FY2020 Commissioned Work for Creating Sustainable, Zero-Carbon Societies through City-to-City Collaboration (Support for the Creation of Zero-Carbon Societies through City-to-City Collaboration between the Cities of Yokohama and Da Nang (Support for the Formulation of a 10-Year Environmental City Plan and Development of Projects on Energy Efficiency)

Final Report

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Institute for Global Environmental Strategies

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1. Background on Participation in the Project

Since signing a "Memorandum of Understanding on Technical Cooperation for Sustainable Urban Development" in 2013, the cities of Yokohama and Da Nang have co-organised the "Da Nang Development Forum" nine times over the past seven years and discussed the formulation of long-term environmental plans and development of smart cities as part of city-to-city collaboration. Tangible results achieved under this collaborative relationship follow.

(1) Support provided to Da Nang by Yokohama and related organisations in the waste management sector

The separation of waste generated by households is being promoted through the JICA Partnership Program, with the second phase of this program launched in 2020. Da Nang is planning to implement a project to improve the efficiency of waste collection through the construction of waste trans-shipment facilities around the city and a second project on developing a complex waste treatment facility in the Khanh Son landfill area through a partnership between the public and private sectors. Yokohama is sharing the city's experience and knowledge on public awareness and public relations on waste separation and other issues with Da Nang.

(2) Project on building a comprehensive sewage treatment system in Da Nang

Between 2015 and 2016, Yokohama Water Co., Ltd., a fully-owned subsidiary of Yokohama Waterworks Bureau, took part in a feasibility study on developing a sewerage system to be funded as a yen-loan project as part of a JICA preparatory survey on improving the water environment in Da Nang. Since 2016, Yokohama Water has installed high-efficiency pumps at a water treatment plant managed by Da Nang Water Supply Company (DAWACO) as part of a JCM Model Project. With support from The World Bank, Da Nang is planning to develop a public sewerage system and sewage treatment facilities in the eastern part of the city and the Da Nang Bay area (Construction has already started in some places). This project is expected to play an important role in improving the water environment in the city.

(3) Support for studies on energy-saving potential

Osumi Co., Ltd., a joint applicant for this project, provided technical services for auditing energy efficiency in factories and private buildings as part of a JICA Private Sector Partnership Program between 2015 and 2017. The company set up a representative office in Da Nang and is currently working on developing their business to offer full-scale auditing services on energy efficiency. Since 2020, Osumi has been conducting energy-efficiency audits on buildings and a fact-finding survey on related systems as part of a new JICA Partnership Project. The survey is being jointly carried out by Yokohama National University and Osumi

Co., Ltd., with Yokohama sharing the city's knowledge from an institutional perspective.

The city-to-city collaborative activities mentioned above have resulted in the steady development of a system of cooperation among local companies, related groups and research institutions in Yokohama. Accordingly, a comprehensive support system is being developed that includes methodologies for accurately understanding information and designing systems and even for the transfer of technologies that are suited to local conditions. Da Nang's 10-Year Environment City Plan and Local Climate Change Action Plan, both targets under this project, have been positioned as top-level plans governing these types of environmental systems in the city. Practical advice and support from Yokohama City on the planning and smooth implementation of long-term environmental policies can be expected to be beneficial to Da Nang. In addition, private companies from both cities are taking part in the "Da Nang City Development Forum" which is held annually, and environmental projects developed by private companies in both cities are expected to be promoted through mutual dialogue.

2. Project Overview

2.1 Purpose of the program

With the entry of the Paris Agreement into force in November 2016, the world has finally reached the implementation phase of the agreement. The Paris Agreement also states that climate change actions should be accelerated by non-governmental actors, as well as municipalities and cities in addition to the central government, with cities and municipalities as key players in considering and implementing tangible local climate change measures and projects. In order to realise the creation of carbon-neutral societies around the world, movements for building sustainable carbon-neutral societies, as well as low-carbon societies as a point of transit to that goal must be accelerated especially in Asia where economic growth is progressing at a rapid clip. There is a growing movement around the world to support the actions of cities to achieve carbon-neutral and low-carbon development, as cities are the sites for activities that support social and economic development.

In this project, research institutes and private companies will conduct research to support activities to build a carbon-neutral and low-carbon society in the City of Da Nang in the Socialist Republic of Vietnam and introduce equipment that will contribute to the creation of such a society in collaboration with the City of Yokohama, which has experience and expertise in the development of a carbon-neutral and low-carbon society.

2．2 Content of project

This project will provide support for the formulation of the Local Climate Change Action Plan (LCCAP) that Da Nan has plans to develop in the future and which will include the reduction of greenhouse gas emissions, as well as the related 10-Year Environment City Plan (2021-2030). In addition, the following activities in the field of energy efficiency in factories for which there is a strong need in Da Nang appear in specifications to be carried out for the purpose of reducing greenhouse gas emissions and developing JCM projects that will help reduce these emissions.

(1) Support in formulating the 10-Year Environment City Plan (2021-2030)

① Da Nang City is in the process of formulating its 10-Year Environment City Plan (2021-2030), which will be submitted for approval to the Da Nang City People's Committee after a period of consultation. This project will facilitate the consultation process with the preparation of proposals for Da Nang's draft plan.

② Where there are priority projects in the abovementioned 10-Year Environment City Plan, the project will provide support to Da Nang in prioritising these key projects and propose areas where local companies from Yokohama can collaborate.

③ The experiences of Yokohama and other cities in Japan will be shared with Da Nang to assist with methods of publicising and communicating the 10-Year Environment City Plan to residents in a way that is easy to understand.

④ Workshops will be held, gathering together relevant government agencies and private companies in Da Nang to explain proposals based on a review of the draft of the 10-Year Environment City Plan.

(2) Support in formulating a Local Climate Change Action Plan

① Da Nang is planning to develop a Local Climate Change Action Plan (LCCAP) after formulating the 10-Year Environment City Plan. This project will assist Da Nang with the basic aspects of formulating the LCCAP. Specifically, the processes and methods used to formulate a "low-carbon plan" will be consolidated based on the experiences of Yokohama in relation to the 10-Year Environment City Plan, and estimated GHG emissions from Da Nang City and the reduction potential of key sectors will be coordinated using existing data and analyses.

② Meetings to exchange ideas with relevant government agencies in Da Nang will be organised to discuss the matters addressed above. Discussions will take place on methods to promote candidate projects on energy efficiency in factories and other facilities and challenges (See "Energy efficiency" below.)

(3) Energy efficiency

① The cities of Yokohama and Da Nang jointly organise the "Da Nang Development

Forum" each year. A business matching opportunity at the 9th Da Nang Development Forum resulted in the selection of a city-to-city collaborative project on comprehensive energy efficiency and conservation in Da Nang Steel. Projects are expected to be developed from initiatives on the installation of LED bulbs in street lights that will contribute to Da Nang's smart lighting plan and the substantial reduction of energy consumption with improvements to the efficiency of air conditioning through the introduction of radiant heating and cooling. Feasibility studies on these projects will be conducted with a view to developing them as JCM Model Projects in the future.

2.3 Implementation structure

The project implementation structure is shown in Fig. 1.

Participating organisations from Japan are as follows.

City of Yokohama: The city has a track record of close collaboration in exchanging ideas and providing information on policies and institutional design, including the joint organisation of the Da Nang Development Forum, which has taken place nine times. In this project, Yokohama will share knowledge to contribute to the formulation of Da Nang's 10-Year Environment City Plan and decarbonisation (low-carbon development) and develop proposals, when appropriate.

Murata Keisokuki Service Co., Ltd.: Murata has conducted field surveys in Da Nang in the past on industrial wastewater management as part of JICA's Support for Small and Medium Enterprises (SMEs) Overseas Business Development programme (feasibility study) and collected basic environmental information on the area. The company also has experience in measuring, monitoring and environmental assessments for air, noise and soil pollution. In this project, Murata will review and develop proposals for Da Nang's 10-Year Environment City Plan.

Macnica, Inc. and Osumi Co., Ltd.: These companies already have experience interacting with local stakeholders and implementing projects through the Da Nang Development Forum. Both local companies also have a wide range of experience with energy efficiency audits, in particular. As companies affiliated with Yokohama City, they also have extensive experience in contributing to overseas collaborative projects organised by Yokohama City. In this project, they will conduct research on JCM candidate projects.

Yokohama Urban Solution Alliance (YUSA): YUSA has a network with member companies and expertise in business matching. As part of this project, the YUSA Secretariat will keep member companies in Yokohama informed about relevant information (such as local environmental improvements and low-carbon project needs, etc.) at workshops

held in Japan and Da Nang. The alliance is expected to play a role in promoting the full participation of member companies in environmental infrastructure projects, such as JCM Model Projects in the next fiscal year and the future.

Institute for Global Environmental Strategies (IGES): IGES has experience in preparing GHG inventories for cities and supporting the preparation of climate change action plans at the city level in several Asian cities. In Da Nang, IGES has established a collaborative system with DONRE and local governmental stakeholders and has extensive experience in conducting studies to access local information and with field surveys for JCM Model Projects. IGES will be responsible for the overall coordination and implementation of this project.

In Da Nang, the Department of Natural Resources and Environment (DONRE) is responsible for environmental management and climate change measures and will act as the direct counterpart for this project. However, where collaboration with other related departments is essential, such as the Department of Trade and Industry for energy-efficiency projects, Department of Transportation for clean transport, Department of Construction for green building, and the Department of Planning and Investment for all sectors, project members will work closely with the Da Nang City People's Committee. Where studies on the JCM include considerations on energy efficiency at Da Nang Steel, LED lighting for streetlights, and energy-efficient radiant heating and cooling systems, the project members will seek the cooperation of relevant institutions and companies in Da Nang.

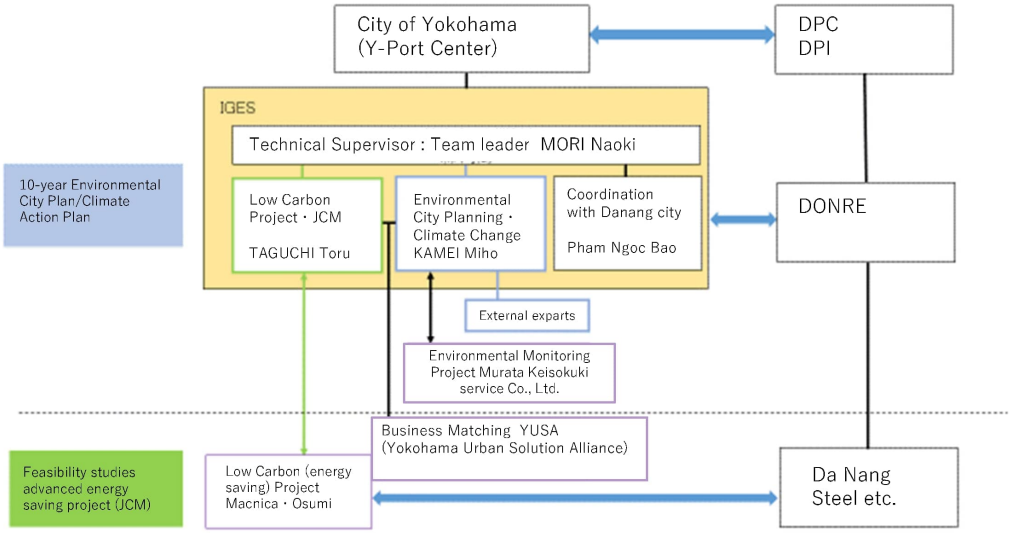


Fig. 1: Project implementation structure

2.4 Implementation process (plans and results)

Fig. 2 shows the plans and results of the project implementation process.

Aspects in which plans and actual results differ are shown below.

（1）Support for the formulation of the 10-Year Environment City Plan: The preparation of the draft of this plan was delayed for about one month due to the impacts of the novel coronavirus (COVID-19) on the practical aspects of administration in Da Nang City. In addition, although collaboration was initially envisioned to extend to the formulation of the plan, a proposal was developed for low-carbon related segments when DONRE requested support for the implementation of the plan (November 2020 to January 2021).

（2）Support for the formulation of the Local Climate Change Action Plan (LCCAP): DONRE will start to develop the LCCAP after the 10-Year Environment City Plan has been formulated, but it has taken time for the People's Committee to approve the 10-Year Environment City Plan, delaying the start of the process to formulate the LCCAP. However, the Japanese team has generally implemented the work required according to the initial plan.

（3）Survey on the applicability of the JCM for energy efficiency projects: Due to restrictions arising from COVID-19, the Japanese team was unable to travel to the site. This inhibited the smooth collection of information from the field and made it impossible for the team to demonstrate the performance evaluation of the technologies to officials in Da Nang in person, which had an effect on the progress of parts of this study.

A local coordinator was hired to mitigate the impacts of COVID-19 on the progress of the project as much as possible. Specifically, the coordinator collected information on the environment and climate change in Da Nang, as well as information on the drafting of the 10-Year Environment City Plan, effectively communicated input from the Japanese team on the plan to DONRE, and assisted in the preparation and operation of workshops. The local coordinator proved to function extremely well.

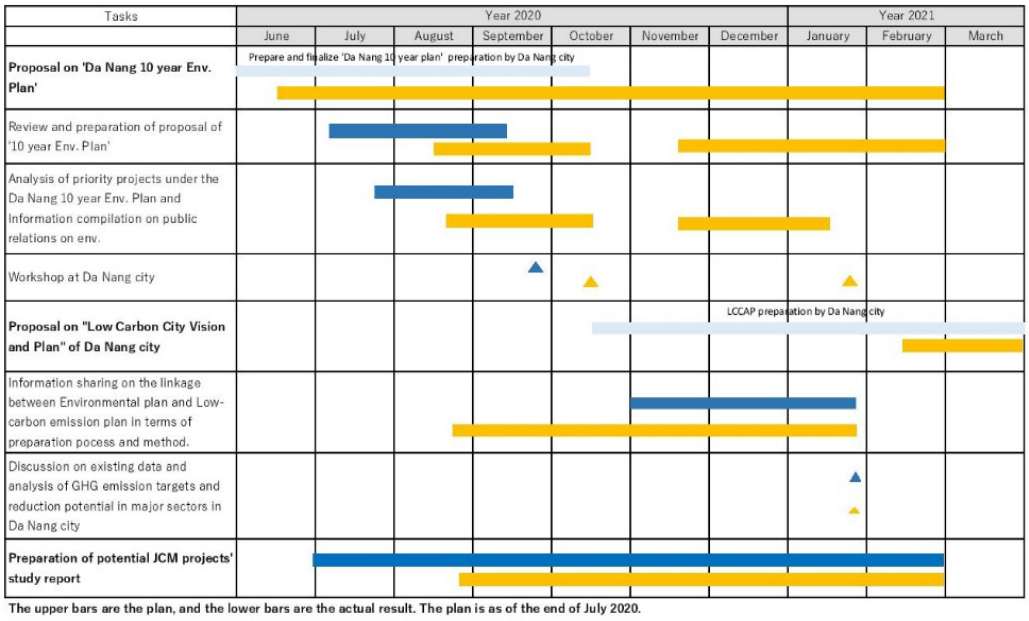


Fig. 2. Implementation process (plans and results)

3. Key Achievements

3.1 Reflecting proposals from Japan in the final draft of Da Nang's 10-year Environmental City Plan

DONRE was responsible for drafting the Da Nang 10-Year Environment City Plan (2021-2030), going through the process of consulting with Da Nang city officials and finally being submitted to the Da Nang People's Committee for approval. After the consultation process, the final draft was submitted to the People's Committee in early November.

The final draft of the 10-Year Environment City Plan contains priority programmes and projects. Of those, the following have been proposed by the Japanese team or are related to those proposals.

① Investigate, examine and propose solutions to build Da Nang into a Low Carbon City

② Set up a public information disclosure system to share results of environmental monitoring using IT (website)

③ Investigate and evaluate the current situation of people's complaints and denunciations about environmental pollution and raise public awareness on environmental protection and efficient use of natural resources

④ Investigate and assess the level of satisfaction of people for environmental quality

It is particularly important to emphasise that the term "low-carbon city" was not

mentioned in the initial draft prepared by DONRE, but is clearly stated in the final draft. One of the primary reasons that the proposals from Japan were positively received was because of a workshop organised by DONRE in mid-October to which the Deputy Minister of the Ministry of Natural Resources and Environment (MONRE) and the Vice Chairman of the Da Nang City People's Committee were invited to discuss the draft version of the 10-Year Environment City Plan. It was at that workshop that the Japanese team had an opportunity to present their proposals on the 10-Year Environment City Plan, which emphasised the following points.

(1) The concepts of "low carbon" and "circular economy" should be clearly incorporated into the environmental management plan from the perspective of the importance of aiming to shift from a designation as an environmental city to a more sustainable city; (2) Climate change measures, including low-carbon measures, should be viewed as an opportunity to strengthen environmental management (for example, energy efficiency and renewable energy can be connected to air pollution measures and the conservation of mangroves to protect the sea can also safeguard marine biodiversity); (3) Public participation should be strengthened in the preparatory and implementation stages of environmental plans; and (4) The results of health and environmental monitoring should be disclosed using ICT (websites, etc.) to encourage public participation and strengthen public health activities.

The Deputy Minister of MONRE commended these proposals. As follow-up, the above proposals were put into writing and sent to the Vice Chairman of the Da Nang City People's Committee and the Director of DONRE a few days after the workshop in a letter from the Director General of Yokohama City's International Affairs Bureau.

The Japanese team also provided information and submitted proposals three times before the workshop (August to September 2020). Details can be found in "4. Activities Based on Specifications"; however, the basic focus was on methods to increase public participation based on Yokohama's experiences, as well as examples of initiatives in the field of low-carbon development.

In addition, a local coordinator was assigned to collect information related to the preparation of the draft 10-Year Environment City Plan by DONRE and to check that the proposals and inputs from the Japanese team were efficiently delivered and reflected in the drafting process of the plan. The coordinator reported that of the proposals and input from the Japanese team, the above recommendations (1) to (4) were taken on board by DONRE.

3.2 The main results of climate action plans for Da Nang City

(1) Proposal for the climate change action plan related to "10-year Environmental Plan"

Although efforts on transitioning to a low carbon city have been included in the final draft of the Da Nang City "10-Year Environmental City Plan," integrated target setting as a measure for climate change is not always sufficient. Therefore, we shared the information such as goal setting, index setting, relationship with other development plans, formulation process, concrete program for developing the newly suggested climate change action plans for the Da Nang City.

(2) Proposal of evaluation method for formulating a concrete climate change action plans for Da Nang City

By reviewing the analysis method of climate change policy in other cities, we have established a research consortium to jointly analyze the status of existing data for climate mitigation measures with the collaboration from Da Nang University. Due to the situation of COVID-19 pandemic, we focused on the literature reviews and analysis from the existing reports. Specifically, these came from the back-casting modeling analysis from "The World in 2050", the climate change policies which Yokohama City developed, as well as London's 1.5 degree climate compatible plan. In addition, the further information about the regional circular and ecological sphere (Regional CES), and the social transformation to achieve the SDGs were also suggested. Based on the reviews and analysis, the GHG reduction potential in the building and transportation sectors was presented to the Da Nang City. Furthermore, in order to effectively propose a climate change action plans, IGES has announced a comprehensive research framework involving several international research institutes (including Da Nang University and the International Institute for Applied Systems Analysis (IIASA)) along with collaborations between Yokohama City and Da Nang City. Moreover, private companies based in Yokohama City can play significant roles for developing implementation strategies and technology transfer components.

