

# Environmental Report 2025

Tokyo Metropolitan Public University Corporation





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## Editorial Policy

The purpose of this report is to provide a broad understanding of the Corporation's environmental initiatives both inside and outside Japan. This report is available on our official website.

Web address: <https://www.houjin-tmu.ac.jp/sustainability/>



- [Scope of Coverage]** Tokyo Metropolitan Public University Corporation  
All campuses of Tokyo Metropolitan University  
All campuses of the Advanced Institute of Industrial Technology  
All campuses of the Tokyo Metropolitan College of Industrial Technology
- [Period Covered]** FY2024 (April 1, 2024 - March 31, 2025)  
\*Includes some activity reports outside the period covered
- [Date of Issue]** December 2025
- [Guidelines Referenced]** Ministry of the Environment, "Environmental Reporting Guidelines (2018 Edition)"



## Message from the Chairperson

I am Yasuo Nakayama, Chairperson of the Tokyo Metropolitan Public University Corporation since April 2025.

In recent years, rising temperatures, extreme weather events, and related disasters have frequently occurred, and environmental problems are growing more serious each day. In 2025, the average summer temperature (June to August) was the highest in the UK, Spain, Portugal, and other parts of Europe, while Turkey had record high temperatures of 50.5 degrees Celsius. These are just some examples of the record-breaking intense heat seen across the globe. In Japan, the average summer temperature (June to August) was the highest since records began (1898), with the highest temperature ever also being recorded. Records were also broken for the number of extremely hot days and sites with temperatures over 40°C. In addition, the state of Texas in the United States, various parts of Asia including China and India, and South America and Africa, suffered devastating damage as a result of heavy rain. In Japan, linear precipitation bands are frequently observed, which are formed when developed rain clouds form a line and pass or stay in almost the same place for several hours, resulting in a high probability of heavy rain. With this being the case, we are getting firsthand experience with the reality that the entire planet is facing a serious climate crisis.

As described above, the occurrence of disasters, which have become more severe due to climate change in recent years, may have a serious impact on the implementation of education and research activities and the safety of students and faculty. In response to these risks, the Tokyo Metropolitan Public University Corporation strives to ensure the safety and sustainability of our education and research environment through crisis management in order to prevent damage and minimize the impacts involved when as situation does arise.

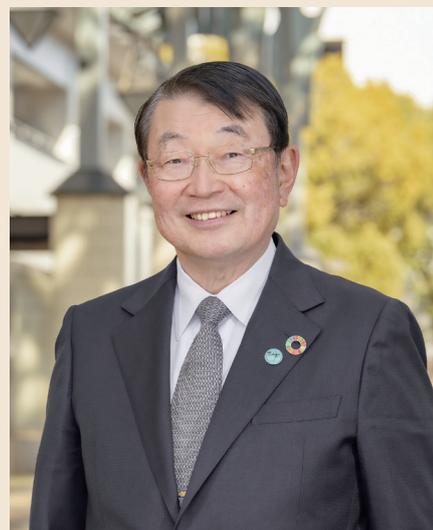
In addition, as the only public university corporation established by the Tokyo Metropolitan Government, we became the first national and public university in Japan to make a Climate Emergency Declaration in

July 2021 and make a Nature Positive Declaration in July 2024. In March 2023, we formulated our Carbon Neutrality Promotion Plan. These are actions we have undertaken in order to take the lead in contributing to the realization of a sustainable society.

This Environmental Report has been published every year since FY2022 as one of the initiatives set forth in our Carbon Neutrality Promotion Plan. It is intended to widely inform the public about the status of our energy management and the efforts we are making to achieve carbon neutrality.

In this report, we introduce details on the release of Carbon Link, an app for promoting carbon neutrality created for our students and faculty members. We also introduce details on the implementation of energy-saving and energy-creating equipment, as well as details on educational and research activities and student activities undertaken with the aim of solving environmental problems at our two universities and technical college. These initiatives are introduced as initiatives conducting during the period spanning from FY2024 to 2025.

It is our hope that these details will shed light on our efforts and provide a catalyst for contemplating the environmental issues surrounding our entire planet.



**NAKAYAMA Yasuo**  
Chairperson, Tokyo Metropolitan  
Public University Corporation



# Corporation Profile

## Overview

**Name:** Tokyo Metropolitan Public University Corporation

**Date of Establishment:** April 1, 2005

**Location:** 2-3-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo, Japan

**Chairperson:** NAKAYAMA Yasuo

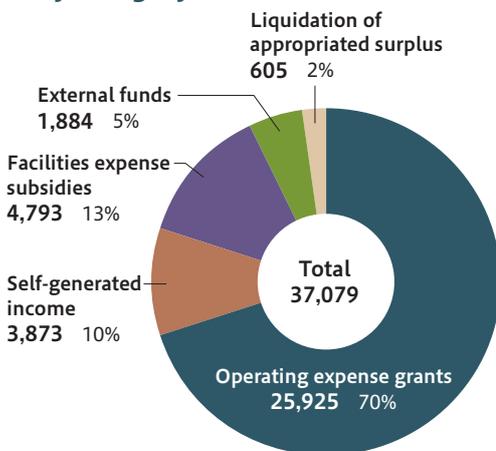
## History

- 2005** Establishment of the Public University Corporation Tokyo Metropolitan University  
Reorganization and integration of Former Tokyo Metropolitan University, the Tokyo Metropolitan Institute of Technology, the Tokyo Metropolitan University of Health Sciences, and Tokyo Metropolitan College to form Tokyo Metropolitan University
- 2006** Opening of the Advanced Institute of Industrial Technology  
Reorganization and integration of the Tokyo Metropolitan College of Technology and Tokyo Metropolitan Aviation Technical College to form the Tokyo Metropolitan College of Industrial Technology
- 2020** Renamed from Public University Corporation Tokyo Metropolitan University to Tokyo Metropolitan Public University Corporation; from Tokyo Metropolitan University (Shuto Daigaku Tokyo) to Tokyo Metropolitan University (Tokyo Toritsu Daigaku); and from the Advanced Institute of Industrial Technology to the Tokyo Metropolitan Advanced Institute of Industrial Technology

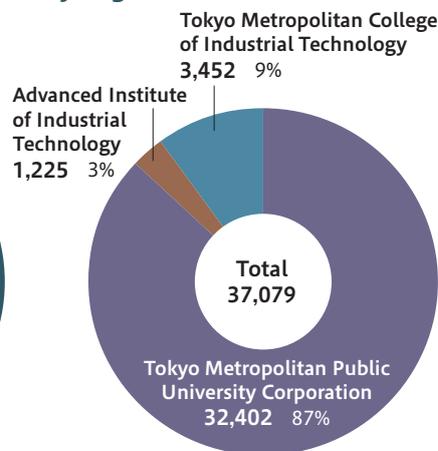
## Financial Status

**FY2025 Revenue Budget** (Unit: million yen) (As of May 1, 2025)

### By category

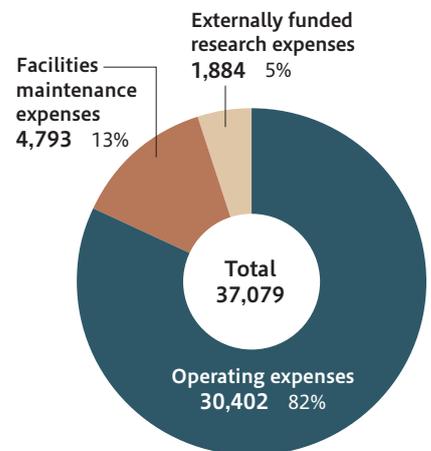


### By segment



**FY2025 Expenditure Budget** (Unit: million yen) (As of May 1, 2025)

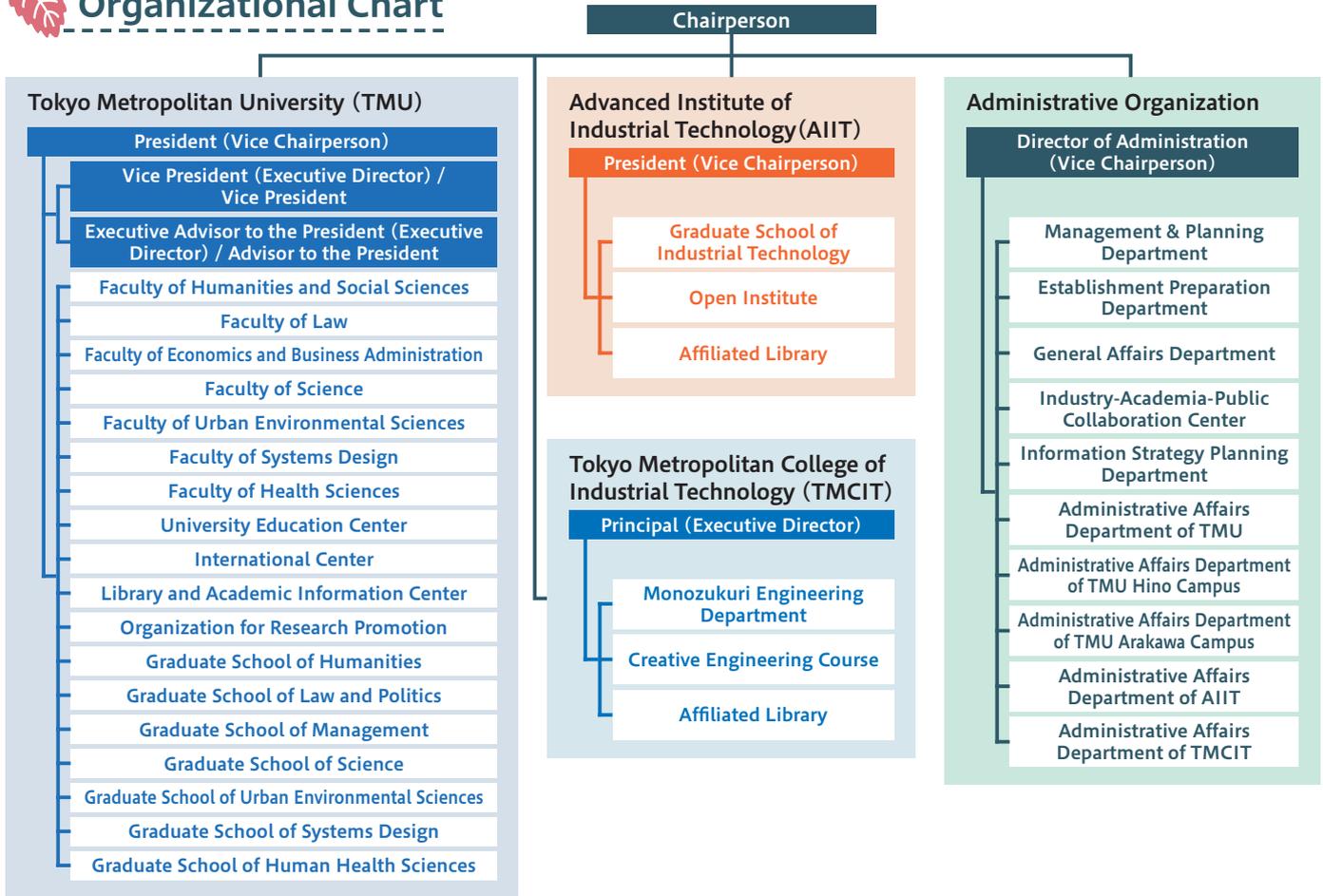
(Unit: million yen) (As of May 1, 2025)



\*As a general rule, each figure is rounded to the nearest unit, so it may not equal the total.

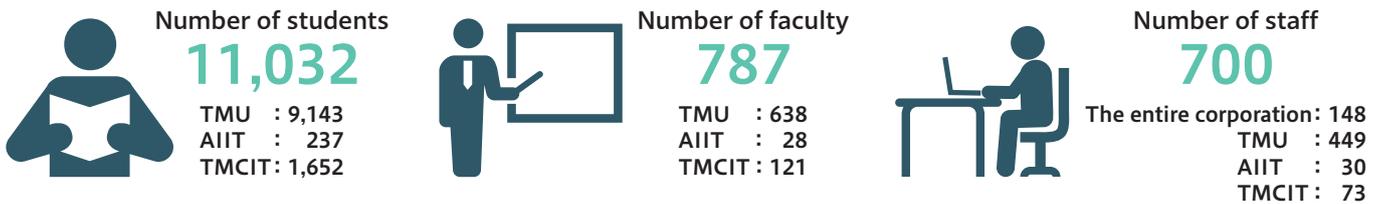
\*As a general rule, percentages are rounded to the nearest unit, so the total does not necessarily equal 100.

# Organizational Chart



## Number of students, faculty, and staff (As of May 1, 2025)

\*The student numbers include those enrolled in the organization before the reorganization in FY2018.  
 \*The staff numbers include temporary staff.



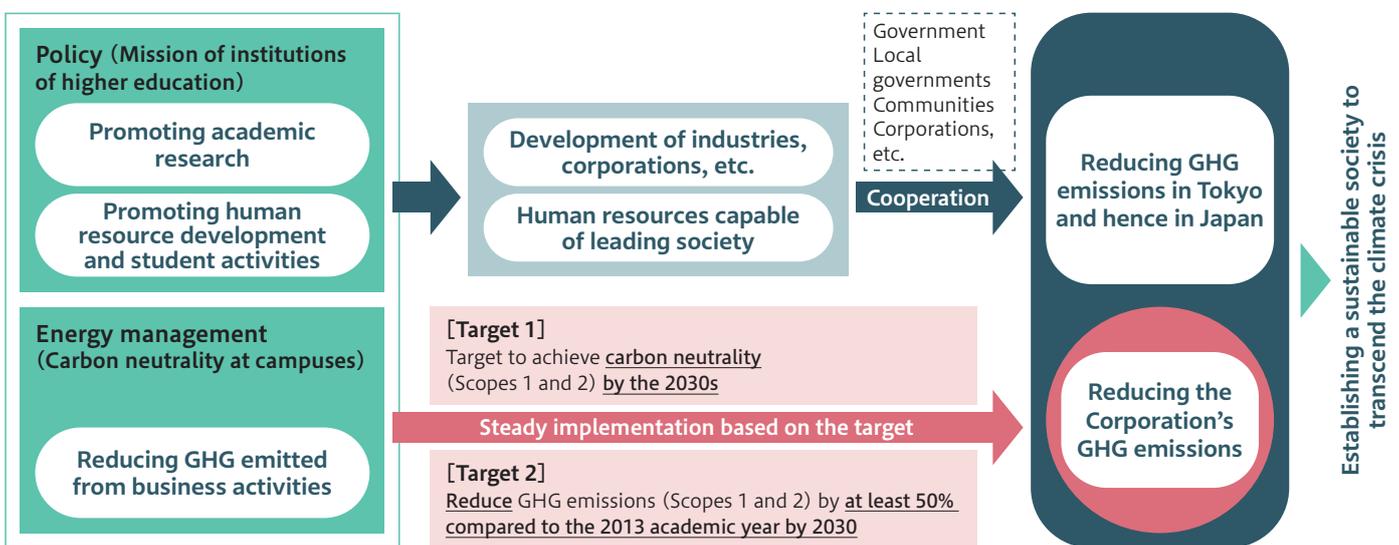
# Toward Carbon Neutrality

## Formulation of the Carbon Neutrality Promotion Plan

Based on the Climate Emergency Declaration issued in 2021, making us the first national and public university to do so, the Tokyo Metropolitan Public University Corporation (hereinafter referred to as “the Corporation”) formulated its Carbon Neutrality Promotion Plan in March 2023.

The plan outlines the fundamental directions for future initiatives, clarifies the Corporation’s greenhouse gas emissions, and sets a target to achieve carbon neutrality (Scopes 1 and 2) by the 2030s, exceeding the goals set by the national government and the Tokyo Metropolitan Government.

## Fundamental Directions



\*Scope 1: Direct greenhouse gas emissions from each institution (e.g., combustion of gases and fuels)

\*Scope 2: Indirect emissions from the use of electricity, heat, and steam supplied by other companies

\*Scope 3: Indirect emissions not included in Scopes 1 or 2 (e.g., indirect emissions related to research, education, and business activities)

### Eco-Activity Promotion Policy

Humanity is facing unprecedented and severe global environmental crises, including global warming, resource and energy issues, and water resource problems. In particular, large cities, such as Tokyo, are not only the driving force behind the development of civilization but also major sources of greenhouse gas emissions due to the large-scale consumption of resources and energy, thereby having a significant impact on the Earth’s environmental burden.

The Tokyo Metropolitan Public University Corporation, in line with its founding principles, strives to reduce environmental impact through educational and research activities for the sustainable development of large cities, and actively contributes to the future of the global environment and scientific and technological advancements.

With this in mind, a basic policy is established to promote eco-activities within the Corporation, and to collaborate and cooperate with citizens, businesses, the national government, Tokyo Metropolitan Government, and local municipalities. The goal is to achieve a sustainable society that overcomes environmental crises, including climate change.

When implementing specific measures based on this basic policy, efforts will take into account the maintenance and enhancement of the educational and research environment within the Corporation, as well as the characteristics of each educational institution, including Tokyo Metropolitan University, the Advanced Institute of Industrial Technology, and the Tokyo Metropolitan College of Industrial Technology.

#### Basic Policy

##### 1. Promotion of academic research

Utilize the resources entrusted by the citizens of Tokyo and society in the most effective way to address environmental issues, promote research related to the environment, and broadly return the results to society.

##### 2. Promotion of human resource development and student activities

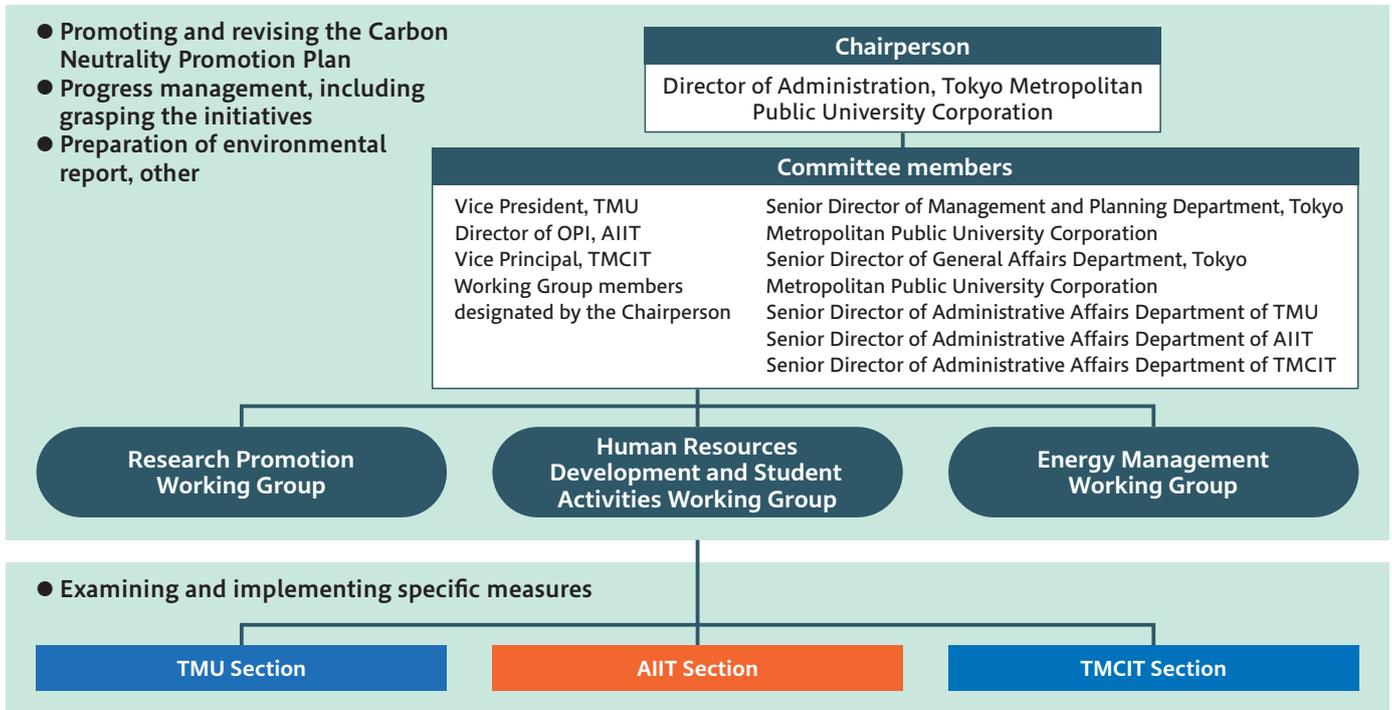
Implement environmental education, foster individuals with a high awareness of various environmental issues, and aim to develop human resources who can actively contribute to society at large.

##### 3. Energy management

Reduce the environmental burden arising from educational and research activities, and contribute to the construction of a low-carbon society and the prevention of global warming. This includes efforts to utilize renewable energy, promote resource and energy conservation measures, and optimize the disposal of waste and pollutants. At the same time, comply with environmental laws and regulations, and build an autonomous and sustainable environmental management system through cooperation among students, faculty, and staff. Strive to ensure proper operation of the system and actively publicize its results.

