countries with less restrictive emission limits).
- From January 2026, a surcharge burden equivalent to the direct emissions generated in the production process of the subject products imported into the EU and, for cement, electricity and fertilizers, the indirect emissions to which the electricity consumed in the production process corresponds, will be required.
- This will take the form of the purchase of "CBAM Certificates" at a price equivalent to that of the EU-ETS.
- Transition period: October 1, 2023 - December 31, 2025
  *Reporting required, no surcharge
- The items covered are as shown on the right. They will be expanded in the future.

Classification	Target Products	Target emissions at the time of full-scale application
cement	Kaolin clay, cement clinker, white cement, alumina cement, other hydraulic cements	Direct/Indirect
electric power	electric power	Direct/Indirect
fertilizer	Nitric acid and nitrous sulfuric acid, anhydrous ammonia and ammonia water, nitrates, nitrogen fertilizers and other fertilizers	Direct/Indirect
iron and	Iron and steel (except ferrosilicon, ferrosiliconsanganese and other silicon compounds and steel scrap), condensed iron ore, steel sheet piles and welded steel shapes, rails (railroad construction materials), cast iron pipes, steel pipes and fittings, structures and parts thereof, steel storage tanks, drums, cans and other containers, screws, bolts, nuts, rivets and other steel products	Direct discharge only
aluminum (Al)	Aluminum ingots (except scrap), powder, flakes, rods and profiles, wires, plates, sheets and strips, aluminum foil, aluminum pipes and fittings, containers such as tanks, drums and cans, aluminum containers for compressed or liquefied gases, stranded wires, cables, braids, etc. (except electrically insulated) (excluding electrically insulated ones), and other aluminum products	Direct discharge only
chemicals	hydrogen	Direct discharge only

Regulations to curb mass production and mass consumption

EU bans disposal of unsold clothes and shoes from two years later (Nikkei, December 6, 2023)

- Proposed amendments to the "Eco-Design Regulations" requiring environmentally friendly design of products.
- Encourage reuse, recycling into other products, repairs, donations, etc.
- Have each garment manage and disclose data on the origin and processing location of raw materials, greenhouse gas emissions over the entire life cycle, and utilization rate of recycled raw materials.



Traceability: Data linkage infrastructure is being developed.

gaia-x

European cloud/data infrastructure building project

Catena-X

The automotive industry's first collaborative, open, decentralized and organized data ecosystem with uniform standards and sharing principles

Ouranos Ecosystem

Japan's Data Linkage Initiative

Use cases vary. Real data distribution between different industries is also in view.

現在

- サプライチェーンCO_2排出量は、業界平均値に基づいて把握することが多い
- 「削減効果が算定結果に反映されない」構造になりやすい

活動量 × 排出原単位 = CO_2排出量

Ex. エネルギー使用量 調達・出荷・運動費用

Ex. 統計データなどの業界平均値

あるべき姿

- 各社固有のリアルな排出量データ（一次データ）を交換させることで、企業はこれを排出原単位として活用し、事業成長と脱炭素を両立できる

Decarbonization can be promoted in tandem with other initiatives

Note: "X" is the wording used in the Japanese policy

GX green transformation	Activities for change and the realization of clean energy with as little fossil fuel use as possible, aiming for carbon neutrality in 2050.
SX Sustainability Transformation	Initiatives to synchronize social sustainability with corporate sustainability and to implement the necessary management and business reforms to achieve this goal, thereby enhancing corporate value over the long term and on a sustainable basis.
NX Nature-Based Transformation	Efforts to halt and reverse biodiversity loss under the Kunming-Montreal Biodiversity Framework (2022), a global goal to be achieved by 2030 (Nature Positive / Nature Restoration)
DX Digital Transformation	Initiatives that transform social systems and organizational culture through the provision of new products and services and the development of new business models by utilizing digital technology.
Circular Economy	In addition to conventional 3R initiatives, economic activities that generate added value through services and other means (circular economy) while reducing resource input and consumption and making effective use of stock
ESG Investment	Investments focusing on a company's environmental, social and governance initiatives (non-financial information)

Image of each relationship

GX/NX and SX can be promoted as a single unit, but GX/NX needs to be aware of the time axis

summary

- Green Transformation (transformation of economic and social systems) is an irreversible movement
- Value provision and market creation for "decarbonization x growth strategies" are progressing.
  - Businesses, products and services that emit less CO_2 are more likely to be selected
  - Businesses, products and services that emit a lot of CO_2 are less likely to be chosen
- Future business management should be both "defensive" and "offensive," with an awareness of sustainability.
  - Defend: Know your company's greenhouse gas emissions status and take action (save money & comply with regulations)
  - Aggressive: Identify and promote the carbon footprint of your products and services (appeal to consumers and business partners)
- CO_2 Understanding and managing emissions data is a must. Why not start by understanding your company's situation?

Thank you for your attention.

akagi@iges.or.jp


Ce qui nous unit
What brings us together
carbon management system
how to calculate GHG emissions in a supply chain and Carbon Footprint of products
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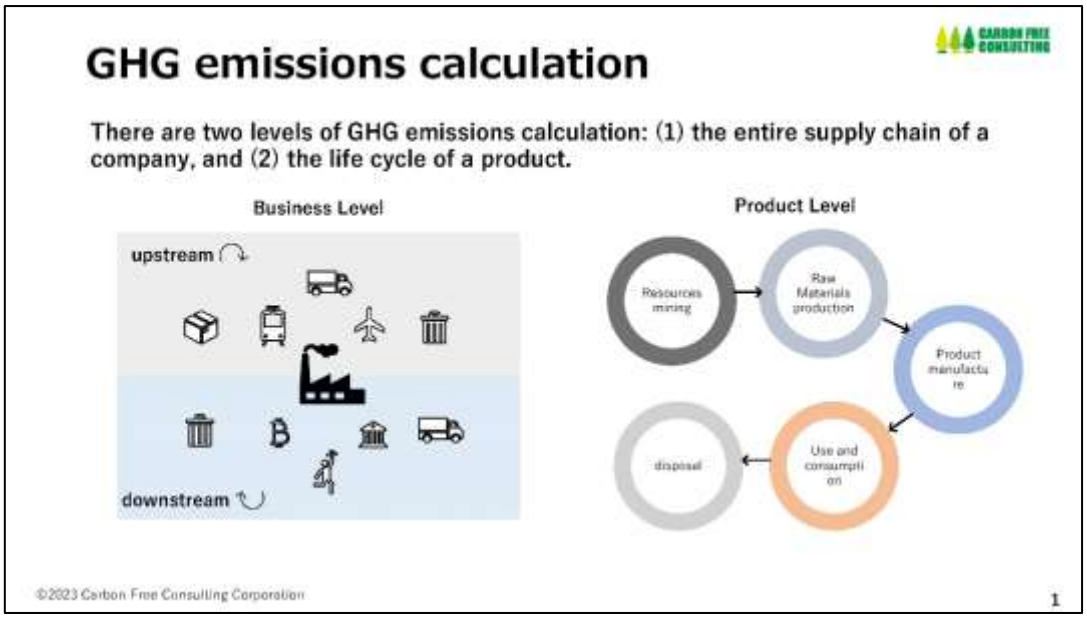
GHG emissions calculation
There are two levels of GHG emissions calculation: (1) the entire supply chain of a company, and (2) the life cycle of a product.
Business Level
upstream
downstream
Product Level
Resources mining
Raw Materials production
Product manufactu re
Use and consumpti on
disposal
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1