(3) Information sharing and climate change policy recommendations at the workshop

At the 2nd Workshop held in January 2021, in addition to the above analysis results, we made a presentation giving suggestions for the direction of a carbon-neutral city based on the climate change policy in Viet Nam and the urban development master plan of Da Nang City. The participants in Da Nang City agreed on the importance of a policy-making process based on scientific knowledge and analysis, and gained the support for further cooperation with local research institutes such as Da Nang University.

3.3 Progress of JCM Applicability Survey for Energy Conservation Project

In this survey, we conducted a feasibility study for three technologies.

(1) Energy conservation in factories (Waste heat utilization)

Regarding waste heat utilization technology, activities were conducted with this year's goals being to investigate the current situation in the field, study design methods in accordance with local standards, and investigate feasible construction methods and scheduling. However, while there were some aspects of the implementation feasibility study that could not be fully conducted since field surveys could not be carried out due to the impact of COVID-19, with regard to the feasibility of implementing (1) a waste heat utilization project and (2) a carbon dioxide emission reduction project, we were able to examine the general course of action. As a result, because of Danang Steel's small production scale, it was decided that, in terms of efficiency and economic feasibility, it would be difficult to install this technology and system as a project for waste heat utilization. As for the carbon dioxide emission reduction project, we were able to obtain diagnostic results that indicate that energy conservation is possible for multiple items. The details will be examined from the next fiscal year onward.

(2) Installing LED bulbs in streetlights

At the beginning of this fiscal year's survey, we attempted to coordinate with related local organizations and the Department of Transport in Danang to contribute to the Danang smart writing concept. At the time, this activity was conducted with the aim of investigating the specifics of the construction methods, illuminance, number allocated, and so on in accordance with local conditions, as well as coordinating with local organizations to determine the quantity that could be installed and the scale of the budget. However, as with other technologies, COVID-19 had an impact on our activities. While the necessary field surveys and discussions took time, we conducted illuminance tests (streetlight tests) to compare the illuminance with other companies' products on the Investment Promotion Center (ITPC) site, and we analyzed the results thereof. As a result, we found that the products selected by this study had advantages.

(3) Efficient air conditioning (radiant cooling and heating air conditioner)

This fiscal year, the plan was to ascertain the efficiency and energy consumption of equipment in accordance with local weather conditions in Danang City, as well as to predict the energy consumption and greenhouse gas emissions that would result from its implementation. Due to the impact of COVID-19, it was not possible to travel to the site, so we explained the radiation-type heating and cooling system to Danang City Department

of Industry and Trade (DOIT) through multiple web conferences. Because we managed to get them to understand to a degree, upon consideration of the evaluation methods, it was agreed that an evaluation test would be conducted at the ITPC. However, because of the limitation of the overseas business trip, we were unable to go to the site and conduct an evaluation test using evaluation equipment.

4. Activities Based on Specifications

4.1 Support for the formulation of the 10-Year Environment City Plan (2020-2030)

4.1.1 Proposals on Da Nang's 10-Year Environment City Plan (2020-2030)

4.1.1.1 Review of the past 10 years of achievements

Da Nang DONRE prepared the "Result synthesis report of the 10-year implementation of the Scheme 'Building Da Nang-An Environmental City'" in 2018. This report lists all the achievements and shortcomings of the 2008-2018 environmental plan, as well as challenges, opportunities and visions for 2020-2025 and targets and tasks for each environmental sector (water, air, forests and nature, soil and waste, environmental management). The new 10-Year Environment City Plan (2021-2030) formulated by Da Nang will be an highly-significant document, as it is expected that additional areas will be added to the plan to further strengthen the targets for 2030 based on an evaluation of the city's performance in 2018. The main points of the report are summarized in Attachment 1.

An overall assessment of the period between 2008 and 2018 indicated that three of the ten environmental indicators had not been achieved. Those that the city achieved included (1) air pollution index, (2) noise levels, (3) average urban green area, (4) percentage of households using potable water, (5) percentage of pre-treated industrial wastewater, (6) urban wastewater treatment rate, and (7) solid waste collection rate. Those that had not been achieved included (1) ratio of factories with air pollution control systems, (2) achievement of water quality standards for rivers, coastal areas, lakes and groundwater, and (3) ratio of reuse of industrial water.

The following deficiencies in the plan were identified: (1) Inadequate environmental management plans (i.e., securing buffer zones between industrial and residential areas, waste collection stations in residential areas, insufficient wastewater and waste treatment due to excessive tourism development in coastal areas, etc.), (2) Lack of investment in pollution treatment facilities, (3) Inadequate investment in monitoring equipment and data management for environmental management and lack of human resources, (4) Insufficient budget for investment in environmental infrastructure from the central government, (5) Inclusion of increased penalties for violators in the National Environmental Protection Law enacted in 2014, but difficulty enforcing crackdowns and penalties, and (6) Lack of adequate

guidance from the central government on national environmental management laws and regulations.

The abovementioned points form a general assessment, but achievements and shortcomings are similarly summarised in the areas of the water environment, air quality and greening, soil environment and waste management, and environmental management.

The report also describes the challenges, opportunities and visions for 2020 to 2025, as well as the targets and tasks for each environmental sector based on the 10-year performance review. The vision for 2020-2025 included the following: (1) Developing a balance between the natural and social environments, (2) Sustainable society and economy through the effective use of resources, responses to climate change, and conservation of the natural environment, and (3) Enhancing measures to address pollution before it occurs and the development of a circular economy. Climate change is mentioned, but there is a stronger focus on climate change adaptation with limited reference to climate change mitigation or low-carbon development. "Low carbon" seems to be described as individual responses to energy efficiency, clean transportation and cleaner production. For example, Attachment 2 includes Da Nang's environmental indicators for the period between 2020 and 2025, with the following indicators related to low carbon: (1) ratio of GHG emissions reduced annually from power sources, (2) rate of energy efficiency in the city, (3) ratio of buses achieving Euro 4 emission standards, (4) forest coverage rate, and (5) urban green space per capita.

The above is an evaluation of the performance of Da Nang's environmental plan between 2008 and 2018, as well as its direction for the period between 2020 and 2025. The review of this report is important in providing an understanding of the extent to which low carbon has been taken into account in the input provided through this project for the new 10-Year Environment City Plan (2021-2030) being prepared by Da Nang.

4.1.1.2 Proposals on setting targets and indicators for the environmental management plan

The Japanese project team participated in a meeting on 31 August 2020 on the drafting of the 10-Year Environment City Plan between DONRE, relevant Da Nang city departments and local consultants. At the meeting, the participants discussed the need for further studies on setting targets and indicators for the environmental plan. In particular, discussions at the meeting focused on the importance of setting environmental targets and indicators for the environmental plan, not only from the perspective of the environment, but also from the viewpoint of urban development. The discussions also pointed out the need for Da Nang to set environmental targets based on the city's distinctive tourism characteristics. Based on its own experience, Yokohama suggested that the participation of residents, especially in environmental management activities, is extremely important and that Da Nang should

consider setting indicators from that perspective.

Targets and indicator settings from Yokohama City's environmental management plans were compiled, and this information was provided to DONRE (Attachment 3). Yokohama formulated the "Yokohama Environmental Management Plan" in 2011, and the city compiles and publishes an annual report on its progress and the state of the environment. The Yokohama Environmental Management Plan sets out basic policies from a comprehensive perspective, as well as an environmental focus, such as in terms of global warming measures and biodiversity, and defines environmental targets and measures to achieve these targets by 2025, as well as indicators on the progress and achievements of these measures. Comprehensive basic policies include those set for the (1) environment and individuals/local communities, (2) environment and economy, and (3) environment and urban development. Basic policies with an environmental focus include: (1) global warming measures, (2) biodiversity, (3) water and greenery, (4) urban farming, (5) resource recycling, (6) living environments, and (7) environmental education and learning.

For example, the following indicators have been set in the section on "Environment, People and Community" as part of comprehensive basic policies in the Yokohama City Environmental Management Plan. Many of the indicators have been set with a focus on public participation.

【Promotion of environmental activities and development of networks】

《Promotion of environmental activities by residents and businesses》

Indicators: Number of organisations that have received awards for environmental activities in Yokohama, number of awards for individuals promoting the "Yokohama 3R Dream" environmental action award, number of awards for the Yokohama City Park Protection Association, and number of organisations receiving the Yokohama Global Warming Countermeasures Award

《Dissemination of information using ICT》

Indicators: Number of followers of Yokohama's environmental information, number of tweets annually on environmental information from Yokohama

《Forest development volunteers》

Indicator: Number of registered forest development volunteers

【Creating spaces and circles for "learning"】

《Biodiversity, YES! On-demand environmental education classes》

Indicators: Number of on-demand environmental education classes, number of participants in on-demand environmental education classes

《Children's Eco-Forum》

Indicators: Number of schools participating in the Children's Eco-Forum

《Children's Eco-Life Challenge!》

Indicators: Number of schools participating in the Children's Eco-Life Challenge, number of primary school-aged children participating in the Children's Eco-Life Challenge, number of corporate sponsors for the Children's Eco-Life Challenge

In addition, the following indicators have also been set for global warming measures under basic policies that have an environmental focus in the Yokohama Environmental Management Plan.

【Promotion of activities through the power of the city's residents and collaboration with companies】

Indicators: Number of companies, residents and other organisations working with the city to promote global warming measures

【Creation of cutting-edge smart cities】

Indicators: Number of energy collaboration bases using the results of demonstration projects

【City-to-city collaboration and dissemination of information on the global stage】

Indicator: Number of times participating in international meetings, other

【Creation of sustainable cities】

Indicator: Total volume of waste and resources

【Introduction of renewable energy to the maximum extent and creation of a hydrogen society】

Indicator: Number of hydrogen stations constructed

【Enhancing adaptation strategies】

Indicator: Newly designated under the green space conservation system

Environmental targets for each of the basic policies under the Yokohama Environmental Management Plan, measures to achieve targets, and indicators related to the progress and achievements of these measures as described above were compiled and submitted to Da Nang City as reference.

4.1.1.3 Proposals related to items that should be included in the environmental management plan

In the past, environmental management plans in Da Nang City have been divided and arranged vertically into water, air, soil, waste, noise and biodiversity. However, a more preferable method would be to consider setting environmental management targets and indicators based on a cross-sectional view of the environment from the perspective of the sustainable development of the city. To do so, Da Nang will need to incorporate the perspectives of climate change measures and a circular economy, in particular. The visions,

targets and indicators for the period between 2020 and 2025 mentioned above may include elements of climate change and a circular economy, but a slightly clearer statement is expected. It will be necessary to suggest that the concept of low-carbon development and specific programmes be incorporated into climate change, as this project will provide support for the development of a low-carbon society.

Another proposal that should be made, based on Yokohama's experience, is to mainstream public participation, including civic society, into environmental management planning as much as possible. Environmental management plans in Da Nang City encourage public participation activities, which are already taking place. However, with the expectation that these activities will become more diversified in the future, residents and companies will also take part in the formulation of environmental management plans, which will raise the effectiveness of these plans, and ultimately, environmental improvement and protection.

Specifically, the following four proposals were developed. These were presented at a high-level workshop and sent in letter form to the senior officials of Da Nang (Vice Chairman of the People's Committee and the Director of DONRE) (Attachment 4).

【Proposal 1: To broaden the scope to low carbon and circular economy in the environmental management plan】

Low carbon development and circular economies are considered to be an important aim for the creation of a "sustainable city", which should be the next stage for an "environmental city" to pursue. These fields will also help enhance environmental management. An example of this would be to enhance energy efficiency activities or develop renewable energy that can reduce GHG emissions to simultaneously reduce air pollutants. A circular economy will increase the efficiency of resources in product lifecycles and reduce pressure on the natural environment. For this reason, the Japanese team suggests the inclusion of low-carbon and circular economy issues with clearer targets in the new 10-Year Environment City Plan.

【Proposal 2: To seek multi-benefits of climate actions for other objectives including environmental management】

Energy efficiency and renewable energy have less of an environmental impact in terms of air pollution, for example, and the introduction of these technologies may contribute to enhancing the local industrial base and increasing employment. Alternatively, mangrove planting in coastal areas can also lead to protection of marine biodiversity. ICT technologies can also provide solutions for achieving economic growth that is in balance with social development and environmental management, including climate change. Smart energy, for example, is the process of improving energy efficiency and promoting eco-friendly options

while driving down costs. These will also help in the development of disaster risk responses in the event that power supply from the grid is disrupted. In fact, both Da Nang and Yokohama have started to discuss the possibility of introducing a smart energy project in some areas of Da Nang in cooperation with private companies. These are some specific areas in which Yokohama can offer their cooperation

【Proposal 3: To mainstream "Public participation" into the environmental management plan】
One of the most important lessons that Yokohama learned from its experience is that the most critical issue in the successful implementation and achievement of an environmental plan is the active participation of the public, businesses, academics, and other stakeholders. For this reason, the Japanese team proposed that the element of "public participation" be included when setting targets, measures, and indicators in the 10-Year Environment City Plan. In addition to this, the team also suggested that the content of the plan and its progress should be made available to the public periodically in a more understandable way by using visual materials, for example.

【Proposal 4: To share information on the results of environmental monitoring in public through ICT】
Strengthening environmental monitoring systems is critical for environmental planning and pollution control. In this regard, it is also important to consider how data can be used not only by administrators and experts, but by residents and the general public as well to promote an understanding of the quality of the environment where they live, and to motivate them to take part in environmental protection activities. In addition to this, data can be used for routine public health activities to protect residents, including children and vulnerable groups. Furthermore, the disclosure of such information can put pressure on companies that are not in compliance with pollution control measures. For this reason, the Japanese team suggested the inclusion of a project to establish an ICT-based information disclosure system to share the results of environmental monitoring as a priority project in the new 10-Year Environment City Plan.

4.1.1.4 Programme and project list in the 10-Year Environment City Plan

In the initial stages of drafting the 10-Year Environment City Plan, Da Nang had developed a list of high-priority programmes and project proposals. From this list, the Japanese team identified those for which they could share knowledge based on Yokohama's experiences, compiled proposals and submitted these to DONRE (Attachment 5). Specifically, the team identified the following programmes/project proposals set out by Da Nang City for which

Yokohama and local companies may be able to contribute their knowledge.

Programmes and projects in Da Nang City	Content of input from Japan
Convert to public transport that operates on clean fuel	This project should contribute to air pollution control. However, considering that most air pollutants are emitted from private automobiles on roads, including motor bikes, measures should be taken directly on those targets. In this respect, the Japanese team suggests the addition of a project to promote fuel conversion from fossil fuels to electric vehicles or fuel cell vehicles in private automobiles. These measures would include not only changes in the technologies of the vehicles themselves, but also the construction of fuel stations and financial incentives to promote fuel conversion. Yokohama City and local companies have experience in developing policies and infrastructure in this field.
Organize competition to learn and compose movies, photos,... about climate change, bring climate change content into activities of organizations, community, and unions	This program aims to raise awareness on climate change and encourage climate change action by the public. In order to make these activities more effective, a framework with clear targets on responses to climate change may be needed. In this respect, long-term goals and a plan on climate change for Da Nang are expected to be developed, including reductions in GHG emissions. In 2008, Yokohama City launched an action plan aiming to reduce per capita emissions of GHG by at least 30% by 2025. This initiative aims to cut GHG emissions through the promotion of energy conservation at public facilities, and by encouraging residents and businesses to adopt lifestyles and practices that reduce GHG emissions. Yokohama is also striving to achieve a 10-fold increase in the use of renewable energy under the Yokohama Action Plan to Stop Global Warming. In 2018, Yokohama City set a higher goal of achieving carbon neutrality by 2050, namely “Zero Carbon Yokohama”. A “zero-carbon Yokohama” cannot be realised by following the current

	course of action, but requires innovations in technology, socio-economic systems and lifestyles. In other words, higher targets are expected to lead to new innovations. These experiences may help Da Nang develop long-term targets and plans for climate change.
Install environmental monitoring systems, networks (air, soil, water) and improve capacity for environmental warnings	The installation of environmental monitoring systems is also critical for environmental planning and enforcing pollution control. In this respect, it is also important to consider how the data can be used not only by administrators and experts, but also by residents to enhance their understanding of the quality of the environment where they live and to motivate them to take part in environmental protection activities. One suggestion would be to add a project to establish an open information disclosure system for the public to share the results of environmental monitoring utilising ICT (website). Yokohama discloses information using ICT so that data is accessible by all residents. This experience may help Da Nang City in establishing a similar system.
Strengthen integrated environmental management	It would be effective for the 10-Year Environment City Plan to incorporate cross-cutting procedures for formulating plans, monitoring and evaluating the status of achievement of goals and implementation of measures, and reflecting the results in the next plan. The following example of methods used by Yokohama may be useful as reference. [Procedures for formulating and revising plans, managing progress and promotions] ・Indicate the current state of and issues in the environment, environmental targets, measures to achieve environmental targets, roles of the city, businesses and residents, and relevance with other related plans. ・Prepare a format for recording the progress towards achieving targets in advance so that implementing bodies can keep records. ・Consult with residents, companies, and experts (councils)

	over the process of drafting plans to reflect their opinions, and once formulated, release the plan on the Yokohama City website. ・Establish a promotional council to coordinate and manage progress in order to promote plans in a cross-cutting and effective manner through cooperation with responsible agencies, related bureaus and wards. ・Revise the basic environmental plan during the implementation period in light of the development of environment-related laws, changes in social conditions, shifts in public awareness, implementation status of measures, and consistency with related individual plans. [Procedures for understanding, evaluating and disclosing the results of goals and implementation of measures] ・Prepare an annual report and publish it for the public on Yokohama's website. ・The annual report describes the status of achievement of environmental targets, implementation status of measures, status of the environment through various types of monitoring, and the results of public awareness surveys on the environment. ・The contents of the annual report are fed back to entities that are implementing measures, which are utilised in plans for the next fiscal year and lead to more comprehensive and cross-cutting coordination in promoting environmental policies.

The Vietnamese government (Ministry of Natural Resources and Environment) and Japan (Ministry of the Environment) signed a joint ministerial statement at the 6th Viet Nam-Japan Environmental Policy Dialogue held on 24 and 25 August 2020, agreeing to cooperate on decarbonisation in both countries, which was also added as input to Da Nang. The statement lists climate change as one area of cooperation and includes the following references to decarbonisation. "Both sides shared the review of climate change measures after the adoption of Paris Agreement and confirmed commitment for continuous and enhanced cooperation in the areas of mitigation, transparency, and adaptation. Regarding mitigation, both sides agreed on comprehensive cooperation for

advancing transition towards decarbonization in Viet Nam through introducing and/or updating policies, instruments, capacity building and diffusion of low-carbon and decarbonized technologies, including developing the long-term strategy and mainstreaming renewable energy…"

4.1.1.5 Reflecting proposals from Japan in the final version of the 10-Year Environment City Plan

Da Nang DONRE held several consultation meetings with stakeholders in Vietnam (including relevant city government agencies, universities, research institutes, related industries, civic groups, and Japanese counterparts in this project). They completed the final draft of the 10-Year Environment City Plan at the end of October 2020 and submitted it to the city's People's Committee in early November 2020 for approval.

