

An aerial photograph of a dense, vibrant green forest. A paved road with a white dashed line curves through the upper portion of the image. The text is overlaid on a semi-transparent green rectangular area in the top left.

# Ensuring the coexistence of nature and humanity

The NTT Group is contributing to resolve environmental issues while also delivering economic growth.



Toward a future that ensures the positive coexistence of nature and humanity

Climate change and other environmental issues are increasing in severity every year causing greater social and economic damage as natural disasters become more frequent and widespread. The NTT Group is “moving toward a decarbonized society,” “implementing closed loop recycling” and achieving “a future where people and nature are in harmony” as part of its goals for “ensuring the positive coexistence of nature and humanity,” and is analyzing the underlying reasons behind each issue in order to take the required action.



What should NTT be aiming for?



	Potential Future and Underlying Reasons	Commitments	Action
Moving toward a decarbonized society	The NTT Group views finding solutions to climate change and other environmental issues that society faces as one of its core roles, and is continuing its existing activities aimed at reducing greenhouse gas emissions. Meanwhile, there is growing hope that environmental challenges can be resolved through the use of ICT. The NTT Group needs to focus on Group-wide efforts at promoting energy efficiency and increasing the use of renewable energy sources, given that 90% of the CO <sub>2</sub> emissions from its business activities arise from the electricity it consumes. Additionally, developing next-generation energy technologies and technologies to enable resilient environmental adaptation, and providing services that help to alleviate the impact that society as a whole has on the environment, will reduce the impact on the global environment and help prevent environmental destruction—these will open the door to a sustainable society in which humans can continue to live in harmony with the environment.	<b>Carbon Neutrality (2040)</b> The NTT Group is committed to initiatives that reduce greenhouse gas emissions throughout its business activities and society as a whole, by rolling out IOWN technology and increasing development and use of renewable energy sources.	Promoting energy conservation Reduction of power consumption by introducing IOWN technologies Developing and expanding the use of renewable energy Providing new services that contribute to carbon neutrality Creation of innovative environmental energy technology
Implementing closed loop recycling	Although our one-way society of mass production, mass consumption, and mass disposal has brought affluence and convenience to our lives, it has brought about various problems such as the creation of massive amounts of refuse, illegal dumping and concern about the depletion of natural resources. To resolve these issues we must first review how companies manage their businesses as well as our social and economic systems, and shift to a closed loop society. In an effort to realize a future with closed loop recycling, the NTT Group promotes the 3Rs (reduce, reuse, and recycle), working to reduce the amount of materials consumed by our business activities and reuse or recycle the resources that are consumed. We will shift from a one-time use consumption-oriented company to a recycling-oriented one. We will promote the effective use of resources throughout the entire life cycle of products and systems, from procurement to use and disposal.	<b>Recycling Rate of 99% or higher (2030)</b> To facilitate the shift from a one-time use consumption-oriented economy to a recycling-oriented one, we will promote the effective use of resources throughout the entire life cycle of our products and systems, from procurement to use and disposal.	Increasing the reuse and recycling of communications equipment, mobile terminals, and other technologies Reduction in plastics use and promotion of recycling Proper treatment, storage, and management of hazardous waste Appropriate and efficient management of water resources
A future where people and nature are in harmony	The telecommunication equipment essential to the NTT Group’s businesses have no small impact on ecosystems. Ecosystems full of biodiversity provide us with a bounty that is crucial for all forms of life on earth—we are focusing on proper conservation as a way of keeping nature the way it was meant to be for future generations.	Through our business and employee activities, we will promote initiatives related to conserving ecosystems within nature.	Thoroughly implementing environmental assessment Contributing to natural ecosystem conservation

## Basic Policy and Action Guidelines

### Basic Policy

The NTT Group is committed to achieving a new level of prosperity where humanity can co-exist and preserve nature for generations to come. To this end, we will work to balance solving ecological problems and improving economic development by reducing the environmental impact of our business activities and creating new technologies and innovations.

### Action Guidelines

#### 1. Reducing greenhouse gas emissions

The NTT Group is committed to initiatives that reduce greenhouse gas emissions throughout its business activities and society as a whole, by rolling out IOWN technology, increasing development and use of renewable energy sources, and providing services that contribute to carbon neutrality.

#### 2. A commitment to resource recycling

We will shift from a one-time use consumption-oriented company to a recycling-oriented one. We will promote the effective use of resources throughout the entire life cycle of products and systems, from procurement to use and disposal.

#### 3. Conserving ecosystems

Through our business and employee activities, we will promote initiatives related to conserving ecosystems within nature.

#### 4. Compliance with laws and regulations and fulfillment of social responsibilities

We comply with the laws and regulations related to environmental issues in each country and region, and act with high ethical standards.

#### 5. Establishing and maintaining environmental management systems

We will establish the Green Innovation Committee chaired by the Representative Director and Senior Executive Vice President, and discuss basic strategies concerning environmental issues, the status of implementation of activities, and information disclosure, and implement relevant initiatives.

#### 6. Stakeholder engagement

We will engage with stakeholders throughout our entire value chain to help resolve environmental issues.

## Disseminating Environmental Activities Policies and Measures among Employees

NTT Group conducts environmental education to disseminate NTT Group policies and measures among employees and develop a shared understanding of Group-wide activities for promoting environmental protection. In fiscal 2021, we also provided training related to the Group's environmental activities for all employees, such as group training and e-learning. The NTT Environmental Protection Office organizes environmental education for staff in charge of environmental issues at each Group company and has been holding study sessions every year since fiscal 2001. Along with lectures for disseminating our environmental policies and sharing outstanding issues, we invite outside lecturers to speak on recent topics. These study sessions are intended for the NTT Group throughout Japan and are therefore offered via a teleconferencing system so that staff in remote areas can attend and ask questions through two-way connections. This paperless approach is also another way the NTT Group is helping to reduce greenhouse gas emissions resulting from holding meetings.

In fiscal 2021, we invited experts on environmental management and CSR to explain the SDGs and ESG and to speak about environmental management. Furthermore, related staff in Group companies introduced their environmental initiatives with the aim of promoting environmental activities at each Group company.

## Compliance with Environmental Laws and Regulations

The NTT Group complies with laws and regulations related to the environment and works to reduce its impacts on the environment. We have established a mechanism that can deal with cases of legal violations on a Group-wide basis by reporting to the Global Environmental Protection Promotion Committee. There were no legal violations nor payments of penalties in fiscal 2021, following the same result for fiscal 2020. As part of its environmental management measures, the Group also tracks the number of complaints related to the environment for each fiscal year. In fiscal 2021, no complaints related to environmental impact were submitted, handled or resolved through our systems for dealing with complaints. Going forward, we will maintain compliance with existing laws and regulations as well as set up a working group on environmental laws and regulations to help step up our preparations for complying with laws and regulations under review or scheduled to take effect.

## Social Challenge

# 1

## Moving toward a decarbonized society

### Business Activity

1. Promoting energy conservation
2. Reduction of power consumption by introducing IOWN technologies
3. Developing and expanding the use of renewable energy
4. Providing new services that contribute to carbon neutrality
5. Creation of innovative environmental energy technology



### Why it matters

The NTT Group views one of its core roles as helping to resolve environmental issues that society faces, and is continuing its existing activities aimed at reducing greenhouse gas emissions. There are increasingly high hopes that the ICT sector will be able to help resolve environmental issues, and this has been outlined in the Paris Agreement. The NTT Group remains committed to measures that utilize ICT services and cutting-edge technology to reduce greenhouse gas emissions.

### What can be accomplished

The NTT Group is committed to initiatives that reduce greenhouse gas emissions throughout its business activities and society as a whole, by rolling out IOWN technology and increasing development and use of renewable energy sources.

### Future vision

The NTT Group is pushing ahead with research and development aimed at curbing climate change, encouraging employees to take part in nature conservation activities, increasing awareness inside and outside the group of its activities that help improve the environment, and many other activities to contribute to a reduction in greenhouse gas emissions throughout society as a whole.



# Feature 1: Environment and Energy Vision

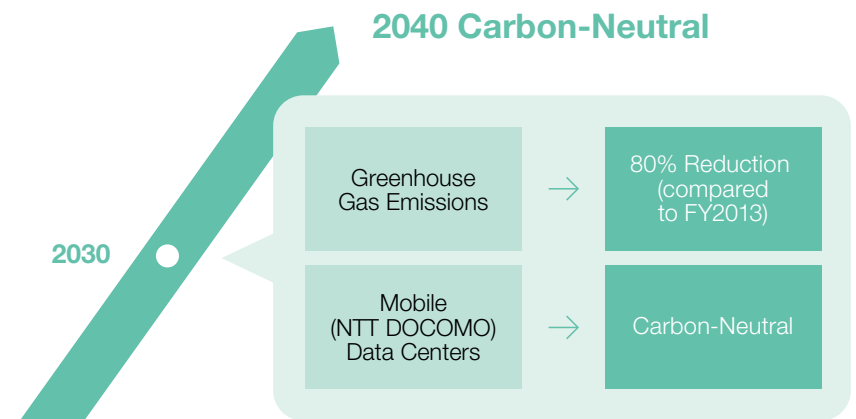
## Achieving carbon neutrality

In September 2021, the NTT Group unveiled its new environment and energy vision, “NTT Green Innovation toward 2040” for achieving “zero environmental impact” while continuing “economic growth” by reducing the environmental impact of its business activities and creating breakthrough innovation, with the aim of creating a well-being society and boosting corporate value through ESG initiatives. NTT will aim to achieve carbon neutrality by fiscal 2040 based on this vision.

NTT has set targets for groupwide carbon neutrality by fiscal 2040 on its way to achieving zero environmental impact. The mobility communications (NTT DOCOMO) and data center business will be the first within the NTT Group to achieve carbon neutrality, as targets have been set to reduce greenhouse gas emissions by 80% of fiscal 2013 levels, by the fiscal year ending March 31, 2031. This target was approved as the 1.5°C level by SBT in December 2021.



## New Environment and Energy Vision NTT Green Innovation toward 2040



\* Scope of reduction targets  
GHG protocol: Scope 1 (own direct emissions of GHG) and Scope 2 (indirect emissions from using electricity, heat and steam supplied by other companies) Mobile: 15 companies in NTT DOCOMO Group (as of September 28, 2021)

# Feature 1: Environment and Energy Vision

## Achieving carbon neutrality

### Key Initiatives Toward Carbon Neutrality

With the current situation, data traffic will increase significantly, leading to an increase in energy consumption and thus greater greenhouse gas emissions. In order to achieve carbon neutrality, IOWN will be rolled out to reduce energy consumption, increase the use of renewable energy sources, and cut down on greenhouse gas emissions.