# Promotion System

## Eco Activities Promotion Committee



# Roadmap of Initiatives

\*Given the uncertainty regarding future electricity supply and other factors at the time of the formulation of the Carbon Neutrality Promotion Plan, a review will be conducted in 2025, five years before 2030.

|   |   | 2023   | 2024   | 2025 | 2026 | 2027 | 2028 | 2029        | 2030           | ~ |
|---|---|--|--|------|------|------|------|-------------|----------------|---|
| Energy management<br>(Reduction of GHG)                     | Energy-saving activities and campaigns  | Further promotion of energy-saving activities at each campus   |  |      |      |      |      |             |                |   |
|   |   | Promoting awareness of energy conservation among students, faculty, and staff  |  |      |      |      |      |             |                |   |
|   | Retrofitting with energy-saving equipment   | Systematic renewal to equipment contributing to energy conservation, including retrofitting with LED lighting                                |  |      |      |      |      |             |                |   |
|   | Introducing in-house power generation equipment   | Implementation   | Additional implementation<br>Depending on the status of external procurement of renewable energy |      |      |      |      |             |                |   |
|   | External procurement of renewable energy (offsite PPA, etc.)  | Examination of methods   | Swift implementation once prospect for procurement is established                                |      |      |      |      |             |                |   |
|   | Use of new technologies, etc.   | Cooperation in verification tests for new technologies, etc., and examining and implementing other energy-saving and energy-creating methods |  |      |      |      |      |             |                |   |
|   | Carbon offsets  |  |  |      |      |      |      | Examination | Implementation |   |
| Promoting human resource development and student activities | Providing a learning environment  |  |  |      |      |      |      |             |                |   |
|   | Supporting environmental activities   |  |  |      |      |      |      |             |                |   |
|   | Strengthening awareness of climate change and climate crisis  |  |  |      |      |      |      |             |                |   |
| Promoting academic research                                 | Promoting research at the department, research center, faculty etc. of the two universities and one college |  |  |      |      |      |      |             |                |   |
|   | Collaboration with the Tokyo Metropolitan Government  |  |  |      |      |      |      |             |                |   |

# Toward Carbon Neutrality

## Target for Reducing Greenhouse Gas Emissions from Business Activities

**Target** \*Scope 1 and Scope 2

- Aim to achieve carbon neutrality by the 2030s
- Achieve a reduction of at least 50% by 2030 compared to FY2013

\*For Scope 3, actively work on appropriate calculation of emissions and exploring countermeasures.

\*Given the uncertainty regarding future electricity supply and other factors at the time of the formulation of the Carbon Neutrality Promotion Plan, a review will be conducted in 2025, five years before 2030

## Approach to Achieving the Target

### Direction (1): Reduce energy consumption

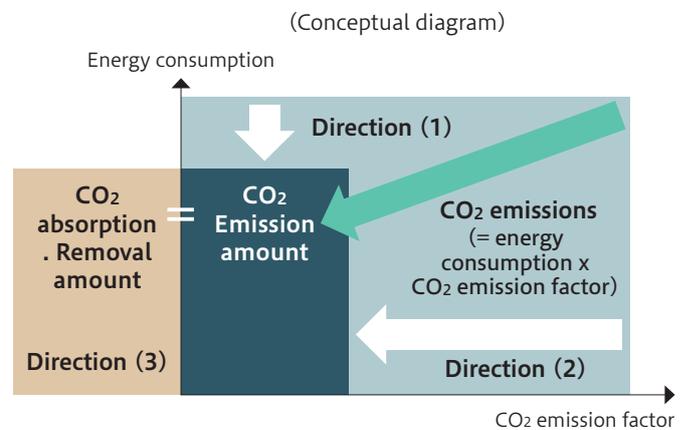
- Thoroughly reduce inefficient energy consumption
- Update energy-saving equipment, such as LED lighting

### Direction (2): Expand use of low-carbon energy

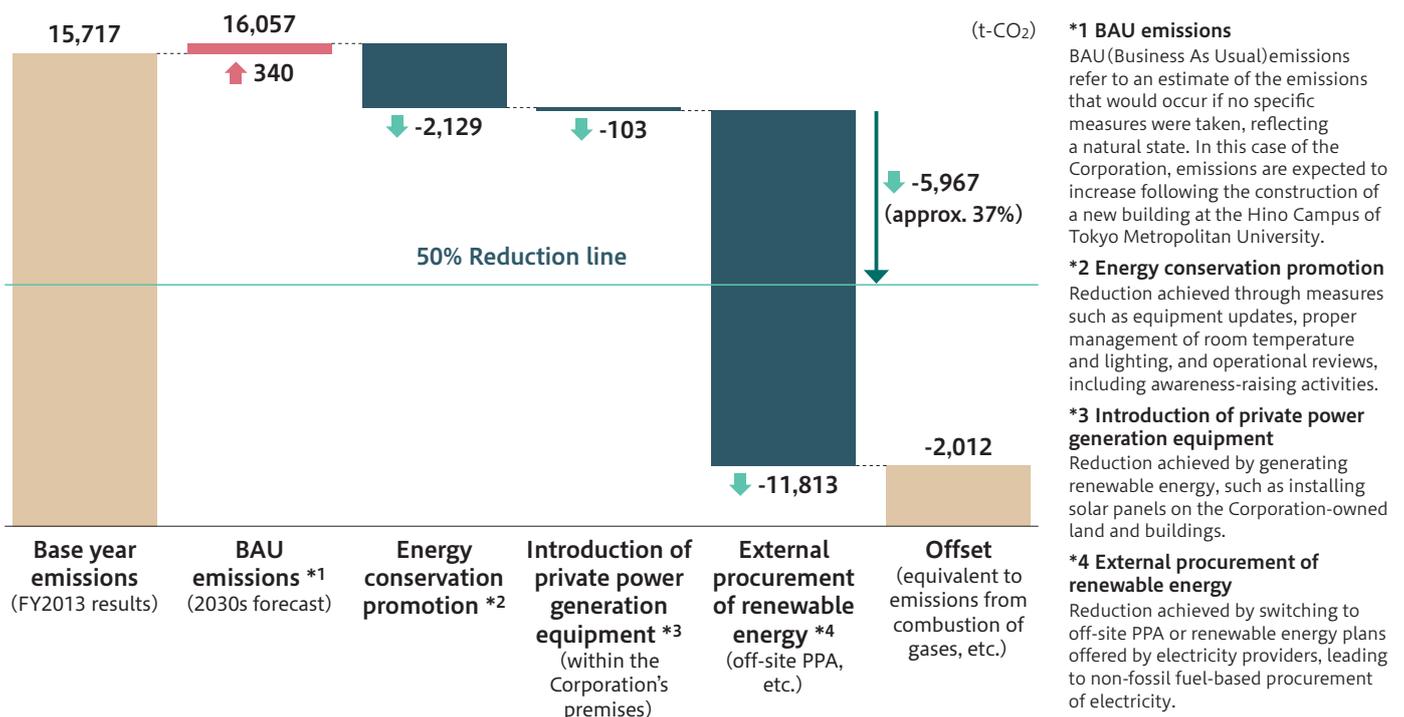
- Introduce private power generation equipment (solar power generation)
- Examine and implement renewable energy procurement methods, such as off-site PPA

### Direction (3): Expand CO<sub>2</sub> absorption and removal

- Green conservation
- Examine carbon offsetting



## Breakdown of Reduction Methods for Achieving the Target



\*Given the uncertainty regarding future electricity supply and other factors at the time of the formulation of the Carbon Neutrality Promotion Plan, a review will be conducted in 2025, five years before 2030.

# Major Activities and Achievements Toward Carbon Neutrality in FY2024

## Release of the "Carbon Link" app to Promote Carbon Neutrality

As part of our efforts to become carbon neutrality and nature positivity, we released a carbon neutrality promotion app called "Carbon Link" in March 2025.

"Carbon Link" is an app for students and faculty members of Tokyo Metropolitan University (hereinafter referred to as "TMU"), the Advanced Institute of Industrial Technology (hereinafter referred to as "AIIT"), and the Tokyo Metropolitan College of Industrial Technology (hereinafter referred to as "TMCIT"). The app aims to provide visualizations of the effects of individual environmentally friendly efforts on reducing greenhouse gas emissions and give a real sense of their contribution to carbon neutrality and nature positivity.

In addition to the "eco-action" function, which records the amount of greenhouse gas emissions reduced through environmentally friendly initiatives, the system is also equipped with a "ranking function", a "quiz function," and a "reward function," which allow users to continue their activities with a sense of enjoyment.

| Key features                     | Function overview  |
|----------------------------------|--|
| Eco-action record                | By making records of environmentally friendly activities undertaken in one's daily life, users are provided with visualizations of CO <sub>2</sub> reduction amounts. CO <sub>2</sub> reductions accumulate and the trees on the home screen grow according to the amount of reduction achieved. |
| Ranking function                 | By selecting the period and your affiliation, you can view multiple rankings related to CO <sub>2</sub> reductions.  |
| Quiz function                    | Users can acquire knowledge about environmental issues by answering quizzes related to carbon neutrality and nature positivity.  |
| Reward viewing function          | Users can earn trophies according to their daily eco-actions.  |
| Action history browsing function | The amount of CO <sub>2</sub> reductions achieved through eco-actions can be checked over various periods.   |



Home screen

Trees grow in accordance with reductions



Eco-action screen

Records of environmentally friendly activities



Quiz screen

Become acquainted with new pieces of knowledge

# Major Activities and Achievements Toward Carbon Neutrality in FY2024

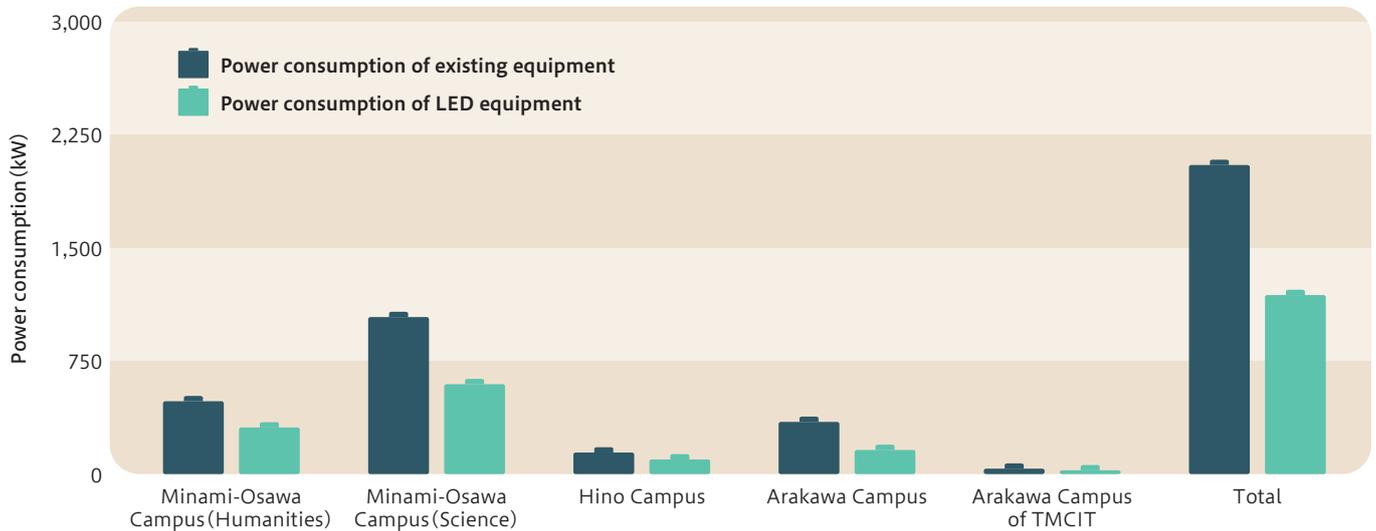
## Introduction of Energy-saving Equipment

In order to achieve carbon neutrality, the Corporation not only calls on students and faculty members to take energy-saving actions such as saving electricity, but also works to upgrade energy-saving facilities and introduce clean energy.

### Switching to LED Lighting

We are gradually switching to LED lighting at each campus. It is generally recognized that switching from fluorescent lamps to LED lighting can reduce power consumption by approximately 50%. By completing the installation of LED lighting by FY2028 as scheduled, we expect to reduce power consumption for lighting by approximately 40%.

### Effects of changing from existing equipment to LED equipment



\*AIIT and the TMCIT (Shinagawa Campus) switched to LED lighting by FY2021.

### Installation of Solar Car Ports

In March 2025, we installed a solar car ports in the parking lots of the Minami-Osawa Campus of TMU. The installed solar car ports measures 848 m<sup>2</sup> (53 m by 16 m) and are expected to generate approximately 150 kW of electricity. This is more than 7 times the amount of electricity generated by the photovoltaic power generation facilities which had been installed at the Minami-Osawa Campus (approximately 20 kW).



### Switching to Electricity Derived from Renewable Energy Sources

From FY2025, the Minami-Osawa Campus of TMU has switched to electricity derived from renewable energy that emits virtually no CO<sub>2</sub>. Electricity accounts for about 80% of the energy used at the campus, and switching to electricity derived from renewable energy sources is expected to significantly reduce greenhouse gas emissions.

## Carbon Neutrality and Nature Positive Fund

The Corporation has established the Carbon Neutrality and Nature Positive Fund to further promote initiatives aimed at realizing carbon neutrality and nature positivity.

The donations received will be used as expenses for initiatives serving to contribute to carbon neutrality and Nature Positivity which are implemented by the Corporation. We sincerely appreciate all support provided.



Tokyo Metropolitan  
Public University Corporation

An outline of this fund can be viewed using the two-dimensional code shown on the right.

[https://www.houjin-tmu.ac.jp/kifu\\_goal/houjin-cn-np-fund/](https://www.houjin-tmu.ac.jp/kifu_goal/houjin-cn-np-fund/)



## Other Related Funds

### Tokyo Metropolitan University Makino Herbarium Fund

Makino Herbarium currently has about 500,000 specimens in its collection, and is promoting research and educational activities utilizing the specimens, digitizing the specimens, and disclosing information. Donations will be used to pass on the herbarium to future generations and further enhance the activities of the Makino Herbarium.

[https://www.houjin-tmu.ac.jp/kifu\\_goal/makino-fund/](https://www.houjin-tmu.ac.jp/kifu_goal/makino-fund/)



### Tokyo Metropolitan University Ogasawara Research Fund

As the only university with a research facility in Ogasawara, TMU has more than 50 years of experience in Ogasawara research. Donations will be used to continue research activities in the Ogasawara Islands (a World Natural Heritage Site), such as natural restoration, measures against non-native species, and the promotion of ecotourism.

[https://www.houjin-tmu.ac.jp/kifu\\_goal/tmu-ogasawara-fund/](https://www.houjin-tmu.ac.jp/kifu_goal/tmu-ogasawara-fund/)



# Major Activities and Achievements Toward Carbon Neutrality in FY2024

## Issuance of a Nature Positive Declaration

Climate change and the increase in human activities are having a serious impact on ecosystems and causing a loss of biodiversity. In response to this situation, we issued our Nature Positive Declaration in July 2024. In it, we expressed our intention to further promote initiatives aimed at carbon neutrality.



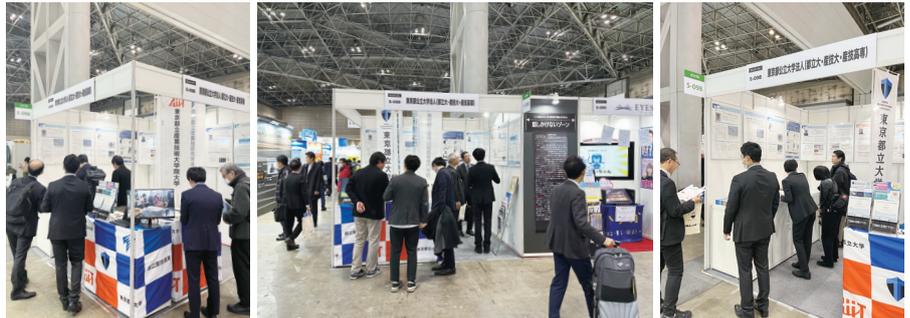
## Preparation of Environmental Report 2024

We have prepared a report in Japanese and English for FY2024, which describes the environmental impact of the Corporation in FY2023, including in terms of greenhouse gas emissions and waste emissions, and also describes the educational and research activities undertaken at our two universities and technical college.



## Exhibiting at EcoPro2024

We participated in EcoPro2024, one of the largest environmental exhibitions in Japan, and disseminated information about the research activities described in the Environmental Report 2024 and the efforts of the Tokyo Research Initiative for Sustainability (TRIS).



## Implementation of Open University Lectures

For winter lectures, we conducted lectures titled The “Significance and Effectiveness of Environmental Management for Promoting Carbon Neutrality” and “Technology for Rapid Recovery of Carbon Dioxide from the Atmosphere” (both of these are lecture titles).

## Investment in Tokyo Green and Blue Bonds

We invested 100 million yen in Tokyo Green and Blue Bonds issued by the Tokyo Metropolitan Government, with the aim of contributing to the achievement of carbon neutrality in Tokyo and Japan through fund management.

## Study of Advanced Cases in Finland

We visited Lappeenranta-Lahti University of Technology LUT, Aalto University and other institutions in Finland, which are making progress on SDGs, including when it comes to climate change countermeasures. We also shared information on our own initiatives with them.



# Overview of the Environmental Management

We promote energy management (Eco-Campus and Green Campus) in order to reduce our environmental impact and to actively contribute to the future of the global environment and the advancement of science and technology through education and research activities.

## Promotion of Eco-Campus and Green Campus

Tokyo and other large cities have a significant impact on the global environment as major sources of greenhouse gas emissions resulting from massive consumption of resources and energy.

In April 2010, the Act on Rationalizing Energy Use (hereinafter referred to as the “Energy Conservation Act”) and the Ordinance on the Environment to Ensure the Health and Safety of Tokyo Residents (hereinafter referred to as the “Tokyo Ordinance Environmental Security”.) were amended, with a new system for reducing environmental impacts being launched.

The Energy Conservation Act stipulates an obligation for corporations as a whole to make efforts to reduce the annual energy consumption intensity by 1% or more on average.

According to the Tokyo Ordinance Environmental Security, Minami-Osawa Campus of TMU alone is required to reduce greenhouse gas emissions by an average of 50% or more (relative to standard emissions) during the 4th Plan Period spanning from FY2025 to the end of FY2029.

During the 3rd Plan Period (spanning from FY2020 to the end of FY2024), we expect to achieve a reduction of 31.33%\*, which is higher than the reduction of least 27% (in relation to standard emission levels) that we had been obligated to achieve.

※This is a provisional value pending verification by a third-party review organization.

### Energy Conservation Targets and Obligations by Law

#### Specific Targets and Obligations

##### Energy Conservation Act

Reduce the annual energy consumption intensity by an average of at least 1% per year over five fiscal years (target)  
(Applies to the entire corporation)



##### Tokyo Ordinance Environmental Security

Reduce greenhouse gas emissions by at least 50% on a five-year average from FY2025 to FY2029 (mandatory)  
(Applies only to the Minami-Osawa Campus)

## Major Initiatives

Proper management of room temperature and lighting

Air conditioning: 28°C Heating: 20°C



Upgrading to high energy-efficiency equipment



Displaying energy conservation awareness posters



Promoting the 3Rs (reduce, reuse, recycle)



Ensuring thorough awareness and adherence to waste separation rules



Tokyo Metropolitan University has installed carbon offset vending machines at the Minami-Osawa and Hino campuses to reduce greenhouse gas emissions by carbon offset, in order to achieve carbon neutrality.



Carbon offset vending machine (Minami-Osawa Campus)

Garbage sorting (Hino Campus)



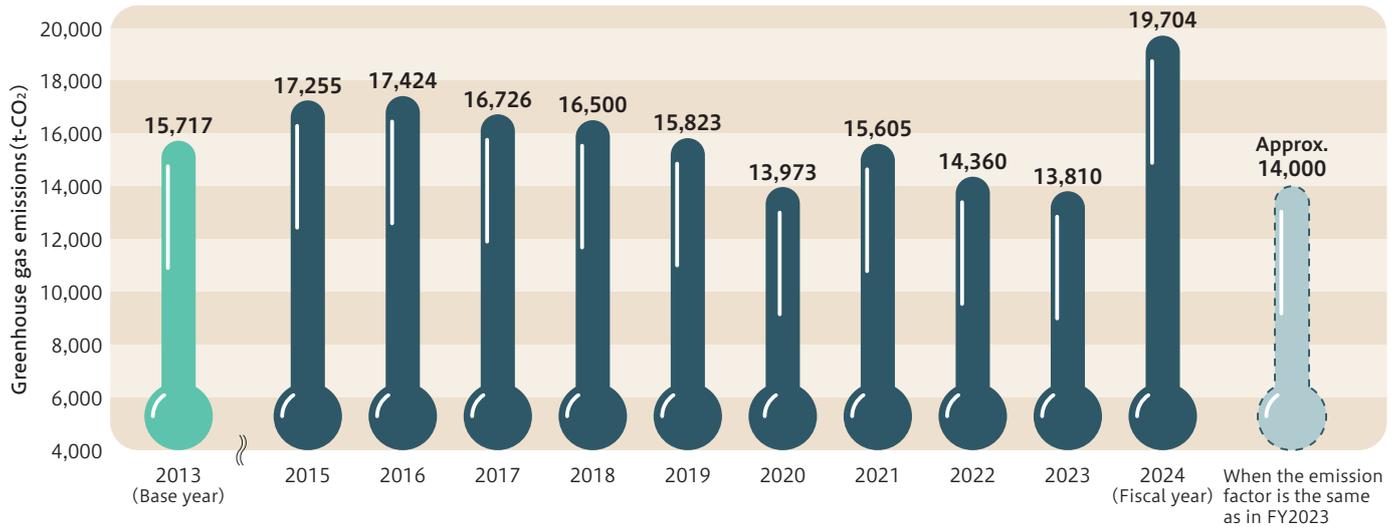
# Overview of the Environmental Management



## Promotion of Energy Conservation and Global Warming Countermeasures

The Energy Conservation Act and the Tokyo Ordinance Environmental Security impose strict energy conservation targets (particularly when it comes to the Minami-Osawa Campus), meaning that is necessary for us to make continuous efforts to conserve energy as a corporation.