The following summary is based on information from the local coordinator hired for this project to confirm the extent to which input and proposals from the Japan team have been reflected in the project. The local coordinator worked with DONRE on a daily basis to gather information and exchange ideas (including supplying information, input and proposals from the Japan team and providing supplementary explanations, etc.) and was also involved in the process of preparing the 10-Year Environment City Plan.

Attachment 6 is the final draft version of Da Nang City's 10-Year Environment City Plan. Sections that reflect the input and proposals made through this project are highlighted in yellow.

(1) Increase in the number of low-carbon related indicators compared to environmental target indicators for 2020 to 2025

Of the indicators in the plan, the following have been listed as low carbon.

Proportion of industrial production establishments applying cleaner production solutions
Percentage of businesses certified with ISO 14000 environmental management systems
Ratio of solar energy generated to total energy used during the year
Proportion of areas for pedestrians, cyclists or other environmentally-friendly vehicles
Proportion of public electric buses compared to the total number of buses in operation in the city
Ratio of roofs and balconies planted with trees to the total area

of roofs and balconies in the city
Proportion of enterprises having a minimum green area of 20% of the total construction area

(2) Clear description of low-carbon related issues in solutions

1) Solutions on institutions and policies

Under energy, the following points are included: "(1) Develop and announce standards of fuel consumption, roadmap to eliminate old and outdated fuel-consuming technologies from energy production and use systems, (2) To replicate the model of using renewable energy into large energy-consuming production and business establishments, (3) Develop a roadmap to change the fuel of public transport from gasoline or diesel to clean fuels with less emissions (piloting on main high-commuter routes), and (4) Label energy saving devices."

2) Scientific and technological solutions

The plan states that the city should "take advantage of Da Nang's strengths of natural energy and waste (sunlight, wind, water, industrial by-products, etc.) to apply energy development models to socio-economic development to reduce pressure on environmental pollution and the budget for waste disposal".

3) Solutions for building and developing resources

The report states that "annual professional training courses will be organised for civil servants and officials in the field of natural resources and environment, in order to improve their capacity to manage, monitor and respond to practical issues, such as environmental incidents and climate change."

(3) Proposals from Japan are listed among priority programmes and projects

The following programmes and projects are listed.

Research, examine and propose solutions to build Da Nang into a Low Carbon City
Set up a public information disclosure system to share results of environmental monitoring using IT (website)
Investigate and evaluate the current situation of people's complaints and denunciations about environmental pollution and raise public awareness on environmental protection and efficient use of natural resources
Investigate and assess the level of satisfaction of people for environmental quality
Propagate and mobilize people to use environmentally friendly means

4.1.2 Compilation of key projects for the 10-Year Environment City Plan and introduction of public relations methods

4.1.2.1 Organisation of potential areas of cooperation on key projects in the 10-Year Environment City Plan

Programmes and projects listed in the final draft of Da Nang City's 10-Year Environment City Plan were examined by the Japanese counterparts involved in this project to determine areas of potential cooperation in the future. Since this project focuses on cooperation to create a low-carbon society in Da Nang, priority has been placed on programmes and projects in this area. However, projects that have been discussed at the Da Nang Development Forum and other meetings since 2013 between the two cities, as well as environment-related projects in cooperation with Da Nang City using funds from JICA's Partnership Program and other sources, were also considered.

The following potential areas for cooperation have been identified.

Potential areas of cooperation in Da Nang's 10-Year Environment City Plan (2021-2030)

1. Potential areas of cooperation in this project (study commissioned by the Ministry of the Environment, Japan)

Programmes/Projects listed in Da Nang's 10-Year Environment City Plan (2021-2030)			Potential areas of cooperation with Japan
I.4	25	Build an environmental monitoring network in Da Nang to 2030 with a vision to 2045	Proposal for building an environmental monitoring network in Da Nang by reviewing the current situation and required improvements (Specific proposal) Introduction of ideas to establish a citywide environmental monitoring network (including the introduction of experiences of other cities in Vietnam or other countries with the installation of environmental monitoring systems and equipment) 【Murata Keisokuki Service】
I.4	28	Set up a public information disclosure system to share results of environmental monitoring using IT (website)	(1) Advice on developing a plan for an information disclosure system on environmental monitoring data (2) Advice on introducing a pilot project for the information disclosure system

			(Specific proposal) Introduction of case studies on disclosing information on monitoring data (including the introduction of equipment required for information disclosure systems for monitoring data) 【Yokohama City】
I.4	29 30	Install automatic water/air quality monitoring stations in the city	Proposal for the introduction of automatic environmental monitoring in the development of a citywide monitoring network described in 1.4 above (including a pilot project seeking JICA funding) (Specific proposal) Submission of ideas on the introduction of automatic monitoring systems (including the introduction of results from a JICA feasibility study) 【Murata Keisokuki Service】
II.1	1	Investigate, examine and propose solutions to build Da Nang into a Low Carbon City	The following are considered to be activities that will contribute to the formulation of a low-carbon plan for Da Nang. (1) Organise processes and methods to formulate a low-carbon city plan linked with the 10-Year Environment City Plan (Specific proposal) Introduction of process used to formulate the Yokohama City Action Plan for Global Warming Countermeasures 【Yokohama City】 (2) Consolidating existing data and analyses on estimated GHG emissions from Da Nang and potential reduction in major sectors (Specific proposal) Introduction of existing data and analysis on estimated GHG emissions from Da Nang and

			potential reduction in major sectors 【IGES】 (3) Study on energy-efficiency projects, including factories, that can be applicable to the JCM (Specific proposal) Introduction of JCM candidate projects that are currently being examined 【Osumi, Macnica】 (4) Support residents in disseminating appropriate methodologies to promote energy efficiency and reduce energy consumption while improving comfort (Specific proposal) Introduction of energy-efficiency methods for general residences and private buildings in Da Nang under JICA's Partnership Program and awareness activities on energy efficiency for residents 【Osumi】
II.4	19	Investigate and evaluate the current situation of people's complaints and denunciations about environmental pollution and raise public awareness on environmental protection and efficient use of natural resources	Preparation of draft pamphlets for both residents and companies that were of particular interest to Da Nang based on the public relations materials sent by Yokohama to Da Nang in September 2020 (Specific proposal) Examination of Yokohama's public relations methods that are of particular interest to Da Nang 【Yokohama City】
II.4	20	Investigate and assess the level of satisfaction of people for environmental quality	Proposal for designing the content of a survey on the awareness level of residents on the environment and global warming and ways to utilise the results of the survey (Specific proposal)

			Introduction of an awareness survey of residents in Yokohama City 【Yokohama City】

2. Potential areas for cooperation using other sources of funding

Programmes/Projects listed in Da Nang's 10-Year Environment City Plan (2021-2030)			Potential areas of cooperation with Japan
I.2	6	Survey and audit waste sources in production, business, and service establishments in Da Nang city	Proposal for establishing a mechanism to sort waste from households and methods of publicising and raising awareness, as well as sharing know-how on waste collection and transportation and recycling technologies (Specific proposal) JICA Partnership Program on a model project to promote separation of household waste 【Yokohama City】【IGES】
I.2	14	Sort waste at source	
I.2	15	Restore the environment in solid waste treatment and landfill facilities	

4.1.2.2 Provision of information on public relations methods used by Yokohama

As Da Nang City has considerable interest in raising public awareness on the environment and encouraging participation in environmental activities, information was provided on the methods used by Yokohama to publicise environmental-related information and activities to residents. The information provided also included publicity on climate change measures (low carbon), as well as environmental protection.

Yokohama City's methods of publicising environmental information and activities to residents were compiled in Attachment 7, organised by public relations type, media/product, environment/climate change, and title of publication, as well as an outline and reference materials (links).

Da Nang City is also disseminating information on the environment and publicising activities on radio programmes, through education and extracurricular activities at schools and award programmes. However, the Japanese team determined that Yokohama City's open lectures, resident/business awareness surveys, joint activities with companies, tours of waste treatment and renewable energy facilities, and use of mascot characters might be a source of new ideas for Da Nang.

For example, awareness surveys are conducted for residents and companies with headquarters or offices in Yokohama to ascertain their awareness of the environment and the

status of implementation of environmentally-friendly activities. The results of the survey are used as basic information for future municipal administration and policy planning in the environment field. Da Nang has expressed interest in the awareness survey, and as mentioned above, this has been listed as one of the programmes and projects in the final draft of the 10-Year Environment City Plan.

4.1.3 Organisation of workshops

4.1.3.1 Workshop 1

Da Nang DONRE conducted several consultation meetings during the drafting phase of the 10-Year Environment City Plan. The highest level meeting was held on 17 October 2020 in Da Nang. Organised by DONRE, the department requested the Japanese project counterparts to take part in the workshop and deliver a presentation online (For this reason, all of the costs for this workshop were borne by DONRE.)

The agenda and list of participants for this consultation meeting are shown in Attachment 8. Attending as a representative of the central government, Mr. Vo Tuan Nhan, Deputy Minister of the Ministry of Natural Resources and Environment (MONRE), and Mr. Tran Van Mien, Deputy Chairman of the Da Nang City People's Committee, participated in the meeting and delivered remarks. Deputy Minister Nhan spoke about how MONRE is currently formulating a National Environmental Protection Strategy and has plans to prepare an action plan based on this strategy. He requested that Da Nang City consider how to ensure that its plan would be consistent with the strategy.

This was followed by an overview of the National Environmental Protection Strategy by the Deputy Director of the Institute of Strategy and Policy on Natural Resources and Environment (ISPONDRE), which included the following key points: (1) focus on proactive measures to deal with pollution rather than post-treatment, (2) use of ICT for environmental monitoring, (3) increased investment in pollution and waste management measures, (4) introduction of a circular economy, and (5) enhancing climate change measures (for both adaptation and mitigation). The Deputy Director also suggested that Da Nang City reflect these perspectives in its environmental management plan.

Next, DONRE reported on the achievements over the past 10 years in building up Da Nang as an Environmental City, mentioning several focal activities, including measures for extremely polluted areas (hot spots), massive investments in sewage treatment, and a number of educational and awareness raising activities. As a result of these activities, the city was highly acclaimed for its environmental activities, winning six awards. However, three of the 10 target indicators (ratio of factories with air pollution control systems, achievement of water quality standards for rivers, coastal areas, lakes and groundwater, and ratio of reuse of

industrial water) have not been achieved. The most significant challenge at this time is waste management; in the future, environmental measures will pose a major issue with the development of the service and tourism industries as a result of rapid urbanisation.

Lastly, the consultant who is preparing the draft of the 10-Year Environment City Plan under the direction of DONRE explained about the framework of the draft plan (draft targets and indicators, forecast of the future state of the environment, and draft list of high-priority programmes and projects).

The session then moved on to comments from participants and an interactive exchange of ideas. First, IGES spoke on behalf of the Japanese team, which has been asked to deliver a presentation, highlighting four proposals on issues expected to be included in the 10-Year Environment City Plan. The contents of those proposals are described in section 4.1.1.3 Proposals related to items that should be included in the environmental management plan. In his comments on the presentation, Deputy Minister Nhan from MONRE expressed his support, particularly on the points for enhancing public participation and the use of ICT to disclose information on environmental quality. He also expressed his strong expectation that environmental cooperation between Vietnam and Japan, as well as city-to-city cooperation between the cities of Da Nang and Yokohama would grow even more.

This was followed by comments from experts in various fields of academia and related industries in Vietnam. Mr. Mein, Vice Chairman of the Da Nang People's Committee offered a summary based on the day's proceedings, covering the following key points: (1) mobilise communities and take multi-sectoral action, (2) utilise ICT, (3) promote the participation of the private sector, and (4) ensure environmental quality and improve monitoring in order to strengthen the development of Da Nang as an environmental city.

The presentation by DONRE (past 10 years of achievements in building Da Nang as an environmental city and an outline of the draft of the 10-Year Environment City Plan) and presentation materials from the Japan team can be found in Attachment 9.

4.1.3.2 Workshop 2

In this workshop, the contents of the 4.1.2.1 Organisation of potential areas of cooperation on key projects in the 10-Year Environment City Plan were introduced. The workshop provided an opportunity to hear opinions on whether the contents met the needs of Da Nang and which areas of cooperation were higher priority for Da Nang City. This workshop was organised by Da Nang DONRE and the Japanese team and held online. About 40 participants were invited from government and public organisations in Da Nang, such as the Department of Planning and Investment, Department of Commerce and Trade, Department of Transportation, Department of Information and Communication, Department of Agriculture

and Rural Development, Investment and Trade Promotion Center, Management Board of the High-Tech Park and Industrial Park, and the local People's Committee, as well as experts from the Danang University of Science and Technology, NGOs, and the media. Dr. To Van Hung, Director of DONRE, facilitated the proceedings, demonstrating Da Nang's ownership of this project. From Japan, Mr. Ken Akahori, Director General of the International Affairs Bureau of Yokohama City, also took part in this workshop and delivered opening remarks. The agenda of the workshop and list of participants can be found in Attachment 10.

During the workshop, DONRE first introduced the main points in the final draft of the Da Nang 10-Year Environment City Plan. This presentation included an explanation of Da Nang's international environmental cooperation activities, including an introduction to this project, as well as a JICA Partnership Project (waste management), USAID water management project, plastic waste measures project by UNDP, ESCAP, WWF and other institutions, and UNHABITAT's Global Covenant of Mayors for Climate & Energy project in relation to climate change. In this sense, the number of low-carbon projects in Da Nang are limited.

Following this, the Japanese team provided an overview of potential areas of cooperation in the 10-Year Environment City Plan. This was followed by presentations on specific potential areas of cooperation by Yokohama, local companies in Yokohama and IGES. In addition, the outline and menu of support provided by the Japanese government for the development of smart cities in ASEAN were introduced. Presentations by the Japanese team at this workshop can be found in Attachment 11.

In response to this, Da Nang City mentioned the following high-priority areas related to low-carbon development: (1) raising awareness to realise an environmental city, (2) development of green buildings, and (3) shift to public transportation. Other issues related to environmental protection included measures and management of wastewater from factories, waste management, and treatment and recycling of organic emissions from agriculture and livestock.

Lastly, the next steps, identification of relevant parties in Da Nang and Yokohama that would implement these steps, and deadlines for action for each of the possible areas of cooperation presented by the Japanese team were added (draft action plan), based on the contents of section 4.1.2.1 Organisation of potential areas of cooperation on key projects in the 10-Year Environment City Plan, mentioned earlier. The draft action plan is shown in Attachment 12. As follow-up to the workshop, the parties agreed to share the draft action plan with Da Nang City in written form after the appropriate revisions were made based on Da Nang City's priorities from the workshop, and to further discuss the potential for individual areas of cooperation.

A recording of the workshop can be found in the attachments.

4.2 Areas of support for the formulation of the Local Climate Change Action Plan

4.2.1 Recommendations for the formulation of the Local Climate Change Action Plan (LCCAP)

4.2.1.1 Overview of Vietnam's Climate Change Policy (About National Determined Contributions [NDC])

Greenhouse gases in the Socialist Republic of Vietnam (hereinafter referred to as Vietnam) have been increasing remarkably along with recent economic growth, and given the concern about this problem and the international framework for addressing it, we have actively been working on climate change countermeasures. With the introduction of the National Climate Change Target Program in 2008, we formulated a National Climate Change Action Plan up to 2020. In the same year, we also formulated a national green growth strategy. Vietnam also compiled its first Intended Nationally Determined Contributions (INDCs) in 2015 under the Paris Agreement adopted by the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). INDC has set a goal of achieving an 8% reduction in greenhouse gases (GHG emissions) by 2030 compared to BAU. In July 2020, it submitted its goals to the UNFCCC as a nationally determined contribution (NDC).

The main details are as follows.

<Mitigation measures>

- Increased energy efficiency and reduced consumption
- Conversion of energy resources in the industrial and transportation sectors
- Shift passenger and cargo transportation models
- Introducing effective renewable energy
- Reducing GHG emissions by introducing a sustainable agricultural system
- Sustainable forest policy, increased carbon sinks, waste management
- Reduction in GHGs through conversion of construction materials

<Adaptation measures>

- Strengthen the management of municipalities and improve the efficiency of adaptation policies
- Increase local resilience by increasing the capacity for adaptation in local communities and in the economy and biodiversity.
- In preparation for the increase in natural disasters and extreme weather caused by climate change, we will improve our ability to respond so as to minimize the risk of disasters and the damage they cause.

Figure 3 shows Vietnam's BAU (Business As Usual) scenario, which is the projection by 2030 based on the actual data in 2014. According to this projection, future increases in the energy sector are particularly remarkable, and they are expected to more than triple compared to 2014. Based on this BAU scenario, the NDC contains the goal of reducing GHGs by a total of 9% compared to BAU by 2030. It also aims for a 27% reduction in the case that international support is received.

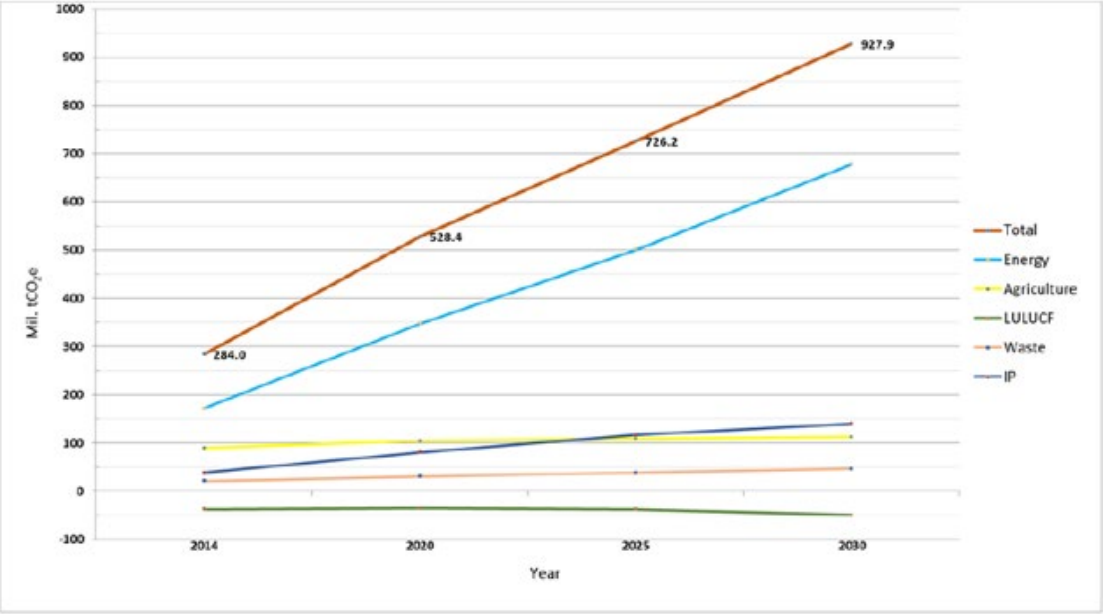


Fig. 3 2030 GHG Emissions Projection for Vietnam (BAU Scenario) (Source: VirtNam NDC)

Table 1 GHG Emissions Projection and Reduction Targets by Sector (Source: VirtNam NDC)

Unit: Mil. tCO_2eq

Year	Energy	Agriculture	LULUCF	Waste	IP	**Total**
2014	171.6	89.8	-37.5	21.5	38.6	**284.0**
2020	347.5	104.5	-35.4	31.3	80.5	**528.4**
2025	500.7	109.2	-37.9	38.1	116.1	**726.2**
2030	678.4	112.1	-49.2	46.3	140.3	**927.9**
Reduction	5.5 %	0.7%	1.0%	1.0%	0.8%	9.0 %

Table 1 shows the projection for GHG emissions in each sector up to 2030 as well as the reduction targets. Among these, while the overall target is a reduction of 9%, a reduction of

5.5% is regarded as the reduction target for the energy sector. The reduction measures in the energy sector, which is considered to have both the most remarkable increases and the highest potential for reduction, are mainly described as follows.