### Illustration of NTT Group Greenhouse Gas Emission\*1 Reductions

- Increased use of renewable energy: Reduce greenhouse gas emissions by 45%\*2 — 1
- Lower energy consumption with IOWN technologies: Reduce greenhouse gas emissions by 45%\*3 — 2

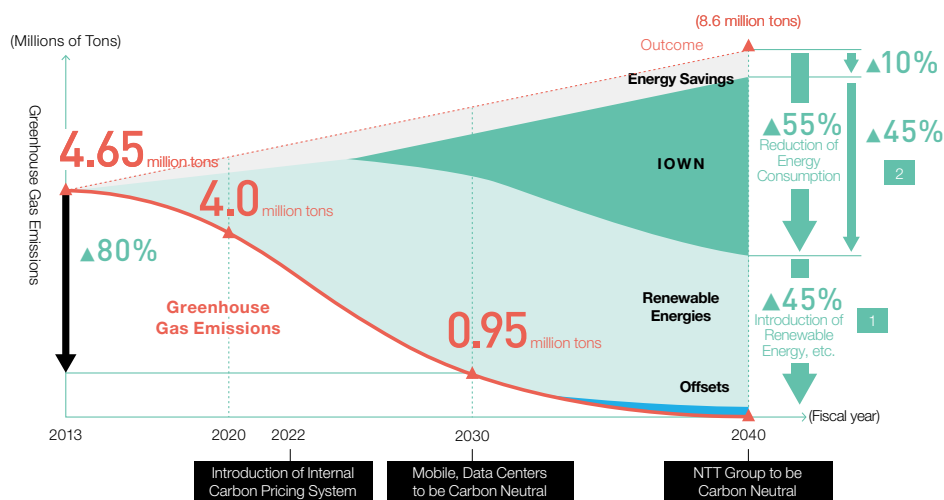


Illustration of NTT Group Greenhouse Gas Emission Reductions (Domestic + Overseas)

\*1 GHG Protocol: for Scope 1 and 2

\*2 Estimated Introduction of Renewable Energy (including actual renewable energy through Non-Fossil Fuel Certificates) → FY2020, 1.0 billion kWh; FY2030 to FY2040, around 7.0 billion kWh. The introduction of renewable energy will have the optimal types of energy determined on the basis of each country's energy composition, etc.

Approximately half of the domestic renewable energy usage is anticipated to be from energy sources owned by NTT (FY2030).

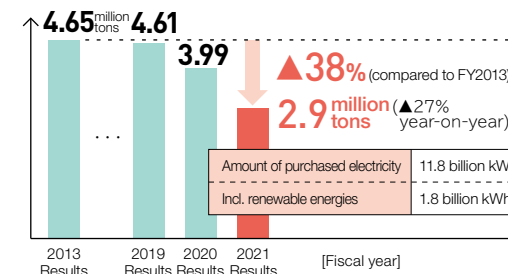
\*3 Estimated Reduction of Energy Consumption through the Introduction of IOWN (Comparison to Outcome).

→ FY2030, (2.0) billion kWh ((15%); FY2040, (7.0) billion kWh ((45%)) Percentage of Introduction of IOWN (Photonics-electronics Convergence Technologies, etc.) out of Total Energy Volume  
→ FY2030, 15%; FY2040, 45%

### FY2021/2022 Initiative Highlights

#### NTT Group

Of the total power consumption during fiscal 2021, switching to renewable energy sources for more than 1.8 billion kWh (approx. 23% of power consumption, approx. 150% compared year-on-year) used by the entire Group resulted in greenhouse gas emissions of 2.90 million tons, a reduction of 38% compared to FY2013 levels.

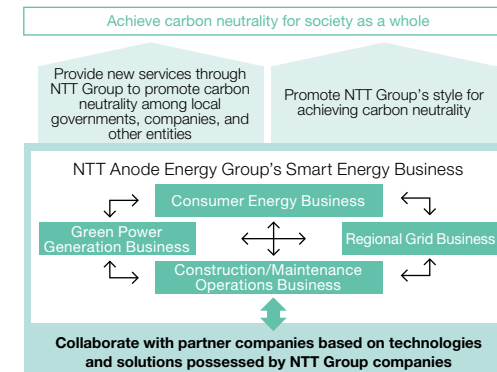


#### NTT Anode Energy

Integrating Power-related Operations to Accelerate Expansion of Smart Energy Business

In July 2022, NTT FACILITIES' power engineering and other power-related operations, primarily design and maintenance of solar power plants and power supply facilities for telecommunications, were transferred and integrated into NTT ANODE ENERGY. Through this integration of power-related operations, NTT Anode Energy will promote four businesses: the green power generation business, regional grid business, consumer energy business, and construction and maintenance operations business. By linking these four businesses into a single integrated value chain, the company will develop a smart energy business.

### Overview of NTT Anode Energy's Post-integration Smart Energy Business



- Green Power Generation Business: Development of renewable energy power plants
- Regional Grid Business: Promote expansion of the use of NTT Group's assets to enhance local production and consumption of renewable energy and resilience
- Customer Energy Business: Promote carbon neutrality among customers by offering decarbonization solutions
- Construction/Maintenance Operations Business: Aim to improve quality and efficiency by enhancing power engineering functions (construction, maintenance, and monitoring)

#### NTT Group

### NTT Group Introduction of Internal Carbon Pricing System

To achieve carbon neutrality, a resolution was passed at the Executive Committee meeting in May 2022 to gradually implement an "Internal Carbon Pricing System" within Group companies. This system encourages reducing our impact on the environment by virtually converting CO<sub>2</sub> emissions into costs.

### Overview of Internal Carbon Pricing System implemented by the NTT Group

Internal carbon price	¥6,500/t-CO <sub>2</sub>
Scope of application/ Method	When it comes to decarbonization-related project decisions and procurement (product selection, etc.), decisions are made while taking CO <sub>2</sub> emission costs into consideration.

# Feature 1: Environment and Energy Vision

## Achieving carbon neutrality

In addition to the “Green of ICT,” which will curb the environmental impact of NTT Group by introducing IOWN technologies and increasing the use of renewable energy, we will also work on “Green by ICT,” which will contribute to reducing the environmental impact of society as a whole.

	Reduction of Environmental Impact through Business Activities	Creation of Breakthrough Innovation
<b>Green by ICT</b>  Contributions to Reducing Society's Environmental Impact	<b>Reducing society's environmental impact</b> <ul style="list-style-type: none"> <li>• Further acceleration of DX and promotion of Remote World</li> <li>• Promotion of regional urban development and the introduction of new social infrastructure development</li> <li>• Reduction of greenhouse gases across the entire supply chain</li> <li>• Provision of new services that contribute to carbon neutrality</li> <li>• Contribute to local production and consumption of energy, through smart grids based on battery farms</li> <li>• Increase in green electricity retail</li> </ul>	<b>Creation of innovative environmental energy technology</b> <ul style="list-style-type: none"> <li>• Use of 4D digital platform for future predictions / optimal use of urban assets<sup>*1</sup></li> <li>• Optimal operation of fusion reactors (ITER / QST)<sup>*2</sup></li> <li>• Lightning charging</li> <li>• Applied genome-editing technology for “Green” (Collaboration)</li> </ul> <p><sup>*1</sup> Energy, transportation, logistics, etc.  <sup>*2</sup> ITER: International Thermonuclear Experimental Reactor            QST: National Institutes for Quantum Science and Technology</p>
<b>Green of ICT</b>  Reducing NTT's Own Environmental Impact	<b>Introduction of IOWN and Expansion of Renewable Energy</b> <ul style="list-style-type: none"> <li>• Reducing power consumption by introducing IOWN technologies</li> <li>• Developing and expanding the use of renewable energy</li> <li>• Introduction of internal carbon pricing system</li> <li>• Issuance of green bonds</li> </ul>	<b>Achievement of Ultra-Low Power Consumption</b> <ul style="list-style-type: none"> <li>• Photonics-electronics Convergence Technologies (IOWN All-Photonic Network)</li> </ul> <b>Creation of Decentralized Technology</b> <ul style="list-style-type: none"> <li>• Photonic disaggregated computing</li> <li>• Space integrated computing network</li> </ul>

### FY2021/2022 Initiative Highlights



#### docomo Denki Green

A service lineup that began supplying “docomo Denki™” from March 2022 as a distributor harnessing its partnership with NTT Anode Energy. One of the plans, “docomo Denki Green,” makes full use of renewable energy sources\* for its supply, helping to achieve carbon neutrality throughout society as a whole.

\* Renewable energy sources include the use of specified non-fossil fuel certificates.

**docomo Denki Green**

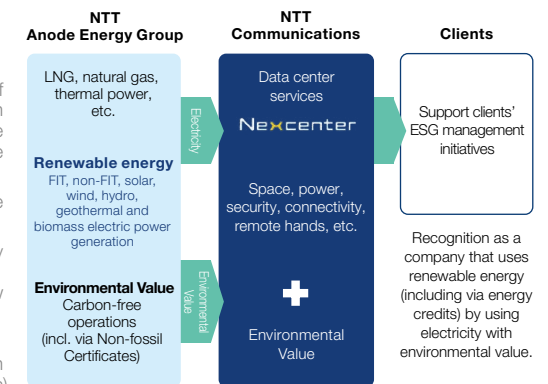


NTT Communications is the first in Japan to offer<sup>\*1</sup> a renewable energy menu that enables customers (subscribers who use cages or rooms) to select the electricity used by their ICT equipment<sup>\*2</sup> for largescale commercial data centers utilizing renewable energy supplied by NTT Anode Energy. In addition, information on the power plant and the amount of electricity used will be provided on an individual basis as a type of “environmental value” utilizing non-fossil certificates<sup>\*3</sup>.

#### [Renewable Energy Menu for Customers]

##### Actual renewable energy utilizing non-fossil fuel certificates

- 1 Renewable energy that comes with a set of tracked non-fossil fuel certificate information indicating the location of the power plant and the power source type (not possible to specify the power source type or FIT/non-FIT<sup>\*4</sup>)
- 2 In addition to 1 above, customers can specify the power supply type<sup>\*5</sup>.
- 3 In addition to 2 above, customers can specifically request non-FIT Renewable energy can be supplied from new power plants
- 4 Off-Site PPA<sup>\*6</sup> (NTT Anode Energy will provide power plants with additionally to meet individual customer requests)



Target Data Centers (as of April 2022)  
 Yokohama Data Center No. 1, Saitama Data Center No. 1, Tokyo Data Center No. 5, Tokyo Data Center No. 8, Tokyo Data Center No. 11

<sup>\*1</sup>: Results of a survey of publicly available information about providing a menu that enables customers to select the type of renewable energy, and the provision of “environmental value” using non-fossil fuel certificates according to the type of renewable energy, at large commercial data centers in Japan that receive extra-high voltage while providing renewable energy (survey conducted by NTT Communications/NTT Anode Energy, March 2022)

<sup>\*2</sup>: Provision of the service may entail equipment modification costs, such as power supply installation.

<sup>\*3</sup>: Certificates issued by separating the value from electricity originating from sources that do not emit CO<sub>2</sub>. This will achieve actually 100% renewable energy.

<sup>\*4</sup>: FIT electricity refers to electricity generated from renewable energy sources and purchased by electric utilities under the feed-in tariff system established by the government (the Amended FIT Act). Because FIT electricity is financed by contributions imposed on electricity users (the public), its environmental value already belongs to the public. By contrast, non-FIT electricity that does not rely on the FIT system is viewed favorably because it contributes to the expansion of renewable energy implementation while reducing the burden on the public.

<sup>\*5</sup>: Electricity generated from solar energy, geothermal energy, or biomass can be specified. (as of April 2022)

<sup>\*6</sup>: Off-site PPA (Power Purchase Agreement) is a scheme in which electricity users conclude contracts with power generation business operators to procure renewable energy over the long term. Off-site PPA, an abbreviation of Off-site Corporate PPA, involves the use of power generation facilities in locations removed from users to supply them with electricity through the power grid.



## Business Activity 1

# Promoting energy conservation

### Our commitment

The NTT Group is committed to improving the energy efficiency of its operations (EP100) \*1

### Our objective

## Two times

2025: Power efficiency (compared to FY2017)

\*1 In October 2018, NTT was the first telecommunications carrier to become a member of the Climate Group's EP100 and EV100 initiatives. EV100 aims to achieve a 100% EV ratio for passenger vehicles by 2030.

\*2 Power Usage Effectiveness: PUE is calculated by dividing the total power consumption of a data center by the power consumption of the computing equipment it houses. It is a figure larger than 1, with higher efficiencies represented by values approaching 1.