Business Level

At the company level, we calculate Scope 1, Scope 2, and Scope 3 in the company's supply chain based on the GHG Protocol.

Scope 1

Direct corporate emissions

*GHG emissions from burning fossil fuels and leaking CFC gases at our own facilities.

Scope 2

Indirect emissions from energy purchased by companies

*GHG emissions from the use of electricity, heat, and steam purchased and used by the company.

Scope 3

Other indirect emissions in the supply chain

*There are 15 categories, including raw material production, disposal, and employee commuting.

Scope 3

Upstream category

1. Products and services purchased
2. capital goods
3. Production of fuel and electricity used
4. Transportation, delivery (upstream)
5. Waste from business
6. Employee travel
7. Employee Commuting
8. Leased assets (upstream)

Downstream category

9. Transportation and delivery (downstream)
10. Processing of sold products
11. Use of products sold, etc.
12. Disposal of sold products
13. Leased assets (downstream)
14. franchise
15. investment

Company Level Calculation Method

- ✓ Calculated by multiplying the company's activity by an emission factor.
- ✓ Emission factors vary from country to country and industry to industry, so choose one based on reliable data.

Scope1

$$E = EN \times EF$$

	Definition.	unit
E	Greenhouse Gas Emissions	t-CO2
EN	Fuel consumption	kl...
EF	emission factor	t-CO2/kl...

Example: If company A uses 420 kl of diesel fuel per year and the emission factor for diesel is 2.585 t-CO2/kl, what is the amount of CO2 emissions?
(A) **1,086** t-CO2
GEM = EN x EF = 420 x 2.585 = 1,085.7

Company Level Calculation Method

Scope2

$$E = EL \times EF$$

	Definition.	unit
E	Greenhouse Gas Emissions	t-CO2
EL	Electricity consumption	kWh
EF	emission factor	t-CO2/kWh

Example: If Company A uses 1,957,000 kWh of electricity per year and the emission factor for electricity is 0.000443 t-CO2/kWh, what is the amount of CO2 emissions?
(A) **867** t-CO2
GEM = EL x EF = 1,957,000 x 0.000443 = 867.0

Company Level Calculation Method

1 **Scope3**
Products and services purchased

$$E = Aproduct \times EF$$

	Definition.	unit
E	Greenhouse Gas Emissions	t-CO2
A	activity level	Currency, kg, m2...
EF	emission factor	t-CO2/activity unit

Example: If pig iron (pig iron) purchased by company A is 213 tons per year and the emission factor of pig iron is 1.35 t-CO2/t, what is the amount of CO2 emissions?
(A) **288** t-CO2
GEM = Aproduct x EF = 213 x 1.35 = 287.6

Company Level Calculation Method

4 9 **Scope3**
Transportation & Delivery

$$E = D \times W \times EF$$

	Definition.	unit
E	Greenhouse Gas Emissions	t-CO2
D	distance	km
W	weight	ton
EF	emission factor	t-CO2/tkm

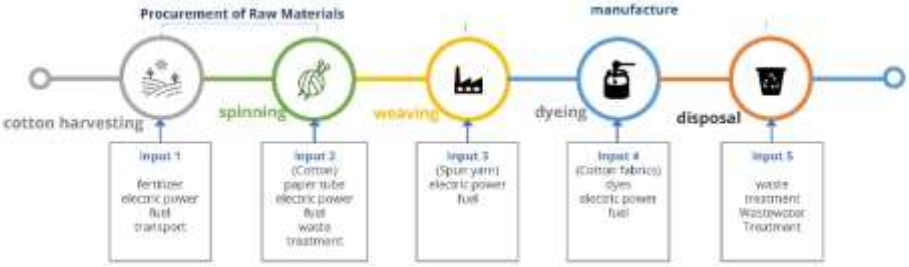
Example: If company A purchases 213 tons of pig iron per year from company B (170 km away) by 10-ton truck, what is the amount of CO2 emissions from the transportation? The emission factor for a 10-ton truck is 0.00013 t-CO2/tkm.
(A) **5** t-CO2
GEM = D x W x EF = 170 x 213 x 0.00013 = 4.7

Product Level

At the product level, we use the Life Cycle Assessment (LCA) method to calculate GHG emissions over the product's life cycle. The product system and calculation method are set up prior to the calculation.

cotton textiles

Product system (scope of calculation)	Cotton harvest → spinning → weaving, dyeing, and disposal
Condition Setting	Assumes 1 m2 of cotton fabric is produced
Calculation Method	Calculated using emission intensity for each activity



Product level Calculation method

$$E = \sum_{i=1}^{n} Ai \times EFi$$

	Definition.	unit
E	Greenhouse Gas Emissions	t-CO2
A	activity level	Currency, kg, m2...
EF	emission factor	t-CO2/activity unit

Product level Calculation method

Example: Manufacturing process for 1 m2 of cotton fabric (from raw material procurement to production).
All emission factors are tentative.