<Main strategies for reducing GHGs in the energy sector>

- Introduction of energy-efficient home appliances
- Introduction of an energy-efficient green building program, including construction processes
- Measures to improve energy efficiency in the industrial field
- Effective introduction of renewable energy
- Improving energy efficiency in the transportation sector
- Mode shift for aviation sector
- Modal shift from private cars to public transport
- Improved energy efficiency in the transportation sector through the introduction of electric vehicles
- Technical improvement of the construction factory production process and materials

In many urban areas, further development is expected in the future. In Vietnam, while the introduction of efficient technology and renewable energy is very promising, region-specific measures for adapting to rising sea levels and an increase in natural disasters is also a pressing issue. In particular, there is concern that these kinds of climate change effects will cause enormous damage to agricultural production, and climate change countermeasures are considered to be an important issue not only for GHG reduction, but also for safety and security.

For Vietnam, which faces many important issues when it comes to adapting to climate change, the benefits of adaptation and mitigation measures have been emphasized, but the synergy between the introduction of renewable energy, forest conservation and appropriate management programs, and sustainable, efficient agriculture has been particularly well-received.

When it comes to considering decarbonization, the following items are considered to be particularly important issues in Vietnam.

<Main issues with mitigation measures>

- Improving the capacity to meet future domestic demand for energy (need to improve market so it is effective and can compete internationally)
- Investment in energy-saving equipment and renewable energy in Vietnam is still limited.

Effective investment and market formation are needed to expand the size of the private market

- The lack of an MRV system. The lack of ordinances for implementation of climate change policies, the capacity for scientific analysis for implementation, and governance
- Incentives and attractive markets for motivating small and medium enterprises have not been formed
- Construction of a nationally controlled system in the waste sector is still insufficient

4.2.1.2 Regarding the current situation in Da Nang and areas with the potential for reducing GHGs

(1) Current situation in Da Nang and climate change policy

Da Nang is one of the five central jurisdictions in Vietnam, and it is also the socio-economic center of central Vietnam. Located at the intersection of important logistics routes and within an hour's flight of Ho Chi Minh City and Hanoi City, it is one of the country's key economic centers. Situated on the central coast of Vietnam, Da Nang has a rainy season and a dry season and a tropical monsoon climate, with the dry season lasting from February to August and the rainy season from September to January. The average annual maximum temperature is about 26°C. During Da Nang's rainy season, it rains in short, intense bursts that are similar to squalls. As a port city, Da Nang has developed tourist attractions such as beach resorts in recent years, and its international airport also functions as a gateway to Hue and Hoi An, which are World Heritage Sites. (From the Foreign Affairs Bureau of Da Nang. See Fig. 4.)

Fig. 4 Overview of the whole mega regions including Da Nang (created by IGES)

What all three major cities have in common is areas facing the sea, which is often hit by heavy floods during the rainy season. Vietnam originally had a culture based around life on the water, and in Hue, home to the Nguyen Dynasty royal palace that existed from the 19th century to the 20th century and is still a World Heritage Site, there are still traces of this water-based culture. In Da Nang and Hoi An, floods affect the city area several times a year, but people are accustomed to taking measures such as traversing the streets in boats. However, this kind of urban infrastructure that is vulnerable to floods is regarded as an issue that needs to be solved from the perspectives of the economy, universities and other educational institutions, development of local culture, maintenance of people's health, and the protection of agricultural crops. In addition, as described in the previous section, the risk of climate change has been increasing in recent years, and should be assumed that there will be a variety of risks, such as a rising sea level, natural disasters, and increased precipitation. A system of cooperation at the regional level will become important for addressing this. Figure 5, based on said situation, is a schematic drawing, recommended for this project, that was created by the Japan side and that proposes making a wide-area plan that takes into consideration not only the Da Nang area, but also the relationship between closely-related large inter-city areas, out of consideration for the sustainable development policy for the long-term future of Da

Nang.

Fig. 5 Partnership proposal that strengthens the framework for cooperation over a wide area (prepared by IGES)

Da Nang currently has a population of 1.1 million and is home to about 270,000 households. About 88% of the population lives in urban areas, and the remaining 12% lives in rural areas. The population density is about 900 people/km^2. Many citizens live in residential areas with 2- to 5-story buildings. The population density in the suburbs (rural areas) is about 180 people/km^2.

Vietnam's rate of economic growth has been high in recent years, and it is predicted that the average growth rate will be about 5% by 2050. Da Nang is one of the cities that will serve as an engine of the economy, and it recorded an average growth rate of about 12.3% from 2000 to 2007. The economy of Da Nang is supported mainly by tourism, IT, technology, and finance, with such service industries driving 55.6% of the economy. The construction industry comprises 42.8%, and agriculture is responsible for 1.6%. (From UN and ESCAP materials.)

In Da Nang, policy decisions are made by the central government and the Da Nang People's Committee, but as shown in Figure 6, with regard to the governance structure for the energy system, decisions are made mainly in Da Nang under the direct control of the Da Nang People's Committee.

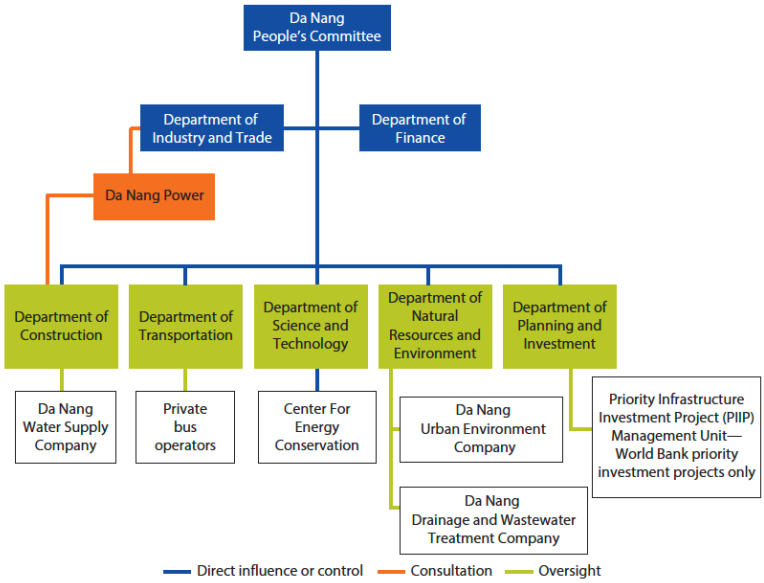


Fig. 6 Policy-making structure related to energy demand in Da Nang (Source: World Bank, 2013)

The Sankey diagram, which shows the energy flow of Da Nang, shows the balance between energy supply and demand in Da Nang. (See Fig. 7) At present, all energy in Da Nang is supplied from external sources, and no energy is being produced in the city, including renewable energy. In recent years, there has been a marked increase in energy consumption in the transportation and industrial fields. In addition, the amount of energy used for the power supply has almost doubled from 2011 to 2015. This power is mainly used in the household sector, and usage is accelerating along with the growth of the population.

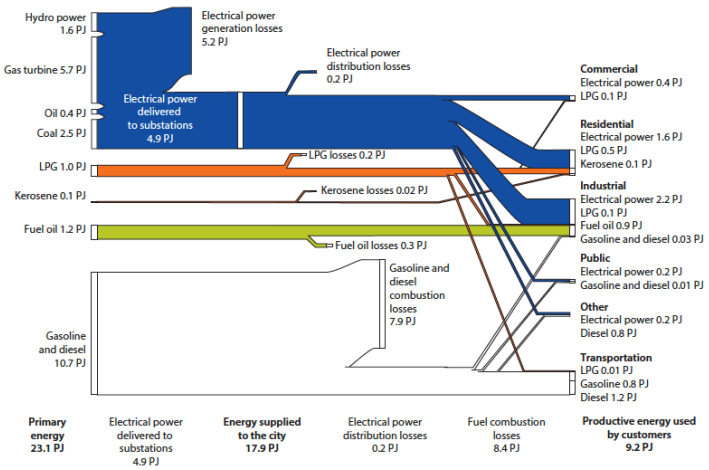


Fig. 7 Energy Flow of Da Nang (Sankey Diagram) (Source: WB, 2013)

(2) Da Nang Development Goals

In Da Nang, the formulation of a master plan for the medium-to-long term (2025 to 2045) is currently underway in parallel with the 10-year environmental plan. It examines long-term development goals and plans in detail, including road planning, BRT, land use planning, neighborhood land readjustment, green & open spaces, and disaster risk management. (See Fig. 8)

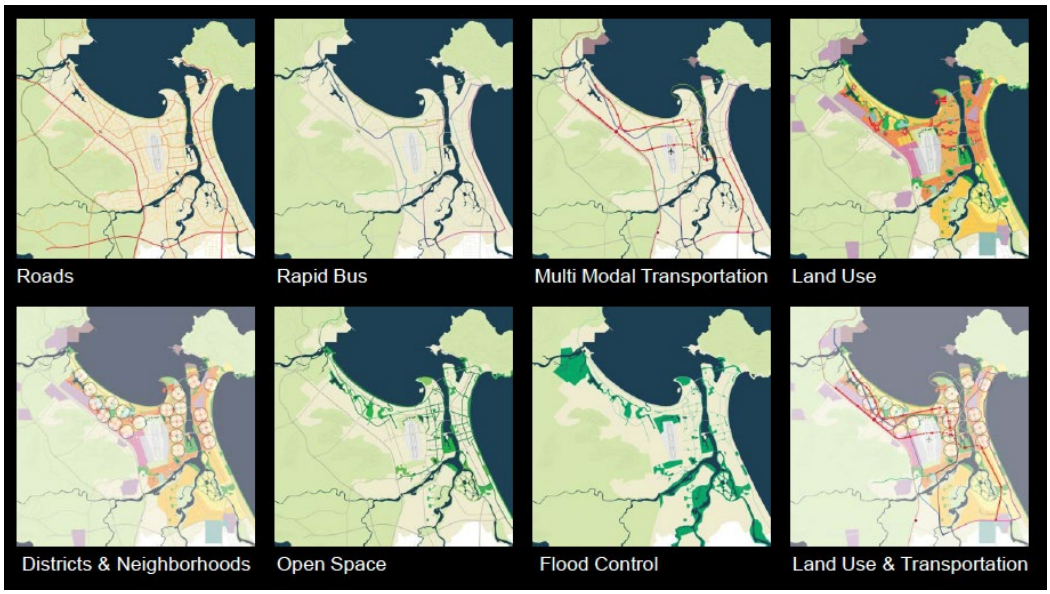


Fig. 8 Da Nang Master Plan (2025 Medium-term Plan)

Fig. 9 shows the governance structure for urban management in Vietnam. Vietnam has 63 provinces and 5 centrally controlled cities. Da Nang is one such city. Da Nang is composed of eight districts as follows.

- **6 Urban:** Hai Chau, Thanh Khe, Son Tra, Ngu Hanh Son, Lien Chieu, and Cam Le.
- **2 Rural:** Hoa Vang, Hoang Sa (islands).

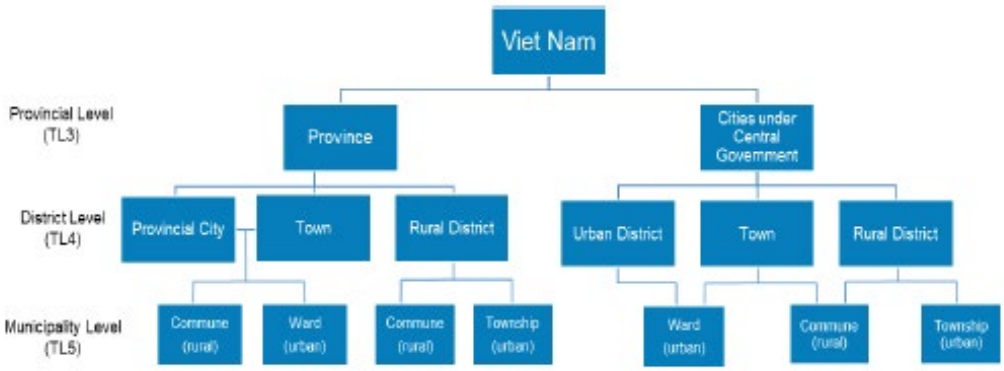


Fig. 9 Vietnam City Management Governance Structure (Source: UN ESCAP)

Da Nang's vision for the long term (2045) is based on the concept of building a global-facing network (connectivity) with unique features and smart technology in transportation, logistics, and general socio-economics. With this as the foundation, it aims to become a leader for other cities in Vietnam in fields such as high-tech agriculture, smart infrastructure, and smart communities. Figure 10 is a conceptual diagram of the sustainability of the Da Nang Master Plan.

Fig. 10 Da Nang target sustainability concept

In Da Nang, a Smart City plan has been formulated in parallel with the long-term master plan. It is a comprehensive plan for society as a whole, including human resource development, local community initiatives, and governance, and it centers on the development of ICT and smart infrastructure. (See Fig. 11) The comprehensive plan includes items such as regional resilience, security, finance, and e-government related to the economy, transportation, and security, and the Integrated Command Center (ICC) is responsible for monitoring the safety of the entire city and the healthy lives of its citizens.

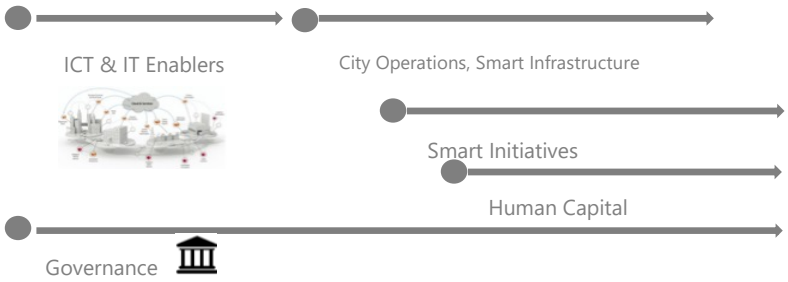


Fig. 11 Da Nang Smart City Concept

(3) Areas with potential for GHG reductions in Da Nang

Figure 12 shows the current energy consumption and GHG emissions by sector from Da Nang.

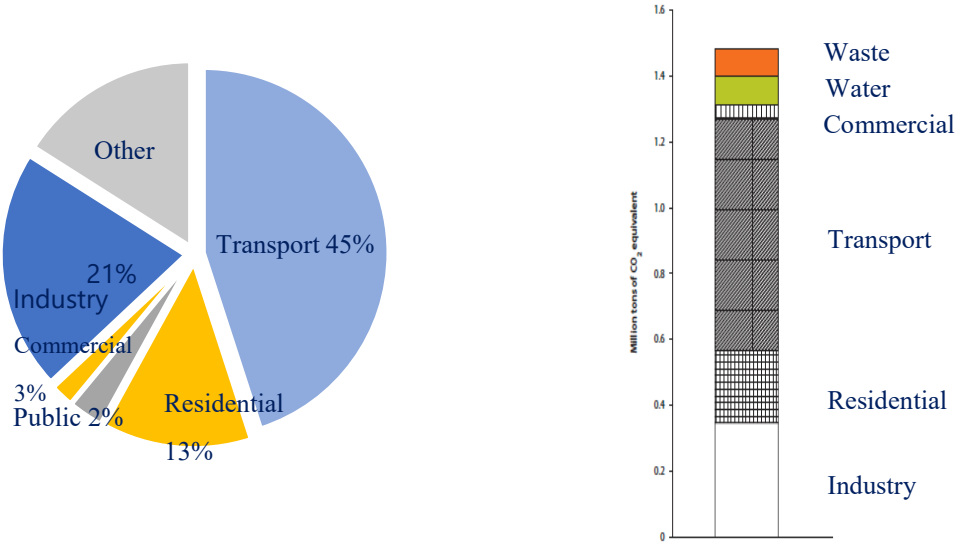


Fig. 12 Energy consumption and GHG emissions in Da Nang by sector (right)

Da Nang uses about 17.9 petajoules annually, with 45% used by the transportation sector, 21% by the industrial sector, 13% by the household sector, 3% by the commercial sector, and 2% by the public sector. With regard to GHG emissions, the city's total CO_2e is 1.54 million tons in terms of carbon dioxide. The basic unit of carbon dioxide emissions per unit GDP is 0.89 kg-CO_2, which is more than double that of Vietnam as a whole. This number is higher than that of other developing countries as well. The transportation sector accounts for 46%, and the household sector accounts for about 14.6%. While the emissions from industry are high, the emissions from the service industry comprise 3.4%.

<Energy Conservation Initiative in Da Nang, Vietnam>

The Vietnamese government has set a high national priority on the field of energy conservation and implemented The National Energy Efficiency Program from 2006 to 2015. The program includes raising awareness for businesses, families, and individuals, as well as promoting science-based analysis, business support, the creation of incentives, and the promotion of green labels.

In addition, Da Nang is also positioned as an important element in relation to sustainable development in the 10-year environmental plan. Specifically, to date, the plan has been implemented as an investment plan for effective management in the drainage sector, public lighting programs, energy conservation in public buildings, and efficient infrastructure.

(4) Building sector

In Da Nang, the development of high-rise buildings is progressing along with the development of the tourism industry, and it is expected that effective climate change-related policies will be implemented in the architecture sector, such as hotels, condominiums, and housing resulting from population growth. In particular, the area of energy conservation has shown a lot of potential.

Currently, energy consumption in the architecture sector in Da Nang is relatively low, but the fundamental reason for this is that there are many factors resulting from poverty, such as the lack of energy usage due to the burden expenses place on households (from a World Bank report). For commercial buildings such as newly constructed hotels, improvements can be expected through energy-saving equipment (efficient air conditioning and lighting programs), facade design, and architecture processes. Da Nang has introduced a green building evaluation system from the Vietnam Green Building Council since 2008, and its effects are expected to manifest further in the future. In Da Nang, the People's Committee is also implementing energy-saving renovations for the city's public buildings, an effort that functions as a pilot project, but it is still insufficient as a comprehensive initiative, and many issues remain, such as setting policy targets based on scientific evidence and implementing governance that involves stakeholders.