\*3 ICT Ecology Guideline Council: An organization established jointly by the Telecommunications Carriers Association, Telecom Services Association, Japan Internet Providers Association, Communications and Information Network Association of Japan and ASP-SaaS-IoT Cloud Consortium to drive industry-wide efforts to address the issue of global warming.

ICT Ecology Guideline Council (Japanese only)  
<https://www.tca.or.jp/information/ecoict/index.html>

\*4 The eight NTT Group companies are NTT, NTT East, NTT West, NTT Communications, NTT DOCOMO, NTT DATA, NTT FACILITIES, and NTT COMWARE.

### Background and Concepts

Electricity consumption accounts for over 90% of greenhouse gas emissions of NTT Group's business activities—the Group consumes the equivalent of 1% of the power generation throughout all of Japan. To combat this, the NTT Group has been working on Group-wide energy conservation activities dubbed the "TPR (Total Power Revolution) Campaign." By promoting efficient energy management at buildings owned by NTT and installing energy-efficient electrical power units, air conditioning systems and telecommunications equipment, we managed to continue to reduce electricity usage across the NTT Group by approximately 180 million kWh from projected levels in fiscal 2021.

Furthermore, the NTT Group is pushing for greater electricity usage efficiency with the aim of reducing the risk of business disruptions and helping to mitigate climate change. The fiscal 2025 target for power efficiency per data transmission in our telecommunications business, including data centers, has been set to double that of fiscal 2017. An efficiency of 1.9-times was achieved in fiscal 2021.

### Energy-Saving Data Centers

NTT Communications offers data centers with a PUE\*2 of less than 1.2, and NTT COMWARE offers data centers with a PUE of less than 1.1, which are at the top worldwide for energy efficiency. We are striving to enhance PUE for our other data centers as well, introducing five-star equipment with the highest level of energy efficiency in accordance with the NTT Group Energy Efficiency Guidelines. NTT FACILITIES has been developing technology for reducing the electricity consumption of data centers by incorporating higher efficiency technology for electrical power units and air conditioning systems as well as central air conditioning control systems.

### Pursuing Initiatives across the Industry for Energy-Efficient ICT Devices

NTT is a member of the Telecommunications Carrier Association (TCA) and in that capacity, participates in the ICT Ecology Guideline Council\*3, an organization that seeks to enhance the energy efficiency of telecommunications-related products. The council formulates guidelines on the criteria for evaluating the energy efficiency of telecommunications devices, and NTT has contributed to the technical aspect of this effort. The NTT Group's Energy Efficiency Guidelines are based on the guidelines created by this council. In August 2010, eight NTT Group companies\*4 acquired the Eco ICT Logo on submitting self-evaluations of their CO<sub>2</sub> emissions reduction efforts, including the establishment of Energy Efficiency Guidelines.

The Eco ICT Logo was created by the ICT Ecology Guideline Council to signify efforts by telecommunications service providers to reduce CO<sub>2</sub> emissions. We will continue to drive the development and procurement of energy-efficient equipment, and work with the ICT Ecology Guideline Council to help bring both vendors and carriers together to promote the industry-wide procurement of energy-efficient equipment. We will ensure that vendors are consistently provided with requirements for NTT Group specification processes, and include energy efficiency information disclosure and our corporate stance on energy efficiency in our criteria for selecting vendors.

### Business Activity

#### Reducing power consumption throughout the network

NTT DOCOMO is developing technology that lowers power consumption of communication networks and is rolling out equipment that reduces power consumption. It is achieving this with efforts like developing more advanced sleep functions for base stations and installing air-conditioning control systems equipped with self-learning functions and actively rolling out 5G power-saving devices. Additional approaches include consolidating base station equipment and using power supplied directly from high-voltage direct current equipment with lower transmission losses.





## Employee Interview

—Hope to protect the future global environment through energy conservation at data centers—



**Yoshihito Ito**  
NTT Network Innovation Center

The amount of annual energy consumption by the NTT Group is said to be some 1% of the total power consumption throughout all of Japan, and data centers use a significant ratio of this amount. To achieve improved level of energy conservation at data centers, the NTT Network Innovation Center is involved in R&D of PADAC, short for Power-Aware Dynamic Allocation Controllers. PADAC is a type of technology that helps to conserve energy use by employing software to control server resources at data centers. A simple way to illustrate this is that servers are much like any other household appliance—the newer it is, the more energy efficient.

In the past, half of the servers were modern units operating alongside old servers, but using each type for different purposes depending on particular usage situations is likely to bring energy savings. Actual conditions are naturally more complex, so we are seeking to control them using software to achieve the best balance of each parameter like compatibility between devices and applications, temperature, and utilization rate. When I joined the project, our first step was to gather all the technical theories available from throughout the company and examine them closely. Yet things are not likely to proceed smoothly if each project member were to simply bring together the type of technologies they

want, even if they featured the same topic of “software for controlling server resources.”

My research colleagues often had different opinions, but the project still went smoothly thanks to the common culture that all NTT researchers possess. Traditionally, the NTT Group never compromises when it comes to quality. Yet a key trait of NTT’s laboratories is that any topic being discussed is solidly based on by science. This means that no matter who you are talking to, you can have a true one-on-one discussion with any researcher here. This may seem obvious, but it is a very important point to note. If a supervisor suggests doing something a particular way, it is perfectly acceptable to say: “I

don’t think so.”

After much discussion and trial and error, we managed to come up with a pattern capable of controlling server resources at a high level of power efficiency. Right now we are finalizing the technology we have developed by filing patents and writing papers, and we are also moving ahead with running a prototype as a proof-of-concept model.

Technology developed at the center has no real social significance unless it is actually put to use. I hope to work with various NTT Group companies and outside affiliates to see PADAC in action in numerous situations in the future as a way of contributing to carbon neutrality.



## Business Activity 2

# Reduction of power consumption by introducing IOWN technologies

### Our commitment

The reduction in power consumption resulting from rolling out IOWN will help reduce greenhouse gas emissions throughout the NTT Group's its business activities and society as a whole

### Our objective

Reduce power consumption with the introduction of IOWN, and reduce the NTT Group's greenhouse gas emissions <sup>\*1</sup> compared to outcome.

### Background and Concepts

There is urgent need to create a society that can cope with global environmental changes such as climate change, major disasters, and pandemics. Developing next-generation energy technologies and technologies to enable resilient environmental adaptation will reduce the burden placed on the global environment and thereby prevent environmental destruction, opening the door to a sustainable society in which humans can continue to live in harmony with the environment. The NTT Group is committed to initiatives that reduce power consumption emissions throughout its business activities and society as a whole, by rolling out IOWN technology and increasing development and use of renewable energy sources.

### Initiatives for Realizing the IOWN Concept

The development of ICT has dramatically increased the volume of information being transmitted through networks. Up to now, energy has been saved by enhancing power efficiency through the introduction and renewal of highly energy-efficient telecommunications equipment. However, the performance and efficiency of integrated circuit technology which has grown in line with Moore's law, is thought to be approaching its limits in terms of speed and energy consumption due to the restrictions of nanoscale fabrication and integration density. NTT Laboratories is advancing research and development that incorporates optical technology into signal processing with the aim of using photonics to realize a base for a new kind of computing. This has resulted in the development of a modulator with the lowest ever reported energy consumption and an optical transistor which transfers a high-speed optical signal to another light with gain (announced in April 2019).

The NTT Group is advancing the development of photonic technology and we have established the IOWN (Innovative Optical & Wireless Network) concept as one of the pillars of an all-photonic network that incorporates photonic-based technology throughout entire networks, including terminals. The target of this all-photonic network will be to realize power efficiency that is 100 times greater in areas where photonics technology is applied, and we expect it will radically reduce energy consumption. We are collaborating with global partners and specialists in a wide range of research and technological fields with the aim of realizing the IOWN concept.

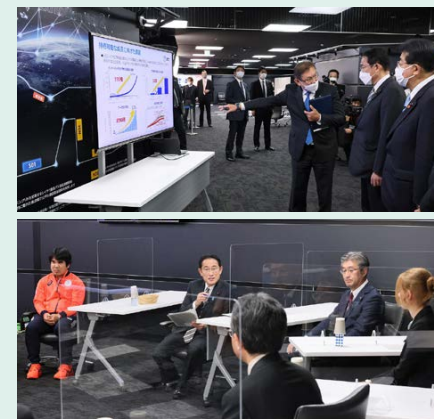
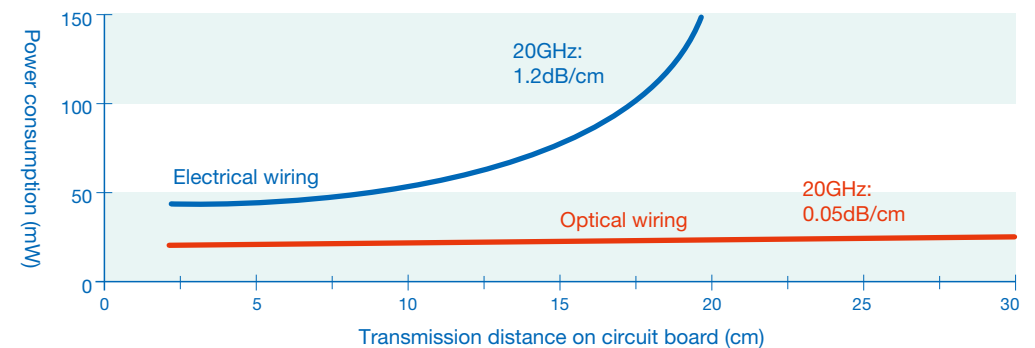
### Promoting Energy Conservation with IOWN

Conservation of the global environment and development of a sustainable society is the management theme of countless companies. The use of the NTT Group's next-generation communication platform "IOWN" for various ICT services used at customer companies not only helps to support these initiatives, but using IOWN extensively throughout NTT Communications' data centers, networks, and other infrastructure will lead to energy sav-

ings, paving the way to achieve carbon neutrality at data centers and networks by fiscal 2030.



### Higher efficiency and lower power consumption using light



### Business Activity

#### Highlighting the reduction in power consumption and other benefits of IOWN to the government

The NTT Group highlighted to the Japanese government the benefits of using its IOWN advanced technology, as a cutting edge communications infrastructure with major future potential for developing businesses in a wide range of fields. Rolling out IOWN to reduce power consumption and help achieve carbon neutrality provides Japan with a significant opportunity to lead the world in this sector.

<sup>\*1</sup> GHG Protocol: for Scope 1 and 2

Looking to the Future: IOWN

NTT R&D is envisaging the arrival of new smart societies that are not yet possible with today’s Internet, with features such as mobility as a service (MaaS) for extreme fail-safe systems and entertainment services offering deep immersion. To realize such smart societies, we will require innovation that cannot be achieved merely by extending the trajectory of current technologies; we will need to realize ultra-low power consumption, high-speed signal processing, and the fusion of virtual worlds that can equal or surpass reality with sophisticated prediction technologies. The NTT Group has proposed the Innovative Optical and Wireless Network (IOWN) concept to realize new smart societies, and we are committed to realizing this concept. In January 2020, the IOWN Global Forum was established in the United States by industry leaders NTT, Intel Corporation, and Sony Corporation, all three of which have superior expertise in the technological areas that form the core of IOWN. Wide-ranging recruitment efforts began in March 2020, with many companies both in Japan and overseas signing up as members, and specific technological considerations commenced through the use of online video conferencing. Going forward, we will work with a variety of partners for the earliest possible implementation of the IOWN concept.

Three Technological Layers that Constitute IOWN

Cognitive Foundation®

The Cognitive Foundation is a mechanism that centralizes management, operation, deployment, setting, and interlinking of ICT resources in different layers such as edge computers, network services, and user equipment, all from the cloud.