raw material etc	putting in (personnel, etc.)	activity level	unit	Emission coefficient	amount of discharge kg-CO2
Input 1	fertilizer	1	kg	1.5	1.500
	electric power	0.007	kWh	0.4	0.003
	fuel	0.100	L	2.5	0.250
	transport	0.700	km	0.	0.070
Input 2	paper tube	0.0..0	kg	1.3	0.013
	electric power	0.200	kWh	0.4	0.080
	fuel	0.100	l	7.5	0.750
	waste treatment	0.07	kg	1.5	0.105

material actors	putting in (personnel, etc.)	activity level	unit	Emission coefficient	amount of discharge kg-CO2
Input 3	electric power	0.150	kWh	0.4	0.060
	fuel	0.100	l	7.5	0.750
Input 4	dyes	0.0..0	L	2.5	0.020
	electric power	0.100	kWh	0.4	0.040
	fuel	0.200	l	7.5	0.500
Input 5	waste treatment	0..	kg	1.5	0.150
	wastewater treatment	1	L	1.0	1.000

Total 4.241 kg-CO2/m2

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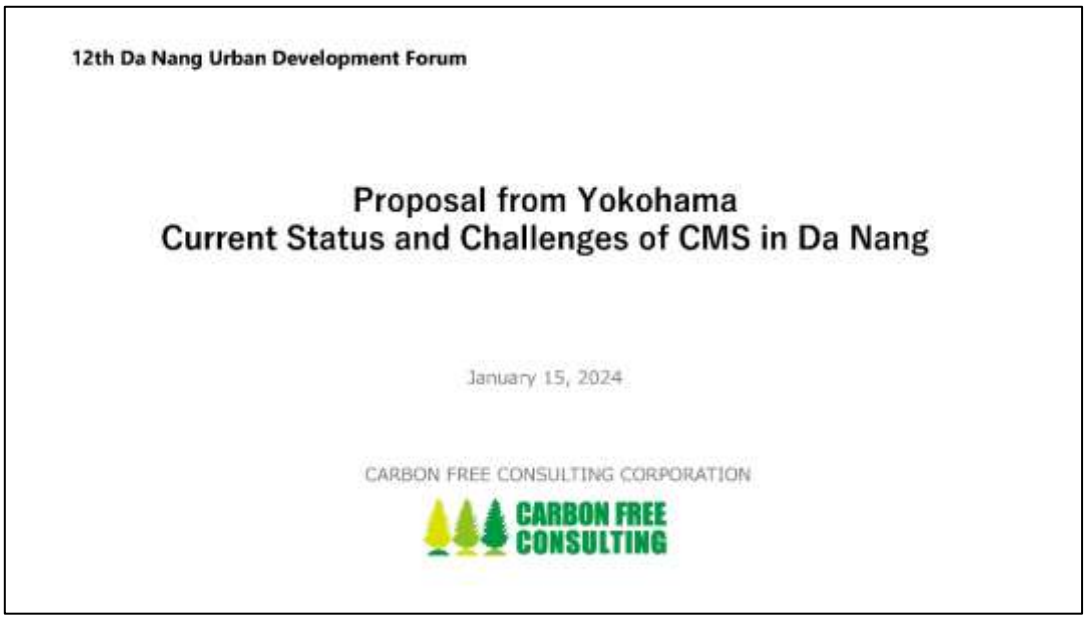
Document 2: Reporting Material at the 12th Da Nang Urban Development Forum



1-1 Legal Framework for CMS

Law on Environmental Protection(72/2020/QH14)

Basic Law on Environmental Protection, including Climate Change (LEP, enacted in 2014, revised in 2020). The law sets out the basics of GHG management, establishment of a national system, reduction measures and monitoring, in addition to environmental protection policies, organizations, individual rights, and environmental impact assessment. It is also the basis for the Vietnamese government's NDC (43.5% GHG reduction by 30 years). Translated with DeepL.com (free version)

Decree on GHG mitigation/ozone layer protection/carbon markets(6/2022/ND-CP)

The decree establishing mandatory GHG accounting and reporting requirements and procedures. Under the coordination of the Ministry of Natural Resources and Environment (MONRE), each ministry and agency is responsible for promoting GHG measurement, reporting, and verification at the municipal and facility level through the formulation of GHG emission reduction plans, notifications, and guidelines. Private companies that own facilities are also required to submit GHG emission reduction plans and report their progress regularly.

Prime Minister's Decision on Sectors and Businesses Subject to GHG Calculation and Reporting (1/2022/TTg)

Lists sectors and establishments subject to GHG accounting and reporting. It also stipulates the implementation of the establishment and updating of an online DB by MONRE.

Notification of GHG emission calculation methods, reporting, and certification (38/2023/TT-BCT)

Regulates the implementation procedures for GHG emissions calculation methods, reporting, certification, etc.

MONRE Notice on emission factors (2626/QĐ-BTNMT)

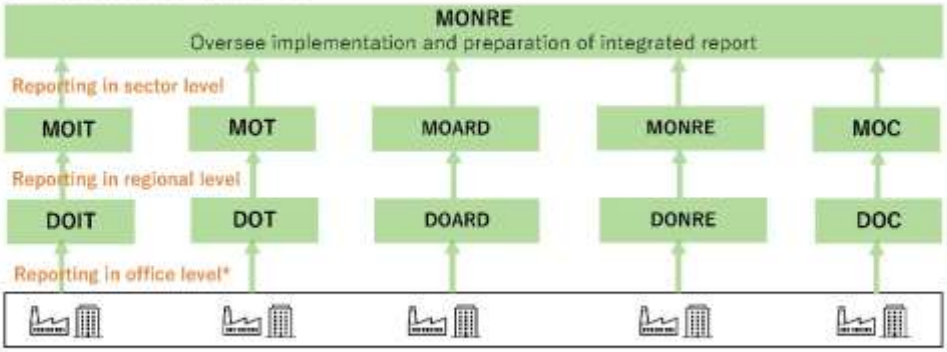
Specify numerical values of emission factors used in the calculation of GHG emissions. There are coefficients for major fuels, minerals, livestock products, waste, etc.

MONRE Notice on LEP implementation detailed regulations (1/2022/TT-BTNMT)

Stipulates procedures and systems for environmental impact assessments, including procedures for evaluating GHG calculation results and reduction measures.

1-2 CMS Implementation Structure

Line ministries compile GHG emissions information for each sector under their jurisdiction and report it to the Ministry of Natural Resources and Environment, which then prepares a consolidated report that includes GHG emissions for Vietnam as a whole. The information is reported from each site to the line ministries through the city administrations. For the time being, GHG emissions will be calculated by a consulting firm commissioned by the Vietnamese government.