### Greenhouse gas emissions

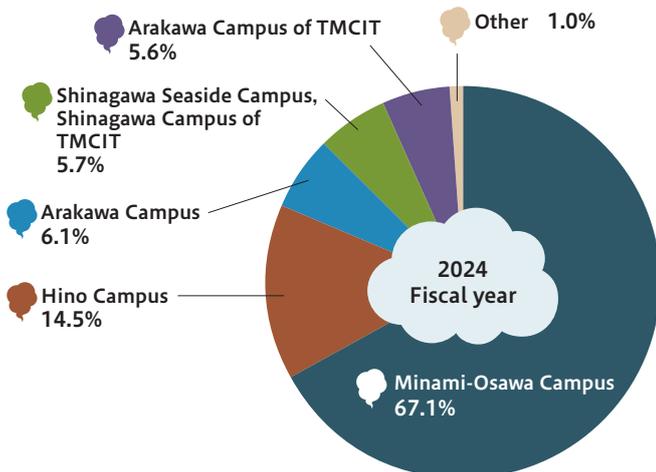


Greenhouse gas emissions are calculated in accordance with the GHG Protocol. Corporate greenhouse gas emissions had been on a downward trend since FY2016, with the exception of FY2020, when the COVID-19 pandemic hit the campus. However, in FY2024, the greenhouse gas emission factor\* of the electricity supplier contracted at the Minami-Osawa Campus, which accounts for approximately 60% of the electricity consumption, became approximately 1.6 times. This meant that despite a decrease in electricity consumption, greenhouse gas emissions increased approximately 6,000 tons. Since FY2025, the Minami-Osawa Campus has switched to electricity derived from renewable energy, which emits virtually no CO<sub>2</sub>.

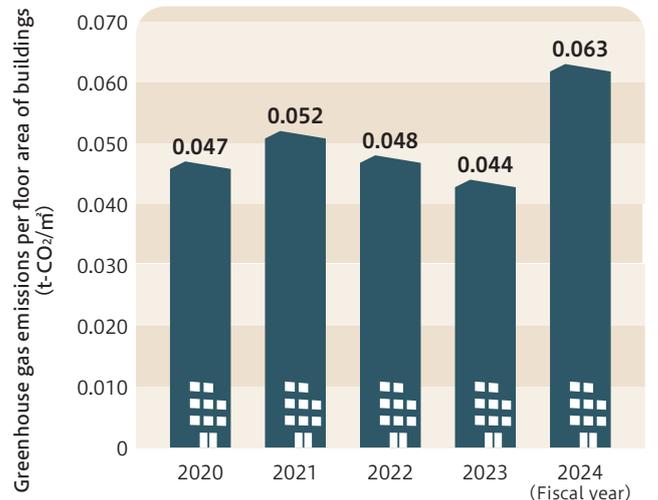
As can be seen from the “Total energy consumption” and “Total energy consumption per floor area of buildings” on the right page, we are working to promote energy-saving activities at each campus and continue to work to reduce greenhouse gas emissions.

\*Amount of CO<sub>2</sub> emitted per kWh of electricity (kg-CO<sub>2</sub>/kWh)

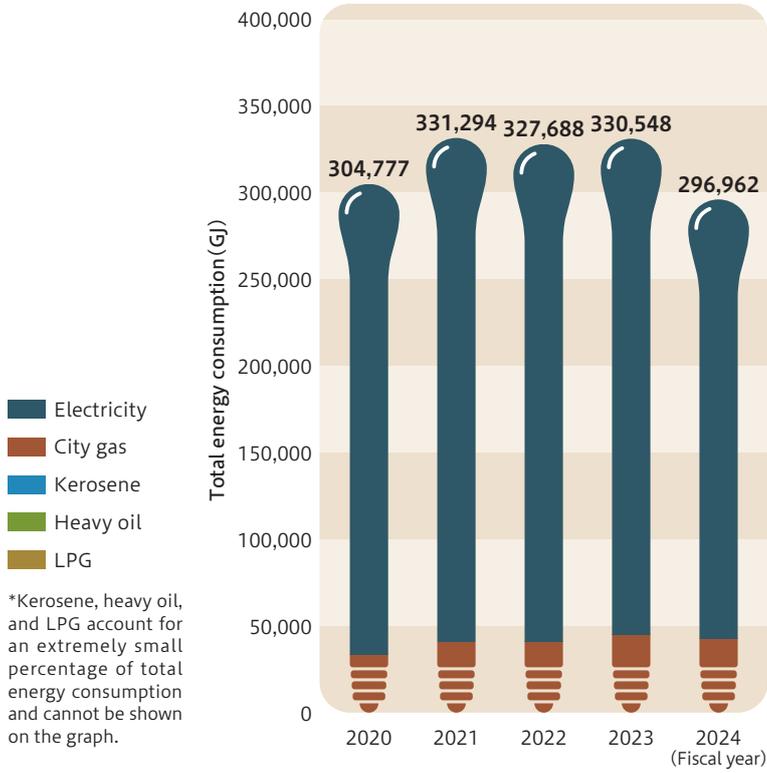
### Percentage of greenhouse gas emissions by campus



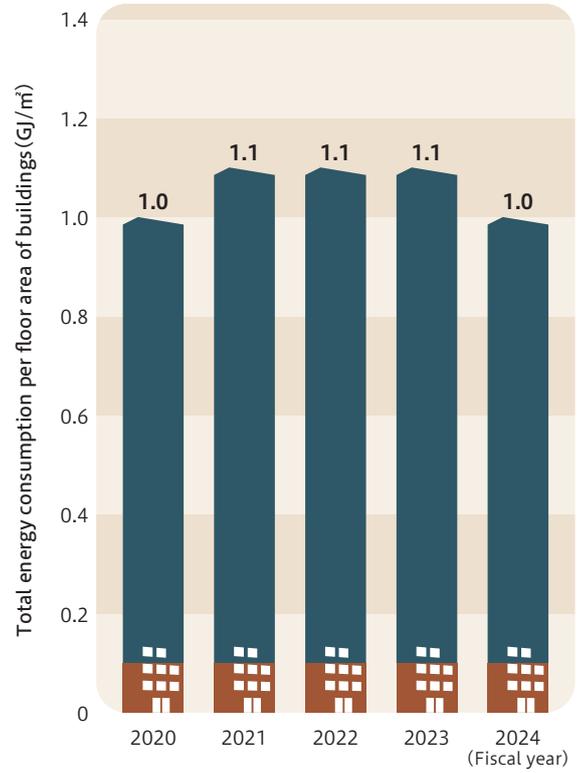
### Greenhouse gas emissions per floor area of buildings



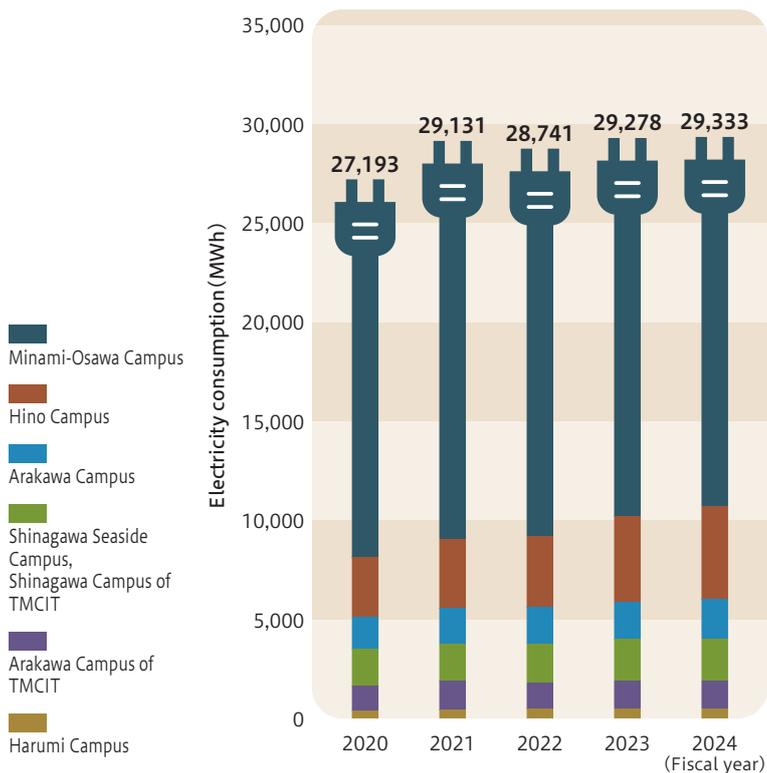
### Total energy consumption



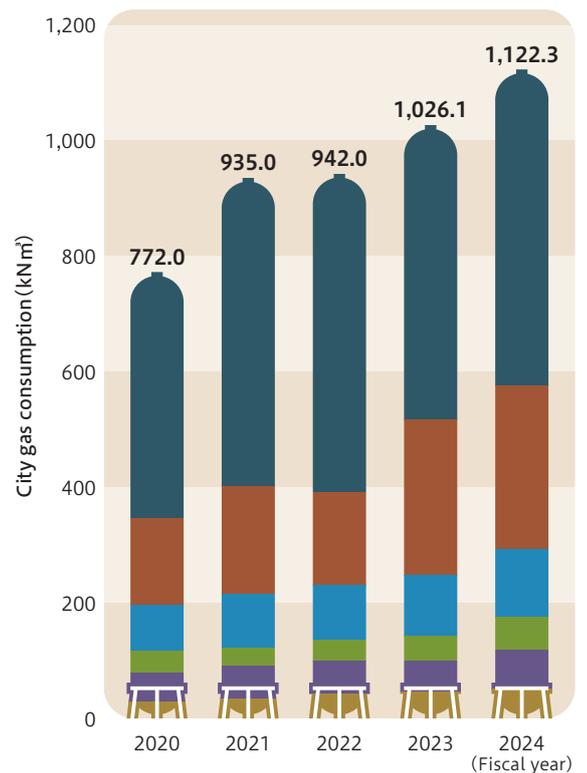
### Total energy consumption per floor area of buildings



### Electricity consumption



### City gas consumption



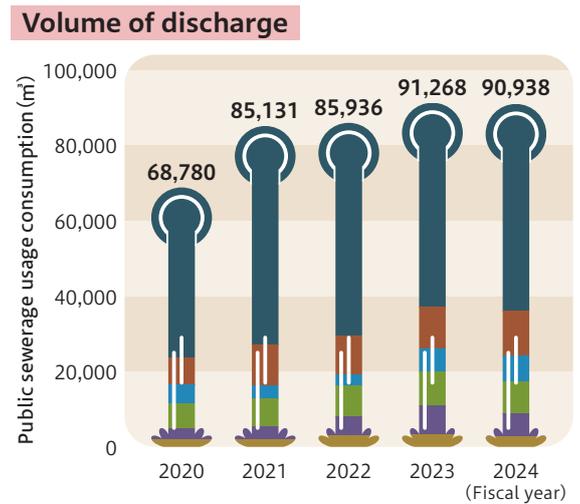
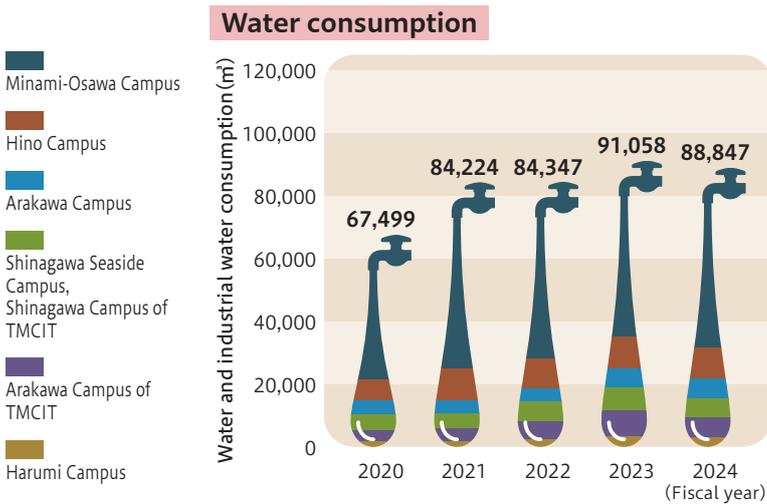
# Overview of the Environmental Management

## Promotion of Resource Conservation

The Corporation promotes resource conservation by implementing countermeasures to reduce water consumption and proper waste management.

### Reduction of Water Consumption

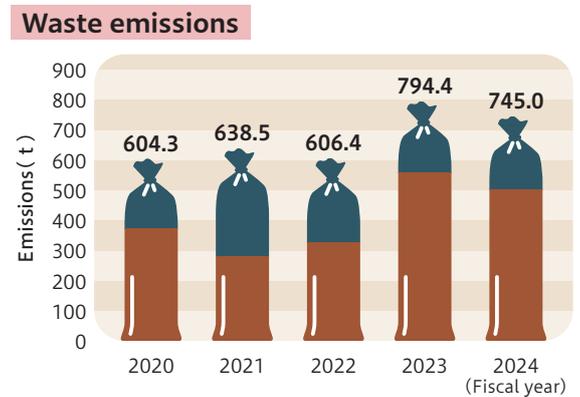
We are implementing water-saving countermeasures, such as upgrading to water-saving toilets.



### Proper Waste Management

The rules for waste sorting are posted at each facility and waste collection point on campus promoting the 3Rs (Reduce, Reuse, Recycle) and the proper sorting and disposal of waste.

Waste generated by the Corporation is properly managed and disposed of by sorting it into general waste (combustible waste, non-combustible waste, etc.) and industrial waste (sludge, controlled industrial waste, etc.).



## Material Balance

The environmental impact associated with education and research activities includes energy usage such as electricity, consumption of water resources, and emissions of greenhouse gases and waste. The environmental impact for FY2024 is as follows.





## Compliance with Environmental Laws and Regulations

The Corporation conducts research on environmental regulations and ensures compliance by implementing appropriate.

### Proper Management of Chemical Substance

The Corporation handles a large number of chemical substances in its educational and research activities. As the Corporation is subject to the Act on the Assessment of Releases of Specified Chemical Substances in the Environment and the Promotion of Management Improvement (hereinafter referred to as the "PRTR Act"), it investigates and aggregates the amounts of chemical substances handled that fall under Class I Designated Chemical Substances, as outlined in the law. For substances exceeding certain quantities, the Corporation reports their release into the environment as well as their transfer as waste. In FY2024, the four substances subject to PRTR reporting are listed in the table. The Corporation manages the purchase, usage, and storage of chemical substances and works to reduce the use of hazardous substances.

In addition, in compliance with the Tokyo Ordinance Environmental Security, the Corporation reports the usage of properly managed chemical substances for FY2024. The substances subject to this ordinance include nine types, such as acetone and chloroform.

### Handling amounts of Class I Designated Chemical Substances under the PRTR Act in FY2024

| Substance name         | Emissions (kg/year)         |   |
|------------------------|-----------------------------|---|
|                        | Emissions to the atmosphere | Amount transferred (kg/year)<br>Transfers outside the business premises |
| Chloroform             | 260                         | 840   |
| Hexane                 | 140                         | 760   |
| Methylene chloride     | 390                         | 830   |
| Lead and its compounds | 0                           | 500   |

### Reported amounts of chemical substances under the Tokyo Ordinance Environmental Security in FY2024

| Substance name    | Amount used (kg/year) | Emissions to the atmosphere (kg/year) | Amount of waste (kg/year) |
|-------------------|-----------------------|---------------------------------------|---------------------------|
| Acetone           | 1,800                 | 350                                   | 1,450                     |
| Hydrochloric acid | 1,600                 | 0                                     | 1,600                     |
| Chloroform        | 1,100                 | 260                                   | 840                       |
| Ethyl acetate     | 290                   | 40                                    | 250                       |
| Dichloromethane   | 1,220                 | 390                                   | 830                       |
| Toluene           | 180                   | 30                                    | 150                       |
| Hexane            | 900                   | 140                                   | 760                       |
| Methanol          | 800                   | 170                                   | 630                       |
| Sulfuric acid     | 170                   | 0                                     | 170                       |

### Proper Management of CFCs

In accordance with the Act on Rational Use and Proper Management of Fluorocarbons (hereinafter referred to as the "Fluorocarbons Emission Control Act"), we conduct regular inspections of commercial air conditioners, freezers, refrigerators, and other equipment. Inspections have found that there were no leaks or any other items which required reporting.

Fluorocarbons have been widely used for various purposes, such as refrigerants in air conditioners and refrigerators. However, their impact on the environment, including ozone layer depletion and global warming, has become evident, requiring thorough management. In managing equipment covered by the Fluorocarbon Emission Control Act, we ensure awareness and strict adherence to the management methods specified by the law, as outlined in the table to the right.

### Management methods for equipment subject to the Fluorocarbon Emission Control Law

- Installation in appropriate locations, etc.
- Equipment inspection
- Leakage prevention measures; in principle, prohibiting charging without repair
- Retention of inspection records, etc.



# Tokyo Research Initiative for Sustainability (TRIS)

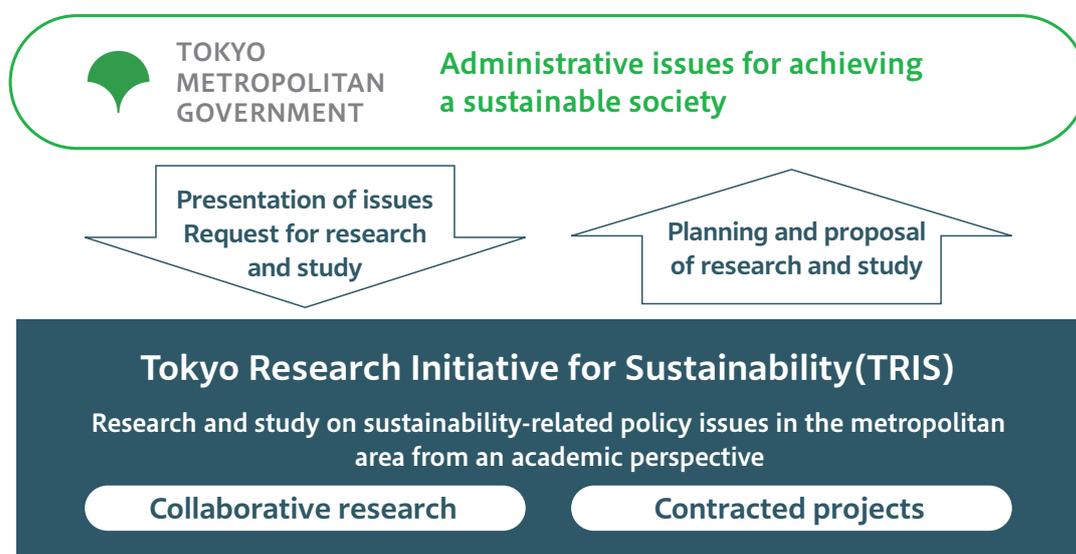
The Corporation established the “Tokyo Research Initiative for Sustainability (TRIS)” in January 2022 to strengthen its research capabilities in solving SDGs-related issues, including environmental problems.

TRIS promotes research aimed at solving municipal issues from an academic perspective, focusing on “sustainability”, and works to contribute research results to the metropolitan government. It also shares the outcomes through policy proposals to the Tokyo Metropolitan Government, publication on the website, and other channels.