Technology development roadmap for realizing the IOWN concept  
<https://group.ntt/en/newsrelease/2020/04/16/200416a.html>  
NTT proposes the “Digital Twin Computing Initiative”  
<https://group.ntt/en/newsrelease/2019/06/10/190610a.html>

All-Photonics Network

Photonics technology is applied not only to networks but also to information processing to achieve large-capacity, ultra-low power consumption and ultra-high-speed data transmission that had been difficult in the past. We can provide multiple functions that serve as the backbones of social infrastructure without mutual interference by assigning a function to each wavelength on a single optical fiber.

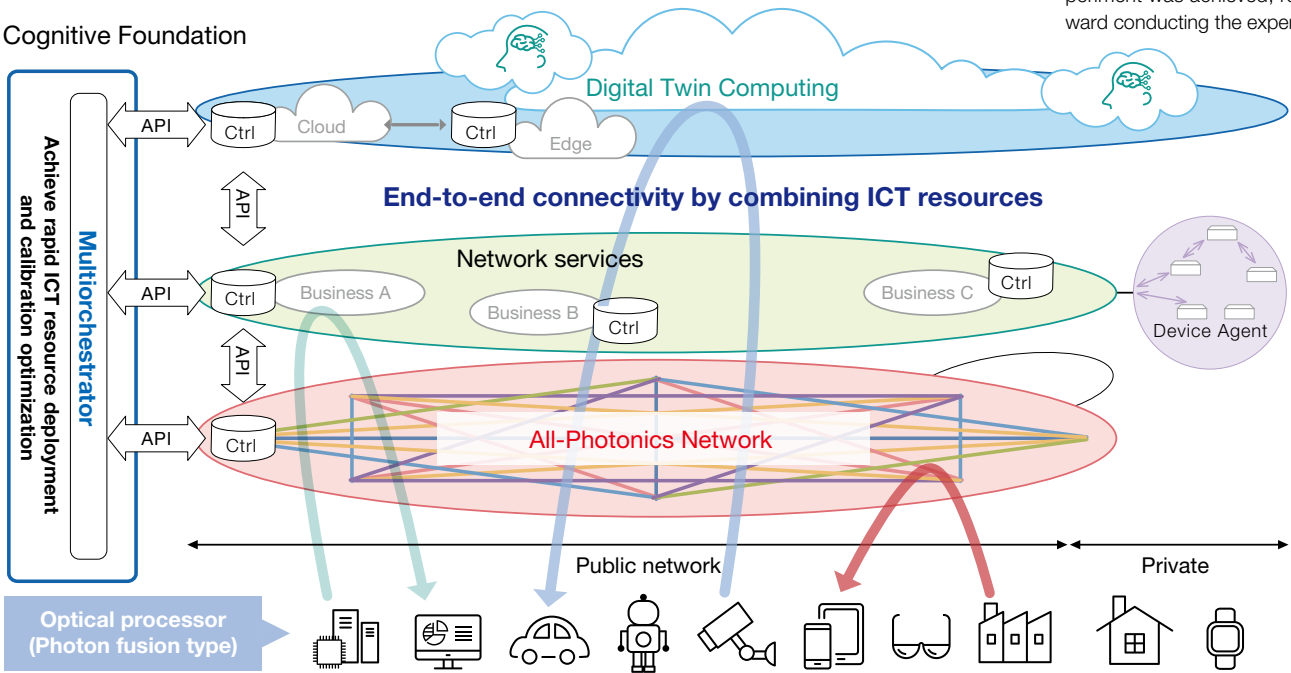
Digital Twin Computing

We combine highly precise digital information reflecting real-world objects, such as things, people and societies, to achieve large-scale, high-accuracy predictions and simulations of the future, and enable extremely advanced, real-time interactions between things and people in cyberspace.

Research and Development to Support the IOWN Concept

By using light as a means for transmitting signals inside the processors that perform information processing and calculations inside a computer, we hope to create a hybrid opto-electrical processor that will solve problems that arise with electrical processing, such as power consumption and increase in heat emission, and realize ultra-low power consumption and high-performance information processing. We have realized ultra-compact photo-electric conversion elements such as an optical transistor that uses nano-photonics technology.

To conduct a comparative time experiment by connecting several optical lattice clocks that are more precise than atomic clocks, the current standard for measuring seconds, we used the optical fiber network of NTT East for an optical frequency transmission experiment with the University of Tokyo. As a result, the required frequency precision for the comparative experiment was achieved, representing a major step toward conducting the experiment.





## Increasing the Capacity of Optical Fiber Communication Networks

Increasing the capacity of mission-critical optical fiber communication networks has become an economic necessity. We have developed new proprietary technology for digital signal processing and ultra-wide area optical devices, increasing the channel capacity per wavelength to the point that transmission speeds achieve a level more than 10 times that of current commercial systems, and achieving a global first of 1 Tbps of capacity in long-distance wavelength-division multiplexed transmission trials. Furthermore, we also succeeded in developing an ultra-high-speed compact optical front-end module with integrated compact, wide-band InP optical modulator.

As another accomplishment, we realized high capacity wireless transmissions at approximately 10 times the speed of LTE and Wi-Fi, and five times that of 5G, by using the following two technologies.

The first one enables wireless transmissions at rates of 100 Gbps by using a method devised by NTT combining a principle called "OAM multiplexing" with MIMO technology. This generates multiple radio waves of different frequencies so that they can transmit simultaneously without interfering with the each other. The result is a dramatic increase in the volume of data that can be transmitted simultaneously, enabling large-capacity communications.

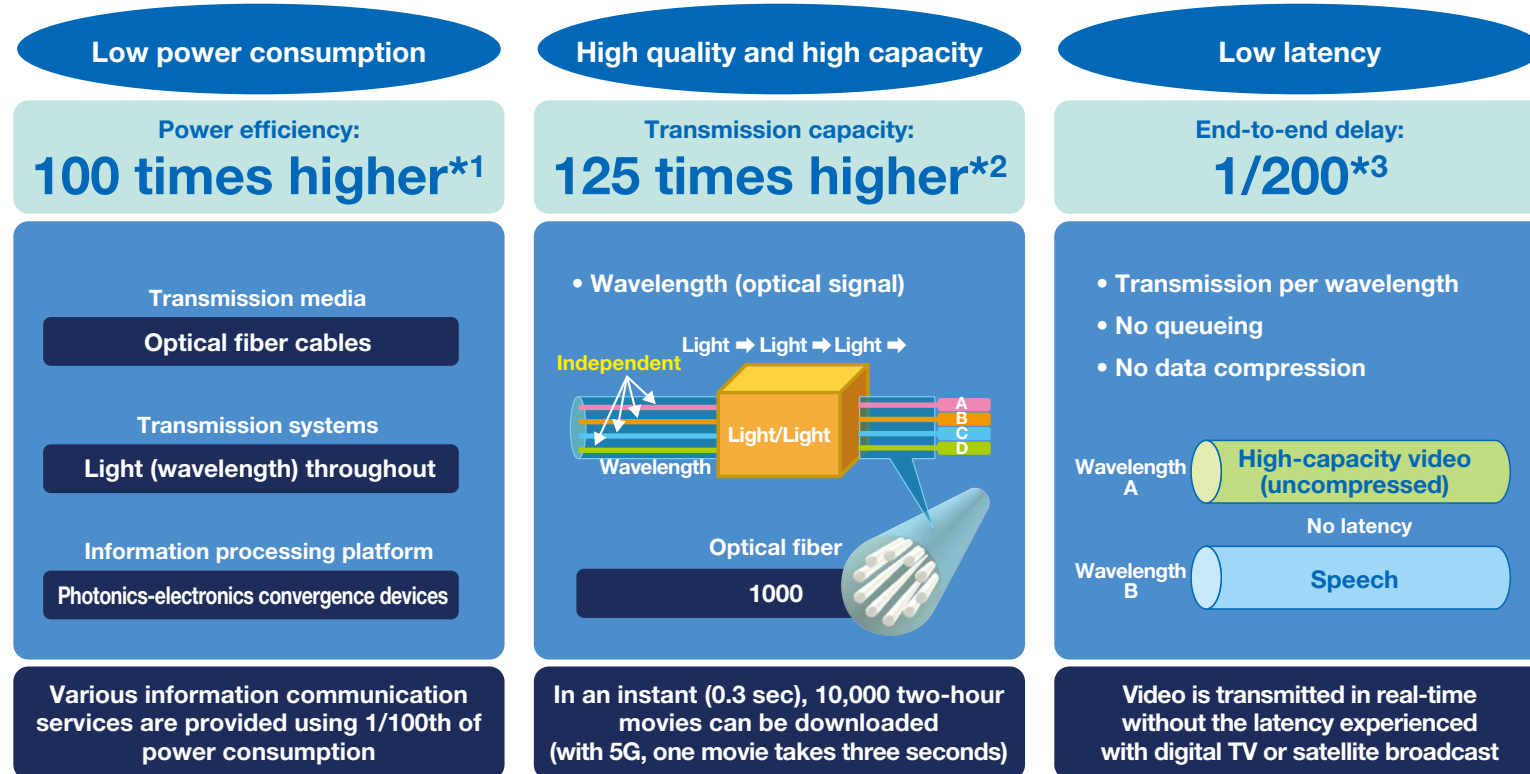
The second one, which was jointly developed with the National University Corporation Tokyo Institute of Technology, enables wireless transmissions of 100 Gbps in the 300 GHz band. It is easier to expand the transmission bandwidth or terahertz waves, including the 300 GHz band, although they require high-performance devices. We developed an ultra-high-speed integrated chip (IC) for wireless frontend devices, leading to the world's first 100 Gbps wireless transmission in the 300 GHz band.

## Optical Transistor Capable of High-Speed Operation with Ultra-low Power Consumption

As Moore's law approaches its limit in electronic circuits, there are expectations for a new, high-speed, energy-saving computing platform that incorporates optical technology. Achieving this requires technologies that have hitherto been considered difficult to achieve with low energy consumption, such as opto-electronic signal conversion and high-speed signal processing in the optical area. NTT has been develop-

ing a semiconductor nanostructure called photonic crystals with which to realize various tiny optical devices. In this work, we used our nanotechnology to realize a nano electro-optic modulator (E-O converter) and a nano photodetector (O-E converter) with extremely small capacitance and low energy consumption.

Moreover, through their integration, we also realized an O-E-O conversion optical transistor. These nano-optical technologies have opened the way to realizing high-speed, low-energy integrated opto-electronic information processing.



\*1 Target power efficiency for portion where photonics technology is applied

\*2 Target communication capacity per optical fiber cable

\*3 Target latency in video traffic not requiring compression within the same prefecture

## Business Activity 3

# Developing and expanding the use of renewable energy

### Our commitment

Developing and promoting greater use of renewable energy

### Our objective

Increase the use of renewable energy, and reduce the NTT Group's greenhouse gas emissions\*<sup>1</sup> compared to outcome\*<sup>2</sup>.

### Background and Concepts

The NTT Group is increasing its use of renewable energy\*<sup>3</sup> as part of efforts to achieve its Environment and Energy Vision. The NTT Group is pushing ahead with development of renewable energy sources with the aim of generating around half of its renewable energy target from its own facilities by fiscal 2030.

### Use of Renewable Energy

During fiscal 2021, a total of 1.8 billion kWh of power consumed (or 23% of power consumption, around 150% year-on-year) throughout the entire NTT Group was switched over to renewable energy sources.

In 2020, the NTT Holdings head office and four facilities of NTT Laboratories made the switch to effectively 100% renewable energy\*<sup>4</sup>. As of April 2022, 132 buildings of the NTT East Group including the Hatsudai Building, 325 buildings of the NTT West Group, and 55 buildings of the NTT DOCOMO Group were among those that have already switched to renewable energy.