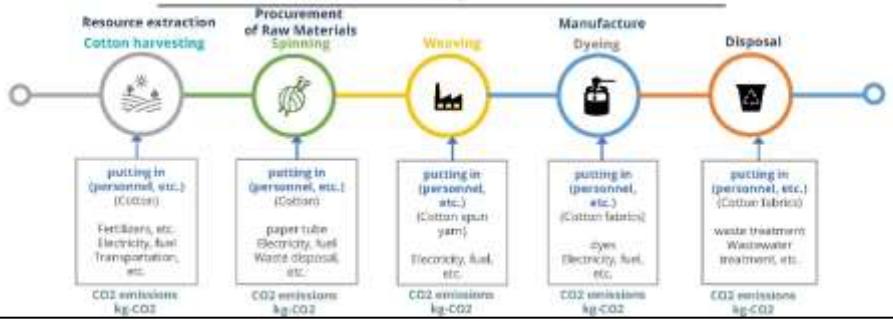
*Companies obligated to calculate GHG emissions
Companies that emit 3,000 t-CO2 or more per year,
Companies with annual fuel consumption of 1,000 tons of oil equivalent (TOE) or more,
Waste treatment facilities that process 65,000 tons or more of waste per year.

1-3 Issues and suggestions regarding CMS

In order to manage GHG emissions at the company/office level, it is necessary to visualize GHG emissions at the product level and take reduction measures. Currently, the challenge is that neither product-level calculation rules nor raw material-level emission factors are in place. We propose that calculation rules be first established for each product and emission factors be developed for raw materials. The following are examples of product-level visualization in Japan.

cotton textiles

Calculation Rules	
Product System (Scope of Data Collection)	Cotton harvest → spinning → weaving, dyeing, and disposal
Condition Setting	Assumes 1 m2 of cotton fabric is produced
Calculation Method	CO2 = Amount of each activity x Emission intensity



2-1 Hòa Khánh Industrial Park Renewable Energy Plan

Steps to consider

Step 1: Organize supply and demand potential in the factory complex (solar power and energy demand)

- Organize the status of and plans for the introduction of solar power generation in the industrial park
- Sorting out potential for new installation
- Method of interconnection of solar power generation (reverse power flow possible or only for private consumption) →Confirm with EVN
- Estimation of solar power generation
- Sorting out demand for solar installation sites
- Sorting out the supply-demand balance (Is there a surplus of solar power or not enough?)

Step 2: Study the possibility of energy flexibility using distribution lines

- Organize methods for energy flexibility (organize methods that are possible under the system and methods that may be possible in the future).
  *In the case of Japan, there are off-site PPA, self consignment, and regional new power, but it depends on whether the consignment business is permitted overseas.
- Organize where there is a surplus of solar power and where there is a shortage (where will be electricity sharing, areal or multi-facility?)
- Study of supply-demand balance in the case of energy interchange

Step 3: Business feasibility of energy interchange *If energy interchange is systematically possible (including cases where it will become possible in the future)

(i) Business feasibility of simple on-site consumption at individual facilities without energy integration (on-site PPA)
(ii) Business feasibility of installing on-site PPA + storage batteries at individual facilities (when there is excess solar power)
(iii) Business feasibility in the case of energy interchange
(iv) Comparison of business feasibility in (i) through (iii), and consideration of policy for introducing renewable energy in industrial parks

Chubu EVN relationship building and discussions

CO2 reduction effect study

feasibility study

Anticipated JCM projects

- Solar power generation projects of individual resident companies
- Photovoltaic power generation project by a group of Japanese companies (power generation + storage batteries + EMS for intra-company energy interchange)
- Solar power generation project for the entire industrial park (expansion of power generation + storage batteries + EMS to desired companies)

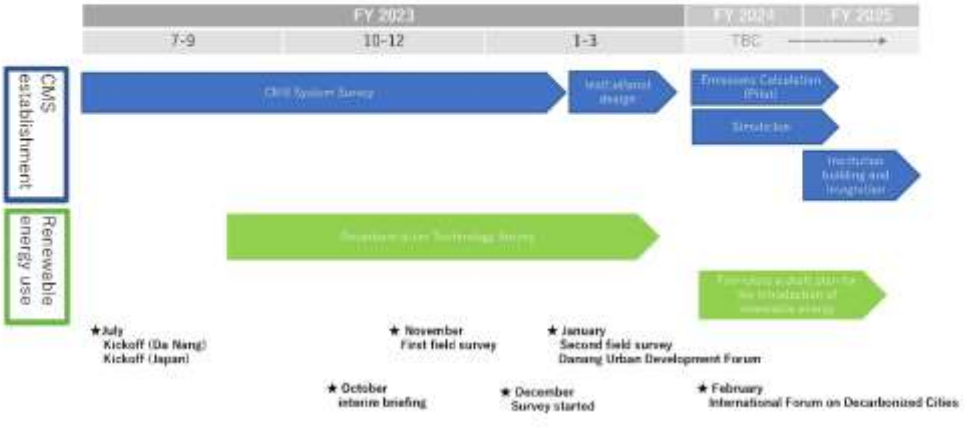
2-2 Hoa Khanh Industrial Park Questionnaire Survey

A survey on the electricity supply-demand situation and the introduction of solar power generation facilities is being conducted among the companies in the Hoa Khanh Industrial Park. The main contents of the survey are as follows

Facility Information	Number of floors, total floor area, age, use, days and hours of operation
Introduction of solar power generation	Installation status, equipment already installed, since installation, restrictions at time of installation
Electricity usage	Electricity contract information, annual electricity usage, monthly electricity usage

3 Future Plans

This project is planned for a three-year period from FY2023 to FY2025. Regarding the decarbonization system, in FY2023, a survey on the current status of CMS establishment will be conducted. Based on the results of the survey, a proposal for a CMS system for Da Nang City will be developed. Regarding decarbonization technology, a survey of companies in Hoa Cain Industrial Park is currently being conducted. Based on the results of the survey, a draft plan for introducing renewable energy will be formulated to propose the introduction of equipment.