In Da Nang, the acquisition of reliable monitoring data from the building sector and the construction of a database are important issues. Figure 13 shows the results of an annual survey of climate change and changes in energy consumption in hotels. In Da Nang, which is warm and has very warm summers, air conditioning in the summer results in a big increase in consumption, and in the same report, it is clear that no major change in this trend can be seen from a slight decrease in tourists. (See Fig. 14)

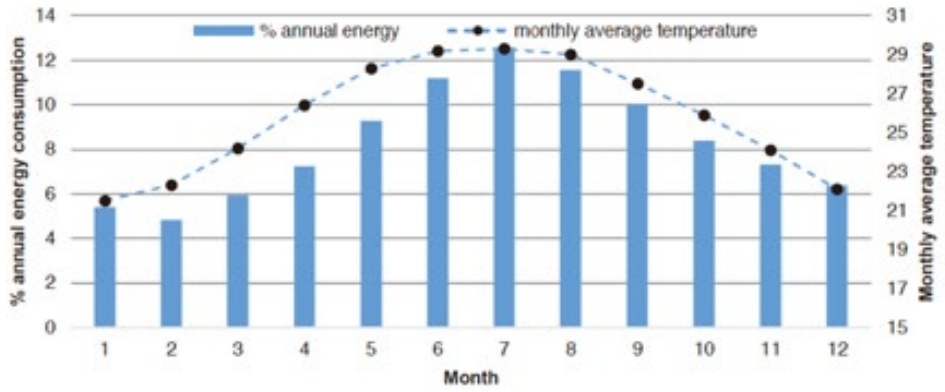


Fig. 13 Monthly Relationship between Climate Change and Energy Consumption at 50 Surveyed Hotels in Da Nang (Source: Nguyenn and Rockwood)

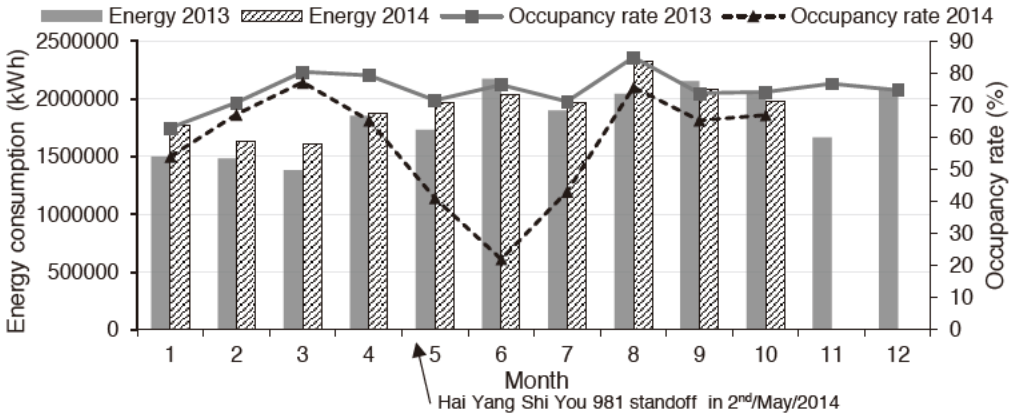


Fig. 14 Relationship between changes in hotel users and energy expenditures (Source: Nguyenn and Rockwood)

Thus, throughout the year, there is a need to develop technologies and build green programs for buildings that are appropriate for the climatic conditions of Vietnam, where the temperature and humidity are high. Currently, the Department of Architecture at Da Nang University is conducting research to analyze the effects of reducing energy consumption in the architecture sector, and in Figure 14, the key actions for reducing energy consumption and the effects of renewable energy are shown. Indicators for planning and other equipment systems are being considered.

	Decision variables
Energy saving measures	Package of building envelope (PBenv.) Efficiency of lighting and appliances Type of heat recovery unit (efficiency%) Efficiency of auxiliary systems (fans and pumps) Size of buffer tank (V_{tank}) Insulation level of the buffer tank (Th_{ins})
Renewable energy sources	Area of solar thermal collectors Area of photovoltaic module (A_{pv}) Overall efficiency of the photovoltaic Slope angle of photovoltaic module Azimuth angle of photovoltaic module
Mechanical systems	Type of primary heating unit Size of the primary heating unit Supply water temperature from the primary heating unit (Ts) Operating hour start at Operating hour stop at

Fig. 15 Variables that influence decision-making for reducing energy consumption (Source: Hamdy, Nguyen, Hensen, 2016)

As shown in Figure 16, the analysis of future energy consumption estimates and optimization in the building sector that take into account the effects of climate change is an area that still requires research not only in Vietnam, but throughout the world. It is a very advanced and challenging initiative for Da Nang, which has not set up a database.

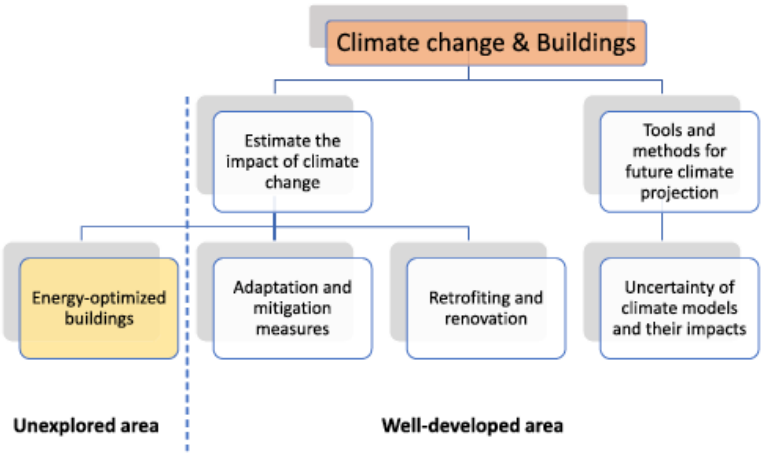


Fig. 16 Consideration of gaps in research in the architecture sector (Source: Nguyen et al., 2021)

Figure 17 shows the results of an analysis conducted by Da Nang University. It compares forecasts of changes in energy expenditure under two different climate scenarios (Representative Concentration Pathways (RCP scenario)) in Da Nang, Hanoi, Kuala Lumpur, and Bangkok. In Da Nang, a significant increase in energy expenditure is projected in both the medium scenario (RCP4.5) and the high scenario (RCP8.5).

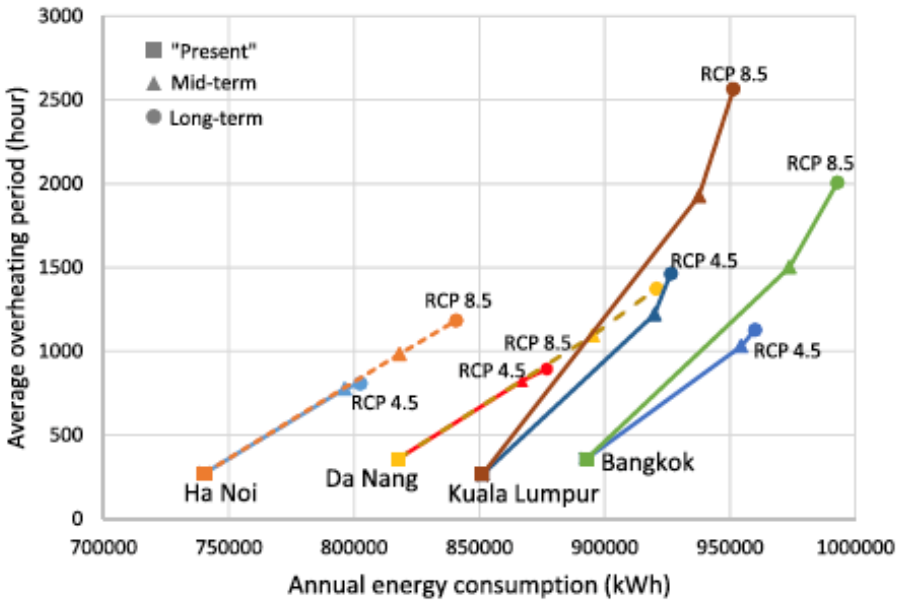


Fig. 17 Comparison of changes in energy consumption by city under two scenarios (RCP4.5, RCP8.5) from the present to the medium and long term (Source: Nguyen et al., 2021)

Based on the results obtained from these previous studies, IGES will use the Shared Socioeconomic Pathways (SSPs) framework, which is also used for future forecasting in the field of climate change, to understand the socio-economic changes in Da Nang. Based on the preconditions (narrative) in Table 2, a rough estimate was made of changes in energy consumption in the building sector in Fig. 18, taking into account changes in the population and improvements in energy efficiency. Since it was difficult to obtain detailed data during this year's survey due to the inability to carry out field surveys as a result of COVID-19, a simple forecast was made using citations from Japan's estimated data. However, in this analysis, the city's target for population growth has had a major impact, and the increase in population and economic growth has resulted in a significant increase in energy consumption. In the future, under the research cooperation system with Da Nang University, we plan to carry out more detailed analysis of social factors and set indicators and parameters, as well as conduct analysis in cooperation with Da Nang's plans for sustainable development and a smart city.

Table 2 Socio-economic prerequisites for Da Nang (Assumptions developed by IGES)

Factors	**Indicators**	**BAU scenario (SSP2)**	**High Growth scenario (SSP4)**	**Balanced sustainability scenario (SSP1)**
Social factors	Population	Maintain the status quo	Increase in central area	Balance
	Cultural value	Decline	Diluting of value	Inheriting and maintaining tradition
	Lifestyle	Slight change	Modern lifestyle	Traditional and modern
	Societal human resources	Low	High	Moderate (diversity)
	Community	Maintain	Decrease	Increase
Urban structural elements	Urban form	Widening disparity and suburbs with poor infrastructure	Urban sprawl begins and urban area expands	Well-balanced distribution
	Urban space quality	Increasing inequality	Improvement in central area; Suburban growth remains low	Overall improvement

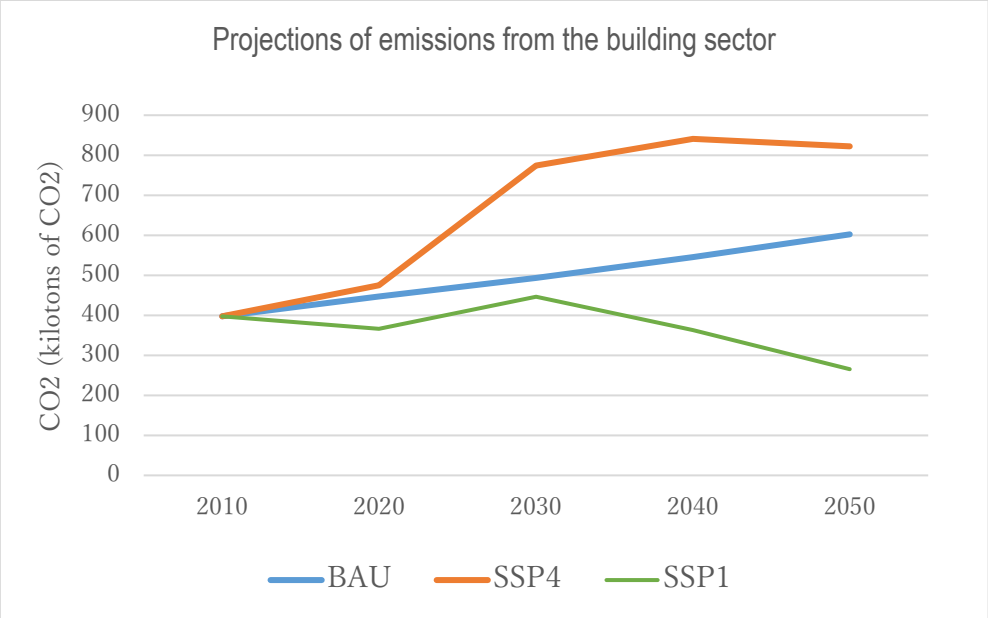


Fig. 18 Projections of future CO_2 emissions in the building sector in Da Nang (analyzed by IGES)

(5) Transport sector

The transport sector in Da Nang has the largest share of both energy consumption and GHG emissions. However, it does not seem to receive much priority in Da Nang. Yet considering the immediate effects energy conservation and emission reductions would have, it is considered to have the highest potential. When aiming for sustainable urban development, investing in infrastructure such as public transportation is an important issue, but in Da Nang, plans for urban transportation, walking and cycling, and green infrastructure are currently in the design stages as priority items in the long-term master plan, including the smart city plan.

Currently in Da Nang, public transportation such as subways and BRT is not well-developed, so private transportation such as private vehicles (including taxis) and motorcycles are the main means of urban transportation, which causes serious traffic congestion and is very problematic both in terms of safety and GHG emissions (see Fig. 19).

Fig. 19 Current state of transportation in Da Nang (Source: APEC, 2014)

In order to consider solutions to such issues, the Economic Research Institute for ASEAN and East Asia (ERIA) conducted a survey of residents' attitudes in 2016. In it, transportation options are shown as in Fig. 20, and after residents grasped the current transportation options and were provided with information such as the reasons for choosing them, new sustainability, environmental considerations, and health benefits, interviews were conducted about changes in awareness and potential shifts in options.

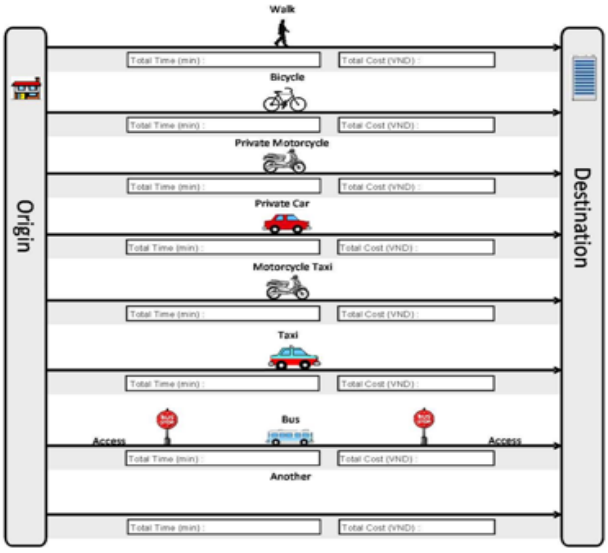


Fig. 20 Transportation option map used for ERIA's public awareness survey (Source: EREA, 2016)

In this survey, residents of Da Nang (699 men and 597 women, for a total of 1,296 people) were interviewed, and in the first interview, 92% of people said they used motorcycles as daily transportation, as shown in Figure 21. The reason for this was that convenience was considered a significant advantage over economic cost and accuracy.

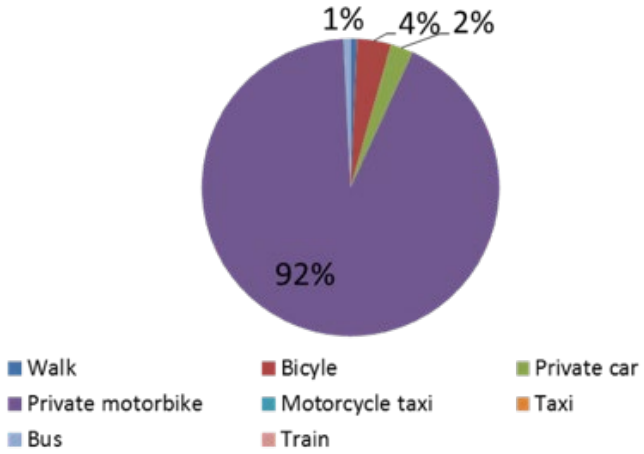


Fig. 21 Transportation (Source: ERIA, 2016)

In addition, as a result of re-interviewing residents after various conditions were changed, such as travel time and cost, there was the suggestion of a change in the modal share, owing to a combination of public transportation methods and so on, could occur such that public transportation would be used nearly as much as motorcycles. (See Fig. 22)

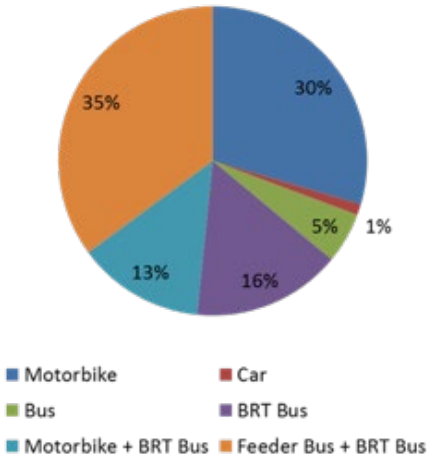


Fig. 22 Combination of traffic modes selected during interviews (Source: ERIA, 2016)

Based on the results of these interviews, the forecast shown in Figure 23 estimates the potential of a traffic modal shift by 2030. While there is no major expectation for a shift from private vehicles to public transport and bicycles, a shift from motorcycles to public transport is seen as the most effective modal shift. In Da Nang, public transportation such as BRT is being gradually developed, so it is expected that the use of public transportation will expand in the future.

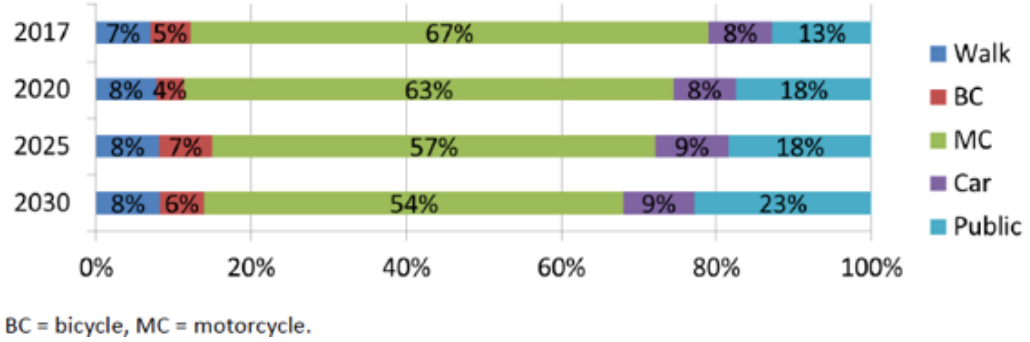


Fig. 23 Forecast of future modal share in Da Nang (Source: ERIA, 2016)

(6) Japan-Vietnam cooperation on climate change action plan

During the process of implementing this project in 2020, it is a great achievement that a system of cooperation was established not only with DONRE, which is our cooperation counterpart in Da Nang City government, but also with Da Nang University as a cooperation partner in academia.