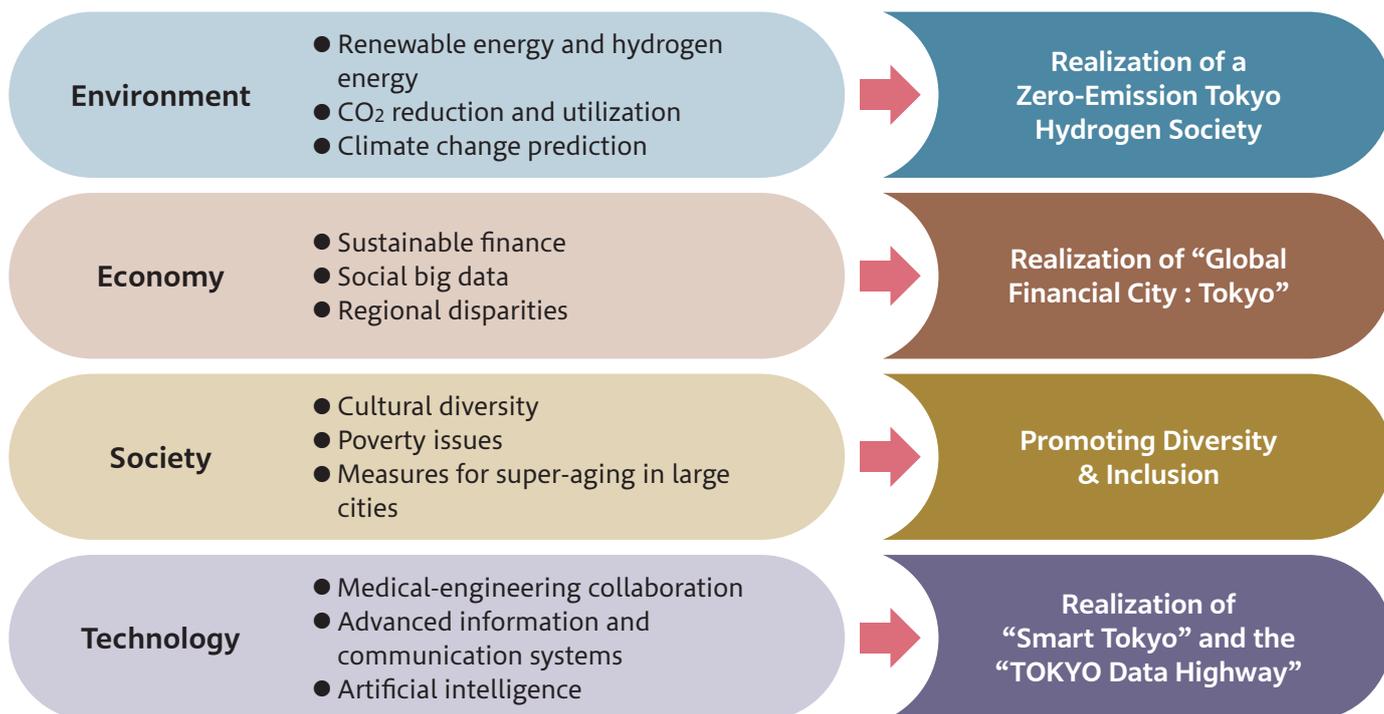


私たちは持続可能な開発目標 (SDGs) を支援しています。

## Matching Government Needs and Research Seeds



## Research Fields and Examples of Initiatives





# Introduction to Research Related to Carbon Neutrality and Nature Positivity

Below is a list of research projects related to carbon neutrality and nature positivity conducted by the Corporation.

| No. | Affiliation / Name  | Research topic  | Overview and URL  |
|-----|---|---|---|
| 1   | <b>YOSHIDA Kenichi</b><br>Tokyo Metropolitan College of Industrial Technology | <b>Solid oxide fuel cells</b>   | From the viewpoint of carbon neutrality, this project involves the conducting of research on solid oxide fuel cells using hydrogen, which does not emit CO <sub>2</sub> , as fuel. From the viewpoint of nature positivity, this project involves the conducting of research on solid oxide fuel cells that use methane gas generated from sewage treatment plants and garbage as fuel.   |
| 2   | <b>YAMAMOTO Shoji</b><br>Tokyo Metropolitan College of Industrial Technology  | <b>Promotion of DX in education through knowledge acquisition, which leads to the promotion of environmental friendliness through greater efficiency of human activities</b>  | Utilizing user models based on individuality (personalities and values), this project involves the use of machine learning to realize individualized learning and skill transfer support. Through DX for education, the aim of the project is to improve the efficiency of human resource development and knowledge acquisition and thereby contribute to the solving of social issues and to sustainable human activities.<br><a href="https://www.houjin-tmu.ac.jp/topics/topics13002/#kijj04">https://www.houjin-tmu.ac.jp/topics/topics13002/#kijj04</a>  |
| 3   | <b>KUDO Masaki</b><br>Tokyo Metropolitan College of Industrial Technology     | <b>Research on advanced Cellulose nanofiber composite materials</b>   | This project involves the conducting of research to improve the functionality of cellulose nanofiber (CNF) composite materials obtained from plants by adding high thermal conductivity and improving water resistance. By increasing the added value of CNF composite materials, the spread of CNF is expected to accelerate and subsequently contribute to the reduction of environmental impacts and to decarbonization. One example is the development of CNF yarn with thermal conductivity that is comparable to that of stainless steel.<br><a href="https://www.metro-cit.ac.jp/contents/000009110.pdf">https://www.metro-cit.ac.jp/contents/000009110.pdf</a>  |
| 4   | <b>FUKANO Azusa</b><br>Tokyo Metropolitan College of Industrial Technology    | <b>Research on nuclear fusion as a new energy source to replace oil and coal</b>  | With the goal of improving the performance of negative ion sources in fusion reactors, the aim of this project is the establishment of high-efficient heating and acceleration technologies through the analysis of electron energy loss in cusp magnetic fields. This will contribute to the realization of fusion-based energy from both the basic and applied aspects of plasma physics, and contribute to the development of sustainable next-generation energy sources to be used as replacements for oil and coal.<br><a href="https://www.nifs.ac.jp">https://www.nifs.ac.jp</a>   |
| 5   | <b>KOIDE Teruaki</b><br>Tokyo Metropolitan College of Industrial Technology   | <b>Research on a vertical axis wind turbine with variable blade pitch</b>   | By variably controlling the blade pitch of the vertical axis wind turbine, this research project involves the optimization of the aerodynamic force according to the wind velocity change that takes place, thereby improving energy conversion efficiency. The aim of this research project is to demonstrate performance exceeding that of conventional models through numerical analyses and experiments and develop the technology as a new energy-saving technology.<br><a href="https://www.metro-cit.ac.jp/contents/000011997.pdf">https://www.metro-cit.ac.jp/contents/000011997.pdf</a>  |
| 6   | <b>Suzuki Tatsuo</b><br>Tokyo Metropolitan College of Industrial Technology   | <b>Research concerning boron phosphide monolayer film, a revolutionary water-splitting photocatalyst for the production of green hydrogen directly using solar energy</b>   | This research involves the theoretical proposal of a boron phosphide monolayer film as an innovative photocatalyst that directly utilizes sunlight to break down water and produce green hydrogen. The aim of the project is to contribute to a decarbonized society by realizing a high-efficiency and low-cost hydrogen production technology.<br><a href="https://www2.metro-cit.ac.jp/~tatsuo/">https://www2.metro-cit.ac.jp/~tatsuo/</a>   |
| 7   | <b>SAITO Hiroshi</b><br>Tokyo Metropolitan College of Industrial Technology   | <b>Development of a phase-change-type self-excited vibration heat transport device using refrigerants entailing low environmental loads</b>   | This project involves the development of a self-excited-vibration-type heat transport device using phase change accompanying evaporation and condensation of refrigerant to realize a technology providing highly effective and efficient heat transport for cooling electronic equipment and power devices with high levels of heat generation density. The aim of the project is to apply machine learning to the evaluation of flow and heat transport characteristics of refrigerants with low environmental impacts (which take environmental impacts into consideration) to clarify the phenomenon involved and establish a sustainable thermal control technology.<br><a href="https://www.mmlab.mech.tuat.ac.jp/mmlab/research/research-ht-j.shtml">https://www.mmlab.mech.tuat.ac.jp/mmlab/research/research-ht-j.shtml</a>  |
| 8   | <b>HASEGAWA Shu</b><br>Tokyo Metropolitan College of Industrial Technology    | <b>Press forming of lightweight materials for automobiles</b>   | This project involves the conducting of fundamental research on bending technologies used when structural materials such as those used in automobile bumpers and seat frames are replaced with aluminum and magnesium alloys and when the copper strands in bus bars are replaced with aluminum strips.   |
| 9   | <b>SAGARA Takuya</b><br>Tokyo Metropolitan College of Industrial Technology   | <b>① Formation of hydrogen storage alloy-encapsulated CNTs and titanium oxide-encapsulated CNTs using a solid-liquid interfacial arc discharge method<br/>② Development of a conductive TPU finger bending sensor for XR applications</b> | ① The production of FeTi alloy inclusion CNT is being attempted. This project involves the experimental verification of the feasibility of hydrogen gas solidification under high GPa pressure in nanocavities in CNT. If that is difficult, the project will involve a study as to whether the hydrogen brittleness of the alloy can be reduced and if the hydrogen storage performance can be improved. Meanwhile, TiO <sub>2</sub> -containing CNTs are considered to be applicable to water purification agents that can be used repeatedly due to the improvement of the photocatalytic effects of one-dimensional TiO <sub>2</sub> .<br>② A general sensor for detecting the bending angle of each finger is expensive, and it is difficult to prepare a sensor adapted to the size of the fingers of each individual person. Furthermore, detection of the bending angle of a finger by an optical system (motion capture, for example) also has limitations such as being obstructed by an object or an angle at which visual recognition is impossible. With that being the case, this project aims to produce a finger bending sensor that can be designed according to the user, and to provide a sensor that can detect the bending angle of a human finger in a VR or AR space using a microcomputer and a computer. |



# Introduction to Research Related to Carbon Neutrality and Nature Positivity

| No. | Affiliation / Name  | Research topic   | Overview and URL  |
|-----|---|--|---|
| 10  | <b>CAO Meifuen</b><br>Tokyo Metropolitan College of Industrial Technology   | ① High-efficiency and high-performance driving for electric mobility<br>② Development of a hexacopter using a variable angle rotor"  | ① Contribute to sustainable energy use by developing high-efficiency, high-performance drive technology for electric mobility.<br>② Propose a hexadrome capable of dynamically adjusting the angle of each rotor for stabilization and efficiency improvements in terms of cargo transportation.<br><a href="https://ieeexplore.ieee.org/abstract/document/5157705">https://ieeexplore.ieee.org/abstract/document/5157705</a> "   |
| 11  | <b>ISHIBASHI Masaki</b><br>Tokyo Metropolitan College of Industrial Technology  | ① Study on high-frequency inverter for driving a NOx reduction device using dielectric barrier discharge<br>② Research on the practical application of electromagnetic welding methods | ① The aim of this research project is to develop a power supply that not only detoxifies NOx using dielectric barrier discharge, but also conserves the electric energy required for discharge. The aim of this approach is to realize efficient energy use while reducing environmental impacts.<br>② The seam welding method, in which members are joined in a straight line, requires a large amount of electrical energy because it is a fusion welding method. The electromagnetic welding method, on the other hand, is a new joining method that is dramatically more energy-saving than the seam welding method and joining can be done in a seam shape instantly. This research is being conducted with the aim of practical application of electromagnetic welding methods. |
| 12  | <b>KAWASAKI Norihiro</b><br>Tokyo Metropolitan College of Industrial Technology   | Research on a supply and demand adjustment system for the large-scale introduction of hydrogen photovoltaic power generation   | With the massive introduction of solar power generation, there is a phenomenon occurring wherein there is surplus electricity during the day. An electric power supply and demand adjustment system has been proposed to store surplus electric power, convert it into hydrogen, and operate for stable supply of electric power. Elements such as the minimization of the hydrogen tank by means of the crafting of an operation method are being considered.  |
| 13  | <b>IKEDA Hiroshi</b><br>Tokyo Metropolitan College of Industrial Technology   | Development of a new environmentally conscious cleaning method using microbubbles and ultrasound   | When precision cleaning of machine parts is carried out in industry, it is very important to clean and reuse the cleaning fluid. In order to reduce the contamination caused by cleaning water, we are developing an environmentally friendly washing method for machine parts. When the cleaning method developed during this research is established, it will be possible to use it effectively for the cleaning of extremely fine machine parts. The cleaning water left after cleaning can be recycled, which is environmentally friendly in that it can be used again and again.<br><a href="https://www.metro-cit.ac.jp/contents/000010997.pdf">https://www.metro-cit.ac.jp/contents/000010997.pdf</a>  |
| 14  | <b>SUGIMOTO Seiichi</b><br>Tokyo Metropolitan College of Industrial Technology  | Development of recycled structural materials using the HHP method for recycling waste materials and the clarification of material properties   | This project involves the development of recycled structural material having high levels of strength and high levels of recyclability from wood using the hydrothermal hot press (HHP) method. The aim of the project is the realization of structural material having higher bending strength than elements such as conventional MDF and which is capable of being repeatedly recycled. The project will serve to clarify the relationship between the characteristics of cellulose fibers and material properties, and contribute to effective utilization of waste materials and sustainable resource recycling.<br><a href="https://www.houjin-tmu.ac.jp/topics/topics16025/#kiji02">https://www.houjin-tmu.ac.jp/topics/topics16025/#kiji02</a>                                  |
| 15  | <b>MURAKOSHI Hideki</b><br>Advanced Institute of Industrial Technology  | Light-transmission-type algae density measuring device and aggregated particle measuring device: Toward Establishing Optimal Cultivation Environments for Microalgae                   | With the aim being the stable and efficient cultivation of Nannochloropsis, a microalga containing omega-3 fatty acids, this project involves the development of a light-transmitting algal density measuring device and an agglomerated particle measuring device. The project involves the utilization of IoT technology-based environmental sensing and data analysis to construct optimal culture conditions. This is expected to be applied to biofuels and CO <sub>2</sub> reduction.<br><a href="https://www.houjin-tmu.ac.jp/sustainability_files/environmental_report_2022/?pNo=30">https://www.houjin-tmu.ac.jp/sustainability_files/environmental_report_2022/?pNo=30</a> "  |
| 16  | <b>TAKASHIMA Shinji</b><br>Advanced Institute of Industrial Technology  | Designing the future of movement   | This project involves the examination of historical changes in the purpose of movement and a focus on the qualitative value of movement. Presuming the future ten years from now, the project involves the proposal of mobility which enables people to encounter various things they did not know about before as a new form of value when it comes to mobility.   |
| 17  | <b>ITAKURA Hiroaki</b><br>Advanced Institute of Industrial Technology   | Sustainable regional management  | Based on the concept of regional value chains, the project aims to maximize the value of regional resources and build sustainable local communities. The project involves the use of data science, AI and machine learning to analyze the well-being, economic and environmental benefits of a region in an integrated manner. The project involves the building of a model for autonomous regional development through various measures such as the utilization of vacant houses, the promotion of tourism, and the promotion of migration.<br><a href="http://www.italabo.com">www.italabo.com</a>  |
| 18  | <b>UCHIYAMA Tomonori</b><br>Faculty of Economics and Business Administration/<br>Graduate School of Management<br>Tokyo Metropolitan University | Economic functions of sustainable investment   | This project involves the examination of the economic function of sustainable investment and optimal portfolio construction from both theoretical and empirical perspectives, and the clarification of the role of investors and their impact on environmental and social issues.<br><a href="https://www.saa.or.jp/learning/journal/prize/35.html">https://www.saa.or.jp/learning/journal/prize/35.html</a><br><a href="https://www.saa.or.jp/english/professional/journalprizes.html">https://www.saa.or.jp/english/professional/journalprizes.html</a><br><a href="https://orsj.org/?p=7874">https://orsj.org/?p=7874</a>  |

| No. | Affiliation / Name   | Research topic   | Overview and URL  |
|-----|--|--|---|
| 19  | <b>MIZUGUCHI Yoshikazu</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University | <b>Development of new thermal control materials using superconductivity</b>  | The purpose of this project is to develop nonvolatile magnetothermal switching technology, which utilizes materials with both superconducting and magnetic properties and switches thermal conductivity through the application of an external magnetic field. Experiments using Sn-Pb solder showed the possibility of a new material that maintains high thermal conductivity at low temperatures through a change from a superconducting state to a magnetic state. Application development using high-temperature superconductors is expected in the future.<br><a href="https://www.tmu.ac.jp/news/topics/36531.html">https://www.tmu.ac.jp/news/topics/36531.html</a>   |
| 20  | <b>SHIMOJO Masahiko</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University    | <b>Intrusion of reaction-diffusion equation related to extinction phenomena of biological species which takes into consideration climate change such as global warming</b> | This project involves the mathematical elucidation of intrusion and propagation phenomena in a prey-predator reaction-diffusion equation system using the entropy method. The purpose of this research is to analyze the stability and asymptotic behavior of traveling waves and spreading wave fronts under conditions wherein the environment changes with time, and to theoretically clarify the mechanism of distribution expansion and extinction of species.<br><a href="https://kaken.nii.ac.jp/ja/grant/KAKENHI-PROJECT-24K06817/">https://kaken.nii.ac.jp/ja/grant/KAKENHI-PROJECT-24K06817/</a>  |
| 21  | <b>OKAMOTO Takashi</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University     | <b>Research on plants that can fix CO<sub>2</sub> efficiently using vitro fertilization system</b>   | This research project involves utilizing advanced technologies such as Intracytoplasmic Sperm Injection and selecting and improving plants with high CO <sub>2</sub> fixation capacities, with the aim being the practical application of negative emission technology. By improving photosynthetic activity and cultivating new varieties, contributions will be made to the realization of a sustainable resource recycling and a carbon-neutral society.<br><a href="https://www.f-rei.go.jp/assets/contents/240401_Energy_02.pdf">https://www.f-rei.go.jp/assets/contents/240401_Energy_02.pdf</a>  |
| 22  | <b>OKA Daichi</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University          | <b>Development of a low-cost thin film synthesis technology for optical energy conversion</b>  | This project involves the development of a low-temperature, low-cost synthesis technology for thin films of oxides and sulfides, which are promising optical energy conversion materials. By controlling crystal growth and electrical and optical properties, the aim of the project is to apply the technology to next-generation energy devices.<br><a href="https://sspc.cpark.tmu.ac.jp/sspc/ja/index.html">https://sspc.cpark.tmu.ac.jp/sspc/ja/index.html</a>  |
| 23  | <b>EHIRA Shigeki</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University       | <b>Production of useful substances from atmospheric carbon dioxide and nitrogen gases using photosynthetic organisms</b>   | This project involves the development of technology used to produce useful substances such as amino acids and lipids from atmospheric CO <sub>2</sub> and N <sub>2</sub> using the metabolic functions of photosynthetic microorganisms. The aim is to build bioprocesses that contribute to sustainable resource recycling and greenhouse gas reduction.<br><a href="https://sites.google.com/site/o3ehira/research">https://sites.google.com/site/o3ehira/research</a>  |
| 24  | <b>YAMAZOE Seiji</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University       | <b>Development of carbon dioxide recovery technology and carbon dioxide conversion catalyst</b>  | This project involves the development of innovative DAC (Direct Air Capture) technology to efficiently capture CO <sub>2</sub> from the atmosphere and catalysts to convert captured CO <sub>2</sub> into useful substances. This will contribute to the construction of a carbon-recycling society by realizing resource recycling undertaken using low amounts of energy and at low costs with a view to seeing application undertaken at plant factories, etc.<br><a href="https://yamazoelab.cpark.tmu.ac.jp/yamazoelab/ja/index.html">https://yamazoelab.cpark.tmu.ac.jp/yamazoelab/ja/index.html</a>  |
| 25  | <b>TAMURA Koichiro</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University     | <b>Development of a green computing molecular phylogenetic analysis method</b>   | This project involves the theoretic development of green computing technologies with the goal of reducing the computational burden and environmental burden of molecular phylogenetic analysis, which are increasing due to the progress of next-generation sequencing technology. In order to analyze differences in the rates of evolution and traces of natural selection, this project involves the construction of a method integrating mathematical models, simulations, and real data analysis with the aim of forming a foundation for sustainable molecular evolution research.<br><a href="https://biol.fpark.tmu.ac.jp/member/tamura/ja/">https://biol.fpark.tmu.ac.jp/member/tamura/ja/</a>   |
| 26  | <b>YAMASHITA Aichi</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University     | <b>Development of superconductors and thermoelectric conversion materials</b>  | In research conducted on superconductors, we are promoting the development of new materials for high-performance superconducting magnets for applications in fusion reactors and medical MRI. In the research on thermoelectric conversion materials, we are promoting the development of high-performance thermoelectric conversion materials for the development of thermoelectric modules that recover waste heat as electric energy.  |
| 27  | <b>KIKKAWA So-ichi</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University     | <b>Absorption and catalytic conversion of carbon dioxide using inorganic functional materials</b>  | The purpose of this research is to develop a technology for the absorption, fixation and catalytic conversion of carbon dioxide using inorganic functional materials such as metal oxide clusters. Focusing on the function of the unique structure, this project involves the construction of an environmentally friendly reaction system through application as a basic catalyst and photocatalyst. The aim is to obtain a next generation material design guideline by utilizing advanced measurement techniques such as synchrotron radiation spectroscopy and clarifying the dynamic behavior of structure and electron states during reactions.<br><a href="https://yamazoelab.cpark.tmu.ac.jp/yamazoelab/ja/index.html">https://yamazoelab.cpark.tmu.ac.jp/yamazoelab/ja/index.html</a><br><a href="https://www.tmu.ac.jp/stafflist/data/ka/30337.html">https://www.tmu.ac.jp/stafflist/data/ka/30337.html</a> |