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Appendix 3 Field Survey Report

City to City Collaboration for Zero-Carbon Society in FY2024 Yokohama / Da Nang City to City Collaboration Project for Realization of a Decarbonized Society through the Introduction of a Carbon Management System (CMS) and Decarbonization Technologies Field Survey Report

January 26, 2024

CARBON FREE CONSULTING CORPORATION

【First field survey schedule】 November 16, 2023 to January 22, 2023

Schedule	Interviews	Survey Point
Thursday, November 16	Travel	
Friday, November 17	Advance Nonwoven Vietnam Co.	GHG emissions calculation
	Da Nang Department of Planning and Investment (DPI)	Investigations in general
	Osumi Vietnam	Investigations in general
Saturday, November 18	Hoa Khanh Industrial Park inspection	Electricity Supply and Demand Survey
Monday, November 20	Danang High-Tech Park and Industrial zones Authority (DHPIZA)	Progress reports and surveys in general
	Department of Industry and Trade (DOIT), Department of Transport (DOT), Department of Agriculture and Rural Development (DOARD), Department of Construction (DOC)	carbon management system

Tuesday, November 21	Mabuchi Motors Vietnam Co.	GHG emissions calculation
	Daiwa Vietnam Co.	GHG emissions calculation
	Department of Natural Resources and Environment (DONRE)	carbon management system
Wednesday, November 22	Travel	

【Second field survey schedule】January 7, 2024 to January 19, 2024

schedule	Interviews	Survey Point
Sunday, January 7	Travel	
Monday, January 8	Danang High-Tech Park and Industrial zones Authority (DHPIZA)	Progress Report, Electricity Supply and Demand Study
	Asia Architecture and Trading Co.	Electricity Supply and Demand Survey
	Tan Long Packaging Co.	Electricity Supply and Demand Survey
	Hifill Joint Stock Company	Electricity Supply and Demand Survey
	Menhoa Manufacturing and Trading Company	Electricity Supply and Demand Survey
Tuesday, January 9	Cement Da Nang Co.	Electricity Supply and Demand Survey
	Da Nang Printing and Service Joint Stock Company	Electricity Supply and Demand Survey
	Bamboo Viet - Da Nang Co.	Electricity Supply and Demand Survey
	Daiwa Vietnam Co.	Electricity Supply and Demand Survey
Friday, January 12	Da Nang Department of Planning and Investment (DPI)	Progress report, seminar preparation
Saturday, January 13	Danang High-Tech Park and Industrial zones Authority (DHPIZA)	Survey Scope
January 15	12th Da Nang Urban Development	Project Introduction

(Monday)	Forum Sectoral Session: Eco-Industrial Parks	and Progress Report
	Training on carbon management systems	Human Resource Development Training
Tuesday, January 16	Courtesy call on Chairman of Da Nang People's Committee	Our Business
	12th Da Nang Urban Development Forum Main Forum	Project Introduction and Progress Report
Wednesday, January 17	EVN Lien Chieu Branch	Business Introduction, Electric Power System
Thursday, January 18	JICA expert (dispatched by MONRE)	Project Introduction and Progress Report
	Embassy of Japan in Vietnam	Project Introduction and Progress Report
Friday, January 19	Travel	

【Main interview details】

Danang High-Tech Park and Industrial zones Authority (DHPIZA)

Part 1

Agenda: Meeting for planning the introduction of photovoltaic power generation equipment	
Date: January 8, 2024 Location: DHPIZA Office	Participants: (The other side) DHPIZA: Mr. Ngo Van Minh, Ms. Dao Thi Ngoc Thuy, Mr. Tran Quoc Cuong (Our side) Osumi Vietnam: Mr. Yoneda General Director, Ms. Ton Nu Minh Giang, Nippon Koei: Mr. Usui, Mr. Aoki, Mr. Ohan Duy Hung, Mr. Nguyen Duc Moc, CFC: Takada, Mr. Phong

Prior to the field survey in Hoa Khanh Industrial Park, the Japanese delegation and DHPIZA exchanged views and opinions, which are summarized below.

1. Approval installation of this project

(1) DHPIZA reported the following

Approval has progressed to submission to the People's Committee.

If we are going to introduce photovoltaic power generation in this project, we need to change the application. Since the introduction of solar power generation is done by the Commerce and Industry Bureau, permission must be obtained from the Commerce and Industry Bureau.

(2) In response, CFC explained that this is only a research project and that there are no plans to introduce it within this project.

2. Investigation of photovoltaic technology

(1) Nippon Koei and Osumi Vietnam explained the following regarding the investigation of photovoltaic technology.

- This year, Step 1 is to investigate the possibility of installing solar panels on the roofs of each company.
- We would like to conduct a survey of the entire industrial park as Step 2 from next year to see if it is possible to supply electricity outside of the tenants. This will make it possible for companies that cannot install solar panels to rent roofs of other companies and supply them with renewable energy.
- We commissioned a survey of companies large and small for the purpose of organizing a database to investigate the feasibility of the project.
- How can I get detailed information on power supply from EVN if I don't know the ID number of each company?

(2) In response, DHPIZA provided the following response.

- The survey is likely to be inaccurate because the companies may have multiplied the monthly amount of electricity by 12.
- Information can be obtained from the EVN once an official letter is issued by the People's Committee, but at this stage it is difficult to get consumption figures of individual companies. If you really need EVN data, you can ask for it from DHPIZA next year.

(3) In response, Nippon Koei and Osumi Vietnam requested the following

- Is it possible to obtain IDs directly from the companies that want to introduce the system and get data from EVN since we want hourly data? Can we contact EVN without going through DHPIZA?
- We would like to collect data as quickly as possible, so we would like to get IDs directly from interested companies ahead of time.

(4) In response, DHPIZA received the following response.

- If it is a company that is interested, the company itself would be able to log in from their ID and give us the data. This survey picks up companies by industry, but DHPIZA believes that there are more suitable companies for the survey, so we would like to consider that as well.
- DHPIZA cannot contact EVN since EVN is not a part of this project (as stated by the other party). You are free to contact them, but it will be difficult to receive data. You are free to collect information, but when you make a formal request, we would like you to issue it in writing from the contact point.
- Some companies are introducing solar power generation in Hoa Khanh Industrial Park, but the cost of feeding the power into the national grid does not match the cost of the solar power generation system. Some companies are hesitant to introduce solar power because they may not be able to use it in their actual facilities. Companies have both offices and factories, so they should consider the load so that they can use the system for both. If panels are eventually installed, it would be more efficient to introduce renewable energy to large companies.