With the support from Da Nang University, which has experiences, research results, and accumulated data from the building sector as well as a strong relationship of trust with the

city of Da Nang and related stakeholders, there are hopes for further detailed analysis and verification based on scientific data as well as dialogue with stakeholders. Figure 24 is a chart of the organization for conducting research on future climate change action plans. Between Yokohama and Da Nang, climate change action plans and specific technologies have already been introduced through this year's project. IGES has a system for taking the initiative in data acquisition, analysis, and reporting in cooperation with experts in related fields by utilizing its research achievements and international network. One of the notable achievements of the project is that the policy-making bodies, scientific research bodies, and the private companies and stakeholders who are attempting practical implementations have all been comprehensively involved and in communication with each other to build a long-term comprehensive system of implementation.

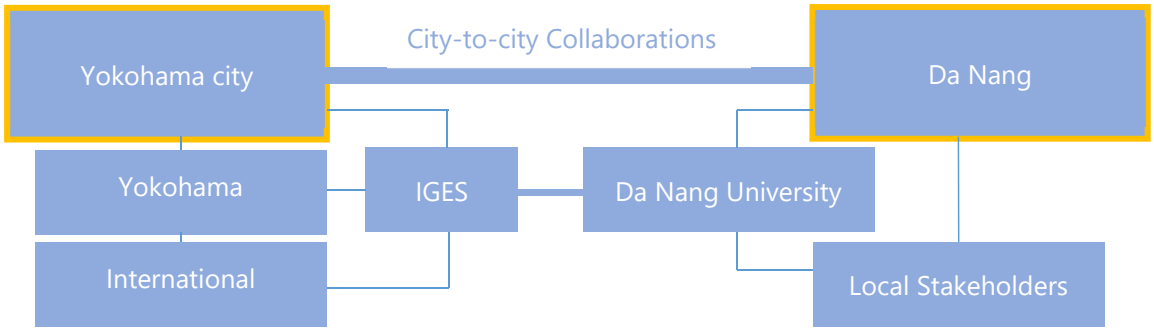


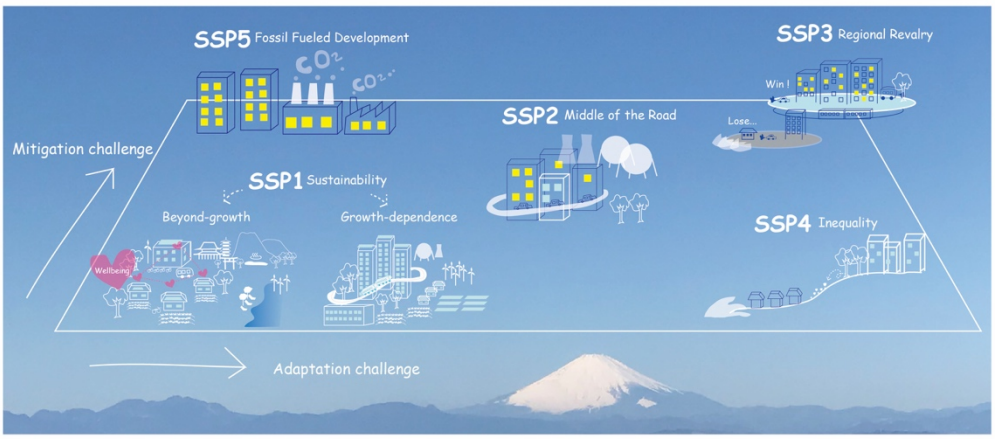
Fig. 24 Implementation system diagram for formulating a climate change action plan

(Reference material) Scenario analysis for the Regional Circular and Ecological Sphere (Regional CES) (formulated by IGES + IIASA)

(In the future, a consortium of Da Nang University, Japanese experts + overseas research institutes (Fig. 24 above) will formulate a case study of Da Nang using the same framework

Fig. 25 Shared Socioeconomic Pathways (SSPs) Framework for Climate Change Policy Analysis

Global original framework (Source: O'Niell et al., 2017)



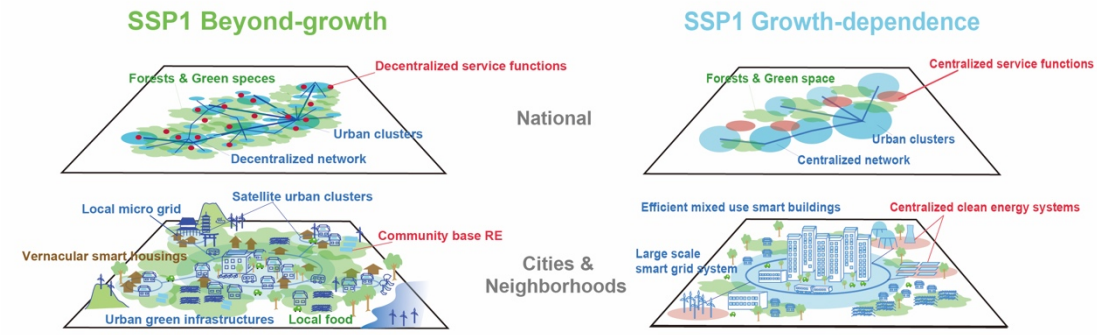


Fig. 26 SSPs (created by IGES + IIASA) reflecting the concept of the Japanese version of the Regional Circular and Ecological Sphere (Regional CES) (Source: Kamei, Mastrucci, and Ruijven, 2021)

4.2.1.3 Examples and References for Climate Change Action Plans for Cities

(1) Climate change measures in Yokohama (Zero Carbon Yokohama)

In 2018, Yokohama City formulated the Yokohama City Climate Change Action Plan "Zero Carbon Yokohama" to widely educate citizens about the importance of mitigation measures and adaptation measures, as well as specific measures for decarbonization. (See Fig. 27)

Fig. 27 Yokohama City Greenhouse Gas Reduction Target (Source: Yokohama City)

In it, the following eight concrete efforts are introduced.

- Cool Choice Yokohama: An initiative that uses educational activities to recognize each person's responsibility for a lifestyle that contribute to decarbonization, as well as product manufacturing and purchasing activities, and develops these efforts as a citywide movement
- Yokohama Smart City Project (YSCP): Aims for implementation of the Yokohama Smart City Project in collaboration with the government and Yokohama Smart Business Council, regional energy management, utilization of unused energy, and strengthening of disaster countermeasures through virtual power plants (See Fig. 28)

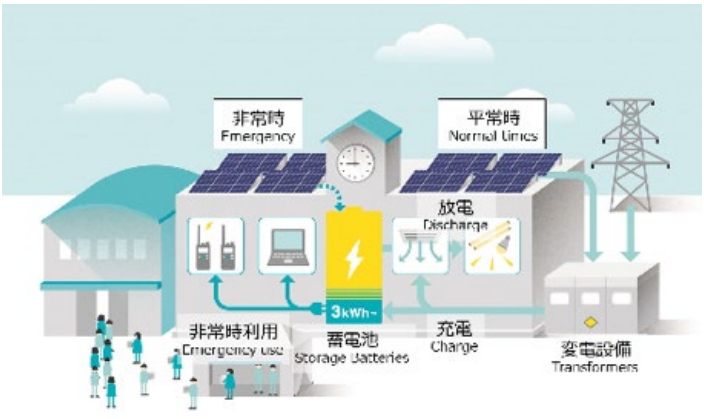


Fig. 28 Yokohama City Virtual Power Plant (includes storage battery installation and emergency measures)

- Promotion of environmental technology/products and environmental finance/investment: Supports efforts to contribute to advancing cutting-edge carbon

productivity and adaptation initiatives while utilizing the technological capabilities of city companies and research institutes, AI, IoT, and more to strengthen the industry-academia-government network.

- Utilization of hydrogen energy: In the industrial, business, household, transportation, and other sectors, businesses and governments cooperate to actively introduce and utilize hydrogen energy to create a society in which hydrogen is used on a daily basis.

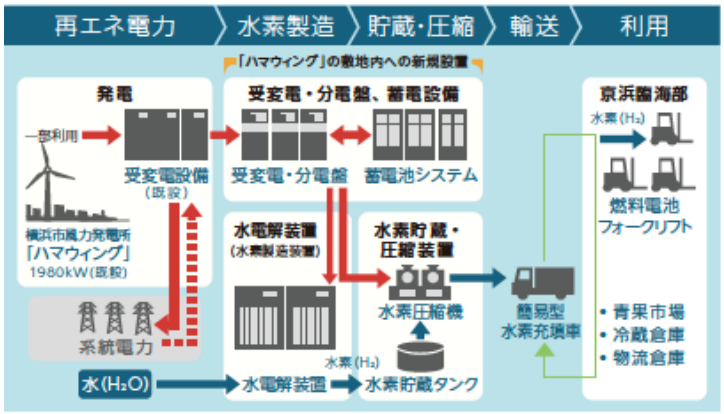


Fig. 29 Hydrogen energy demonstration project in the Keihin coastal area of Yokohama City (Source: Yokohama City)

- Investigating smart utilization of renewable energy: Along with introducing renewable energy into the city area and promoting local production for local consumption, strengthen the promotion of wide-area cooperation with other local governments and cooperation with RE100 companies located in the city.
- Low-carbon community development for areas: Plans the development of each model area in the city center and suburbs as an environmental model zone where highly convenient urban functions and low carbonization are in harmony by having various stakeholders build and share a future image based on the characteristics of the area and the natural environment, and promoting extended use of energy through electricity and heat are distributed in a self-sustaining fashion.
- Strengthening of adaptive crops: Promote adaptive measures in each sector more effectively, such as improving agriculture and the natural environment, countermeasures against storms, floods, and landslides, and reducing the risk of heat stroke and infectious diseases.
- Intercity cooperation and international dissemination: As the role of cities in combating global warming is increasing, we will strengthen cooperation, from domestic cities/regional networks to international intercity networks, and share experience and knowledge.

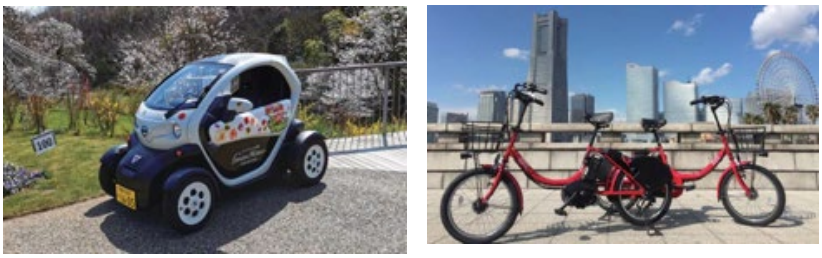


Fig. 30 Yokohama City Compact EV (Left) and Public Shared Bicycles (Right) (Source: Yokohama City)

(2) Climate change action plans in London (UK)

In 2018, London created the Greater London Authority (GLA) roadmap for climate change action plans by 2050, the Zero Carbon London: A 1.5ºC Compatible Plan. It provides specific goals and a time-series roadmap to 2050, primarily in its priority measures for decarbonization in London.

<Main priority measures>

1: Construction of distributed energy network (especially in the thermal field)

2: Electrification of the entire city (architecture + transportation sectors)

3: Conversion to hydrogen energy using gas pipes

4: Efficiency and decarbonization through mixed use of heat pumps, a heat network, and hydrogen

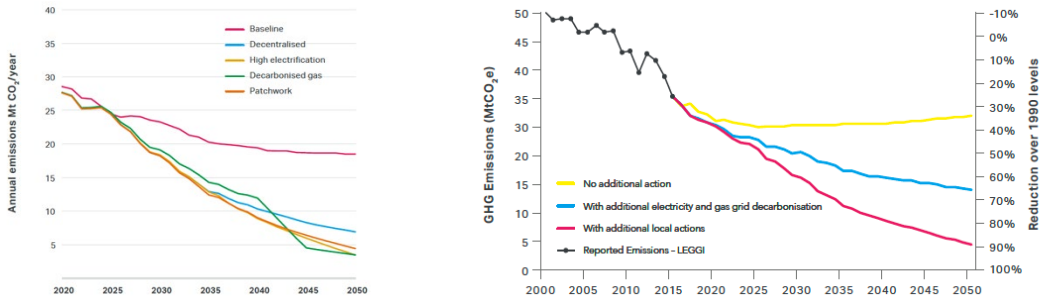


Fig. 31 Reduction scenarios for the four measures (left) and reduction potential of each action in London (right)

The effect of building renovations in London in terms of improving energy efficiency is very high, but 70% of buildings have not yet been renovated for improvement, and urgent action is required. Incentives from government agencies are currently lacking, which has delayed individual measures.

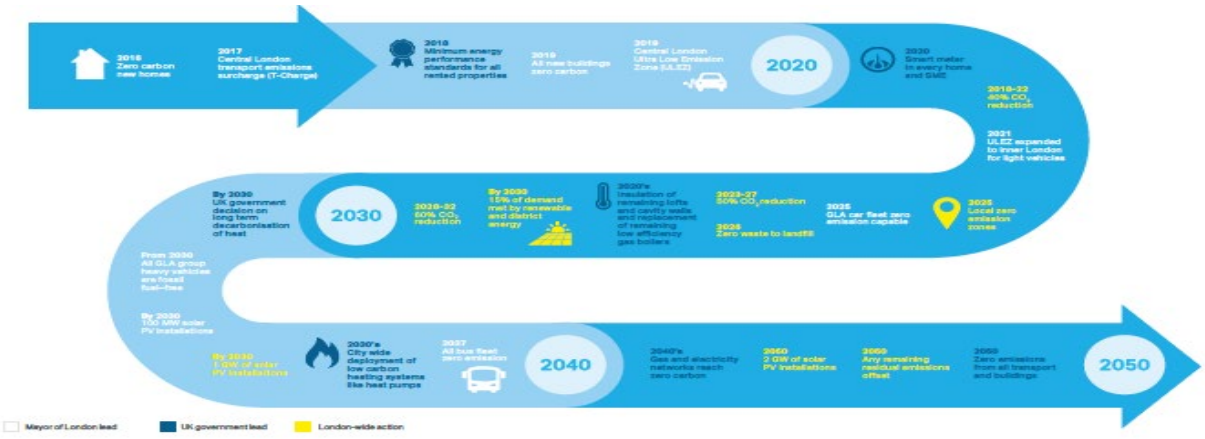


Fig. 32 What is needed by 2050? Action Roadmap (Source: GLA, 2018)

(3) Los Angeles City Green New Deal Policy Analysis (Carbon Neutral LA)

(Reference material: Created by IGES)

Analysing sustainable pathways and carbon reduction trajectories based on SSPs in Los Angeles to achieve a carbon neutral and sustainable city (Phase 1: SSP narratives)

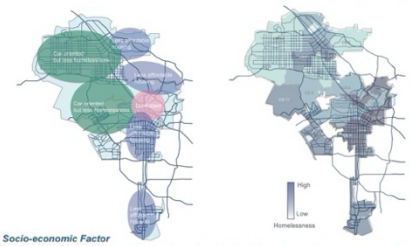
Miho Kamei
Institute for Global Environmental Strategies (IGES), Japan

Backgound

Under the Paris Agreement, which was adopted in 2015, Los Angeles has been strongly motivated to be a global leader by creating an achievable climate action plan and sustainable solutions. To meet its goals, the city has developed L.A.' s Green New Deal, which is an expanded version of the first Sustainable City pLAn developed in 2015. This Green New Deal calls for a carbon neutral city by 2050, which is an ambitious target considering current carbon emissions in Los Angeles. To realistically achieve this target, Los Angeles has to develop innovative pathways to dramatically reduce its emissions that align with creating a sufficient green economy and lifestyle transitions. Therefore, this study investigates possible pathways and carbon reduction trajectories in key sectors linked with concrete, sustainable solutions.

Phase 1 : Development of SSP for Los Angeles (results)

SSP2 : BAU, Carbon Lock-in & Disparity L.A.



Socio-economic Factor

Los Angeles has set many ambitious targets for sustainable growth and the green economy. However, the city' s lack of relevant policy actions and financial mechanisms has resulted in a significant delay in the implementation of these targets. As long as the city' s current industrial structure and fossil-fuel-based energy supply continue, green economic innovations will be unable to occur. Population growth is projected to remain stable at 0.26% per year—the same as in recent decades—through 2050. As long as these plans are not implemented, the social disparity between wealthy and poor households will only increase. Homelessness will also increase, as the city cannot afford to provide more affordable housing for low-income residents. The city' s failures in sustainable planning will also lead to declines in quality of life and a lack of sufficient access to public transit. Because the city currently lacks sufficient public open spaces and green roads, it cannot promote walking and cycling. These insufficient social circumstances only serve to further increase traffic congestion and crime.

Climate actions and SDGs

Due to the lack of climate-related policy implementations, environmental pollution has not decreased, and carbon emissions are staying at recent levels. Due to the city' s lack of policy actions, its citizens do not have greater awareness of the problem and are not willing to change their behaviours or lifestyles. Even though the city has introduced innovative technologies such as zero-emission vehicles, this has not attracted consumers and has not made the market any more efficient. The city' s delayed climate action has also causes delays in the development of sustainable infrastructure and renovations, which has thus led to further social disparities due to the segregation of low-income citizens—who are the most affected by climate change. Without relevant policy actions, Los Angeles cannot truly realise any of its SDGs.

SSP1 : Carbon neutral, Sustainablity Super Star L.A.

- Achievement of the targets of L.A.' s Green New Deal
- Locally appropreate Sustainable Neighbourhood Strategies
- New potential affordable housing for low income residents
- All building are expected to operate 100% on clean power
- 100% buildings are expected to be net zero carbon by 2050
- Increase of zero emission vehicles and EV chargers
- Increase of walking and cycling
- Improve of quality of life and achieve sustainable living

Strong achievement of SDGs

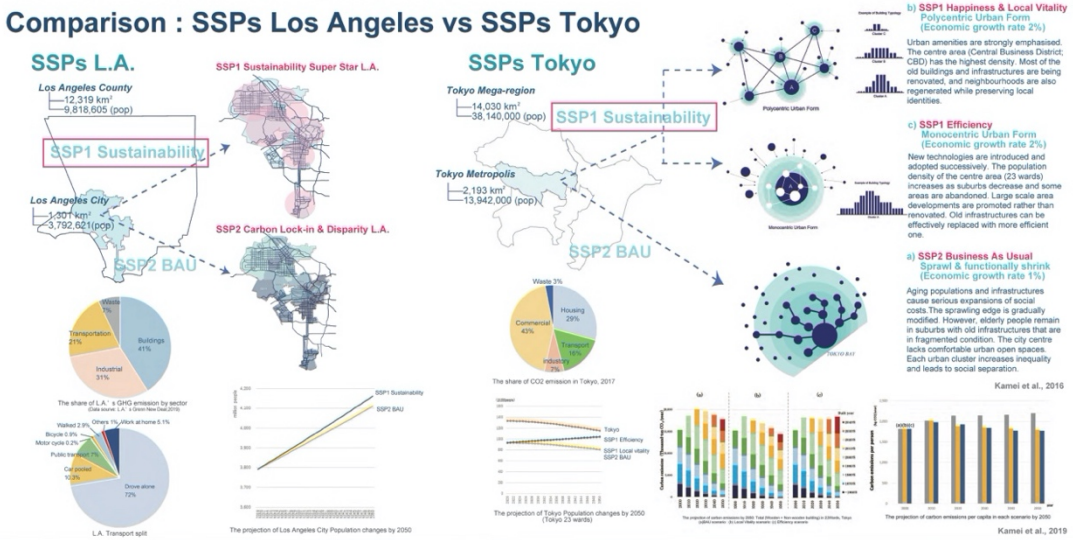
Socio-economic Factor

The Green New Deal could be implemented in an effective and timely manner in Los Angeles. The promotion of renewable energy could increase job creation and lead to new investments that advance the green economy. Owing to this, Los Angeles will be able to increase its population by 0.3% per year through 2050 and remain stable. It should also be able to increase the available housing supply to meet the demand for affordable low- and medium-income housing. Some new areas are planned in transit and mixed-use developments so as to reduce daily car use. The city will also provide solar and electric car sharing to reduce the energy burden for low-income households. Environmental justice can be truly fair, thus increasing prosperity and eliminating homelessness in the city so that all neighbourhoods have the same level of amenities and services. Increasing both public-transit access and water-quality management can dramatically improve the city' s air and water quality. With this transition, including the renovation of urban infrastructures, disaster risks can also be properly managed, and climate-adaptation strategies can be effectively implemented.