# Introduction to Research Related to Carbon Neutrality and Nature Positivity

| No. | Affiliation / Name  | Research topic   | Overview and URL   |
|-----|---|--|--|
| 28  | <b>KATO Hidetoshi</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University   | <b>Collection and accumulation of biodiversity information in Tokyo</b>  | Project to collect and accumulate wildlife information in Tokyo through public-private-academic collaboration using DX   |
| 29  | <b>NOMURA Kotohiro</b><br>Faculty of Science/<br>Graduate School of<br>Science<br>Tokyo Metropolitan<br>University  | <b>Development of Bio-Based Advanced Polymers and their Depolymerization, Chemical Recycle</b>   | This project is concerned with the development of polymer functional materials that can be decomposed and reused from natural abundant non-edible plant resources, and the development of synthesis methods for fine chemicals by means of selective bond scission, decomposition, and highly efficient material conversion of polymers. In particular, in order to establish a resource recycling cycle from plant resources to polymer synthesis and chemical recycling, the project involves work on the development of new materials based on precision polymerization and end-functionalization using high-performance catalysts, and on the development of innovative catalyst technology that is useful for efficient synthesis of chemicals from polymers (chemical recycling and up-cycling).<br><a href="https://www.jst.go.jp/kisoken/crest/project/1111113/1111113_2021.html">https://www.jst.go.jp/kisoken/crest/project/1111113/1111113_2021.html</a><br><a href="http://biobase.tmu-orgchem-lab.com/">http://biobase.tmu-orgchem-lab.com/</a> |
| 30  | <b>ISHIDA Tamao</b><br>Faculty of Urban<br>Environmental Sciences/<br>Graduate School of Urban<br>Environmental Sciences<br>Tokyo Metropolitan University       | <b>Conversion of CO<sub>2</sub> into useful compounds using heterogeneous metal catalysts</b>  | This project involves the development of heterogeneous metal catalysts to convert CO <sub>2</sub> into other useful chemical substances with the aim of facilitating carbon neutrality.  |
| 31  | <b>SHUDO Toshio</b><br>Faculty of Urban<br>Environmental Sciences/<br>Graduate School of Urban<br>Environmental Sciences<br>Tokyo Metropolitan University       | <b>Research on environmentally conscious energy utilization and automotive power systems using alternative fuels such as hydrogen and ethanol</b>                        | This research project aims to improve the efficiency and reduce the environmental impact of next-generation energy sources such as hydrogen, methanol, and biofuels at each stage of production, conversion, and utilization.<br><a href="https://shudo.fpark.tmu.ac.jp/">https://shudo.fpark.tmu.ac.jp/</a>   |
| 32  | <b>YAMATO Masafumi</b><br>Faculty of Urban<br>Environmental Sciences/<br>Graduate School of Urban<br>Environmental Sciences<br>Tokyo Metropolitan University    | <b>Research for Direct Air Capture (DAC)</b>   | The aim of this research project is the development of ultra-high gas permeable membranes used for the realization of a gas-separation-membrane-type DAC system which achieves direct recovery of CO <sub>2</sub> from the atmosphere with low energy costs.   |
| 33  | <b>KAJIHARA Koichi</b><br>Faculty of Urban<br>Environmental Sciences/<br>Graduate School of Urban<br>Environmental Sciences<br>Tokyo Metropolitan<br>University | <b>Development of inorganic functional materials (high-efficiency light-emitting materials, solid electrolytes, magnesium secondary battery cathode materials, etc.)</b> | The purpose of this project is to develop optical and electronic functional materials for inorganic solid materials that support a sustainable urban environment and a low-carbon society. Focusing on elements such as high-efficiency luminescent materials, solid electrolytes, and magnesium secondary battery cathode materials, this project involves the development of a wide range of research from basic research to research for application through low-environmental-impact synthesis methods, structural and physical property analyses, and searches for new materials.<br><a href="https://kajiharalab.fpark.tmu.ac.jp/">https://kajiharalab.fpark.tmu.ac.jp/</a>  |
| 34  | <b>KATO Shungo</b><br>Faculty of Urban<br>Environmental Sciences/<br>Graduate School of Urban<br>Environmental Sciences<br>Tokyo Metropolitan University        | <b>Measurement of atmospheric hydrogen concentrations in urban and remote areas</b>  | This research involves the conducting of observations in urban and remote areas in order to ascertain the actual conditions in terms of atmospheric hydrogen concentrations, with the goal being to realize a hydrogen society. The purpose of this project is to analyze the source and diffusion behavior of hydrogen using high-precision measuring instruments, and to obtain knowledge that contributes to environmental impact assessments and to ensuring the safety when it comes to hydrogen energy usage.<br><a href="https://hydrogen.fpark.tmu.ac.jp/research.html">https://hydrogen.fpark.tmu.ac.jp/research.html</a>   |
| 35  | <b>IMAMURA Yoshiyuki</b><br>Faculty of Urban<br>Environmental Sciences/<br>Graduate School of Urban<br>Environmental Sciences<br>Tokyo Metropolitan University  | <b>Flood risk management</b>   | This project involves the development of flood forecasting and assessment methods using AI and satellite data to respond to increasing flood risks arising due to climate change and urbanization. The aim is to build a sustainable disaster prevention and mitigation system through river basin flood control and international cooperation.<br><a href="https://suimon.fpark.tmu.ac.jp/">https://suimon.fpark.tmu.ac.jp/</a>   |
| 36  | <b>TAKAHASHI Hideo</b><br>Faculty of Urban<br>Environmental Sciences/<br>Graduate School of Urban<br>Environmental Sciences<br>Tokyo Metropolitan University    | <b>Urban climate environment, urban heat island effect, short-term heavy rain in cities, and climate change</b>  | Through observation, statistics, and simulations, the project involves the multi-angle analysis of mechanisms behind the heat island effect and short-duration heavy rain caused by urbanization and climate change. It entails ascertaining changes in the urban climate environment and providing scientific knowledge for sustainable urban development.<br><a href="https://www.ues.tmu.ac.jp/geog/guide/studies/index.html#studies02">https://www.ues.tmu.ac.jp/geog/guide/studies/index.html#studies02</a>   |

| No. | Affiliation / Name  | Research topic  | Overview and URL  |
|-----|---|---|---|
| 37  | <b>UENO Atsushi</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University         | <b>Research on carbon pool concrete</b>   | With the aim of reducing CO <sub>2</sub> emissions during concrete production, this project involves the development of carbon pool concrete to facilitate CO <sub>2</sub> fixation. By allowing CO <sub>2</sub> to act on by-products such as recycled aggregate and sludge powder, both the improvement of material properties and reduction of environmental load will be achieved. With a view to societal implementation as a pavement material, the aims of the project consist of the standardization and international standardization of evaluation methods.<br><a href="https://carbon-pool.com/">https://carbon-pool.com/</a>  |
| 38  | <b>OKU Mami</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University             | <b>Utilization of legal policies and various policy methods to solve environmental problems, environmental legal policies in local governments, and legal policies related to town planning and urban formation</b> | This project involves research on legal policies that combine environmental management systems and regulatory and information methods to address issues such as climate change and environmental pollution. The aim is to build a sustainable society through institutional design concerning the role of local governments and urban formation. The project also involves comparisons of domestic and overseas legal systems which are being undertaken along with the practical examination of cooperation with local governments.<br><a href="https://www.tmu.ac.jp/stafflist/data/a/356.html">https://www.tmu.ac.jp/stafflist/data/a/356.html</a>   |
| 39  | <b>OSAWA Takeshi</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University        | <b>Ecosystem-based disaster prevention and mitigation and evaluation of functions as green infrastructure for ecosystems</b>  | This project involves the evaluation of flood control functions of ecosystems such as farmland and rice paddies, which is undertaken in order to address the increase in water disasters caused by climate change. Statistical analyses and simulations for the entire watershed showed that farmland away from cities also contributes to flood damage reduction in urban areas. This has highlighted the importance of land-use planning involving the utilization of ecosystems as green infrastructure.<br><a href="https://www.tmu.ac.jp/news/topics/35212.html">https://www.tmu.ac.jp/news/topics/35212.html</a>  |
| 40  | <b>NUMATA Shinya</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University        | <b>Research on the sustainable use of natural resources</b>   | Focusing on ecosystems in Japan and Southeast Asia, the project involves research on the relationship between people and nature conducted through natural tourism and protected area management. By exploring the possibility of tourism activities that do not involve resource exploitation, the aim is to achieve both ecosystem conservation and regional development. GIS, questionnaire surveys, and other methods are being used to find ways to use natural resources sustainably.<br><a href="https://nmt.fpark.tmu.ac.jp/">https://nmt.fpark.tmu.ac.jp/</a>   |
| 41  | <b>HIHARA Katsuya</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University       | <b>Analysis of sustainable tourism markets</b>  | While the achievement of a sustainable society is extremely important on a global scale from the perspectives of climate crisis countermeasures and biodiversity protection, enormous additional costs are expected [about US \$4 trillion for international flights fields (United Nations)], and it is necessary to share them appropriately among users, investors, entrepreneurs, local governments and national governments. In the tourism sector, which faces various issues such as tourism pollution, it has been essential to ascertain the decision factors and structures related to additional payments for measures for tourists and to estimate the amount of willingness to pay. Furthermore, it has been pointed out that the impact of the COVID-19 pandemic has changed the decision factors [Braje et al. (2022) and others], and there is a possibility that these issues will become more complicated. Combined with the rapid recovery taking place in the post-COVID period, there is currently a particular lack of scientific knowledge on the structural analysis of sustainable tourism demand. This joint research project has researchers from Spain (which have accumulated experience in advanced analysis of the tourism market) and our university, collaborating to form an international research base and intensively analyzing the demand structure of the tourism market in the post-COVID-19 era by combining advanced experimental economics, psychostatistics, machine learning methods, etc., with the aim of actively contributing to the achievement of a sustainable society. The expansion of ties to Southeast Asia is also envisaged for the future. |
| 42  | <b>SHISHIDO Tetsuya</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University     | <b>Development of CO<sub>2</sub> conversion catalysts</b>   | Development of catalysts to convert CO <sub>2</sub> into useful products such as CH <sub>4</sub> , CO and lower alcohols  |
| 43  | <b>KAWAHIGASHI Masayuki</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University | <b>Assessments of the functionality of urban green soil</b>   | Urban green spaces planted on land developed by people are referred to as green infrastructure from the viewpoint of disaster prevention and recreation. Plant growth taking place within this green infrastructure is generally good. However, the soil is often underdeveloped, and the relationship between soil formation and the growth of planted trees and the material cycle are unknown. Research is being conducted concerning spatiotemporal variations of soil properties when it comes to urban green spaces, the area of which has been expanding since half a century ago.   |



# Introduction to Research Related to Carbon Neutrality and Nature Positivity

| No. | Affiliation / Name  | Research topic   | Overview and URL   |
|-----|---|--|--|
| 44  | <b>KAWAKAMI Hiroyoshi</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University | <b>Fuel cells, all-solid-state secondary batteries, and DAC</b>  | To improve the performance of fuel cells and all-solid-state lithium secondary batteries, this project involves the development of high-performance electrolyte membranes using nanofibers. In addition, when it comes to DAC (direct air recovery), which is attracting attention as a CO <sub>2</sub> separation and recovery technology, this project will involve work on the creation of ultra-high gas permeability materials utilizing the interfacial structure of polymer membranes and nanoparticles. These technologies will be used to achieve both an energy-saving society and a reduction in environmental impacts.<br><a href="http://www.comp.tmu.ac.jp/kawakami-labn/">http://www.comp.tmu.ac.jp/kawakami-labn/</a>  |
| 45  | <b>TAKAHASHI Hiroshi</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University  | <b>Physical climatological research on climate change</b>  | This research entails the clarification of the mechanisms of climate change from the viewpoint of physical climatology, focusing on the water and energy cycle in the Earth's surface layer, and meteorological and climatic phenomena such as the Asian monsoon, typhoons, and atmosphere-land interactions. The purpose of this project is to contribute to improving the accuracy of future climate predictions by analyzing the causes of abnormal weather, heavy rain, and drought through simulations using satellite observations, ground observations, reanalysis data, and climate models.<br><a href="https://camo.fpark.tmu.ac.jp/pg129.html#research_j">https://camo.fpark.tmu.ac.jp/pg129.html#research_j</a>   |
| 46  | <b>TANAKA Manabu</b><br>Faculty of Urban Environmental Sciences/Graduate School of Urban Environmental Sciences<br>Tokyo Metropolitan University      | <b>Water electrolytic hydrogen production, polymer electrolyte fuel cells, storage batteries (Lithium and air batteries)</b> | Through the development of polymer materials that contribute to solving environmental and energy problems in cities, the project aims to produce highly efficient hydrogen via water electrolysis, improve the performance of polymer electrolyte fuel cells, and commercialize next-generation storage batteries. The project will entail the design and evaluation of anion exchange membranes and nanofiber electrolyte membranes and their application to new types of batteries such as lithium-air batteries and zinc-air batteries. The project will contribute to the creation of a sustainable energy society by having work consistently undertaken through the process spanning from material design stage to the trial manufacture and evaluation stages.<br><a href="https://m-tanaka.fpark.tmu.ac.jp/">https://m-tanaka.fpark.tmu.ac.jp/</a> |
| 47  | <b>KOBAYASHI Satoshi</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University                              | <b>Cost reduction of hydrogen storage containers</b>   | In order to reduce the cost of hydrogen tanks for fuel cell vehicles, a method is being developed to reduce the use of carbon fiber as much as possible.   |
| 48  | <b>OTA Ryouzuke</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University                                   | <b>Wireless power transmission for electric vehicles during operation</b>  | By developing a wireless power transmission technology for electric vehicles (EVs) that is utilized while they are in motion, the aim of this project is to reduce the need for charging, extend driving range, and optimize battery capacity. The project will contribute to the realization of a next-generation mobility society through coordination with road infrastructure.<br><a href="https://pbs.twimg.com/media/FyJVmfealAAA9B_?format=jpg&amp;name=4096x4096">https://pbs.twimg.com/media/FyJVmfealAAA9B_?format=jpg&amp;name=4096x4096</a>  |
| 49  | <b>TAKESUE Naoyuki</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University                                | <b>Construction methods involving industrial robots using lightweight material with the aim of saving energy</b>             | The aim of this project is to construct industrial robots with high levels of energy conservation and safety by utilizing lightweight materials and low-power actuators. The project will realize robot design which creates a balance between portability and efficiency by introducing a wire drive mechanism and a gravity compensation mechanism. It entails work on the development of flexible control technology that is compatible with collaboration with humans and special environments.<br><a href="https://www.robocip.or.jp/">https://www.robocip.or.jp/</a>   |
| 50  | <b>WADA Keiji</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University                                     | <b>Research on power electronics</b>   | This project involves research aimed at improving the performance and reliability of power electronics, focusing on the structure and mounting of power conversion circuits and noise suppression technology. It involves the development technologies to improve energy efficiency and power quality, such as harmonic suppression, EMC countermeasures, and the application of next-generation power devices.<br><a href="https://sites.google.com/view/tmupel">https://sites.google.com/view/tmupel</a>   |
| 51  | <b>SHIMOMURA Yoshiki</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University                              | <b>Design theory, innovation design, product service system (PSS), and environmentally conscious design</b>                  | The project involves the construction of creative design models based on knowledge manipulation, which is undertaken through research on design support technologies covering the entire life cycle of artifacts. The project entails the promotion of the integrated design of products and services from the perspective of service engineering and PSS, thereby contributing to the realization of an environmentally conscious society. Development is also being undertaken for a design knowledge database using Web information and for a general-purpose inference environment UAS.<br><a href="https://smmlab.fpark.tmu.ac.jp/">https://smmlab.fpark.tmu.ac.jp/</a>   |

| No. | Affiliation / Name   | Research topic  | Overview and URL  |
|-----|--|---|---|
| 52  | <b>SUZUKI Yukihisa</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University   | <b>Large-scale computer simulations, electromagnetic environments, wireless power transmission, and AI applications in generative systems</b> | Aiming to speed up large-scale numerical simulations in electromagnetic field and fluid analyses, this project involves development of a calculation method that utilizes GPUs and many-core processors. It also involves the conducting of safety assessments of electromagnetic environments, including wireless power transmission and 5G communications, and an analysis of biological effects. In addition, by fusing mathematical models with AI, advanced system designs that contribute to solving social issues are being promoted.<br><a href="https://www.tmu.ac.jp/extra/download.html?d=assets/files/download/keisya/r3/e4_suzuki.pdf">https://www.tmu.ac.jp/extra/download.html?d=assets/files/download/keisya/r3/e4_suzuki.pdf</a><br><a href="https://steps-emf.net/">https://steps-emf.net/</a><br><a href="https://www.sd.tmu.ac.jp/research/data/sa/6279.html">https://www.sd.tmu.ac.jp/research/data/sa/6279.html</a> |
| 53  | <b>SHIBATA Yasukuni</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University  | <b>Lidar system development for measurement of greenhouse gas distribution and its application</b>  | This project involves the development of a highly accurate remote measurement system for the vertical distribution of trace gases such as CO <sub>2</sub> and water vapor in the atmosphere using lidar technology involving the use of laser light. Non-contact observation from the ground will contribute to climate change predictions and environmental monitoring by capturing the spatial distribution and temporal changes of greenhouse gases. In cooperation with observation bases in Japan and overseas, applied research for practical application is underway.<br><a href="https://lidar.fpark.tmu.ac.jp/labo/">https://lidar.fpark.tmu.ac.jp/labo/</a>   |
| 54  | <b>TAKAHASHI Satoru</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University  | <b>International standardization of the integrity testing method of thermal barrier coatings for carbon neutral turbines</b>                  | This project was adopted for the “FY2024 Energy Supply and Demand Structure Advancement Standard Certification Promotion Project Expenses (International Standard Development for Energy Conservation, etc. (International Standards Field))” of the Ministry of Economy, Trade and Industry. Work is underway to develop an integrity test method for preventive maintenance of thermal barrier coatings, which are essential for high-temperature components of hydrogen- and ammonia-fired gas turbines aiming at carbon neutrality, through industry-academia-government collaboration, and international standardization.  |
| 55  | <b>SUGAWARA Hiroharu</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University | <b>Research on technology to effectively utilize low-temperature excess waste heat</b>  | For the purpose of effective utilization of low-temperature excess waste heat generated in industry and public facilities, this project explores the possibility of small-scale power generation by means of the application of thermoelectric conversion technology. In low-temperature regions where binary power generation is difficult, the aim is to establish a sustainable energy recovery technology through the use of thermoelectric conversion which allows for operation to take place even with a small amount of heat present (and without operating parts) and through demonstrations in facilities such as those for sewage treatment.<br><a href="https://scrapbox.io/tmuMSEsugawaraLabPR/LowTempWasteHeat">https://scrapbox.io/tmuMSEsugawaraLabPR/LowTempWasteHeat</a>  |
| 56  | <b>ABO Makoto</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University        | <b>Development of water vapor differential absorption lidar to improve prediction accuracy of linear precipitation zones</b>                  | In order to improve prediction accuracy when it comes to linear precipitation zones, the frequency of which has been increasing due to global warming, this project aims at the development and practical application of a differential absorption lidar for measuring lower layer water vapor.   |
| 57  | <b>ABO Makoto</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University        | <b>Estimation of CO<sub>2</sub> flux in large emission sources by means of differential absorption lidar observation</b>                      | In order to achieve carbon neutrality, it is necessary to increase the accuracy of CO <sub>2</sub> flux estimation from large-scale emission sources and urban areas, which is important for reducing greenhouse gas emissions and evaluating the effectiveness of reduction measures. Therefore, a CO <sub>2</sub> emission estimation system using satellite observation data is being developed, and a differential absorption lidar observation system is being developed to verify its accuracy.   |
| 58  | <b>SHIMOMURA Yoshiki</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University | <b>Advocate for and promote philosophical design</b>  | In modern society, the design of technologies and artifacts is required not only to maximize functional and economic values, but also to contribute to the appropriate construction of interrelationships among diverse values, including in terms of environmental and social sustainability. Based on the above, this research addresses the following questions:<br>① How is sustainable innovation positioned in terms of the co-evolution relationship existing between artifacts and society?<br>② How does abductive thinking and empathy drive sustainable innovation?<br>③ What are the means to implement empathy-based value co-creation in society?<br><a href="https://smmlab.fpark.tmu.ac.jp/">https://smmlab.fpark.tmu.ac.jp/</a>  |
| 59  | <b>OBARA Hiromichi</b><br>Faculty of Systems Design/Graduate School of Systems Design<br>Tokyo Metropolitan University   | <b>Environmental energy conversion via vibration-induced circulating flow</b>   | It is important to establish a technology to utilize the energy of the sea, such as that of tidal currents, in an environmentally friendly manner. This research involves a technology used to carry out power generation and culture by utilizing the technology of vibration-induced circulating flow which can convert the vibration of flexible tubes into circulating flow.  |



# Introduction to Classes Related to Carbon Neutrality and Nature Positivity

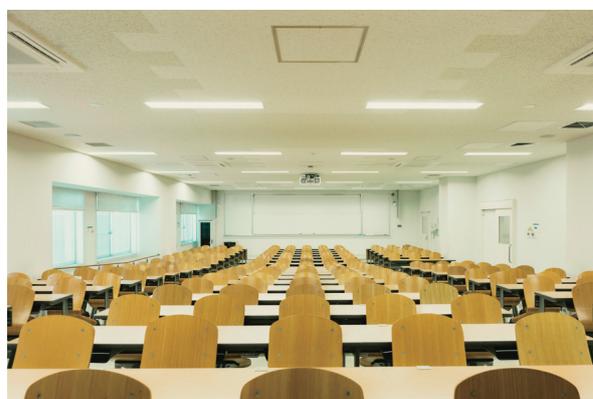
TMU offers many classes related to carbon neutrality and nature positivity. For the specific contents of the related classes, please visit the following website.

[https://www.houjin-tmu.ac.jp/sustainability/topics/research\\_carbon\\_neutral\\_nature\\_positive25/](https://www.houjin-tmu.ac.jp/sustainability/topics/research_carbon_neutral_nature_positive25/)

|                                 |  | Number of Courses | Total Course |
|---------------------------------|--|-------------------|--------------|
| General University-Wide Courses | English, & Uncompleted Language Courses (Basic Courses)          | 3                 | 22           |
|                                 | Basic Seminar & Information Literacy (Basic Courses)             | 6                 |              |
|                                 | Fundamental Courses  | 1                 |              |
|                                 | General Education Courses  | 11                |              |
|                                 | Health and Physical Education & Career Education (Basic Courses) | 1                 |              |
| Specialized Education Courses   | Faculty of Humanities and Social Sciences                        | 2                 | 56           |
|                                 | Faculty of Economics and Business Administration                 | 1                 |              |
|                                 | Faculty of Science   | 23                |              |
|                                 | Faculty of Urban Environmental Sciences                          | 30                |              |
| Total Course                    |  |                   | 78           |

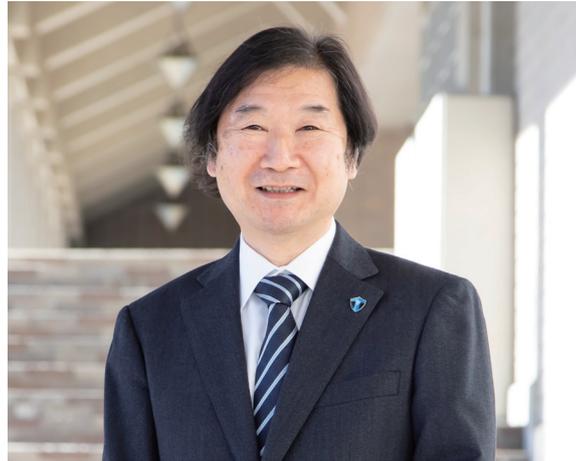
|                 |   | Number of Courses |
|-----------------|---|-------------------|
| Graduate School | Graduate School of Humanities                   | 6                 |
|                 | Graduate School of Management                   | 8                 |
|                 | Graduate School of Science                      | 11                |
|                 | Graduate School of Urban Environmental Sciences | 12                |
|                 | Graduate School of Systems Design               | 2                 |
| Total Course    |   | 39                |

|              |     |
|--------------|-----|
| Total Course | 117 |
|--------------|-----|





# Tokyo Metropolitan University (TMU) Message from the President



 **OHASHI Takaya**  
President, Tokyo Metropolitan University

The planet Earth is probably the only habitable planet in the universe that is within the reach of humanity for the foreseeable future and is irreplaceable both for humanity and for academic purposes. The Earth, in which life has evolved throughout its 4.5 billion year history, is the parent of all forms of life, including humans, and it is our mission to protect this beautiful planet. However, recent climate change and the frequent occurrence of natural disasters, believed to be caused by climate change, indicate that the global environment is changing to a serious degree as a result of human activities. What should we do now to protect the earth and preserve life? Universities should take the initiative to bring together people's knowledge and undertake this challenge.