3. Future Plans

DHPIZA will send data on the remaining 21 companies in the survey to the Japanese side by the afternoon of January 8.

DHPIZA will respond as soon as possible after Tet.

● Danang High-Tech Park and Industrial zones Authority (DHPIZA) Part 2

Agenda: Future Prospects for Intercity Cooperation Projects	
Date: January 13, 2024 Location: Grand Café	Participants: (The other side) DHPIZA: Mr. Ngo Van Minh （Our side）Osumi Vietnam: Yoneda General Director, Ms. Ton Nu Minh Giang, CFC: Kiyohara, Takada

At DHPIZA's request, a meeting was held on short notice to discuss how to proceed with the intercity collaboration project, and a summary of the discussion follows.

1． Scope of this project

(1) At a meeting held on January 8 between the Japanese survey team (Nippon Koei, Osumi Vietnam, and CFC) and DHPIZA, CFC pointed out that this was the first time DHPIZA had heard of the "introduction" of solar power generation equipment in this project, and if it was to be introduced, the approval letter from the People's Committee would have to be submitted again. We asked why this expression was problematic, despite the final objective is obviously to install photovoltaic installations, since it is FS.

(2) In response, DHPIZA explained that this misunderstanding arose because the permit application letter only mentions a survey, but the Vietnamese translation of the presentation materials for the Urban Development Forum on January 15 states that the solar power facilities will be physically installed.

(3) In response, we (CFC) explained that this project was only a "feasibility study," that we would not bring equipment from Japan to be installed in this project, and that we did not have the budget to do so, DHPIZA's doubts were dispelled.

2． Provision of Electricity Data from EVN

(1) We (CFC) understand that at the same meeting on the 8th, Nippon Koei requested EVN to provide data on electricity consumption in the Hoa Khanh Industrial Park, but DHPIZA said that it was not possible to

make a request to EVN. However why this was not possible.
(2) In response, DHPIZA explained that it is difficult for DHPIZA to collect data, but DHPIZA can make a request to EVN if there is a specific request from the Japanese side.

- DHPIZA is obligated to protect the companies in the industrial park and we cannot force them to disclose confidential information. If we want electricity demand data from companies, there are two ways. One is to obtain it from EVN, and to do this, we need to know the IDs of the companies, create a list of companies, obtain permission from those companies, and then apply to EVN. This is expected to be quite time-consuming. So far, DHPIZA has never made such a request to EVN, and it is difficult to read how long it will take.
- The other means is to get it directly from individual companies. Small and micro factories do not automatically manage data and often do not produce data when asked to do so. Medium to large factories are open and can get it directly from those companies. That is why we recommended medium to large factories for Monday's interview. Large and medium-sized companies can be approached directly by Nippon Koei and Osumi if they know them, or through DHPIZA; if through DHPIZA, Nippon Koei will send a list of factories to DHPIZA → DHPIZA will check the list and complete the list → DHPIZA will DHPIZA will go to the factory together with Osumi and Nippon Koei.
- There are three levels of EVNs: regional EVNs, which have jurisdiction over a region; city-level EVNs, which have jurisdiction over an entire city; and provincial EVNs, which have jurisdiction over a region of South Vietnam. The jurisdiction differs depending on which data is desired. For example, in order to obtain data from the EVN with jurisdiction over all of South Vietnam, it is necessary for the Director of DHPIZA to write a letter to the EVN and request information, which is a difficult procedure. In this case, I don't know which level of EVN manages the data needed for the survey, but I would like to check.

3. Survey on electricity flexibility

(1) CFC asked if DHPIZA would provide information on data, related information, and government policies regarding electricity flexibility, as we would like to study the possibility of electricity flexibility and installation of storage batteries for this purpose in this study.
(2) In response, DHPIZA said that they are the department in charge of the Da Nang side of this project, and of course they can do so, but they need to get power data for the entire Hoa Khanh Industrial Park from EVN, and they need to ask DOIT or EVN for government policy, although as mentioned earlier, EVN varies in level of difficulty, DHPIZA can make arrangements, and the same procedure will be applied to other departments such as DOIT, DOT, etc. He said that he would like to receive a letter from CFC to DHPIZA asking what specific information they want, so that it will be easier to move forward.

4. How to proceed in the future

Finally, the CFC stated that, in principle, the CFC would contact the DHPIZA Min Experts directly whenever new materials or information regarding the project were released. DHPIZA stated that they would be happy to do so and that they were very happy to have everything cleared up. Later, CFC and DHPIZA exchanged emails and agreed to proceed as follows (see emails between 1/13 and 1/14).

① This project is a feasibility study for establishment of a decarbonized society in Da Nang City, and does not provide any photovoltaic power generation equipments.
② In this project, Japanese team can conduct a study on de-carbonization framework i.e. carbon management system (CMS), and de-carbonization technologies such as energy management system (EMS), photovoltaic power generation equipment in cooperation with DHPIZA.
③The information and data necessary for the study will be mainly collected through DHPIZA. First, CFC send a letter to DHPIZA with description of the information and data which Japanese team wishes to collect. DHPIZA will review the description and discuss possible collected data.

After that, DHPIZA will discuss with CFC about suitable data collection method for each type of data as well as other members of the Japanese team (including Osumi, Nippon Koei…) to connect with relevant government organizations and companies to collect the data. The member of the Japanese team will participate in data collection process if necessary and required by DHPIZA.

Finally, DHPIZA provides the collected information and data to the Japanese team.

5. To Do

Future to-dos based on the above exchange are as follows,

① Nippon Koei will analyze the results of the 51 companies surveyed, narrow the focus of future surveys, organize the necessary data and information, and communicate the results to CFC.

② CFC will issue a cooperation request letter to DHPIZA describing the data and information needed, and DHPIZA will request cooperation from each company, EVN, and other organizations based on the contents of the letter.

③ DHPIZA will collect information by visiting individual companies and provide it to the Japanese side. If necessary, Nippon Koei and Osumi can accompany DHPIZA.

④ Other data and information required for the project will be collected in accordance with the procedures described in 4. above.

⑤ As progress is made in this project, DHPIZA and CFC and other members on the Japanese side will hold web conferences to keep in close contact.