### Development of Renewable Energies

Renewable energy like solar power, wind power, geothermal, and biomass do not generate greenhouse gases when producing power, an advantage that makes developing and expanding the use of renewable energy an essential part of initiatives aimed at achieving a decarbonized society. The NTT Group established NTT Anode Energy in June 2019 with the aim of delivering smart energy solutions that leverage the technology, expertise, and resources of the NTT Group. Focused on achieving a decarbonized society and the promotion of local energy production for local consumption, NTT Anode Energy operates on three core approaches: (1) Providing customers with green energy solutions; (2) Promoting NTT's own decarbonization efforts; and (3) Utilizing battery farms to increase use of renewable energy.

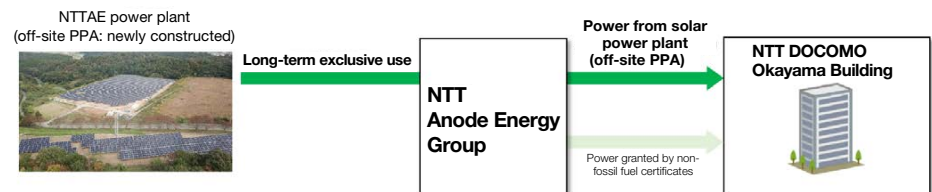
NTT Anode Energy is working together with various partners to develop renewable energy power plants in order to meet the green energy requirements of NTT Group companies. With a primary focus on sustainability, the company advancing development that takes into consideration ecosystems and living environments.

## Business Activity

### Initiatives rolled out at company buildings

By utilizing an off-site corporate PPA\*<sup>5</sup> mechanism, power derived from renewable energy, procured from NTT Anode Energy's newly constructed solar power plant, is being supplied into the NTT DOCOMO Okayama Building, which houses network facilities.

Greenhouse gas emissions at the NTT DOCOMO Okayama Building, where the new system will be installed, are expected to be reduced by approximately 10,000 tons per year (including non-fossil fuel certificates).



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\*1 GHG Protocol: for Scope 1 and 2

\*2 The introduction of effectively 100% renewable energy (including actual renewable energy through non-fossil fuel certificates) will have the optimal types of energy determined on the basis of each country's energy composition, etc. Approximately half of the domestic renewable energy usage is anticipated to be from energy sources owned by NTT (FY2030).

\*3 Includes actual renewable energy through non-fossil fuel certificates.

\*4 Refers to power generated from actual renewable energy that includes specified renewable energy through non-fossil fuel certificates.

\*5 Japan's first off-site corporate PPA scheme, which involves business operators building renewable energy power plants in locations removed from users for use exclusively by specified consumers, such as companies or municipalities, and supplying these users with electricity via the power grid over the long term.

## Expanding the Use of Renewable Energy

Together with the development of renewable energy sources, the NTT Group is also expanding its concept of local energy production for local consumption to stabilize the power grid, by charging and discharging its constructed battery farms.

There are some 7,300 NTT buildings located around Japan, housing around 4 million kWh of battery storage capacity that the NTT Group uses to maintain communications in the event of power outages. The group will develop battery farm operations around Japan by utilizing these battery farms to increase the use of renewable energy and help stabilize the power grid. With these businesses, NTT Anode Energy will partner with subsidiaries ENNET and NTT Smile Energy to help overcome various challenges on the way to developing a carbon-free environment for all of society.

This is achieved through a corporate PPA (Power Purchase Agreement), where customers use the electrical power generated from renewable energy power plants constructed on their sites or in remote locations.

Leading companies focus on the “Additionality” concept, where companies are encouraged to make investments in renewable energy projects as their selected source of financing, as a way of displacing the use of fossil fuels. NTT Anode Energy projects comply with the “Additionality” framework, so customers are able to use power generated from renewable energy via a corporate PPA.

\*1 Japan's first off-site corporate PPA scheme, which involves business operators building renewable energy power plants in locations removed from users for use exclusively by specified consumers, such as companies or municipalities, and supplying these users with electricity via the power grid over the long term.

### Business Activity



#### NTT Anode Energy

Supplying 100% renewable energy to Seven & i Holdings stores and operations

In a joint project with Seven & i, NTT Anode Energy began powering 40 Seven-Eleven stores and the Ario Kameari shopping center completely with renewable energy. NTT Anode Energy supplies electricity via the power grid from two solar power plants established through an off-site corporate PPA<sup>\*1</sup>. The NTT Group's green power plants are used to cover any shortfall in power supply.

### Business Activity



#### NTT Anode Energy

Woody biomass power generation project in Ikoma City, Nara Prefecture

NTT Anode Energy is taking part in a woody biomass power generation project (Ikoma Project) operating in Ikoma City in Nara Prefecture, Japan. The Ikoma Project involves the construction

and operation of a 9,980 kW-scale power plant that uses around 100,000 tons of wood-derived fuel to generate 81 million kWh of power annually. The fuel used to generate power with this project is wood waste and unused wood collected from around the Kinki region, providing a supply of locally produced and local consumed power, including fuel for power generation, to customers in the Kinki region. Around 75% of the power generated is non-FIT that does not fall under FIT systems; the supply of carbon-zero electricity helps to create a carbon-free society.

### Business Activity

#### NTT Anode Energy / NTT West

Supplying green electricity to regional exchange centers in Yamaguchi City as part of the “Smart Energy Utilization Project”



NTT Anode Energy and the Yamaguchi Branch of NTT West joined forces to begin supplying green electricity to the Hirakawa Regional Exchange Center and the Ootoshi Regional Exchange Center in Yamaguchi City via NTT Anode Energy. Renewable energy equipment—solar panels and battery storage systems—have been installed at both centers to supply power during normal conditions as well as for specific uses during power outages (such as lighting, wireless disaster warning systems, computers, and communication equipment), which helps to boost resiliency at evacuation facilities.

ICT is also in use for visualizing the characteristics like the amount of power generated, weather information, on-site usage ratio, battery level, and the amount of power generated and consumed on-site. This data is not only available at the site, but can also be viewed at the main government building and other remote locations. Efforts will continue to be made to resolve local issues through joint studies on the “Smart Energy Utilization Project” that makes use of renewable energy and ICT, as a part of the project to develop Yamaguchi City as a smart city.



## Business Activity 4

# Providing new services that contribute to carbon neutrality

### Our commitment

Promoting the provision of new services that contribute to carbon neutrality

### Our objective

Provide new services designed with the environment in mind, such as the development of services that use renewable energy, and visualization of the reduction in greenhouse gas emissions.

### Background and Concepts

In addition to the Green of ICT, which will curb the environmental impact of NTT Group by introducing IOWN technologies and increasing the use of renewable energy, we will also work on Green by ICT, which will contribute to reducing the environmental impact of society as a whole.

### NTT DOCOMO Green 5G

In September 2021, NTT DOCOMO announced “2030 Carbon Neutral Declaration,” committing to the reduction of the greenhouse gas emissions arising from its business activities effectively to zero by 2030. In addition to its own business activities, DOCOMO has devised the slogan “Saving Our Planet With You” to help achieve carbon neutrality throughout the whole of society, together with its customers and partner companies. DOCOMO provides Green 5G as part of its service aimed at achieving carbon neutrality.

While the power used to recharge smartphones and other mobile devices may be the first thing one thinks of when it comes to the power that these devices use, a significant amount of power is actually consumed by mobile network communications that operate base stations and exchanges.

The majority of electricity in Japan still uses fossil fuels for power generation, thus resulting in greenhouse gas emissions like CO<sub>2</sub> that is one of the causes of global warming. DOCOMO is making the switch to power sources free of greenhouse gas emissions, by using solar-powered green base stations and renewable energy (corporate PPA<sup>\*1</sup>) generated by solar panels installed specifically for DOCOMO.

The ratio of actual renewable energy<sup>\*2</sup> out of DOCOMO's total power consumption is higher than the ratio of 5G subscribers out of the total number of subscribers, which means the Green 5G service is provided effectively free of greenhouse gas emissions.

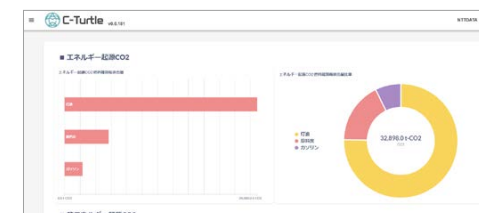


### NTT DATA's greenhouse gas emissions visualization platform, C-Turtle™

To achieve carbon neutrality throughout the whole society, NTT DATA has been providing C-Turtle™, its greenhouse gas emissions visualization platform.

In recent years, companies have been expected to visualize their greenhouse gas emissions, but with so many different calculation methods available, choosing the best method has proven to be a difficult task. The most common method that companies use to calculate their emissions uses the formula “Amount of activity (quantity and value of raw materials and products)” x “Emissions intensity (fixed emissions set for that product (industry average))”. The problem with this method is that the calculation results do not show any effects of reduction even when switching from older products to green products or services in order to reduce the amount of emissions. The provided platform offers a “visualization process construction method” that facilitates the creation of calculation methods suitable for each company based on its business characteristics and the data it possesses. It also offers a “supplier-specific calculation method” that incorporates the emissions reduction efforts of suppliers into the same reductions at procuring companies. This allows for efficient and effective visualization of emissions specific to each company.

DOCOMO's 5G service is Green 5G with effectively zero greenhouse gas emissions



Emissions data and sales figures provided by global non-governmental organization CDP are used to calculate emissions intensity for each company. NTT DATA is the only company in Japan licensed to use CDP's corporate emissions data.

<sup>\*1</sup>: PPA, an abbreviation of Power Purchase Agreement, is a scheme in which electricity users (DOCOMO) conclude contracts with power generation business operators to procure renewable energy over the long term.

<sup>\*2</sup> Achieves effectively 100% renewable energy, including non-fossil fuel certificates for specified renewable energy.

## Business Activity 5

# Creation of innovative environment and energy technologies

### Our commitment

Creation of innovative environmental energy technology for reducing global environmental impact

### Our objective

Promoting the creation of innovation with next-generation energy technologies.

### Background and Concepts

The NTT Group is creating innovative technologies aimed at addressing a range of issues related to the environment and energy such as climate change. In July 2020, we established the NTT Space Environment and Energy Laboratories for regenerating the global environment and achieving a sustainable and inclusive society. We will create technologies that will drive innovation in the field of smart energy, including next-generation energy, and for the future of the global environment.

### Energy network technologies

Indoor direct-current power supply technology—a field that the NTT Group excels at—is being developed for outdoor use with the aim of achieving a high-resilience, autonomous, decentralized, and coordinated energy network to link NTT buildings and consumers in the surrounding area with direct current supply, for a flexible and efficient power supply system that is also reliable when disasters strike. Research is being conducted into technology that simulates information on energy demand, generation and storage capacities in cyberspace in an integrated manner, and applies the optimal figures to control the actual grid and achieve an ideal balance between supply and demand. Another field of study is focusing on technology for the spatial and temporal reallocation of communications traffic between multiple regions or calculations and other information processing capabilities for more efficient use of renewable energy, which is prone to fluctuations due to weather conditions.