The Tokyo Metropolitan Public University Corporation issued a Climate Emergency Declaration in July 2021, formulated a Carbon Neutrality Promotion Plan to implement initiatives for carbon neutrality in FY2022, and issued a Nature Positive Declaration in July 2024. The plan calls for reducing greenhouse gas emissions (Scopes 1 and 2) by 50% from the FY2013 level by 2030, aiming to achieve carbon neutrality by the 2030s. Efforts have been commenced to achieve this goal. In the field of research, the Tokyo Research Initiative for Sustainability, established by the Corporation, is conducting research on seven themes and aims to contribute to solving social issues from the perspective of sustainability.

In the Tokyo Metropolitan University Environmental Report, we introduce research that will lead to the realization of carbon neutrality and to solutions to abnormal weather, such as research on the development of carbon stations that capture, convert, and supply carbon dioxide from the atmosphere, research aimed at by the Research Center for Hydrogen Energy-based Society (ReHES), research on the pristine wilderness of the island of Minami Iwo-to, "Nature, Society, and Culture," an extracurricular hands-on liberal arts course in education, and "Ikimono! Circle Tokyo" as a student activity. We hope that this will facilitate an understanding of how our university is engaged in various activities to improve the global environment.

This is the fourth environmental report compiled by the Corporation and TMU. We will continue to actively promote various initiatives as a university and communicate them effectively. We appreciate your guidance and support.



## Overview

**Name:** Tokyo Metropolitan University

**Date of Establishment:** April 2005

**President:** OHASHI Takaya

### Number of students, faculty, and staff (As of May 1, 2025)

\*The student numbers include those enrolled in the organization before the reorganization in FY2018.

\*The staff numbers include temporary staff.



Number of students  
**9,143**



Number of faculty  
**638**



Number of staff  
**449**

### Number of students

#### 【Undergraduate Programs】

| Faculties  | Current enrollment (persons) |
|--|------------------------------|
| Faculty of Humanities and Social Sciences        | 907(554)                     |
| Faculty of Law                                   | 913(431)                     |
| Faculty of Economics and Business Administration | 888(355)                     |
| Faculty of Science                               | 862(266)                     |
| Faculty of Urban Environmental Sciences          | 1,135(402)                   |
| Faculty of Systems Design                        | 1,406(269)                   |
| Faculty of Health Sciences                       | 824(666)                     |
| Total  | 6,935(2,943)                 |

\*Figures in parentheses indicate the number of female students.

#### 【Graduate Programs】

| Graduate Program              | Current enrollment (persons) |
|-------------------------------|------------------------------|
| Graduate Program of Midwifery | 10(10)                       |

\*Figures in parentheses indicate the number of female students.

#### 【Graduate schools】

| Graduate schools                                  | Total master's program enrollment (persons) | Total doctoral program enrollment (persons) | Total professional degree program enrollment (persons) |
|---|---|---|--|
| Graduate School of Humanities                     | 98(66)                                      | 104(65)                                     | —  |
| Graduate School of Law and Politics               | 7(1)  | 16(6)                                       | 91(29)   |
| Graduate School of Management                     | 99(20)                                      | 40(8)                                       | —  |
| Graduate School of Science                        | 303(82)                                     | 100(27)                                     | —  |
| Graduate School of Urban Environmental Sciences   | 352(102)                                    | 103(29)                                     | —  |
| Graduate School of Systems Design                 | 523(98)                                     | 114(25)                                     | —  |
| Graduate School of Human Health Sciences          | 136(77)                                     | 100(38)                                     | —  |
| Students prior to FY2017 (prior to restructuring) | 0(0)  | 12(3)                                       | —  |
| Total   | 1,518(446)                                  | 589(201)                                    | 91(29)   |

\*Figures in parentheses indicate the number of female students.

# Campus Map

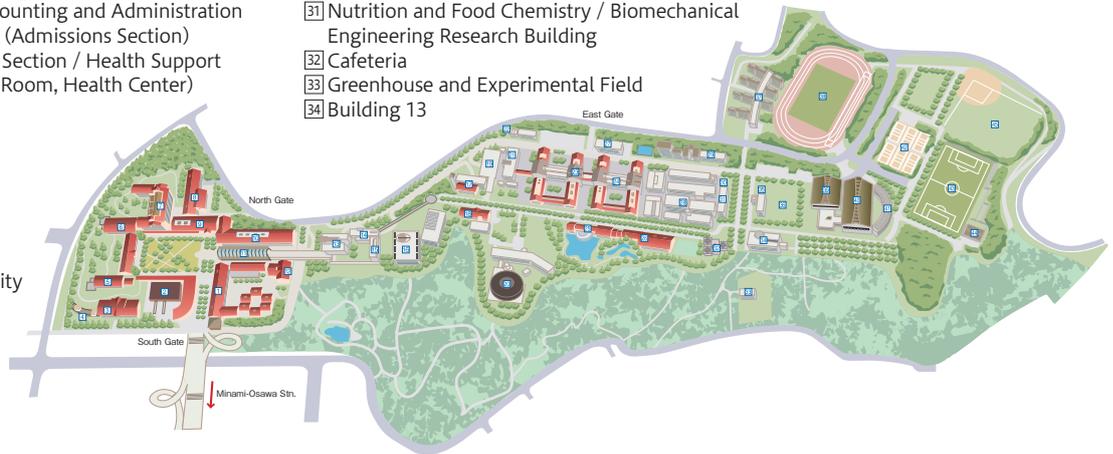
## Minami-Osawa Campus

■ Faculty of Humanities and Social Sciences ■ Faculty of Law ■ Faculty of Economics and Business Administration ■ Faculty of Science ■ Faculty of Urban Environmental Sciences ■ Faculty of Systems Design (mainly 1st and 2nd year) ■ Faculty of Health Sciences (1st year) ■ Graduate School of Humanities ■ Graduate School of Law and Politics ■ Graduate School of Management ■ Graduate School of Science ■ Graduate School of Urban Environmental Sciences ■ Graduate School of Human Health Sciences (Department of Health Promotion Sciences) ■ Tokyo Metropolitan University Premium College

- 1 Building 1 Classroom Building / Educational Affairs Division / Student Affairs Division / Volunteer Center
- 2 Auditorium
- 3 Building 2 Department of Urban Science and Policy (Faculty of Urban Environmental Sciences) / Tokyo Metropolitan University Premium College Office
- 4 The 1991 Hall Curatorial Training Course Exhibition Room
- 5 Building 3 Faculty of Economics and Business Administration
- 6 Building 4 Faculty of Law
- 7 Building 5 Faculty of Humanities and Social Sciences
- 8 Building 6 Classroom Building
- 9 Headquarters Building Accounting and Administration Section / Admissions Center (Admissions Section)
- 10 Building 7 Career Support Section / Health Support Center (Student Counseling Room, Health Center)
- 11 Information Gallery
- 12 Audio Visual Facilities
- 13 Campus Store
- 14 Student Hall
- 15 Student Refectory
- 16 Central Library/Diversity Promotion Office
- 17 Information Processing Facility
- 18 The Makino Herbarium
- 19 The Makino Herbarium Annex TMU Gallery
- 20 International House / International Center
- 21 RI Research Facilities

- 22 Breeding Building
- 23 Building 8 Faculty of Science / Faculty of Urban Environmental Sciences
- 24 Building 9 Faculty of Science / Faculty of Urban Environmental Sciences / Faculty of Systems Design
- 25 Building 11 Classroom Building
- 26 Building 12 Classrooms Building
- 27 Frontier Research Building
- 28 Building 10 Laboratory Building
- 29 Environmental Conservation Facility
- 30 General Breeding and Experimentation Building
- 31 Nutrition and Food Chemistry / Biomechanical Engineering Research Building
- 32 Cafeteria
- 33 Greenhouse and Experimental Field
- 34 Building 13

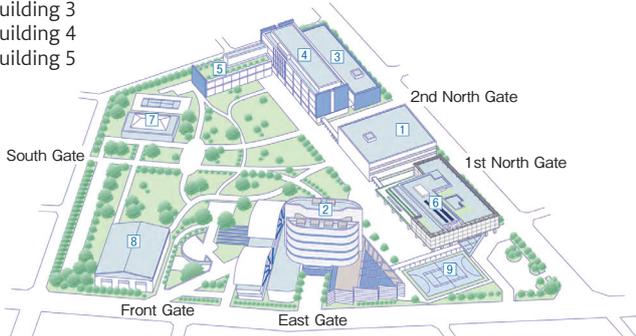
- 35 Project Research Building
- 36 Multi-Purpose Playground
- 37 Student Dormitory
- 38 Athletic Field
- 39 Indoor Heated Swimming Pool
- 40 Gymnasium
- 41 Club Rooms
- 42 Tennis Courts
- 43 Football Ground
- 44 Japanese and Western Archery Field
- 45 Baseball Field



## Hino Campus

■ Faculty of Systems Design (mainly 3rd and 4th year) ■ Graduate School of Systems Design

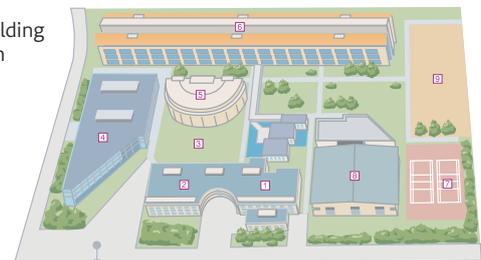
- 1 Building 1
- 2 Building 2 ([B1F] Library)
- 3 Building 3
- 4 Building 4
- 5 Building 5
- 6 Building 6
- 7 University Hall
- 8 Gymnasium
- 9 Futsal/Tennis Court



## Arakawa Campus

■ Faculty of Health Sciences (2nd-4th years) ■ Graduate Program of Midwifery ■ Graduate School of Human Health Sciences (excluding Department of Health Promotion Sciences)

- 1 Welfare Building
- 2 Administration Building
- 3 Courtyard
- 4 Library Building
- 5 Auditorium
- 6 School Building
- 7 Tennis Court
- 8 Gymnasium
- 9 Ground



Toritsudai-Arakawa Campus (Tokyo Metropolitan Univ. Arakawa Campus)

## Minami-Osawa Campus

1-1 Minami-Osawa, Hachioji-shi, Tokyo 192-0397, Japan  
Land area: 428,041.26 m<sup>2</sup> Total floor area: 166,916.32 m<sup>2</sup>

## Hino Campus

6-6 Asahigaoka, Hino-shi, Tokyo 191-0065, Japan  
Land area: 62,439.61 m<sup>2</sup> Total floor area: 43,767.96 m<sup>2</sup>

## Arakawa Campus

7-2-10 Higashiogu, Arakawa-ku, Tokyo 116-8551, Japan  
Land area: 34,999.97 m<sup>2</sup> Total floor area: 29,635.27 m<sup>2</sup>

## Harumi Campus (jointly built with Tokyo Metropolitan Harumi Sogo High School)

1-2-2 Harumi, Chuo-ku, Tokyo 104-0053, Japan  
Land area: 1,687.30 m<sup>2</sup> Total floor area: 9,869.02 m<sup>2</sup>

## Iidabashi Campus

Tokyo Kusei Kaikan 3F, 3-5-1 Iidabashi, Chiyoda-ku, Tokyo 102-0072, Japan  
Total floor area: 873.83 m<sup>2</sup>

## Marunouchi Satellite Campus

Marunouchi Eiraku Building 18F, 1-4-1 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan  
Total floor area: 1,394.64 m<sup>2</sup>

## Ogasawara Field Research Station

1-3 MiyanoHamamichi, Chichijima, Ogasawara-mura, Tokyo 100-2101, Japan  
Land area: 771.45 m<sup>2</sup> Total floor area: 546.73 m<sup>2</sup>



## Carbon Station Development Project by DAC

Professor YAMAZOE Seiji

Department of Chemistry, Graduate School of Science

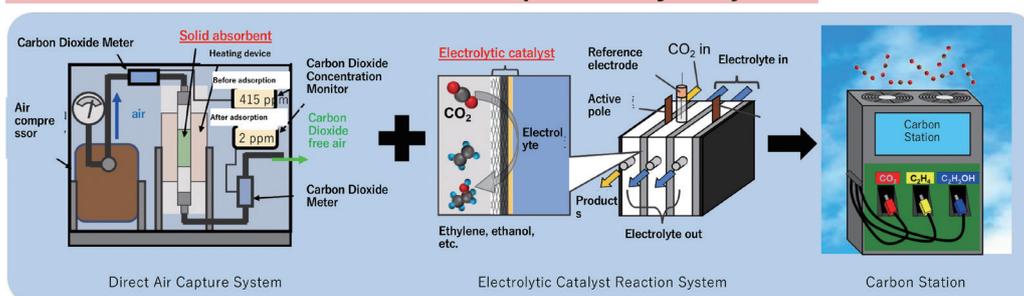


The Tokyo Metropolitan Government is aiming to achieve the Zero Emission Tokyo initiative, which will contribute to net zero carbon dioxide emissions by 2050. A project for the development of carbon stations using DAC (Direct Air Capture), a technology that absorbs and collects carbon dioxide directly from the atmosphere, was adopted by the Tokyo Metropolitan Government under a project proposal system that it has in place for university researchers. We spoke with Professor Yamazoe about everything from the project's development to the outlook on the future.



## Capture, Convert, and Supply Atmospheric Carbon Dioxide

### Overview of the Carbon Station Development Project by DAC



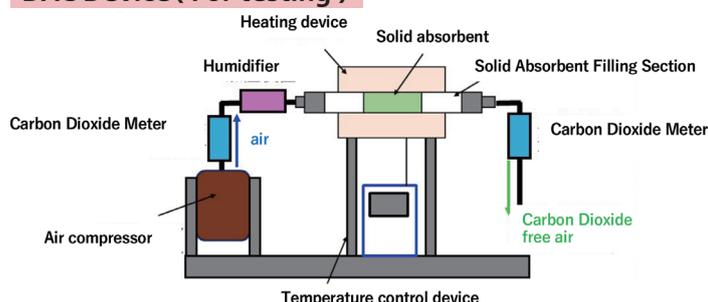
The aim of this project is to develop a carbon station that synthesizes and supplies carbon resources directly from the air by combining two technologies: (1) a DAC system that efficiently absorbs and recovers a small amount of carbon dioxide contained in the atmosphere and makes it highly concentrated, and (2) a carbon dioxide electrolysis system that converts high concentrations of carbon dioxide into useful carbon resources (ethylene, ethanol, etc.).

Since 2019, we have been developing a DAC technology that uses a simple method to mass-produce a solid absorbent, which is a hard sponge-like material made of silica, a component of glass, modified with an

amino group that absorbs carbon dioxide.

When collecting carbon dioxide, it is important not to emit more carbon dioxide than collected, and energy balance must also be considered. The technology used to collect carbon dioxide from exhaust gas and so on already exists, so there is little need for us to work on it again. However, there is no established technology for absorbing and collecting low concentrations of carbon dioxide and making them highly concentrated. We believe it is of great significance to create a system to efficiently capture carbon dioxide in urban areas where people gather and consume a large amount of energy.

### DAC Device ( For testing )



## Capabilities of Carbon Stations

This project started in 2024, and we are currently studying how to effectively use collected carbon dioxide and converted and synthesized hydrocarbons (ethylene, ethanol, etc.) in preparation for future commercialization.

When it comes to the carbon station, we are considering to convert carbon dioxide into ethanol, which can be used as energy, and into ethylene, which can be used as synthesis gas. This is in addition to supplying collected carbon dioxide. For example, gasoline mixed with bioethanol is becoming popular, and if we install carbon stations at gas stations, we can have them absorb carbon dioxide from the atmosphere, convert it into ethanol, and supply it instead of bioethanol. This means that when a car runs, carbon

dioxide is emitted back into the atmosphere, but it is absorbed again and recycled for use as a resource.

It is also important to develop effective ways to use carbon dioxide. I think there are devices that use carbon dioxide cylinders to turn water into carbonated drinking water, but if we can use carbon dioxide collected at carbon stations instead of carbon dioxide cylinders, we can enjoy carbonated drinking water without worrying about the emission of carbon dioxide. In addition, in some greenhouses, we promote the growth of crops by increasing the concentration of carbon dioxide. If we use carbon dioxide collected at carbon stations for that, we can create a new resource cycle. We are aiming to make carbon stations as we look ahead to the next ten or twenty years.

## 2050: Challenges for the Future

The DAC roadmap isn't clear yet, but first we need to build a prototype that can provide a stable supply of carbon dioxide. Methane, hydrogen, and other elements are also generated when carbon dioxide is converted into ethylene and ethanol. We need technology that can selectively produce a large amount of pure carbon dioxide. Using DAC, we hope to reduce atmospheric carbon dioxide emissions in Tokyo and contribute to the construction of a futuristic urban society that uses these emissions as resources.

In 2050, I don't think our daily lives will change

significantly, but I think it will be essential not to rely on fossil fuels and to use renewable energy such as solar power. In other words, burning fossil fuels and converting them into heat will gradually cease to be a method that gets used, and we will move to an electrified society based on renewable energy.

This should significantly reduce carbon dioxide emissions. Failure to achieve carbon neutrality by 2050 is expected to cause environmental changes on a global scale, which means that the aforementioned is important when it comes to preventing such environmental changes.

### Message to Students

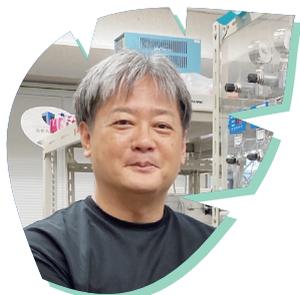
I originally liked cars and was interested in machines. At my university laboratory, I designed and constructed a gas line and a device to decompose toxic gases using photocatalysts based on themes such as the purifying of exhaust gas. I found the research incredibly interesting.

The excitement of research is felt not only when the results are expected, but also when students make unexpected discoveries. We tend to be bound by existing knowledge and have a fixed frame of mind. However, students who are not constrained by knowledge are sometimes able to think outside the box and produce unexpectedly good results.

We want students to be active and not merely doing what they have been instructed to do. We want to see them take an active approach in making attempts and things they want to do. I believe that gaining a diverse array of experiences and gaining observation skills will lead to new discoveries. And I think that the results of that process are something that we will see leveraged in research.



## Toward the Realization of a Hydrogen Energy Society



**Professor SHISHIDO Tetsuya**  
Department of Applied Chemistry for Environment,  
Graduate School of Urban Environmental Sciences

As global warming and energy problems become more serious, hydrogen is attracting a great deal of attention as a clean energy that does not emit carbon dioxide. In 2016, the university established the Research Center for Hydrogen Energy-based Society (ReHES) (hereinafter referred to as the “Center”), with the aim of implementing hydrogen energy within society. We asked Professor Shishido, Director of the Center, about the background of the establishment of the Center, the forefront of research, and future prospects.

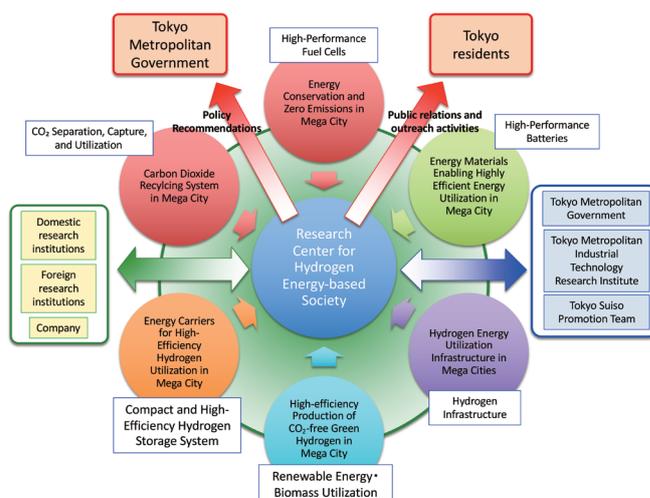


## Taking on Challenges Across Disciplines! Role of the Center

The Tokyo Metropolitan Government is actively promoting the adoption and utilization of hydrogen. The Research Center for Hydrogen Energy-based Society (ReHES) was established to bring together researchers from various fields so as to have the universities fulfill their roles in that context as well. The purpose of the Center is to bring together research from various fields and to expand the use of hydrogen in society.