The 12th Da Nang Urban Development Forum

Agenda: Current Status and Future of Intercity Cooperation Projects	
Date: January 15-16, 2024 Location:	Participants* Main participants related to intercity cooperation projects (Vietnam side) Mr. Le Trung Chinh, Chairman, Da Nang

Da Nang City Center Hall	Municipal People's Committee (courtesy only) Mr. Le Quang Nam, Vice Chairman MONRE: Dr. Luong Quang Huy, Chief of Section DPI: Mr. Le Minh Tuong, Deputy Director and others DOIT: Ms. Nguyen Thi Thuy Mai Deputy Director and others DONRE: Several staff members DHPIZA: Mr. Nguyen Cong Tien Vice Chairman and others (Japan side) Director, International Bureau, Yokohama City Hashimoto Yokouchi Section Chief, Mikami Section Chief, and Ms. Nagai Companies in Yokohama City CFC: Kiyohara, Naito, Takada

The following is a summary of the presentations and other presentations made on this inter-city collaboration project at the 12th Da Nang Urban Development Forum hosted by the City of Yokohama and the City of Da Nang.

1. Thematic Session: Eco-Industrial Park (from 08:40 on 15th)

(1) Following the opening remarks by Yokohama City and Da Nang City, the CFC made the following report with materials. About 30 participants from Yokohama City and Da Nang City attended this session.

- Overview of the project
- Report on the results of a study on the legal and implementation framework for the Carbon Management System (CMS) in Viet Nam and Da Nang City
- As a challenge and suggestion for CMS, proposal to promote visualization at the product level as well as at the organizational level.
- Explanation of the steps in the planning and study of conversion to renewable energy and the content of the questionnaire survey of the

enterprises in Hoa Khanh Industrial Park.

- Explanation of future plans.

(2) In response, DHPIZA stated that it welcomed the proposal in this project and would fully support this project.

2. Courtesy call on Mr. Chinh, Chairman of the People's Committee (from 1:30 p.m. on 16th)

Mr. Hashimoto, Director General of Yokohama International Bureau, and about 20 people from companies related to Yokohama City paid a courtesy call on Mr. Le Trung Chinh, Chairman of the People's Committee of Da Nang City. After opening remarks from People's Committee Chairman Chinh and Yokohama City Director Hashimoto, companies from the city had the opportunity to speak. CFC expressed its appreciation for the cooperation in this intercity project and requested future cooperation from DOIT and DONRE.

3. Main Forum (from 14:20 on 16th)

(1) Following the opening remarks by Yokohama City and Da Nang City, reports were made for each session. Regarding the Eco-Industrial Park related to this inter-city cooperation project, Mr. Yokouchi, Director of Yokohama City, reported on the following points.

- Explanation of the history of inter-city cooperation projects.
- Regarding the Carbon Management System (CMS) in Da Nang City, it is proposed to visualize and manage CO2 emissions at the product level as well as the reporting and management system at the organizational level.
- As for carbon management technology, a study is underway to introduce photovoltaic facilities, and further cooperation from the Da Nang side is requested.

(2) CFC continued to request the involvement and cooperation of the Da Nang Department of Industry and Trade (DOIT) and the Da Nang Department of Natural Resources and Environment (DONRE) in addition to the current structure, since this project is closely related to Vietnam's carbon management system and electricity policy.

(3) In response, Mr. Nam, Vice Chairman of the People's Committee of

Da Nang City, expressed his commitment to DOIT and DONRE's involvement and cooperation in this inter-city collaboration project.
(4) Afterwards, CFC had a stand-up meeting with DOIT and DPI officials off-site and again requested their cooperation in this project.

Carbon Management System (CMS) training

Date: January 15, 2024 Location: Da Nang City Center Hall	participant (Vietnam side) DOIT: Ms. Nguyen Thi Thuy Mai, Deputy Director and others MONRE: Dr. Luong Quang Huy, Director, Mitigation and Ozone Layer Protection Division, Department of Climate Change DONRE: Several staff members DHPIZA: Mr. Ngo Van Minh Specialist About 20 people from private companies in Da Nang City (Japan side) JICA Expert Fukuda IGES Manager Akagi CFC: Kiyohara, Naito, Takada

In parallel with the 12th Da Nang Urban Development Forum organized by Yokohama City and Da Nang City, a training course on Carbon Management System (CMS) was conducted for Da Nang City government officials and private companies, which is summarized as follows. The training was co-hosted by CFC and IGES, with Da Nang DOIT as the host department. Five participants from Da Nang City government agencies, 30 participants from Da Nang City private companies, and others from the web participated in the training.

1. Yokohama City-Danang City Intercity Cooperation Project Phase 2

(1) At the beginning of the presentation, Mr. Kiyohara, Vice President of CFC, reported the following points regarding the current status of this inter-city collaboration project.

- This project is a study that aims to introduce decarbonization systems and technologies in Da Nang city to use Yokohama's experience.
- Regarding the Carbon Management System (CMS), the Vietnamese government's legal system is in place to some extent, and guidelines and other practical measures need to be developed. In addition, CO2 visualization at the product level needs to be developed in the future.
- The implementation structure is as follows: on-site offices → Da Nang city departments in charge → central government line ministries and agencies, with the final report compiled by the Ministry of Natural Resources and the Ministry of Environment.
- In order to implement this CMS, it is important to improve the knowledge and skills of Da Nang city officials and private companies, and this training is part of that effort.

(2) In response, DOIT made the following comments

- We are aware that this Inter-City Partnership Project comprises a decarbonization scheme and decarbonization technologies. However, the Vietnamese government has restrictions on the photovoltaic power generation project envisioned under the decarbonization technology, and Da Nang City can only generate the remaining 30 MWh of power. These policy aspects need to be fully understood.
- As you know, line ministries oversee the decarbonization program, which is ultimately compiled by the Ministry of Natural Resources and Environment. What does DONRE, its regional department, think about this?

(3) DONRE continued with the following comments.

- As DOIT pointed out, the Ministry of Natural Resources and Environment is in charge of the decarbonization program, and DONRE is in charge of the coordination of Da Nang City. In this sense, DONRE needs to be involved in the CMS of this inter-city cooperation project.

(4) In response to these comments, CFC stated that since this session is

a CMS training, it would like to discuss this agenda item again at a later date, and that it is aware that DHPIZA is currently the counterpart, but if there is a more appropriate department, it would like to work with that department.