### Sustainable systems technologies

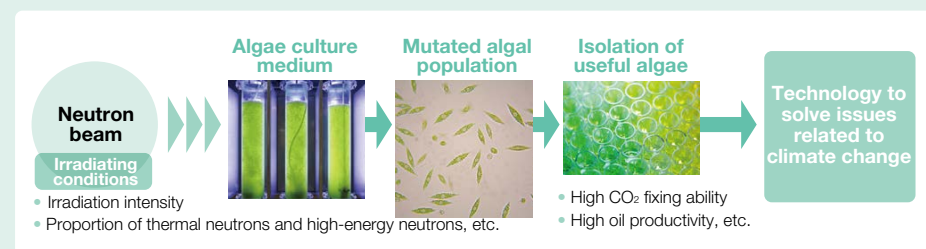
Practical applications of technology that reduces CO<sub>2</sub> in the atmosphere or water are being developed, covering artificial photosynthesis (based on an electrochemical approach) achieved with semiconductor technology and catalyst technology, as well as technology that maximizes the capabilities of plants and algae (based on a biological approach). The electrochemical approach utilizes materials informatics to test combinations of materials that would not have been possible to discover using traditional experimental techniques or existing concepts. The biological approach involves research using digital twins, where various cultivation environments are recreated in cyberspace to test the effects of genome editing or climate control, before applying them to the real world for additional testing.

### Proactive environmental adaptation technologies

We are focusing our efforts on research topics enabling society to take a proactive stance and adapt physically to extreme weather or environmental conditions. Lightning is an example of research being conducted on weather control. We have developed advanced technologies as a means of protecting communications facilities from lightning strikes, and we are now expanding our research in this field to develop lightning control and lightning charging technologies. More specifically, this research involves high-precision forecasting of areas prone to lightning strikes, employing lightning control technology so that drones trigger lightning strikes, and then lightning charging technology to store the energy from that lightning. The future goal is to develop floating lightning energy absorption systems that operate autonomously using natural energy including that from lightning strikes to absorb energy before the lightning strikes the ground.

### Business Activity

NTT has teamed up with Euglena Co., Ltd. to begin a proof-of-concept for seaweed growth technology aimed at resolving climate change-related challenges by using neutron beams<sup>\*1</sup> to reduce greenhouse gases or create energy resources. The technology showcased with this proof-of-concept uses neutron beam irradiation to trigger genetic mutation<sup>\*3</sup> for increasing the useful characteristics<sup>\*2</sup> of algae, such as its CO<sub>2</sub> (carbon dioxide) absorption and fixation potential and ability to produce oils that form the raw material of biofuels. Neutron beams have a much higher level of permeability than other types of radiation, and can provide an effective and irregular form of energy required for living organisms growing in liquids, like algae. Selecting and irradiating with suitable thermal neutrons or high-energy neutrons enable various forms of genetic mutation to occur, which will make it possible to grow and produce algae that is more usable, and more suited to particular applications. And in addition to reducing greenhouse gases or producing energy resources, the technology is hoped to play a role addressing various other climate change-related issues, with solutions involving the creation of food sources or agricultural, forestry and fisheries-derived feed.



\*1: Neutron beam: A neutron is a particle that makes up an atomic nucleus. When a nucleus undergoes nuclear fission, neutrons are released from the nucleus along with kinetic energy. The unidirectional movement of this energy is called a neutron beam.

\*2: Morphological characteristics: Refers to the properties or characteristics of living organisms.

\*3: Genetic mutation: Refers to when the base sequence of DNA that makes up genes mutate from the original sequence. Genetic mutation modifies the functions of proteins that are made by genes.

## Other initiatives

### Reduction of environmental impact throughout the supply chain

The NTT Group has released the “NTT Group Guidelines for Sustainability in Supply Chain” outlining various areas that we require all parties throughout our supply chain to comply with, as part of efforts to develop and achieve a supply chain free from social problems like human rights violations, environmental concerns and safety issues. These guidelines contain the responsibilities that each company in the supply chain should be taking in order to achieve a sustainable society.

The “NTT Group Green Procurement Standards” has been released to cover environmental-related details outlined in the “NTT Group Guidelines for Sustainability in Supply Chain.” These standards provide an outline of the NTT Group’s environmental activities, and include areas and laws that suppliers must follow, reference and strive to achieve, as well as items covering procurement assessments for products and suppliers. This document applies to NTT Group companies, including those overseas.

We assess environmental and other risks by conducting the Supply Chain Sustainability Survey (SAQ) using the Supply Chain Sustainability Promotion Check Sheet to confirm the status of compliance with environmental and other guidelines and technical requirements. The survey targets all of the NTT Group’s critical suppliers that account for at least 90% of total procurement value, supplier of non-substitutable products and supplier of important products. From fiscal 2022, we have started holding “direct dialog” every year with 40 to 50 companies covered by the SAQ.

### Highest rating in 2021 Supplier Engagement Ratings by CDP

The NTT Group was praised for its efforts aimed at reducing CO<sub>2</sub> emissions throughout its entire supply chain, and has been selected as the highest “Supplier Engagement Leader” in the “Supplier Engagement Survey”<sup>\*</sup> run by CDP, an international non-governmental organization assessing environmental-related matters.

<sup>\*</sup> Supplier Engagement Survey: Assesses company supply chain activities that affect climate change. Companies assessed with the highest ratings are selected as “Supplier Engagement Leaders.”



#### Technical Requirements listed in the NTT Group Guidelines for Sustainability in Supply Chain (Environment)

1. Obtain environmental permits and report to the government
2. Manage chemical substances contained in products
3. Manage chemical substances
4. Minimize environmental pollution (wastewater, sludge, exhaust, noise, vibration, etc.)
5. Reduce energy consumption and greenhouse gas emissions
6. Reduce environmental burden by implementing product assessment
7. Effectively use resources and manage waste
8. Conserve biodiversity
9. Implement environmental investigations in the supply chain

#### Environmental risk assessments with the Supply Chain Sustainability Survey (SAQ)

In fiscal 2021, NTT ran a sustainability survey for around 130 suppliers with the aim of assessing and identifying environmental and other risks throughout the entire supply chain. The survey covers 25 environmental-related items such as regulation and administrative reporting, management methods, and energy-saving and decarbonization initiatives.

#### [Examples of survey items]

Tell us about your activities aimed at reducing greenhouse gas emissions.

(options)

1. We release our targets and results for greenhouse gas emissions (greenhouse gas emissions targets are equivalent or higher than NTT’s targets (\*))
2. We release our targets and results for greenhouse gas emissions (greenhouse gas emissions targets are lower than NTT’s targets (\*), but there are plans to revise them to the equivalent or higher than NTT’s targets within a year)
3. We release our targets and results for greenhouse gas emissions (greenhouse gas emissions targets are lower than NTT’s targets (\*), and there are no plans to revise them within a year)
4. We do not release our targets and results for greenhouse gas emissions

(\*) Emissions in the supply chain related to business activities (Scope3): 15% reduction by FY2030 from a FY2018 base year  
(Reference) <https://group.ntt/en/newsrelease/2021/12/03/211203a.html>



## Procurement Through NTT Group Green Finance

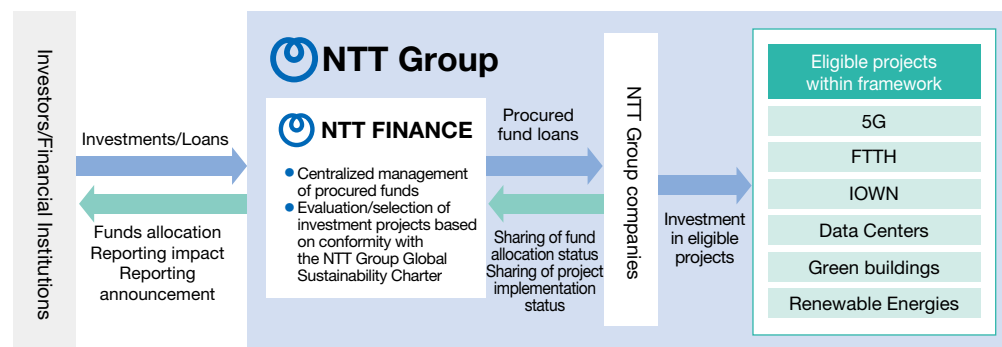
NTT Group has formulated the NTT Group Green Finance Framework with the goal of strengthening its commitment to Group-wide efforts to achieve a sustainable society and promoting them vigorously, including from a financial perspective. Since its establishment in June 2020 as the NTT Group Green Bond Framework, this framework has been revised in accordance with the Group's initiatives for making a sustainable society a reality.

NTT FINANCE, the Group's core financial company, will issue green bonds or procure funds through green loans in accordance with the Green Finance Framework.

The funds raised will be invested in projects that contribute to solving environmental issues at Group companies.

When raising funds, NTT FINANCE will evaluate and select investment projects based on conformity with the NTT Group Sustainability Charter. It will also centrally manage procured funds and confirm their appropriation for projects. The Group will report annually on the allocation of funds and the project's environmental impact. The Green Finance Framework as well as Fund Allocation Status Reporting and Impact Reporting are available on the NTT FINANCE website.

(<https://www.ntt-finance.co.jp/eng/ir/greenbonds/index.html>)



## Green Bond Issuance Status

June 2020 ¥40 billion in total	Eligible projects: Green buildings
October 2021 ¥300 billion in total	Eligible projects: 5G-related investments, FTTH-related investments, R&D for achieving the IOWN concept, and renewable energy
December 2021 EUR 1.5 billion in total	
July 2022 USD 1.5 billion in total	

## Green Finance Framework Target Projects

Eligible projects:	Specific projects	Impact reporting item
5G-related investments	Development and installation of energy-saving 5G base stations/installation of commercial base stations and development of base stations capable of conserving electricity by automatically switching to sleep mode, such as during the evenings and time of low traffic	<ul style="list-style-type: none"> <li>Number of 5G base stations installed</li> </ul>
FTTH-related investments	Construct and operate optical fiber networks (FTTH) as foundation for a remote world, to help reduce amount of electricity used compared with the Company's conventional equipment	<ul style="list-style-type: none"> <li>Number of subscribers (households)</li> </ul>
R&D to make IOWN a reality	Roll out/aim to commercialize by 2030 photonics-based connections between bases at endpoint devices, such as handsets and computers, R&D to make possible an optical disaggregated computing architecture that should sharply reduce electricity usage through the use of photonics connections (optics inside LSI) when transmitting signals between chips on circuit boards	<ul style="list-style-type: none"> <li>Desired effects</li> <li>R&amp;D progress</li> </ul>
Highly efficient and power-conserving data centers	Construction, renovation, acquisition, and operation of new and existing data centers with a Power Usage Effectiveness (PUE) of less than 1.5	<ul style="list-style-type: none"> <li>CO<sub>2</sub> emissions (t-CO<sub>2</sub>)</li> </ul>
Green buildings	Construction, renovation, and acquisition of various environment-related building certifications and evaluations for properties to be acquired	<ul style="list-style-type: none"> <li>Green building names, certification level, acquisition/re-acquisition period</li> <li>CO<sub>2</sub> emissions (t-CO<sub>2</sub>)</li> </ul>
Renewable Energies	Construction, renovation, acquisition, and operation of renewable energy projects (solar power, wind power, etc.) NTT Group is involved in	<ul style="list-style-type: none"> <li>Generation capacity/generated electricity (GWh)</li> <li>Amount of CO<sub>2</sub> reduced (t-CO<sub>2</sub>)</li> </ul>

## Social Challenge

# 2

## Implementing closed loop recycling

### Business Activity

6. Increasing the reuse and recycling of communications equipment, mobile terminals, and other technologies
7. Reduction in plastics use and promotion of recycling
8. Proper treatment, storage, and management of hazardous waste
9. Appropriate and efficient management of water resources



### Why it matters

Although our one-way society of mass production, mass consumption, and mass disposal has brought affluence and convenience to our lives, it has brought about various problems such as the creation of massive amounts of refuse, illegal dumping and concern about the depletion of natural resources. To resolve these issues we must first review how companies manage their businesses as well as our social and economic systems, and shift to a closed loop society.