Climate actions and SDGs

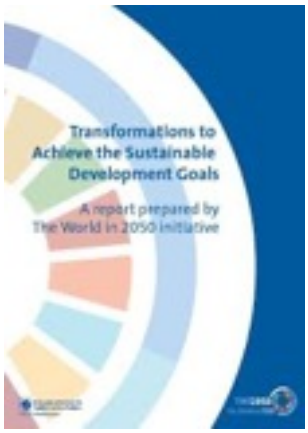
Successfully installing 100% renewable energy would help the city to reduce its GHG emissions by more than 85%. In addition, a new investment of $8 billion to upgrade the city' s power infrastructure would create many new green jobs. Green New Deal projects will also include installing solar panels at no cost to help low- income families; this will increase overall energy efficiency, social equity, and well-being. All buildings can also be upgraded with passive designs that meet energy-efficiency standards. In addition, all neighbourhoods can be given sufficient access to public transit (i.e., within a walkable distance), and all vehicles can be replaced with zero-emissions vehicle. These strategies will lead to balanced sustainable development and help the city to meet its overall SDGs.

Comparison : SSPs Los Angeles vs SSPs Tokyo



This work was supported by CD-Links, COMMIT, and S-16

(4) The World in 2050 Report (Reference: Project members contributed to the report and shared information with Da Nang.)



TWI2050 Report 2018: Transformation to Achieve the Sustainable Development Goals

A call for evidence-based social change to achieve the SDG targets

.

The World in 2050: A consortium of 60 policy-making bodies and research institutes around the world.

TWI2050 Report 2019: Digital Revolution and Sustainable Development

Potential and risks of drastic change in urban infrastructure and consumer behavior through a digital revolution

Chapter 5.6 Smart Cities:

Nakicenovic, N (IIASA)., Grubler A (IIASA)., Bona Kiss, B (IIASA)., and Kamei, M (IGES)

Graphic: developed by Kamei (IGES) in TWI2050, 2019

4.2.2 Local policy dialogue on "Climate Change Action Plan"

(1) Online workshop as a local policy dialogue

Due to the COVID-19 pandemic, the 2nd workshop was held online on 28 January in 2021. At the workshop, we reported on the above survey and analysis results, activities for proposing a climate change action plan, and the cooperation structures between the two cities and related parties. Since the analysis results showed that the potentials for GHG reduction in the building sector is high, the introduction of specific energy-saving equipment and a monitoring system from Yokohama City companies was very effective. We also provide information about "Zero Carbon Yokohama", a climate change action plan in Yokohama City. We successfully held effective discussions with the related departments such as DONRE and their expert panels. In particular, Japanese energy-saving programs and evaluation systems such as CASBEE in the building sector attracted significant interests from Da Nang City and the expert panels. The Da Nang City strongly sympathized with the need for proposals for long-term policies based on scientific data analysis, and encouraged the future cooperation with various players and a dialogue with related stakeholders. There were also comments from policy makers (DONRE, etc.) that they expected policy proposals based on the further comprehensive research and analysis through this project.

4.3 Operation 4-3. <Energy conservation sector>

4.3.1 JCM feasibility survey for Energy Conservation Project of Factories in Danang City

In this survey, the “Danang Steel Comprehensive Energy Efficiency/Energy Conservation Project" was proposed as an City-to-city Collaboration project at the business matching event conducted at the 9th Danang Urban Development Forum held jointly by Yokohama City and Danang City. Based on this project, we conducted a survey on energy conservation (utilization of waste heat) in factories. In addition, regarding the use of LED light bulbs in street lights, we will investigate its commercialization as a candidate technology that contributes to the Danang City smart lighting concept. And with the aim of significantly reducing energy consumption by improving the efficiency of air conditioning, we investigated the feasibility of commercializing radiation-type heating and cooling as a technology for addressing this. In Japanese fiscal year 2020, due to the impact of COVID-19, it became difficult to travel to sites directly, so while there were cases where the activities we initially envisioned could not be sufficiently carried out, we believe that there we achieved some results that will facilitate efforts during the following fiscal year.

(1) Energy conservation in factories (Waste heat utilization)

1) Envisioned technology

At the start of this survey, the system information and data possessed by Danang Steel in Danang City, which was the assumed site of implementation, was limited. Originally, the proposed system was to be made to order in accordance with local systems after a thorough investigation of the local systems, circumstances, and so on. For this reason, at the start of the survey during the initial fiscal year, as one potential technology, we envisioned a binary power generation system installed by Tsukishima Kikai Co., Ltd. in sewage treatment plants that utilizes the waste heat from incinerators in a sludge incineration facility, given that Danang Steel sprays water during ingot casting to cool the ingot. The power generation efficiency is 6.6% when looking at the amount of power generated (generating end) of 2.203 million kWh/year compared to the available heat capacity of 33.413 million kWh/year, and this can be considered a reasonable value assuming a small binary power generation system from Kobe Steel, Ltd. (KOBELCO).

[Waste heat utilization flow]

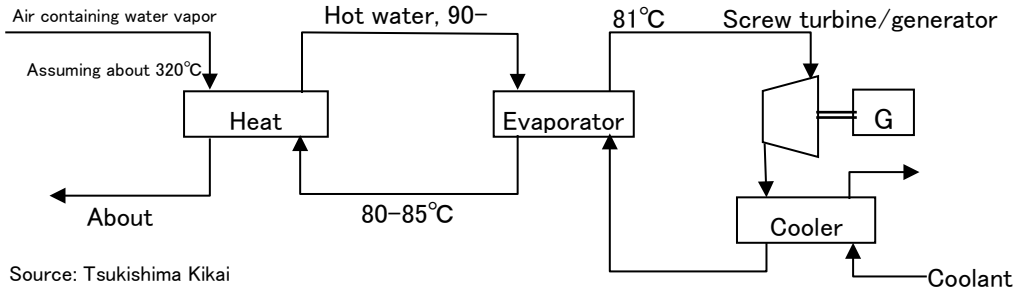


Fig. 33 Overview flow diagram (concept) for binary power

2) Implementation method

① Waste heat utilization project

This fiscal year's survey was conducted by grasping the potential of unused waste heat produced by the manufacturing processes of Danang Steel, then selecting the waste heat recovery technology suitable for the situation and examining the potential for implementation.

a） Understanding the potential of unused waste heat produced by the manufacturing processes of Danang Steel

i） The flow of the manufacturing process was organized and the applicability of the waste heat recovery technology was investigated based on the information from previously conducted site visits. (Attachment 14)

ii) Through discussions about the manufacturing process and equipment generating sensible heat from exhaust gas, we have studied the basic information necessary for examining the waste heat recovery process based on the response data from Danang Steel. (Attachment 15)

b） Interviews with domestic manufacturers

Based on the above examination results, we provided information on Danang Steel to two domestic manufacturers possessing waste heat recovery technology, explained the two proposals examined (see the figure below), and heard their views on their applicability.

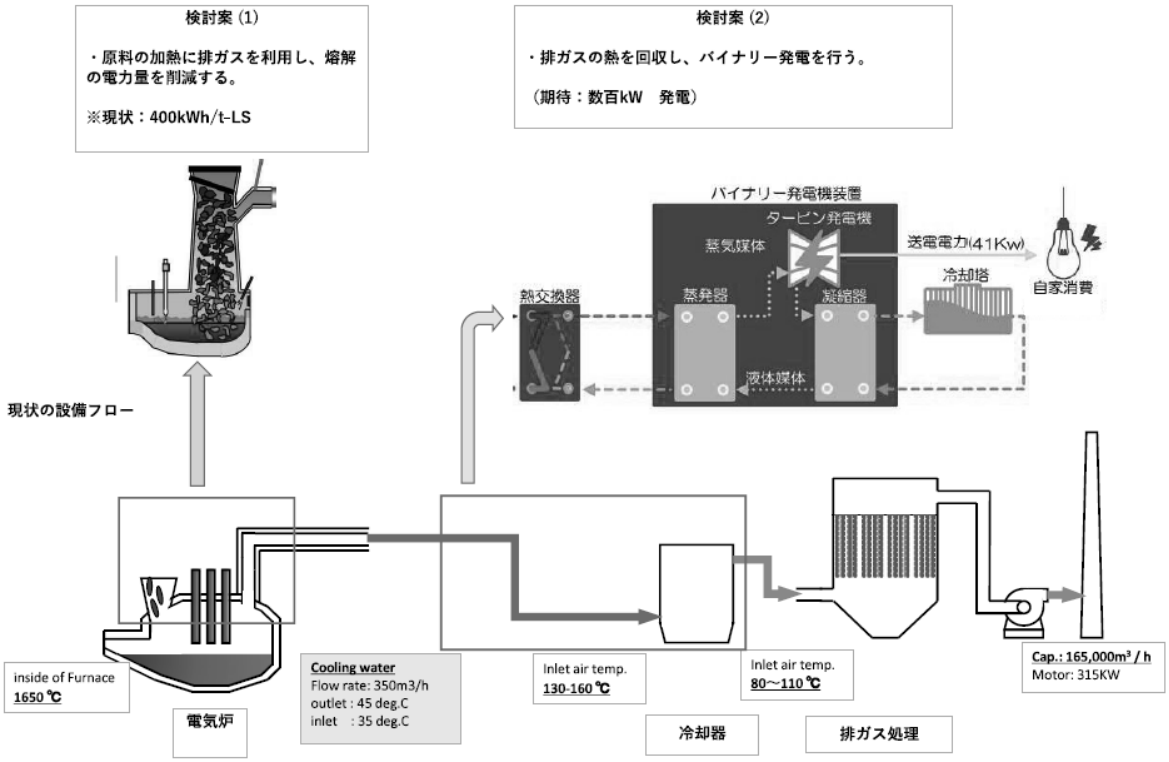


Fig. 34 Two proposals offered to domestic manufacturers

i) Self-consumption of the power generated from the waste heat temperature difference power generation system

[Company name: Xenesys Inc. (Koto-ku, Tokyo)]

- In situations where field surveys are not conducted, it is difficult to present the predicted power generation amount, an economic feasibility evaluation, and so on. In terms of cost factors, in addition to the power generation unit, the heat recovery equipment is a major variable factor, and even if a field survey has not been conducted, unreliable figures cannot be provided.
- There is concern that Danang Steel is too small for the scale required to install this

system.

ii） A method for raising the temperature of raw material scrap using waste heat and reducing the amount of electric power consumed during melting
[Company name: Steel Plantech Co. (Yokohama City, Kanagawa Prefecture)]

- ECOARC (eco-friendly high-efficiency arc furnace) installs a preheating device called a shaft that holds scrap in a normal electric furnace, but the overall equipment scale is not designed in perfectly direct proportion to the capacity of the electric furnace. For this reason, because Danang Steel's electric furnaces are so small, they inevitably end up being expensive.
- Since the production volume at the moment is too small, as long as this is assumed to be the case, we could conclude that feasibility is low even if JCM is used.

c） Consultation with Danang Steel

Based on the results of interviews from domestic manufacturers, a video conference was held with Danang Steel on July 21st, 2020 regarding the waste heat recovery plan. The purpose of this discussion was not to discuss the pros and cons of implementation, but to confirm the current situation and conduct a more detailed examination. The attendees were Danang Steel on the Vietnamese side, Genesis (manufacturer) on the Japanese side, the Development Cooperation division, International Affairs Bureau of Yokohama City, MACNICA, Inc., Osumi Co., Ltd., and IGES. At this conference, Xenesys explained the waste heat temperature difference power generation system, and we exchanged opinions on the issues to be examined when installing the equipment at Danang Steel (heat exchanger system [corrosion, dust adhesion, etc.] inserted into the exhaust gas system, system that generates power according to temperature fluctuations, impact on bug filter operation, etc.), and both sides were able to mutually confirm the situation. In addition, we requested the provision of the necessary information and decided to use this to investigate applicability on the Japanese side. (Attachment 16)

d） Examination of waste heat availability

Based on the results of discussions with Danang Steel, the potential for implementation was investigated by related domestic organizations.

According to a research report by Xenesis, it is believed that the cooling system that extends up to the scrubber of the EBT exhaust gas system (eccentric furnace bottom steel system) has a power generation potential of about 120kW (able to produce about 120kW at 160 → 120℃, ΔT = 40℃, 2,300kW waste heat, and 5-6% efficiency). However, it seems that

an exhaust gas boiler and such would be required, and we were told that it would be difficult through a standalone evaluation of economic efficiency. (Attachment 17)

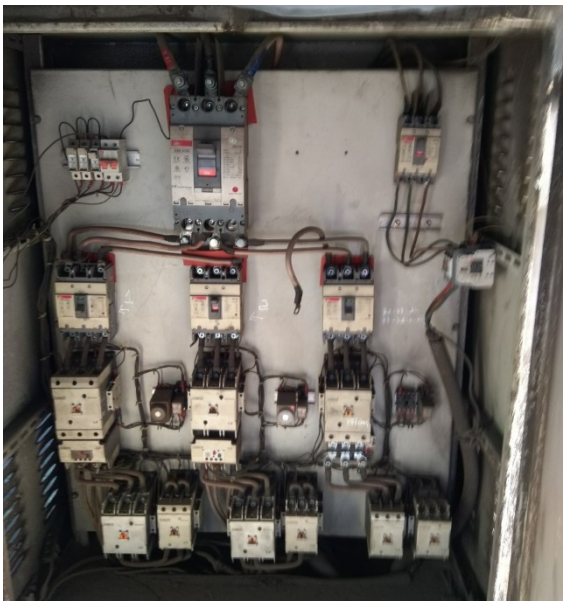
Based on the above report, discussions so far, and other findings, it was decided that the availability of waste heat at Danang Steel alone could not meet the guidelines required by JCM from the viewpoint of efficiency and economic benefits. The above results have been reported to Danang Steel.

② Carbon dioxide emission reduction project

In this survey, we conducted an energy-saving diagnostic test of Danang Steel and attempted to form a potential project based on the diagnostic results. The Japanese side prepared a plan for a simple energy-saving diagnostic test for Danang Steel and submitted it to Danang Steel. Based on this plan, Danang Steel provided information on available field instruments. With all of this in mind, in September 2020, a simple energy-saving diagnostic test was conducted in the presence of company employees at the Danang Steel plant (bottom photo), and operation data was acquired as necessary. Based on the obtained information, a simple energy-saving diagnostic report was prepared and submitted to Danang Steel (Attachment 18). Additionally, in response to a request from Danang Steel, the report also includes a proposal for solar power generation. The report describes measures that can save energy and proposals for solar power generation, and specific discussions are scheduled for the next fiscal year and beyond.

Cooling tower 1

Cooling tower 2



Cabinet

Pump power

Fig. 35 Photographs from the simple energy-saving diagnostic test

3) Summary of activities and future issues

Although it was not possible to carry out a field survey this fiscal year, we managed to carry out a feasibility study to the extent that circumstances allowed using whatever means we had available and with the cooperation of Danang Steel. As a result, it became clear that Danang Steel alone, which was a candidate for JCM's consortium, does not meet the requirements of Financing Programme for JCM Model Projects due to its small scale. For this reason, during the next Japanese fiscal year, we would like to consider expanding the scale of the project by involving neighboring companies in the industrial park where Danang Steel is located so that the JCM requirements can be met.

(2) Installing LED bulbs in streetlights

1) Envisioned technology

Large-scale installation of LED bulbs in streetlights is anticipated to highly contribute to the achievement of Danang City's smart lighting concept. Under these circumstances, since before this survey, we have been considering the installation of LED bulbs in Danang City by utilizing the Financing Programme for JCM Model Projects. The LED bulbs that we are considering installing on this occasion are brighter than conventional bulbs, cheaper while providing the same illuminance, and have a longer light source lifetime. In addition, since the lighting module is small, it is easy to design the exterior, and the design and construction management by local engineers can be expected to proceed more smoothly. Compared to conventional mercury lamps, the installation costs can be recovered in about one to two years

due to the energy-saving effects, and by the fifth year, reductions in electricity bills equal to about three times the initial installation costs can be expected.

2) Implementation method (explanation of specific activities and achievements this fiscal year)

Because it is assumed that there would be no technical barriers to device installation for the LED bulbs manufactured by ShinyU of Taiwan and provided by MACNICA, Inc., which are expected to be installed on this occasion, it was assumed that the stakeholder meeting would be key to them being installed as a contribution to the smart lighting project in Danang City. In addition, through discussions with Danang City Transportation Bureau and local engineers, plans were made to consider the LED lines and quantity expected to be installed, as well as the allocation of initial investments.

① Streetlight maintenance requirements in Danang city

Based on Vietnam Building Standard TCXDVN 259: 2001, "Design Standards for Artificial Lighting of Roads, Streets, and City Plazas," it was confirmed that the road lighting standards in Vietnam were met. The standard includes general regulations, technical requirements, structural and safety requirements for certification systems, and methods for calculating and designing lighting for roads, streets, and plazas. In addition, we obtained the results of analysis by DIALux Simulation Soft on the Philips LEDs already installed on the roads in Danang City, and product candidates were selected upon confirming the road size, lighting tower dimensions, the arrangement of the streetlights, the lighting brightness, the degree of uniformity, and so on for locations where the Philips LEDs were installed. (Attachment 19)

② Test of conformity with the evaluation criteria for selected LEDs

ShinyU conducted a test on the candidate product to see if it conformed to the evaluation criteria and confirmed that it does indeed conform. Based on these results, we conducted an on-site illuminance confirmation test for ShinyU's Jackson Lighting 125W. (Attachment 20)

Fig. 36 ShinyU LED streetlight

③ Illuminance confirmation test for lighting equipment

A sample lighting device (evaluator) was sent to Danang City and installed on the ITPC site and on surrounding roads in Danang City to test the brightness and illuminance (see the table below for the test results). Based on the results of this test, upon confirming the opinion

of the manufacturer ShinyU, we found that if two Philips lights were used as one, even if the illuminance was simply halved for calculations, it would be superior in most respects. In addition, considering the low power consumption of 20W, it is believed that there is are clear merits for their installation compared to Philips-made products.