Hydrogen is a clean energy that only produces water when burned, but there are many issues to be solved before it can be implemented in society. The biggest challenges are how to produce hydrogen and how to efficiently store and transport gases in very large volumes. In particular, building and civil engineering experts have joined the team to pursue the use of hydrogen as part of the urban development of Tokyo, which has many office buildings.

### Overview Diagram of the Research Center for Hydrogen Energy-based Society



## Taking on the Challenge of the Popularization of Hydrogen Energy

Hydrogen is a clean energy source, but many issues must be resolved before it can be put to practical use. About 90% of hydrogen produced today comes from fossil fuels, which emit carbon dioxide. To produce green hydrogen that does not emit carbon dioxide, renewable energy is necessary. However, Tokyo cannot secure enough renewable energy on its own because there is not enough land for solar panels. Therefore, it is necessary to produce green hydrogen using

renewable energy procured from other prefectures and overseas, store it, and transfer it to the necessary places. Currently, a plan is underway to establish a port in Kawasaki to receive hydrogen and supply it to Haneda Airport through a pipeline. People tend to think that hydrogen explodes easily, so laying pipelines in cities requires the understanding of residents and technology to ensure safety. Utilization of hydrogen requires not only technological development but also legal systems

and consensus building within society.

Our achievements so far include research to improve the efficiency of hydrogen fuel cells and solar cells. We are also conducting biomass research to extract hydrogen from waste and carbon recycling research to produce synthetic methane (e-methane), a substitute for city gas, by having carbon dioxide react with hydrogen. The aim of this is to not have us dipping into our savings when it comes to the fossil fuels stored in the piggy bank that is our Earth; instead, the aim is to create a sustainable society that follows natural cycles in a manner that is like the photosynthesis of plants.

## Building an Ideal Future

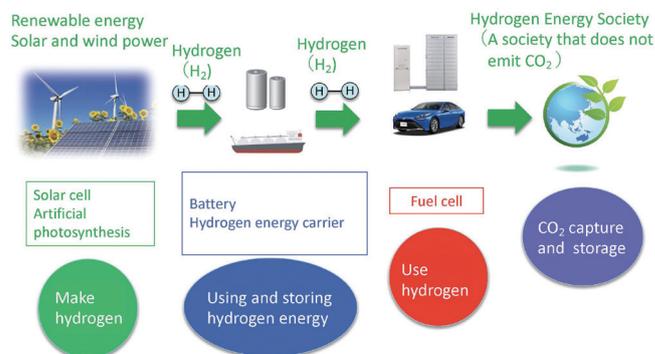
My ideal vision for the future is a society in which hydrogen derived from renewable energy is widely used and where carbon dioxide emissions steadily decrease. We believe that petroleum should be limited to non-fungible uses such as plastics, and its use as a fuel should be minimized.

Achieving this ideal requires a balance between costs and benefits. In particular, if the Japanese automobile industry, which is lagging behind in EV adoption, focuses on hydrogen fuel cell vehicles, infrastructure development will constitute an urgent task.

There are several hydrogen stations in Tokyo, but there are also sentiments found among residents to the effect that they do not want them to be installed in

## Building a Hydrogen Energy-based Society

### Research Center for Hydrogen Energy-based Society



The construction of a hydrogen energy society through the advanced utilization of hydrogen energy is indispensable for the realization of a carbon cycle society. That's why we are promoting comprehensive and cross-sectional research and constructing a research organization aimed at the realization of a hydrogen society.

their neighborhoods. It is not enough to simply develop technology; it is necessary to build social consensus.

The Center actively holds seminars and lectures for citizens in order to make hydrogen energy widely known to the general public. In the lectures, not only are there explanations on hydrogen technologies, but the importance of understanding and discussing things from various angles without being confused by new words and technologies is also something that is conveyed.

I believe that it is important to carefully explain that the use of hydrogen will lead to the solution of environmental problems and a sustainable society, and to gradually have society make a shift in that direction.

### Message to Students

When I was a student, I was fascinated by the possibility of catalysts that can manipulate molecular bonds freely when I was involved in research on solid catalysts. My experience in studying the reaction between hydrogen molecules and catalysts led me to the path of hydrogen energy.

As a researcher, the most important thing is to be curious. Always ask why and don't give up even if you don't get an answer right away. Another important factor is integrity. Experimental data doesn't lie. It's important to be honest with yourself about the results you've obtained, and to keep working hard until you can say you understand the experiment better than anyone else.

In this day and age, research requires an awareness to the effect that you are competing on the world stage from the beginning. Making friends at international conferences and studying abroad from a young age will be a great asset for your future. Also, find topics that you can be passionate about which you can only experience in school. That experience will be of great value to you in the future. I hope that you will pursue your own curiosity and use it to help society build a better future.



## Birds Transport Fertilizer Sea to Land and Fertilizer Flows Away Over 150 Years: The role of Seabirds as Taught by the Pristine Wilderness of Minami Iwo-to

Adjunct Assistant Researcher **SATO Nozomu**  
Graduate School of Urban Environmental Sciences

In collaboration with the Forestry and Forest Products Research Institute (FFPRI), the Institute of Boninology, the Kanagawa Prefectural Museum of Natural History, and the Japan Wildlife Research Center, the university produced the world's first study of the cycle of nitrogen carried by seabirds from the sea to the land and the loss of nitrogen after the extinction of seabirds on island of Minami Iwo-to, which maintains pristine wilderness in the Ogasawara Islands, a World Natural Heritage Site. We spoke with Adjunct Assistant Researcher Sato, the first author, about this study.



### First in the World! Revealing the Island's Nitrogen Cycle

This research began in 2017 with a survey of the natural environment of Minami Iwo-to which was conducted in cooperation with Tokyo Metropolitan University ("Tokyo-Toritsu-Daigaku" in Japanese, which at the time of the commencement of the research was called "Shuto-Daigaku-Tokyo"), the Tokyo Metropolitan Government, and the Japan Broadcasting Corporation (NHK). With no history of human settlement and virtually no non-native species, Minami Iwo-to is the only island which maintains the pristine ecosystem of the Ogasawara Islands. In a project to clarify the food chain and material cycle of this precious ecosystem, I participated in the analysis of biological samples.

During this research project, the researchers first clarified the circulation of nitrogen originating from the sea in Minami Iwo-to, where pristine wilderness remains. The island is an oceanic island free of predators like foxes and weasels, with a high density of ground-

nesting seabirds. These seabirds carry a lot of material from the sea to the land because they eat fish in the sea and excrete on the land. Nitrogen is one of the main substances carried by seabirds, but it is also one of the three major elements of fertilizer and is essential for plant growth. For this reason, seabirds play an important role in forest ecosystems. We collected samples of plants and herbivorous insects, which are the main components of the ecosystem; lizards and land birds, which are their predators; flies, crustaceans, and seabirds, which break down animal carcasses; and analyzed the stable nitrogen isotope ratio ( $\delta^{15}\text{N}$ ) contained in each organism. As a result, it was found that the stable isotope ratio of nitrogen was high on Minami Iwo-to, and that nitrogen from the sea circulated within the ecosystem. And the nitrogen was diffused into the ecosystem by the Blackback Land Crab (which is widely distributed within the area spanning from the island's coast to its mountaintops) by eating and breaking down the seabird carcasses. Nitrogen stable isotope ratios tended to be higher at lower altitudes, possibly because larger seabirds, which are located higher in the ecosystem, breed at lower altitudes.

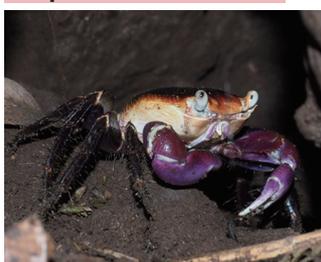
Next, the researchers conducted the same analysis on Kita Iwo-to Island, which has been without seabirds for more than 50 years, and the islands of Chichijima and Hahajima, which have been without seabirds for more than 150 years, and compared them with the data from Minami Iwo-to Island. As a result, it was found that the nitrogen carried by seabirds circulated on the ground within about 50 years after extinction and was

**A Bonin petrel flying to Minami Iwo-to**



(Photo: KAWAKAMI Kazuto)

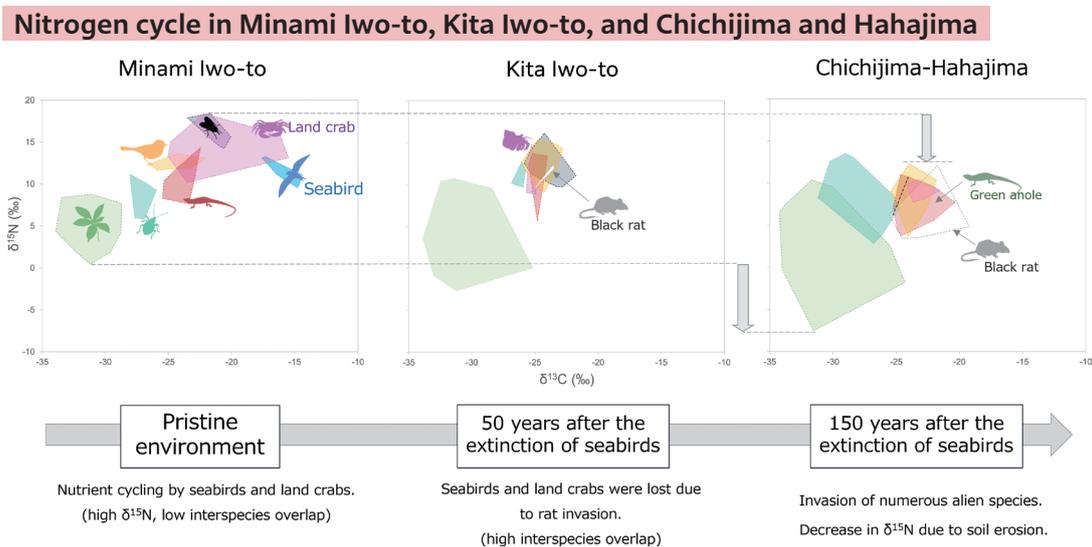
**A Blackback Land Crab, a decomposer of pristine nature**



(Photo: SASAKI Tetsuro)

not largely lost. On the other hand, after 150 years, the amount of nitrogen from the sea decreased significantly, which was thought to be caused by soil runoff.

This is the first time in the world that we have clarified the nitrogen cycle on a pristine island and how it decreases over time.



## Toward the Restoration of Ecosystem Functions

This research is one of the results of the Minami Iwo-to Natural Environment Survey (2017) and the Kita Iwo-to Natural Environment Survey (2019), and was made possible by the efforts of a large number of people, including the team that conducted the surveys on the uninhabited islands and collected biological samples. By understanding the unique ecosystem of Ogasawara and what has been lost from it, I think we have been able to show the goals for the future when it comes to ecosystem management in Ogasawara.

In the Ogasawara Islands, measures against invasive species have advanced, and seabird populations are recovering on some islands. Through this research, we were able to show the state of pristine nature, which is the target of ecosystem conservation projects, from the perspective of the functions performed by seabirds.

The research also revealed the functions of land crabs. Land crabs have also been greatly reduced owing to the influence of invasive species of mice, and it is necessary to restore the population of land crabs in order to restore a healthy forest ecosystem.

Furthermore, it was found that nitrogen from the sea is maintained in the soil for at least 50 years after the extinction of seabirds. In other words, there is a time lag between extinction and its impact. If conservation efforts can be made during this period to restore seabird breeding grounds, the impact on the ecosystem can be minimized by restoring the supply from the sea before the nitrogen available to plants is significantly reduced. These achievements will contribute to the ecosystem management of the Ogasawara Islands as a World Natural Heritage Site.

### Message to Students

The university is equipped with facilities and support to conduct research activities on the Ogasawara Islands, and many studies on the island's natural surroundings have been conducted. Meanwhile, the Ogasawara Islands are still home to many species whose ecology and classification are unknown, so there is still room for further research. I hope that the results of this research will give you a chance to become deeply interested in the nature of the Ogasawara Islands and the island environment.



## Off-campus Hands-on Liberal Arts Course: Nature, Society, and Culture

Associate Professor KATO Shungo

Department of Applied Chemistry for Environment, Faculty of Urban Environmental Sciences



Our university's unique course, called "Nature, Society, and Culture," is conducted outside the classroom on the Tokyo islands of Izu Oshima, Hachijojima, and Ogasawara. It is an intensive course involving overnight stays, in which students learn through discussions undertaken through hands-on experience gained outside the university campus, such as by seeing, hearing, observing, and investigating things for themselves on the islands mentioned.

We spoke with Associate Professor Kato, who is in charge of this course, about the outline of the course, its appeal, and what students should be taking away from the course.



### Practical Fieldwork Undertaken in Contact with Nature and Culture

In the fieldwork undertaken during this course, students learn about a wide range of subjects from diverse perspectives, including culture, history, industry, and the natural environment. The students speak directly to local workers such as craftsmen of Kusaya, a traditional industry on the island, and Kihachijo, a silk fabric dyed with vegetation, as well as dairy farmers and fishermen. They learn about the deep meaning of industry and culture, as well as about the thoughts of those who are responsible for those elements.

At the same time, they learn about the island's natural environment on site. In Ogasawara, which is a World Natural Heritage Site and home to many precious creatures, there are areas where you cannot enter without washing the soles of your shoes to protect against non-native species. Here, we observe the current situation of non-native species that have already invaded

the island and threatened the ecosystem. In addition, on Izu Oshima, specialists who study marine organisms dive into the sea and fertilize the collected organisms on the spot, and after returning to the inn, observe them under a microscope to consider the relationship between the sea and life. By viewing a single event from a variety of perspectives, one can get a real sense of the fact that environmental issues are closely related to people's lives.

#### Practical training in the sea of Izu Oshima



#### Practical training in the forest of Hachijojima



#### Message to Students



In this class, we emphasize the deepening of learning by interacting with various people, which is something we do by having students and teachers from different departments working together. One way we do that is with a system in which past students support classes as SAs (Student Assistants). By helping junior students learn, SAs strengthen vertical and horizontal connections between students. Interactions with local people are also very important. We want to have participants hear the thoughts of the local people when it comes to the efforts they are making and for participants to understand the feelings of those local people.

In this day and age, you can look up anything on the Internet, but whatever you get out of that will be only one aspect of the thing you are looking up. We believe that it is important to have the ability to create new value based on actual experience and awareness gained in the field. We want students to actively try various things without fear of failure.

## Ikimono! Circle Tokyo

Representative **HAMAGUCHI Naoto**  
Department of Biological Sciences, Faculty of Science

### Contents of Activities

The circle has two main types of activity content. The first is fieldwork. At the Matsugi Hinata Green Space, which is adjacent to the Minami-Osawa Campus, activities include bamboo shoot digging, bird watching, searching for organisms in the soil, and studying and observing ants, violets, and other living things on campus. Participants also catch fish in rivers and look for sea creatures in the sea outside of the university. During training camps, they observe nature in Okinawa and Hokkaido, and visit aquariums and museums.

The second is exhibition activities. Participants run exhibits at events organized by museums, facilities in local parks, and cultural festivals. Exhibitions are designed to appeal to a wide range of age groups, with photographs of living things displayed on large panels to create an impact, and with an emphasis on showing interesting ecology.

During summer vacation, we held a free research event for elementary school students on a joint basis with

We asked about the activities of the Tokyo Metropolitan University's only biology-related circle, the "Ikimono! Circle Tokyo," which brings together students who love nature, insects, fish, birds, plants and other living things.

a cram school. Here, we introduced and exhibited soil organisms, including pill bugs and small creatures whose size is measured in millimeters. By the time everyone left, many children were able to say the names of the insects shown. They seemed to enjoy the event very much. We believe that it is difficult to understand the vague term "living things in the soil," so in our educational outreach activities, we place importance on such actual hands-on experience and have participants feel the fun and enjoyment that comes with such experience.



**Campus hike near Hyotan-ike (Hyotan pond) on campus**



Japanese Brown Frog



Narcissus Flycatcher

### Toward Environmental Conservation

The campus waterside is a spawning ground for frogs that are an endangered species found even in Tokyo, and is a valuable breeding ground for aquatic insects. However, non-native species such as bullfrogs also inhabit the area, and this has led to the problem of them preying on and eradicating valuable native

species. In order to protect precious creatures and watersides, we conduct regular observation surveys and capture bullfrogs and other animals, and record the contents of their stomachs. In order not to waste the lives of the frogs we capture, we use them as food for the creatures we raise.

### Future Activities

When it comes to exhibitions, we would like to provide more interesting things to participants by digitizing images and sounds. We have also started community-wide activities in cooperation with NPOs in the city. I hope that these activities will continue into the future.

Also, maintenance activities to be undertaken within the Matsugi Hinata Green Space will see full-fledged commencement starting this year. I do think there will

be various effects on living things as fallen trees are sorted out and sunlight comes into the forest. We are considering whether we at the Circle can conduct a fixed-point recording survey of the impacts.

I would like to see our juniors take walk through the forest with their five senses and get a feel for the state of the living things there. I'm looking forward to observing the differences when it comes to forest creatures before and after the maintenance activities take place.



# Advanced Institute of Industrial Technology Message from the President



 **HASHIMOTO Hiroshi**  
President, Advanced Institute of Industrial Technology

I would like to talk about environmental issues.

Whenever people and things are active, energy (including food) is inevitably consumed. Activities drive the economy and enrich people's lives. Moreover, in the context of global recovery from wars and natural disasters, restoring daily life will consume vast amounts of cement and steel.

Agriculture, which accounts for 25% of all CO<sub>2</sub> emissions, and the cement and steel industries, which together account for 14% of emissions (\*), are expected to be in conflict with environmental issues.

Next, promoting a DX society requires securing rare metals and rare earths. However, mining and refining these materials generate large quantities of pollutants and radioactive waste. If strict management is not implemented, there is a significant risk of severe environmental pollution.

Solving environmental problems requires considering the trade-offs intertwined with various factors, such as the richness of life, recovery, a sustainable society, a DX society, and the diverse values of each individual. It is essential to develop human resources capable of managing these challenges holistically in line with the flow of the times. This complexity connects to the concept of VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) often discussed today. Furthermore, individuals capable of responding to VUCA are said to be able to address the global goal of a sustainable society, SDGs. In other words, people who can address environmental issues can also respond to the SDGs.

Outstanding individuals who can tackle complex issues in real-world society are said to excel in competencies. The introduction of competency as an indicator stemmed from research in the 1970s that showed little correlation between staff capabilities in U.S. government agencies and IQ or educational background. Since then, the concept of competency has expanded, and many different indicators have been proposed.

At our university, we define competency as the ability to perform tasks and have developed our own indicators and measurement methods for competencies suitable for each field of industrial technology, as well as learning methods, which we have put into practice. The results of our efforts are recognized not only in Japan but also by various institutions and organizations overseas. To contribute to solving complex environmental issues and building a hopeful future society, we will continue to nurture human resources who have honed their competencies.

\*Reed Landberg and Jeremy Hodges: What decarbonization means for cows, steel and cement, Bloomberg QuickTake, Oct.,08, 2019



# Advanced Institute of Industrial Technology Overview



## Overview

**Name:** Advanced Institute of Industrial Technology

**Date of Establishment:** April 2006

**President:** HASHIMOTO Hiroshi

### Number of students, faculty, and staff (As of May 1, 2025)

\*The staff numbers include temporary staff.



Number of students

**237**



Number of faculty

**28**



Number of staff

**30**



## Features

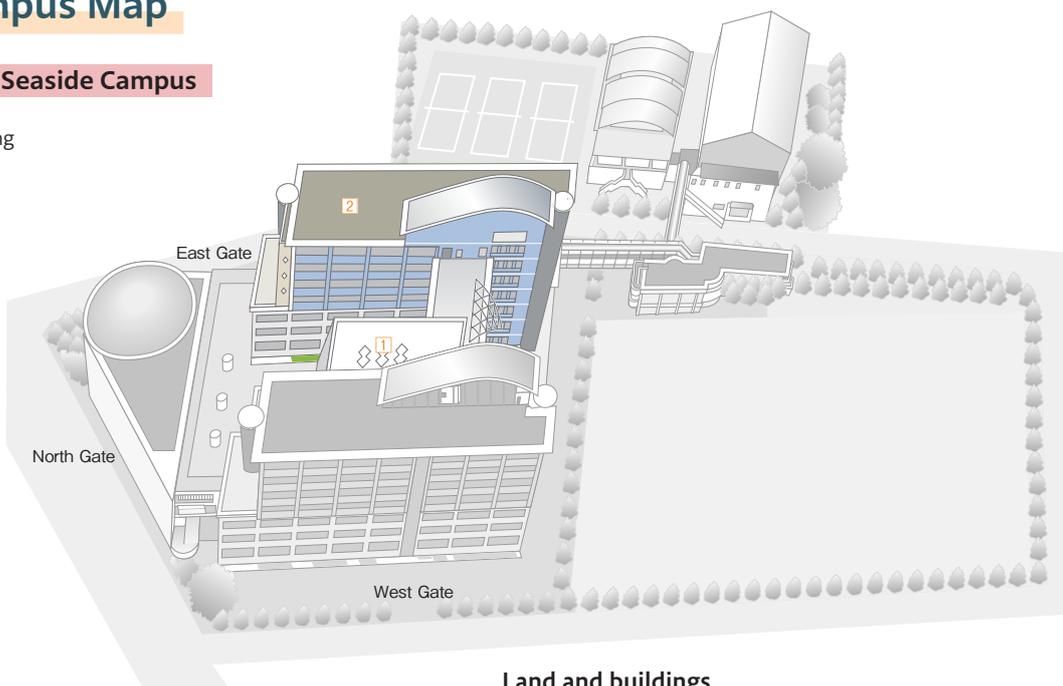
The university offers three courses: the Business Systems Design Engineering Course, which trains “business innovators” who will create future value through entrepreneurship, business start-ups, and succession; the Information Systems Architecture Course, which develops “information architects,” super-players in the field of information technology; and the Innovation for Design and Engineering Course, which cultivates “manufacturing architects” who bring innovation by integrating sensitivity and functionality. These courses provide advanced practical education through collaboration between faculty members with extensive real-world experience and those with high research achievements, aiming to develop professional, highly specialized experts who will bring innovation to various fields.