### What can be accomplished

In an effort to realize a future with closed loop recycling, the NTT Group promotes the 3Rs (reduce, reuse, and recycle), working to reduce the amount of materials consumed by our business activities and reuse or recycle the resources that are consumed.

### Future vision

We will shift from a one-time use consumption-oriented company to a recycling-oriented one. We will promote the effective use of resources throughout the entire life cycle of products and systems, from procurement to use and disposal.



## Business Activity 6

# Increasing the reuse and recycling of communications equipment, mobile devices, and other technologies

### Our commitment

Promoting the 3Rs (reduce, reuse, and recycle), working to reduce the amount of materials consumed by our business activities and reuse or recycle the resources that are consumed

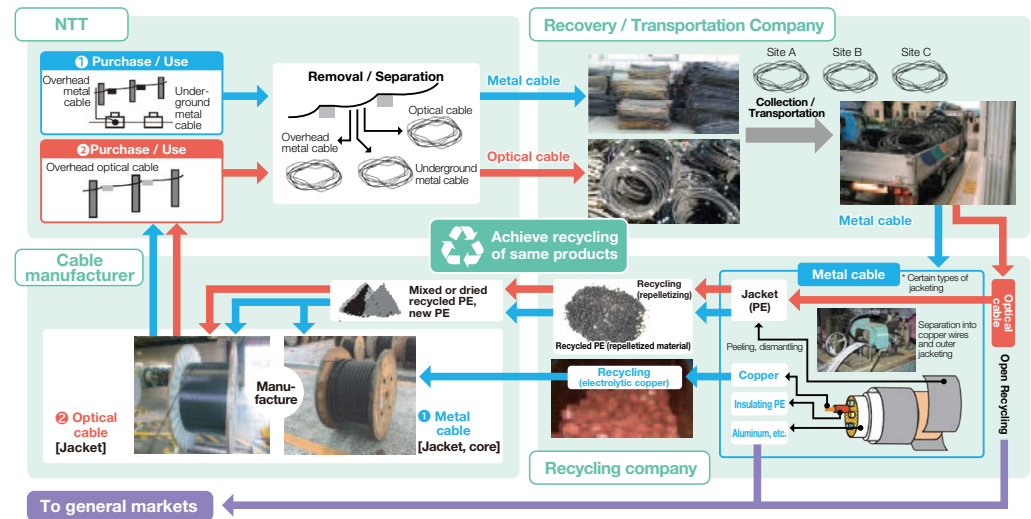
### Our objective

**99% or higher**

FY2030: Recycling ratio of disposed waste generated by the NTT Group

### Background and Concepts

The NTT Group has established a target for achieving a 99% or higher recycling ratio of disposed waste generated by the NTT Group by fiscal 2030. We require a large amount of resources in order to sustain our business operations and provide various services including information communication. This is why we have set a target to contribute to both the avoidance of business continuity risks and achievement of closed loop recycling. In fiscal 2021, the recycling ratio of disposed waste was 97.8%. We will continue to work hard to promote the 3Rs toward our goal of 99% or higher. Regarding decommissioned telecommunications equipment, we have achieved zero emissions (1% or lower final disposal ratio of waste) for 18 consecutive years since fiscal 2004.

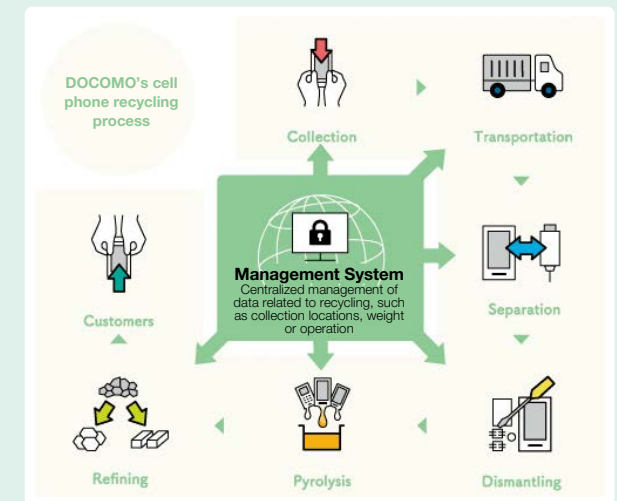


### Business Activity

#### NTT DOCOMO Recycling Process for Mobile Phones

Since 1998, NTT DOCOMO has collected used mobile phones from customers at its approximately 2,300 docomo shops throughout Japan, and through various events. Containing gold, silver, copper, palladium, and other metals, mobile phones could be regarded as a valuable recycling resource in Japan with its paucity of mineral resources.

1. In fiscal 2021, we collected about 3.23 million\*1 mobile phones, bringing our cumulative total to 121.55 million units collected.
2. In fiscal 2011, the company introduced a new recycling process for pyrolyzing any plastic used in mobile phones to turn it into oil for use as a fuel, after which gold, silver, and other metals are recovered from the residues of this process.



\*1 The number of units collected for reuse is included in the figure after fiscal 2015.



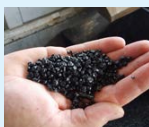
## Business Activity

### NTT Communications

#### Sustainable Systems Produced by Subsea Cable Recycling

The normal length of subsea cables installed in Japan's territorial waters is 20 to 30 km per cable run, but the cable managed by NTT Communications connecting Kagoshima Prefecture with Okinawa Prefecture is 250 km in length as it passes through various islands en route. The cable went out of service in 2018 and was expected to result in about 850 tons of waste, presenting a significant challenge in terms of environmental impact and disposal costs. Therefore, NTT Communications concluded an agreement with South Africa's Mertech Marine, the only operator in the world capable of completely disassembling subsea cables to the level of raw materials, to develop a new scheme for controlling both environmental impact and disposal costs by recycling 99% of the cable that requires disposal. It is also contributing to creating regional safety nets through Marine Mertech with the employment of unskilled workers and donations to non-profit organizations engaged in initiatives such as supporting impoverished families.

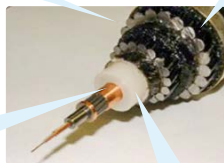
Coal tar coating for armor wire completely separated and pelletized



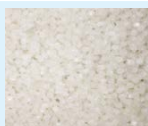
Outer armor wire properly coiled



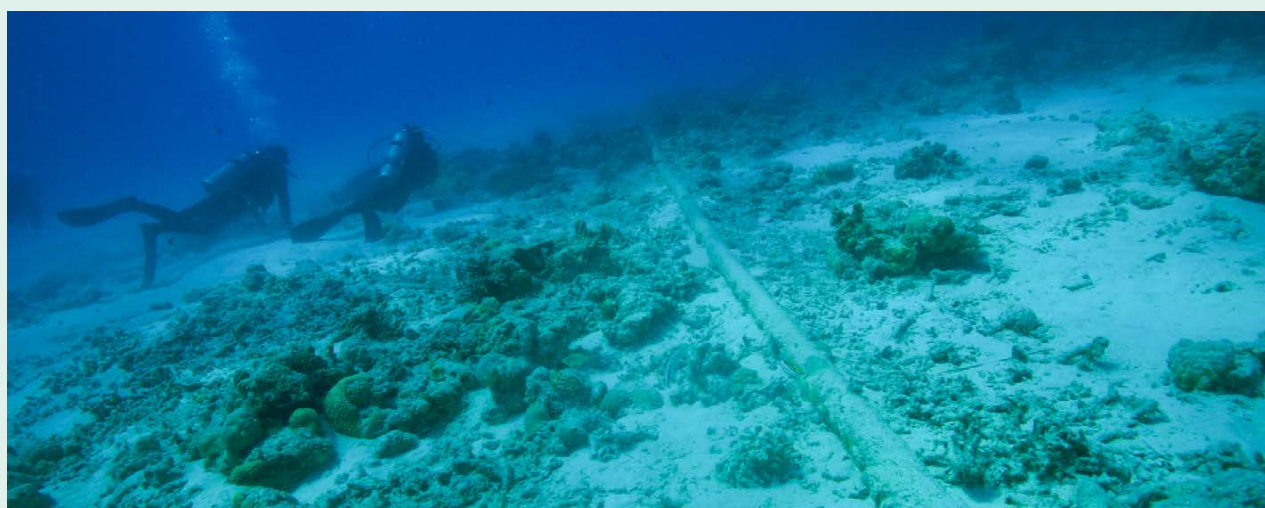
Copper tape separated and pelletized



High-purity polyethylene used for outer cover can be sold at high price if completely separated and pelletized



**Currently, all components other than optic fibers are completely recycled (99% of total volume).**



## Business Activity 7–8

# Reduction in plastics use and promotion of recycling Proper treatment, storage, and management of hazardous waste

### Our commitment

Reduction in plastics use and promotion of recycling Proper treatment, storage, and management of hazardous waste

### Our objective

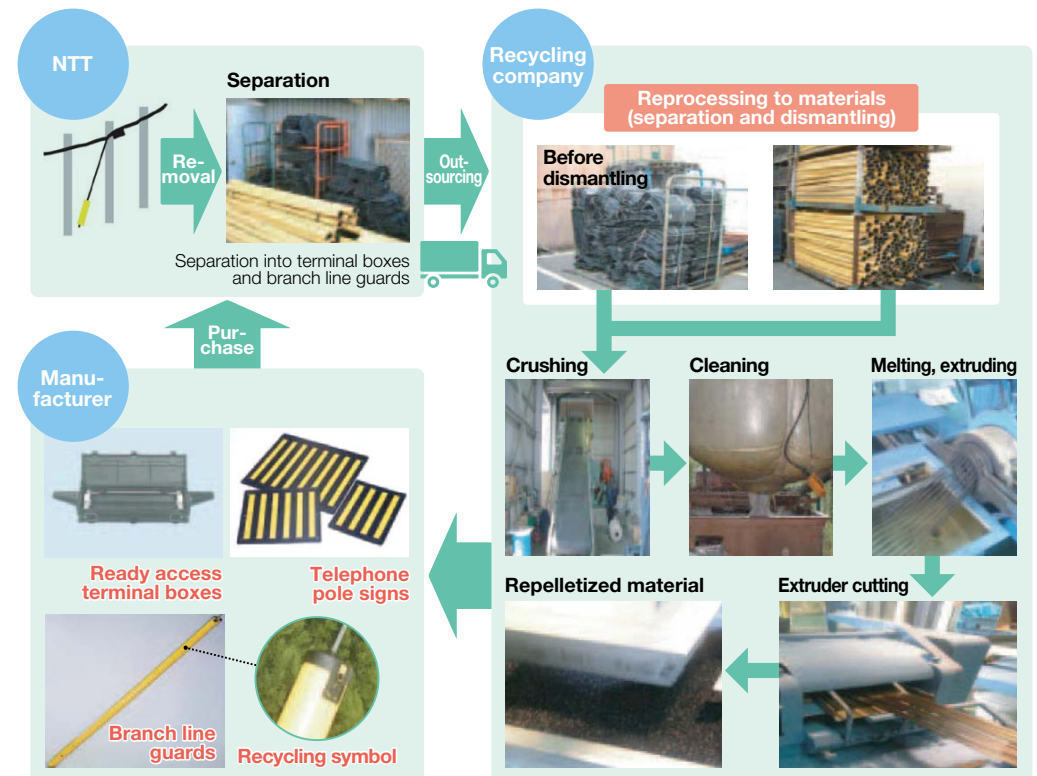
Reduction in plastics use and promotion of recycling of plastics including telecommunications equipment, hazardous waste disposed of in compliance with laws and regulations, and ensure proper storage, management, and disposal.