2. Policy Update on the Implementation of NDC and Net Zero Targets in Vietnam

Mr. Huy, Director of MONRE Division, and Mr. Fukuda, JICA expert, explained the following points on the current status of the Vietnamese government's policy on NDC and net zero targets.

- The Vietnamese government has set a target of reducing the BAU ratio to 15.8% by 2030 through self-help efforts and 45.5% through international assistance.
- The revised Environmental Protection Law and other legal frameworks are in place and the government is providing the precision and structure to address decarbonization.
- The implementation of this system requires the development of guidelines and manuals to support GHG accounting, the establishment and operation of electronic systems and information security, and the establishment of capacity for the operation of the system.
- Regard to calculation capacity, it is important to strengthen the capacity of companies and operators that carry out calculations. MONRE has been conducting training programs for business offices in cooperation with JICA.
- The results of the calculations must be certified by the Vietnamese government, and each department is required to have the capacity for such certification. This training is targeted at Da Nang city administrative officials and private companies and is recognized as important from the viewpoint of capacity building.
- In Southeast Asia as a whole, Singapore is the only country that has introduced a carbon management system. Vietnam should be proud of the fact that it has developed its legal system and structure to this extent. Japan has more than 17 years of experience and should learn from Japan's experience.

3. International Trends in Decarbonization Toward Net Zero

Mr. Akagi, IGES Research Manager, explained the following points regarding the international trend of decarbonization.

- The Green Transformation (GX) is transforming the economic and social system, a move that is irreversible. In the Stockholm Resilience Center's Planetary Boundary, six of the nine items have already reached the danger zone. Climate change is the biggest risk factor.
- The "Decarbonization x Growth Strategy" is providing new value internationally and facilitating the creation of markets. Investment in clean energy is increasing every year, reaching $1.1 trillion.
- The future of business management in companies needs to be both defensive and offensive, with an awareness of sustainability in terms of the environment and decarbonization. For companies, the CO2 emissions of their suppliers are also counted as their own Scope 3 emissions, and companies like Apple are increasingly working with their suppliers to reduce their Scope 3 emissions. As a defensive measure, a company can be aware of its own greenhouse gas emissions and take action, while as an offensive measure, it can promote the carbon footprint of its products and services. We recommend that you first assess your company's situation.

4. Methodology for calculating GHG emissions in the supply chain and carbon footprint.

(1) Mr. Kiyohara, Vice President of CFC, explained the calculation method of GHG emissions.

- The calculation of GHG emissions has two levels: (1) the entire supply chain of a company, and (2) the life cycle of a product.
- At the corporate level, Scope 1, Scope 2, and Scope 3 are calculated for a company's supply chain in accordance with the GHG Protocol. Basically, emission factors are multiplied by the amount of corporate activities.
- At the product level, the Life Cycle Assessment (LCA) method is used to calculate GHG emissions over the product's life cycle. The product system and calculation method are set before the calculation.

This is also basically calculated by multiplying the company's activity by an emission factor.

(2) Then, due to time constraints, only one question and answer session was held with the participants, and this training was completed. Note that after the training, a private company told us that there is a voluntary carbon credit trade in Vietnam, and that the World Bank purchases the carbon credits for US$5 per t-CO2.

Q：We are a Japanese subsidiary, but which coefficient, the Japanese coefficient or the Vietnamese coefficient, should be used to calculate CO2 emissions from electricity at our plants?

A: If the factory is located in Vietnam, use the Vietnamese coefficient.

EVN Lien Chieu Branch

Agenda item: Collection of Electricity Demand Data for High Tech Park	
Date: January 17, 2024 Location: EVN Lien Chieu Office	Participants: (The other side) EVN: Tran The Toh Director of Lien Chieu Branch, Pham Quang Hieu Deputy Director of Lien Chieu Branch, and two others （Our side）Osumi Vietnam: Yoneda General Director, Ms. Ton Nu Minh Giang, CFC: Kiyohara, Naito, Takada

CFC briefed the EVN Lien Chieu branch office on this inter-city collaboration project, followed by an exchange of views on how to collect electricity demand data for the High Tech Park, and the main information obtained from the other party is as follows.

Although the Hoa Khanh Industrial Park area is under the jurisdiction of the Lien Chieu Branch, electricity supply and demand data are under the jurisdiction of Da Nang City EVN and cannot be submitted by the Lien Chieu Branch.

The amount of renewable energy generation is capped by the Vietnamese government, and Da Nang City can only generate electricity within its quota. Since the government notification on solar power generation

expired on December 31, 2020, and no new notification has been issued, connecting solar power to the grid has been stopped. The reason for this is not known, but perhaps the restriction is due to the many glitches caused by connecting solar power and other unstable power to the grid in the experience up to 2020.
I think it is difficult to implement the installation of independent power sources in industrial parks because there is no legal basis for it. Without a government notification, it is difficult to say. In any case, it is under the jurisdiction of DOIT, so please ask them.

JICA Expert (dispatched by MONRE)

Agenda: Introduction of CMS and renewable electricity facilities	
Date: January 18, 2024 Location: MONRE	Participants: (The other side) Fukuda JICA Expert (Our side) Kiyohara, Naito, Takada

The following is a summary of the main information obtained from the JICA experts and the CFC during the exchange of views on the CMS and the installation of renewable electricity facilities.

- The GHG Protocol and other relevant protocols will be used as a reference for GHG emission calculation methods and coefficients, as the MONRE Circular stipulates that international practices should be followed. Emission coefficients will be developed by the Vietnamese government budget.
- Each ministry and agency contracts with a consulting firm to certify the calculation results for their jurisdiction. However, the calculation itself is the role of the company. In this regard, there is a need to improve the calculation skills of ministry administrative officers and company employees, and we believe that training should be provided. The budget of the Vietnamese government is limited, and support from donor countries is required.
- The Vietnamese government has decided to establish an emissions trading system (ETS) in Decree No. 6 on the carbon credit market,

modeled after the ETSs of China and South Korea. The model is the ETS of China and Korea, but there is no exchange yet, and it will be developed in the future. As for the voluntary market, international credits are already in circulation, but they may be controlled by the Vietnamese government.

- The limitation on solar power generation facilities is largely due to the fact that many solar power generation facilities were installed in the past when the FIT was introduced, which caused problems with the grid. No new notification has been issued since the end of 2020 and it would be difficult to increase the number in the future.