Note: For "Brightness in the middle of two poles (Point C and D)," because there is more light approaching the point between the poles in the case of two lights compared to one, the figure when one light is installed is actually less than half.

Table 1 Illuminance test results for lighting equipment

TT	Measurement	Unit	Sodium 1 250W	ShinyU LED 125W	Phillips LED (2 arms pole) 150W x 2units
1	Brightness under pole (Point A)	(lux)	55.6	37.6	68.6
2	Brightness across the road (Point B)	(lux)	8.11	10.83	33.1
3	Brightness in the middle of two pole (Point C and D)	(lux)	26.1	22.1	50.1
			25.2	18.0	32.2
4	U/Voltage	V	220	220	220
5	I/Current	A	1.51	0.59	-

Fig. 37 LED lighting at ITPC

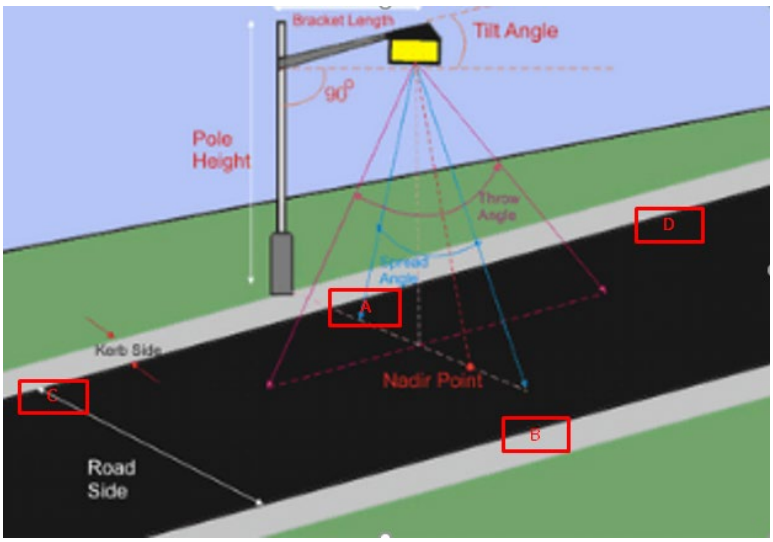


Fig. 38 Measurement points for the illuminance test

Based on the results of this test, it was found that the ShinyU LED selected this time is superior in performance to the Philips LEDs that are commonly used in Vietnam. For this reason, in Danang City, where Philips products have a long installation track record, we will consider working with DOIT if it can be differentiated from this company's products.

On the other hand, considering the application to the Financing Programme for JCM Model Projects, because the reference emissions are to a certain degree set low given that many Philips products are being used, a large amount of greenhouse gas emissions reductions cannot be expected even if this product is installed. For this reason, meeting the requirements of the Financing Programme for JCM Model Projects is considered difficult. During the next fiscal year, we would like to reconfirm the amount of greenhouse gas emission reductions and the costs they would require, and consider the potential for applying to the JCM equipment maintenance project.

3) Summary of activities and future issues

This fiscal year, we examined the potential for installing LED bulb products selected for the streetlights in Danang City. As a result, it was confirmed that the selected ShinyU Jackson Lighting 125W has a sufficient performance advantage over the Philips products that are already widely used. On the other hand, we found that given that many Philips LED bulbs are already being used, even if ShinyU's Jackson Lighting 125W, which has excellent performance, were to be installed, greenhouse gas reductions would not be so large, and the requirements of the Financing Programme for JCM Model Projects would not be sufficiently met.

During the next fiscal year, we will promote the formation of JCM projects, including the potential for installing smart streetlights with multiple functions, such as reducing electricity consumption by finely managing the lighting on/off time and illuminance through the use of IoT, and providing information while gathering information on the surroundings by installing cameras, microphones, various sensors, speakers, etc., while focusing on the installation of LED bulbs for streetlights so as to meet the requirements of the Financing Programme for JCM Model Projects.

In addition, since discussions with DOIT are important in this matter, we will continue to investigate business proposals while exchanging views and fully grasping the hopes and intentions of DOIT.

(3) Efficient air conditioning (radiant cooling and heating air conditioner)

1) Envisioned technology

In Danang City, reducing energy consumption in the air conditioning sector has the potential to have significant effects. Therefore, in this project, we investigated the possibility

of installing radiant cooling and heating air conditioner, which consumes significantly less energy. The radiant cooling and heating system possessed by MACNICA, Inc., which is planned for installation on this occasion and is the subject of the survey, is currently expected to be widely used in Japan in the future. In terms of features, it does not use a mechanism that cools the air and forcibly convects cold air to cool it, as with an air conditioner, but rather an air-conditioning method in which the heat emitted from people and objects is directly absorbed by the aluminum radiation panel, thus lowering the temperature of said people and objects. In addition, it alleviates the temperature unevenness peculiar to air conditioning (such as cooling only the feet) and achieves a silent space that does not kick up dust because it does not generate wind by conditioning the air only in areas where people are present, not all areas overall. This offers advantages such as achieving extremely high energy conservation (80-90%). In addition, since it can be designed and installed to meet various needs, it can be installed anywhere from factories to office buildings. Although the initial costs are a little higher than those of conventional air conditioning, this can be made up for quickly due to the energy-saving effects.

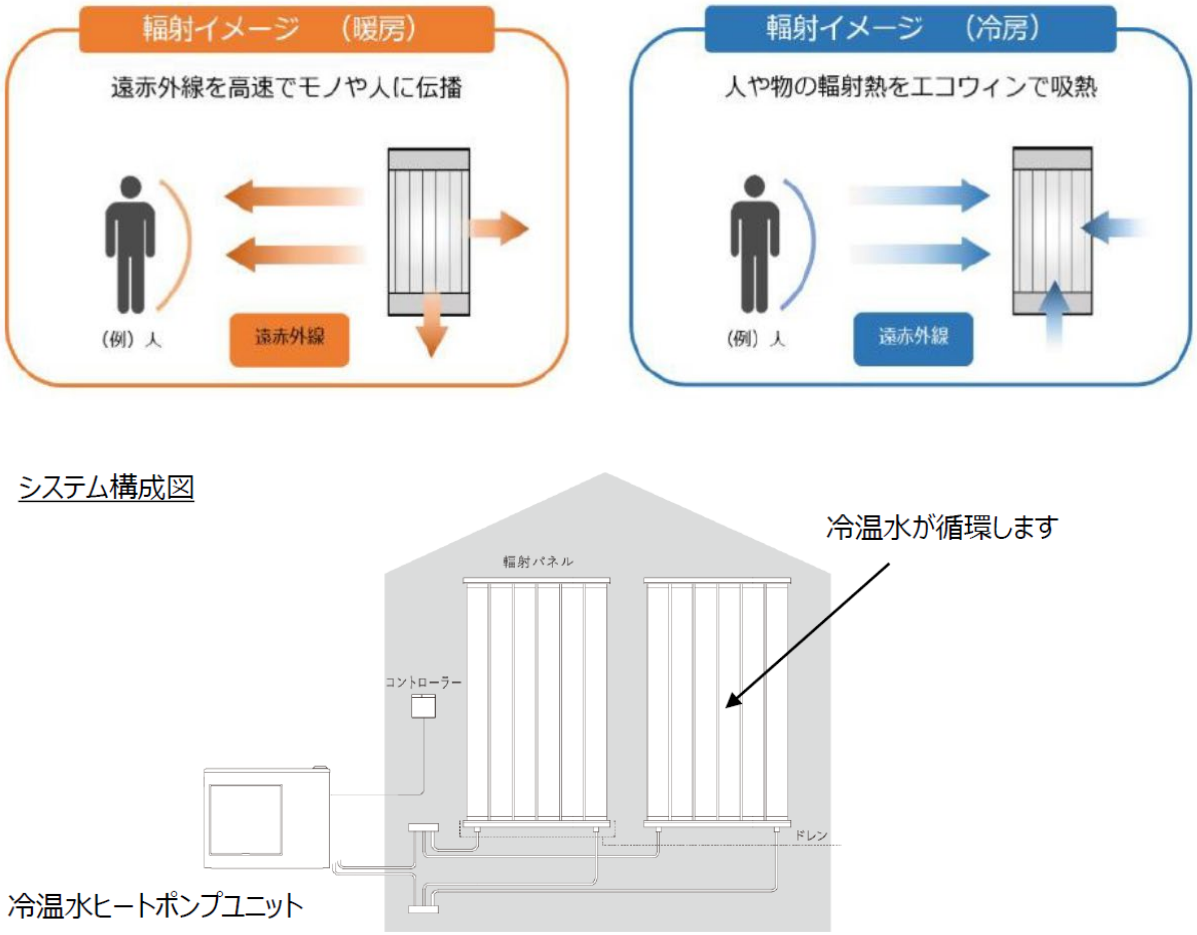


Fig. 39 Radiant cooling and heating system (concept)

2) Implementation method

With an eye toward the above target, this fiscal year, we planned to investigate the detailed performance of the equipment in accordance with local climatic conditions, measure the performance of the equipment under various building conditions, and calculate the effects of installation.

① Verifying the compliance of the radiant cooling and heating system

Originally, this was supposed to be explained and discussed locally, but since it was difficult to travel to the site, explanations about the radiant cooling and heating system were provided to the DOIT multiple times, mainly through online conferences. Based on these explanations, Danang City came to understand the mechanism of the system, but in many cases it was not possible to understand it without actually experiencing it, so it was decided that evaluation equipment would actually be installed and that an evaluation test would be conducted. For this reason, the Japanese side examined the evaluation items and prepared to conduct an evaluation test at the ITPC.

To conform to local legal investigations and confirm product conformity, it was necessary to set the conformity requirements and evaluation items upon careful examination of local environmental requirements. In addition, it was necessary to study efficient energy utilization methods under local usage conditions.

② Radiant cooling and heating system evaluation test

Based on the results of conformity verification with the DOIT, preparations were made for conducting an evaluation test. On this occasion, the policy was to evaluate the following items.

- Time it takes to reach set temperature
- Discomfort index
- Power usage
- Humidity
- Temperature continuity
- Verification of maintenance support methods

It took a long time to prepare for installation because it was difficult to travel to the site, and it was not possible to install an evaluation machine due to budgetary constraints. For this reason, we decided to continue preparations so that this evaluation test can be conducted from next fiscal year onward.

3) Summary of activities and future issues

This fiscal year, we were able to install the radiant cooling and heating system and prepare for on-site evaluation and verification. However, it was difficult to truly understand the cooling effect of the radiant cooling and heating system by only utilizing various materials and oral explanations, so we reconfirmed that it is important to see and experience the actual equipment to help others understand for themselves. Thus, we would like to install and evaluate the actual product during surveys from the next fiscal year onward, as well as make preparations to provide opportunities for others to experience it as soon as possible.

Regarding the expected product evaluation, we plan to study the evaluation methods, support the construction of the evaluation environment, and handle the actual evaluation work. In addition, based on the evaluation results, we would like to consider the outline of the implementation project.

5. Lessons from This Project

Lessons learnt from the implementation of this project are summarised below.

(1) Use of local coordinator

In the stage when Da Nang was in the process of preparing the draft of the 10-Year Environment City Plan, the Japanese team initially provided input directly to DONRE. However, hiring a local coordinator as part of COVID-19 measures made the process of this input and feedback to and from Da Nang more efficient and effective.

The local coordinator promptly translated input from the Japanese team into Vietnamese and exchanged ideas with DONRE to properly convey the intentions of the team. The opinions from DONRE were also promptly fed back to the Japanese team, which was helpful in providing subsequent input. This made it possible to track which sections of DONRE's final version of the 10-Year Environment City Plan took into account and reflected the input from the Japanese team.

With a doctorate from Kyoto University and experience with JICA partner projects, the local coordinator, a professor at Da Nang University, is highly capable of understanding the intentions of the Japanese team. The coordinator also has experience in working with DONRE on other research projects and has gained their trust, both of which are believed to be reasons why she was able to effectively fulfil her function as coordinator.

(2) Involvement of the central government

DONRE organised several consultation meetings during the preparatory stage of the 10-Year Environment City Plan and also invited the Deputy Minister of the Ministry of Natural Research and Environment (MONRE) to attend consultations prior to the preparation of the

final draft. The Japanese team was also invited to take part and deliver a presentation at these consultation meetings. The input from the Japanese team to the 10-Year Environment City Plan during the presentation (which included strengthening public participation, promoting low-carbon development, disclosing the results of environmental monitoring, other) were commended by the Deputy Ministry of MONRE, which is believed to have been effective in the inclusion of these points in the final draft.

This reaffirmed the importance of establishing contact with the central government, even in cases of city-to-city cooperation. MONRE and the Ministry of the Environment, Japan signed a joint ministerial statement at the 6th Viet Nam-Japan Environmental Policy Dialogue held in 2020, in which they agreed to cooperate on decarbonisation efforts in both countries. From this perspective, it may be necessary to consider an approach in which MONRE encourages Da Nang to promote city-to-city collaboration with Yokohama with an aim towards decarbonisation (one step further than low carbon).

（3）Methods to demonstrate an assessment of the performance of Japanese technology

This project includes a study to introduce LED lighting for streetlights as an energy-efficiency project that will be a candidate for the JCM. The approach taken by this survey will be to show the advantages of LED lighting that the Japanese team is considering introducing by comparing them with products from other countries in terms of performance. However, it may be difficult to clearly show the differences because of assumed conditions.

For this reason, rather than simply comparing the performance of LED products themselves, the approach taken to evaluate performance may include multi-faceted proposals developed from the perspective of smart energy, such as automatically lowering illumination levels on roads with low pedestrian and automobile traffic at night, or installing additional automatic air monitoring devices on streetlights.

To put this in perspective, it would be beneficial to reconsider the promotion of low-carbon projects from the perspective of how they can generate co-benefits with other sustainability goals of the SDGs.

（4）Collaboration with local academic institutions

In a review of Da Nang's low-carbon plan and based on studies conducted by other institutions, energy efficiency in buildings is one of the priority areas for reducing GHG emissions in the city. However, there is not necessarily a rich stock of relevant published data or research outcomes in this field in Da Nang. In order to supplement this data, the parties have agreed to conduct joint research with experts from the Da Nang University of

Science and Technology and other institutes in cooperation with Da Nang.

The parties reaffirmed that in order to promote low-carbon development in city-to-city collaboration, it is important to focus on collaboration not only with the municipal administration and the business community, but also with academic circles by obtaining consensus with stakeholders on the basis of scientific data.

6. Planned activities for the next step

Based on the results and lessons learned from this project, and also considering the needs of Da Nang achieving environmental friendly and low carbon city, the following ideas are currently under consideration for the next step. We plan to continue exchanging views with the city of Da Nang.

(1) Objectives

Same as the Phase 1. However, low carbon aspect should be more focused, following an instruction by the Ministry of the Environment of Japan. .

(2) Activities

1) Support in enhancing awareness raising about environment and climate change in Da Nang city.

This activity will include (a) preparing public relation tools/materials for both citizens including school students and companies, and (b) designing & implementing a resident survey to citizens/companies on environment and climate change.

Expected outputs:

(a) Draft pamphlet/leaflet for awareness raising on environment and climate change

(b) Draft resident survey format

2) Support in developing smart (toward carbon neutral) & sustainable city planning strategies.

This activity will include (a) proposing planning process and institutional arrangement in Da Nang city in developing the low carbon city plan linking with the 10-Year Environment City Plan (2021-2030), and (b) conducting a science based analysis to identify key factors and potential reductions of GHG emission in Da Nang city, and (c) proposing potential cooperation in developing climate action plans in the sector(s) in higher potential in GHG emission reduction, for example, building, transport, wastewater treatment, and waste management in Da Nang city.

Expected outputs:

(a) Idea note on planning process and institutional arrangement in developing Da Nang low carbon city plan
(b) Research paper or recommendation report on priority areas in reducing GHG emission in Da Nang city
(c) List of low carbon technologies with policy options in priority sectors in reducing GHG emission applicable to Da Nang city

3) Support in developing a model project in low carbon technology in Da Nang city.
In the Phase 1 of the project, the feasibility of the projects was conducted targeting low-carbon technologies on the energy demand side such as factory exhaust heat utilization, LED lighting, and radiant heating and cooling system.
In the second phase, this activity is proposing a development model for smart energy system in Da Nang. Specifically, a project to optimize energy demand and supply and reduce carbon emission by combining technologies such as solar power generation, rechargeable batteries, smart LED lighting, and radiant heating and cooling systems for specific areas in Da Nang city.
Expected output:
Feasibility study report of a smart energy system model project at a specific area of Da Nang city

(3) Issues to be considered in implementing the Phase 2 of the project
1) Interactive approach between Da Nang and Yokohama city
2) Cooperation with other relevant departments in Da Nang city under the leadership of DONRE as the counterpart of this project
3) Facilitating participation of private sector both in Da Nang and Yokohama city including a business matching seminar
4) Information sharing on this project with MONRE and ISPONRE
5) Conducting one workshop in Da Nang city other than several online meetings among project stakeholders

Attachments

Attachment 1: Building Danang – An Environment City (Decision 41/2008/QD-UBND, 21 August 2008): Summary of the key points from the report on the 10-year performance review (Japanese, English)

Attachment 2: Environmental city indictors of Da Nang (2020-2025) (Appended table to Attachment 1) (Japanese, English)

Attachment 3: Basic policies, key measures and indicators in the Yokohama City Environmental Management Plan (Japanese, Vietnamese)

Attachment 4: Letter to the Vice Chairman of the Da Nang City People's Committee: Four proposals on the formulation of the 10-Year Environment City Plan (English)

Attachment 5: Letter to the Director of Da Nang DONRE: Input on proposed programmes and projects to be included in the 10-Year Environment City Plan (English)

Attachment 6: Final draft of the 10-Year Environment City Plan ("Building Da Nang into an Environmental City" project for the 2021 – 2030 period) (Japanese, English)

Attachment 7: Public relations on the environment and climate change measures in Yokohama City (Japanese, English)

Attachment 8: Agenda and participants list from Workshop 1 (English)

Attachment 9: Presentation materials from Workshop 1 (English)

Attachment 10: Agenda and participants list from Workshop 2 (Japanese, English)

Attachment 11: Presentation materials from Workshop 2 (Japanese, English)

Attachment 12: Draft action plan on potential areas of cooperation in Da Nang City's 10-Year Environment City Plan (Japanese, English)

Attachment 13: Letter to the Director of Da Nang DONRE: Draft action plan on potential cooperation areas (English)

Attachment 14: Danang Steel manufacturing flow (20200407)(Japanese)

Attachment 15: Flow sheet (Exhaust Gas) (English)

Attachment 16: Meeting documents (Japanese, English)

Attachment 17: Reviewing report (created by Xenesys) (Japanese)

Attachment 18: Report (2nd report) (Japanese, English)

Attachment 19: Vietnam Danang Road_125W Jackson Street Light-20200826-Eng (English)

Attachment 20: ShinyU125W LED Street Light-JSL-125M29 (English)

Recorded material: Record of Workshop 2