## Campus Map

### Shinagawa Seaside Campus

- ① Central Building
- ② East Building



### Land and buildings

1-10-40, Higashioi, Shinagawa-ku, Tokyo 140-0011, Japan

Land area: 37,134.15 m<sup>2</sup> (Shared use of the Shinagawa Campus of TMCIT)

Total floor area: 4,625.88 m<sup>2</sup>



### Development Using Embedded Systems and Their Application



**Professor MURAKOSHI Hideki**  
 Innovation for Design and Engineering Course, Master Program of Industrial Technology,  
 Graduate School of Industrial Technology

Professor Murakoshi specializes in embedded systems, which are computer systems incorporated into machines and equipment in order to realize specific functions. He is engaged in application development that meets the needs of society, such as solving environmental problems and contributing to society.



### Development of a triple signal dual light path particle counter and its application to algae cultivation

Microalgae *Nannochloropsis* is a type of green algae that is currently used as a supplement and for animal feed. In the future, it may be used as biofuel, but for this purpose, it is necessary to realize highly efficient and stable green algae cultivation. However, there are various issues which arise when it comes to green algae cultivation, such as the optimization of growth conditions and early detection of particulate foreign matter present in cultivation solutions.

Therefore, we developed an environmental information sensing device using IoT technology, and conducted experiments to derive optimal environmental conditions for green algae cultivation by analyzing the environmental data which had been accumulated. The triple signal dual light path particle counter is a system for controlling the culture

environment of green algae. As a result of the experiment, it was found that the agglomerated particles of *Nannochloropsis* were smaller than expected, so it was difficult to use this equipment for *Nannochloropsis* cultivation. However, it has been confirmed that it can be used for measuring the number of particles in general suspensions, so it is expected that it will be used for environmental research in other fields.

Appearance of the triple signal dual light path particle counter



### Development to Meet Societal Needs

At the Advanced Institute of Industrial Technology, students mainly conduct PBL (Project Based Learning)-type education during their second year after acquiring basic knowledge and skills in their first year. With PBL-type education, class members, which includes students, decide on projects based on the needs of society and work on them over the course of a year.

Currently, it is required that people make an effort to wear bicycle helmets, but I predict that it will become mandatory in 10 years and that violations will be punished severely. So, for example, we are developing a system that attaches sensors

to helmets and tells the wearer that they are committing a violation and asks them how much the fine will be when they are found to have committed a violation. Children who don't understand traffic rules may violate many rules. That's why we are also planning to have collected data for traffic safety education by making it can be checked in the home and elsewhere.

The commonality between our projects is that they involve things that are computer-controlled. We aim to solve environmental problems and contribute to society through the systems we have developed.

#### Message to Students



I would like to see students be interested in various things. When someone says something to them, I want to see them be curious about what is being said while thinking with their feet firmly planted on the ground in terms of what sounds interesting to them and what sounds like something they would like to make happen.

When you get an idea when it comes to something specific you want to do in terms of research, it's important to take a look at how far the current technology is. It is my hope that students will think about how to get from their starting point to their goal.



# Tokyo Metropolitan College of Industrial Technology

## Message from the Principal



 **YOSHIZAWA Masasumi**  
Principal,  
Tokyo Metropolitan College of Industrial Technology

The Sustainable Development Goals (SDGs) adopted at a United Nations summit in 2015 have a deadline of 2030, and two thirds of that time has already passed.

The 17 goals of the SDGs are all extremely important items that all countries in the world should aim to achieve, and active efforts are expected to be undertaken not only by national governments but also by local governments.

As one of the largest cities in the world, Tokyo consumes a large amount of resources and energy, erodes nature at the cost of convenience, and suffers damage from new infectious diseases. Due to its size, there are many challenges that need to be addressed by industry, academia, government, and the private sector.

The Tokyo Metropolitan College of Industrial Technology has long been engaged in the training of practical engineers who can contribute to solving problems in Tokyo. The school provides five years of practical and specialized education (seven years in the case of advanced course) from an early stage after graduation from junior high school. The school aims to develop engineers with the ability to apply things to new situations and the ability to use their imagination, who can respond to the needs of the industrial world and respond quickly to the rapid advancement, complexity, and globalization of science and technology. Of the 17 goals, this effort falls under the categories of goal 9 (Industry, Innovation, and Infrastructure) and 4 (Quality Education). Furthermore, having female engineers who acquire technical will make it easier for society to achieve goal 5 (Gender Equality). In addition, students working on the development of energy-saving cars are encouraged to incorporate goal 7 (Affordable and Clean Energy) into their work. In this way, the educational activities that our school has conducted are highly compatible with the SDGs, and I am confident that they will continue to be useful when it comes to achieving the SDGs.

This year, we revised the curriculum of the Electrical and Electronics Engineering Program at the Shinagawa Campus and launched the course as an Electric, Electronic and Energy Engineering Program. Electric, electronic and energy engineering is a technical field that supports social infrastructure such as energy, information, communications, and transportation. The engineers newly developed during this program—who can adapt to social conditions and technological progress and contribute to building a sustainable society and who understand green energy generation and conversion technologies as well as digital and IoT technologies and can implement hardware and software—are expected to play a central role in solving environmental problems that have emerged on a global scale in recent years.

This year's Environmental Report provides a detailed description of the new Electric, Electronic and Energy Engineering Program. Please take a look at the Tokyo Metropolitan College of Industrial Technology's efforts to develop the green digital human resources needed to realize the Zero Emission Tokyo initiative by 2050. At the same time, it introduces initiatives that have raised students' environmental awareness and interest in contributing to society through familiar activities.

I hope that many people will learn about the Tokyo Metropolitan College of Industrial Technology, which will protect the environment and nurture young people who will play a key role in realizing the SDGs in the coming decades.



# Tokyo Metropolitan College of Industrial Technology Overview

## Overview

**Name:** Tokyo Metropolitan College of Industrial Technology

**Date of Establishment:** April 2006

**President:** YOSHIZAWA Masasumi

**Number of students, faculty, and staff** (As of May 1, 2025)

\*The staff numbers include temporary staff.

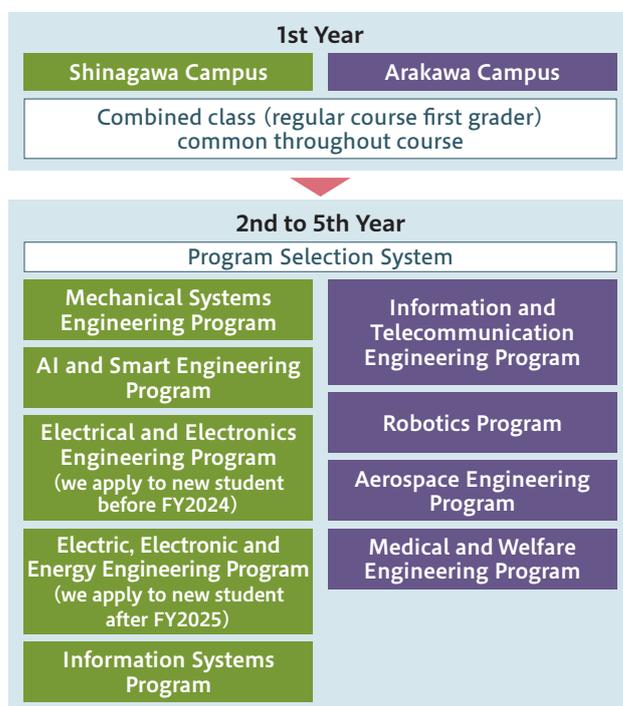


## Features

The Monozukuri Engineering Department (Regular Course) has eight\* education courses at two campuses to meet the diverse needs of society. In the first year, students take a common education course to acquire the basics of manufacturing engineering, and from the second year, they are divided into different courses, aiming to become specialists who contribute to the promotion of industry and solving problems in Tokyo.

After completing five years of education in the regular course, students can learn advanced specialized knowledge and skills in the advanced course for another two years. Our advanced course is accredited by the National Institution for Academic Degrees and Quality Enhancement of Higher Education (NIAD-QE) as specially-applied majors, and upon completion, students can obtain a bachelor's degree (in engineering) by applying to the institute for a consolidated degree review.

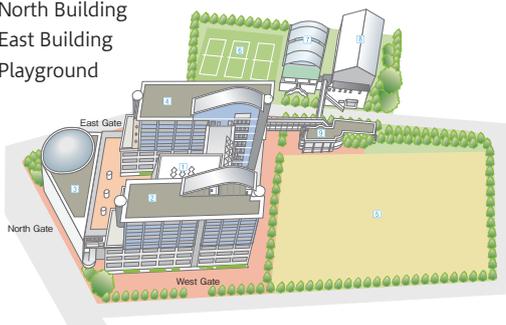
\*Due to the reorganization of courses in FY2025, there will be 9 courses temporarily until FY2028.



## Campus Map

### Shinagawa Campus of TMCIT

- 1 Central Building
- 2 West Building
- 3 North Building
- 4 East Building
- 5 Playground
- 6 Tennis Court
- 7 Pool Building
- 8 Gymnasium
- 9 Gymnasium

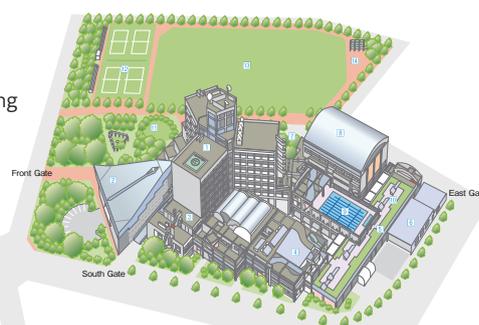


#### Land and buildings

1-10-40, Higashioi, Shinagawa-ku, Tokyo 140-0011, Japan  
Land area: 37,134.15 m<sup>2</sup> Total floor area: 34,139.54 m<sup>2</sup>

### Arakawa Campus of TMCIT

- 1 Main Building
- 2 Technology pavilion
- 3 Joint Research Center
- 4 Laboratory Building
- 5 Laboratory Building
- 6 Aviation Training Building
- 7 Multi-Purpose Plaza
- 8 Gymnasium
- 9 Pool
- 10 Roof Garden
- 11 Student Plaza
- 12 Tennis Court
- 13 Playground
- 14 Golf Range



#### Land and buildings

8-17-1 Minamisenju, Arakawa-ku, Tokyo 116-8523, Japan  
Land area: 48,370.10m<sup>2</sup> Total floor area: 31,496.24m<sup>2</sup>



# Tokyo Metropolitan College of Industrial Technology

## Environmentally Conscious Education and Student Activities

### Introduction of the Electric, Electronic and Energy Engineering Program

Professor ISHIBASHI Masaki

Electric, Electronic and Energy Engineering Program/Electrical and Electronics Engineering Program

In order to develop green digital human resources who will continue to take on the challenge of technological innovation for the development and sustainability of society toward the realization of the Zero Emission Tokyo strategy, the college reorganized the Electrical and Electronics Engineering Program\* into the Electric, Electronic and Energy Engineering Program in FY2025. We talked to Professor Ishibashi, who was involved in the course reorganization, about the background of this move and the outlook for the future.

\*Students who entered the college before FY2024 will belong to the Electrical and Electronics Engineering Program.



### Fostering Future Engineers for a Decarbonized Society

The revamping of the Electrical and Electronics Engineering Program was prompted by the recognition that it was essential to address the societal trends of decarbonization and carbon neutrality. In particular, there is a need for technological contributions in the power sector, which is a major contributor to CO<sub>2</sub> emissions. The name of the program was changed to

the Electric, Electronic and Energy Engineering Program in order to shift to the development of human resources who will be responsible for the energy of the future while maintaining the foundation of conventional electrical and electronic technologies. We aim to develop human resources who can contribute to reducing, producing and storing energy.



### Practical Learning Created by Teams

In the curriculum of this program, students learn basic technologies related to electrical and electronic information in the lower years, and in the higher years, they learn about energy technologies for reducing environmental impacts and the digital technologies necessary to realize that. We will also introduce classes which involve students learning together with others. This is because in the energy sector, people from a diverse array of disciplines need to work together to create something new. Particularly noteworthy is the new system design and production class. Students team up to come up with energy-related technical solutions and actually produce something which provides those solutions. As part of these efforts, we have installed solar power generation systems on campus, and we are considering ways to use the generated electricity. In order to strengthen this kind of practical learning, we enlist the cooperation of companies to encourage students to use their ideas in product development. We expect students studying in this course to be active in energy-related companies focusing on carbon neutrality in the future.

What's interesting about this course is that it serves to reinforce manufacturing and allows teams to collaborate. Electricity is an energy source that generates light, sound, and movement, and students can acquire the knowledge and skills to freely design and manufacture electrical and electronic circuits that properly control electricity. There are some students who are not great at making things, but I hope that they will acquire the ability to do things without giving up by finding a way that suits them through trial and error, asking others for help, and cooperating with their peers. In addition, by learning design-focused thinking from the lower years, students can acquire the kind of mindsets that allow them to come up with ideas and solve problems, which we will prepare them to hit the ground running when they enter the workforce.

Rooftop solar power generation system



### Message to Students

This program provides students with a wide range of basic knowledge in electrical and electronic areas, and fosters engineers who can contribute to a sustainable society by making the most of this knowledge. The strength of this program is found in the fact that we can aim to nurture people who can play an active role technologically in various fields such as robots, trains, automobiles, telecommunications, medical care, and entertainment, not just when it comes to energy-related problems. In particular, students who are good at making things with their hands or who are interested in environmental issues and want to make a broad contribution to social issues can have a fruitful student life. We believe that by deepening your professional knowledge and acquiring practical skills, you can expand upon your future career options.





# Tokyo Metropolitan College of Industrial Technology

## Environmentally Conscious Education and Student Activities

### Meeting for a Discussion with the Governor (FY2024): Proposal for Carbon Neutrality Contribution Game

"Zero Emissionaries", OKAWARA Yuma, SEKIGUCHI Tasuku, NAKANISHI Go, NABA Ikuma, MATSUBARA Kotaro, MOTOHASHI Koyo, YAMANISHI Sara

Associate professor ISHIZAKI Akio

Electric, Electronic and Energy Engineering Program/Electrical and Electronics Engineering Program

#### Team 'Zero Emissionaries'



On December 26, 2024, Tokyo Governor Koike and high school students held a Meeting for a Discussion with the Governor to discuss the achievement of zero emissions. A team of seven third-year students, "Zero Emissionaries," from the Electrical and Electronics Engineering Program participated. Associate professor ISHIZAKI, who provided instruction to the participants, was present and we spoke with the students.

We are learning about electricity and energy, and we conducted a survey on the Internet and via other means, and we felt that there were major issues in terms of the low awareness of carbon neutrality among Tokyo residents and the high levels of energy consumption in the home. As a measure to address that situation, we first proposed the Carbon Neutrality Contribution Game with the aim of raising awareness among the younger generation. The idea is to use information from smart meters to turn daily environmental contribution activities into a game. Each region has its own character that grows in response to the activities of its residents. In terms of incentives for activities, we devised two types of reward points: Enecoin, which can be used to improve local public facilities, and e-Point, which can be used by individuals.

As we went about having discussions amongst team members starting from around July to reach the goal in December, we sometimes had a clash of opinions, but by

respecting each other's ideas, we were able to come up with a better proposal, resulting in a significant sense of accomplishment. As a result, Governor Koike provided a comment to the effect that turning such an initiative into a game is wonderful idea.

We hope that this proposal will have a ripple effect throughout society. In the future, I think it would be great if, for example, the Tokyo Metropolitan Government could expand the deployment of this game to schools in Tokyo, thereby improving the environmental literacy of young people and thereby enabling society as a whole to tackle the zero emission initiative.

Our college has a climate in which students can freely participate in off-campus events, and an environment in which they can dig deeper into one subject area and pursue expertise. We believe our college is perfect for people who want to try various things, so please check out our website!

### Collection of PET Bottle Caps

Arakawa Campus

Since 2023, the Arakawa Campus has been collecting PET bottle caps under the leadership of the Environmental Improvement Committee.

In order to prevent waste from entering the building, we have placed special bags in the elevator hall, a place many people pass through, in a spot that is separated from where the general trash cans are. As a result, we have collected more than 9,000 caps. As a result, CO<sub>2</sub> emissions have been reduced by more than 65 kg.

This activity has been steadily expanding, with people asking for the cooperation of others during cultural festivals and gaining the cooperation of parents during open house week. Some students have provided comments to the effect

that their small daily activities contribute to society, meaning that this activity has served as an opportunity to raise environmental awareness.

Collected caps are converted into recycled plastic materials through the Ecocap Movement and used for various social contribution activities such as medical assistance, support for those with disabilities, and environmental education.

#### Recovered ecocaps





## Third-Party Opinions

Policy Planning Section, General Affairs Division,  
Bureau of Environment, Tokyo Metropolitan Government

In 2025, a record 29 extremely hot days were recorded in central Tokyo, and disaster-level heat was rampant again this summer. In the face of frequent natural disasters caused by climate change, there is no time to delay countermeasures, and further efforts toward decarbonization are important.

The role of cities, as places where the effects of climate change are radically manifested, has never been greater. In March this year, the Tokyo Metropolitan Government formulated the “Zero Emission Tokyo Strategy: Beyond Carbon Half,” setting a new target of reducing greenhouse gas emissions by 60% or more from the 2000 level by 2035 and promoting effective initiatives. Specifically, the TMG will accelerate their efforts undertaken as a result of the mandatory installation of solar power generation facilities in new houses that began in April this year, and also leverage Tokyo’s potential and advanced technologies, which includes efforts such as promoting thermal insulation renovations for existing houses, expanding the use of “Air Solar”, an ultra-thin and flexible solar cell developed in Japan that stands for Anywhere, Innovative, and Renewable energy, introducing floating offshore wind power, and facilitating the popularization of green hydrogen to realize a decarbonized city that will serve as a model for the world.

In the Carbon Neutrality Promotion Plan, your

organization has set the goals of carbon half by 2030 (compared to the FY2013 level) and carbon neutrality by the 2030s, and has clarified a roadmap for efforts to achieve them. In addition, the Tokyo Research Initiative for Sustainability (TRIS) is promoting research and studies that contribute to solving issues faced by the Tokyo government under the theme of sustainability. This is something we see as an important initiative.

We highly value your organization’s advanced and wide-ranging initiatives in the environmental field, including when it comes to the installation of solar car ports and the introduction of clean energy undertaken by means of switching to electricity derived from renewable energy, the renewal of energy-saving facilities, and the development and distribution of a dedicated app that enables students and faculty members to get a sense of the efforts they are making in relation to decarbonization.

Expectations are growing for universities and other higher education institutions to achieve results in various research projects that contribute to society, including decarbonization, and to develop and produce capable human resources in various fields. As the only public university corporation established by the Tokyo Metropolitan Government, we hope that your advanced research and activities will be widely disseminated and developed, leading to the realization of a sustainable society.

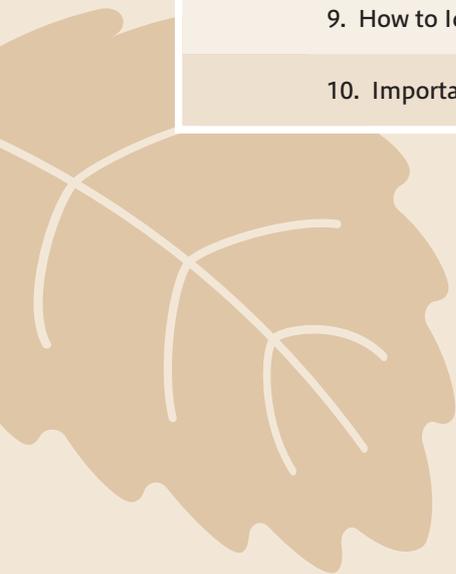




## Environmental Reporting Guidelines Comparison Table

We included a comparison table with the “Environmental Reporting Guidelines 2018 Edition” issued by the Ministry of the Environment.

| Item  | Relevant page(s)              |
|---|-------------------------------|
| <b>Chapter 1 Basic Information on Environmental Reporting</b> |                               |
| 1. Basic Requirements for Environmental Reporting             | 1                             |
| 2. Trends in Key Performance Indicators                       | 12~16                         |
| <b>Chapter 2 Contents of Environmental Report</b>             |                               |
| 1. Commitment from Senior Management                          | 2, 26, 37, 40                 |
| 2. Governance   | 4, 6                          |
| 3. Stakeholder Engagement                                     | 11, 17, 44                    |
| 4. Risk Management  | 16                            |
| 5. Business Model   | 3, 4, 27, 28, 38, 41          |
| 6. Value Chain Management                                     | 8~15                          |
| 7. Long-Term Vision   | 5~7                           |
| 8. Strategy   | 5~7, 17                       |
| 9. How to Identify Critical Environmental Issues              | 5~7                           |
| 10. Important Environmental Issues for the Organization       | 5~7, 18~25, 29~36, 39, 42, 43 |





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Tokyo Metropolitan  
Public University Corporation

Toward a Sustainable Society