### Background and Concepts

The NTT Group is seeking to reduce the use of plastics and promoting recycling. For example, plastic parts of telecommunications equipment such as coverings for branch lines and ready access terminal boxes are used in a closed recycling system in which similar types of disposed covers are recycled into plastics to manufacture new products. We are also seeking to abolish the use of plastic packaging materials for devices used at customers' homes when connecting optical lines such as optical network units (ONU) and home gateway (HGW) units.

### Hazardous Waste

For NTT Group operations, hazardous waste as defined by law applies to asbestos contained in waste generated from construction work on relay stations, waste such as transformers and condensers containing PCBs, and lead batteries. These are disposed of appropriately and in compliance with the Waste Management and Public Cleansing Law (Waste Disposal Law) as well as other laws and regulations, and the NTT Group does not have a record of disposing of such waste in foreign countries. We also pay meticulous attention to the proper storage and management of equipment containing PCBs and PCB contaminated wastes, and dispose of them with safe and appropriate methods in conformity with the Law Concerning Special Measures Against PCB Waste.





## Business Activity 9

# Appropriate and efficient management of water resources

### Our commitment

Managing water usage and protecting valuable water resources

### Our objective

The NTT Group is Reducing its Consumption of Tap Water, and Implementing Thorough Measures Against Leakages of Chemical Substances into Wastewater.

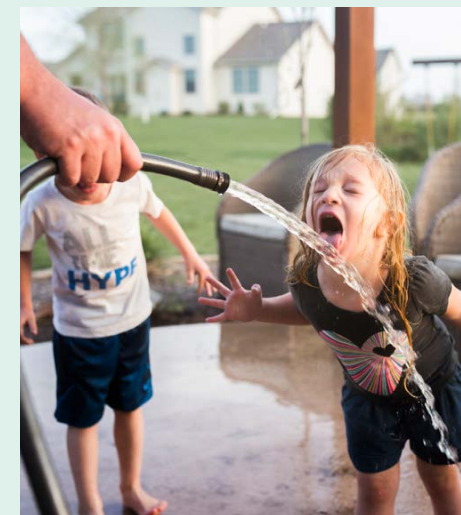
### Background and Concepts

Due to the nature of the NTT Group's business, little water is consumed in our operations. In Japan, one-year domestic and industrial water consumption totaled 25.5 billion m<sup>3</sup><sup>\*1</sup>, while the NTT Group's water consumption totaled 4.751 million m<sup>3</sup>, only about 0.02% of the total for all of Japan. Moreover, our water use is spread out across the country and so we believe our water intake does not have any significant impact on water sources. The NTT Group reduces its consumption of tap water by using recycled wastewater and rainwater. Research centers where we use chemical substances in our research activities implement individual measures against leakages of chemical substances into wastewater. For example, at the Atsugi R&D Center, which carries out research on the physical properties of materials, we have installed equipment to treat chemical-infused waste liquid discharged by the laboratories. Furthermore, we regularly monitor the quality of this wastewater to confirm that it is within legal regulation values. The NTT Group has not been involved in any significant spills.

### Business Activity

#### Providing People All Over the World with Clean, Safe Drinking Water

NTT DATA Italia has been researching smart water management systems that incorporate IoT since 2016. Through processes such as hackathons, in which various engineers from throughout the company meet to share opinions and ideas, it has developed origAMI (original Advanced Metering Infrastructure). In addition to enabling appropriate monitoring, such as reducing leakage rates by monitoring pipe networks in real time, this infrastructure also functions as a tool for the prevention of accidents by running simulations and accumulating measurement data for each region. Currently it is being used in public works in Italy and we plan to expand its use to other parts of Europe and then Asia.



### Business Activity

#### NTT DATA Services

#### Water restoration project in Chennai

Waste and other forms of pollution have significantly affected the biodiversity of Lake Ka Nagar Nagar in Perambur, Chennai of Tamil Nadu, India. In light of these conditions, NTT DATA Services worked with the Environmentalist Foundation of India (E.F.I.) constructing recharge wells and removing waste and foreign plants, which helped to improve the environmental conditions of the lake.

<sup>\*1</sup> From the Ministry of Land, Infrastructure, Transport and Tourism website. Actual water use in 2018 (water intake basis) was approximately 79.1 billion m<sup>3</sup> per year (domestic and commercial use of water: approximately 15.0 billion m<sup>3</sup>; water for industrial use: approximately 10.6 billion m<sup>3</sup>; water for agricultural use: approximately 53.5 billion m<sup>3</sup>).



## Other initiatives

### Business Activity



#### NTT BUSINESS SOLUTIONS

##### Providing resource recycling solutions for regional foods

Reducing food waste and developing food recycling programs are drawing increased attention around the world these days. One way to address these recycling problems like these is the resource recycling solution for regional foods provided by NTT Business Solutions. Compost created from leftover food is supplied to farms to help grow vegetables and achieve a recycling-oriented community.



stores helps to increase awareness amongst workers, and this scheme is anticipated to help resolve problems related to food recycling.

Summit, Inc., which operates food supermarkets in the Tokyo area, implemented this scheme at its Setagaya-Funabashi store that it opened in April 2022. Vegetables scraps and other waste are processed at the back dock of the store, where the “Four Stars” is installed to ferment and break down the scraps as part of an efficient raw waste processing system. Building on the positive results achieved at the Setagaya-Funabashi store, Summit is planning to install the system at 20 other stores during fiscal 2022 (expanding to more stores the following years). Recycling scheme processes can remain obscure after the sorting and collection stage. Developing a system that processes waste at

## Social Challenge

# 3

## A future where people and nature are in harmony

### Business Activity

- 10. Thoroughly implementing environmental assessment
- 11. Contributing to natural ecosystem conservation



### Why it matters

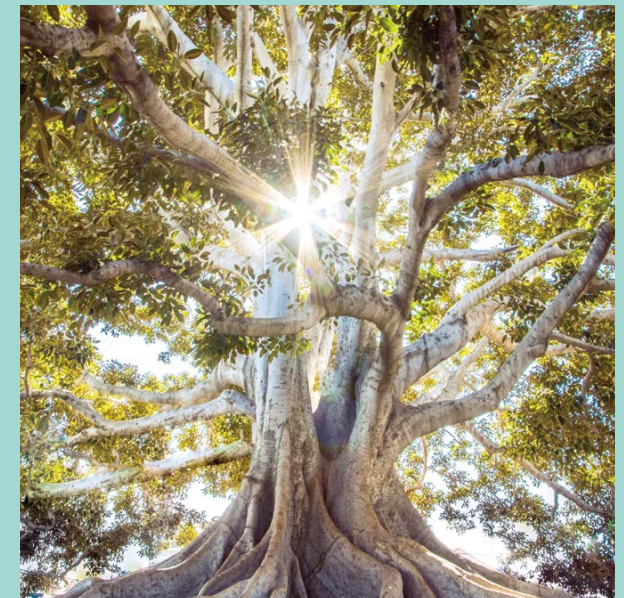
The NTT Group's businesses have an impact on ecosystems. For example, the telecommunication equipment essential to our business operations, particularly telephone poles and communications cables, is installed in the natural environment. At the same time, we are sometimes affected by the ecosystem, for example cables are bit and damaged by squirrels or crows. Ecosystems full of biodiversity provide the bounty, such as water and food, which is critical to supporting all forms of life on earth, and thus require a proper approach for conservation.

### What can be accomplished

Through our business and employee activities, we will promote initiatives related to conserving ecosystems within nature, in order to ensure that nature is left untouched for future generations.

### Future vision

The NTT Group is working to preserve the ecosystems, which are the foundation of society's activities, while also conducting environmentally friendly business activities that take into consideration the mutual influence between ecosystems and the NTT Group.



## Business Activity 10

# Thoroughly implementing environmental assessment

### Our commitment

Implementing environmental assessments during the construction of data centers and other buildings

### Our objective

The NTT Group adheres to its Green Design Guideline for Buildings when constructing new data centers or other buildings, and endeavors to reflect the necessary aspects in the facility's design.

### Background and Concepts

Communications equipment, data centers and other buildings as well as solar panels required for the NTT Group's business activities present an impact on the environment. In light of this, facilities are designed to minimize impact on the ecology.

### Environmental Assessments during the Construction of Data Centers and Other Buildings

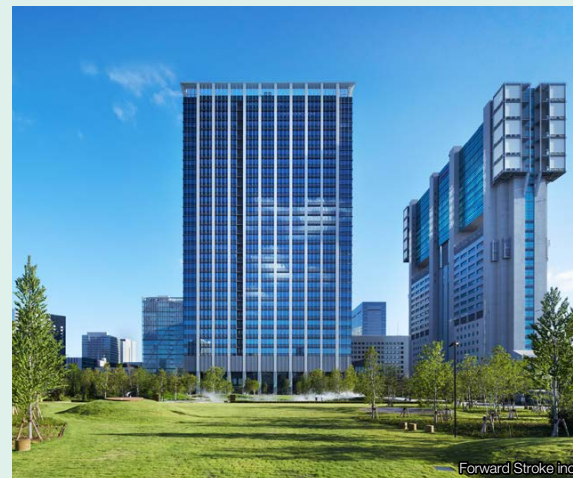
When planning to construct new data centers or other buildings, we research the historical, social, geographical, biological, and environmental attributes of the prospective building site and surrounding district based on our NTT Group Green Design Guideline for Buildings, and endeavor to reflect the necessary aspects in the facility's design. For example, we use native plant species as vegetation for greening our data centers, which have in recent times become the core components of ICT infrastructure.

When drawing up proposals for the construction of new data centers for customers, the NTT Group applies the Comprehensive Assessment System for Built Environment Efficiency (CASBEE<sup>\*1</sup>) and submits proposals designed to obtain the highest CASBEE rank of S. While paying due consideration to the environment in this way, we also take care to minimize noise and vibration and maintain the scenic appeal of the district during construction while endeavoring to ensure that exhaust heat and noise from the air conditioning outdoor units and emergency generators of functioning data centers will have minimal impact on neighboring areas.

<sup>\*1</sup> CASBEE: A system for the comprehensive assessment of the quality of a building from such perspectives as environmental performance, interior comfort, and scenic appeal

<sup>\*2</sup> ZEBs are defined as buildings using advanced architectural designs that aim to realize substantial energy savings while maintaining the indoor environment by (1) reducing the energy loads, (2) positively utilizing natural energy by applying passive technologies, and (3) introducing high efficiency equipment and systems. They additionally aim to achieve the highest degree of energy independence and reduce the annual primary energy balance to zero by (4) introducing renewable energy.

### Business Activity



### NTT Urban Development

#### Shinagawa Season Terrace acquires "ZEB Ready" certification

Compared to standard buildings, Shinagawa Season Terrace is able to reduce its annual primary energy consumption in its office areas by 51% (43% for the entire building), and acquired the top 5 star rating in the Building-Housing Energy-efficiency Labelling System (BELS) and ZEB<sup>\*2</sup> Ready" certification in December 2019 for the office area that is its main application. Featuring atriums filled with natural light and wind, a heat discharge system using cool external air, air-conditioning using a sewage heat recovery system, recycled water, and more, Shinagawa Season Terrace is one of the highest standard environmentally friendly office buildings in Japan, with eco designs and facilities offering excellent comfort and energy efficiency.



## Business Activity 11

# Contributing to natural ecosystem conservation

### Our commitment

Business activities that contribute to preservation of the Ecosystem

### Our objective

The NTT Group is working on activities that contribute to preservation of the ecosystem by harnessing our information dissemination capabilities.

### Background and Concepts

As a company providing ICT services, we are working on contribution activities that harness our information dissemination capabilities. The guidelines that apply to various business types and industries within the NTT Group outline the requirements for materials used for business activities. This applies to procurement and purchasing activities conducted at each business site within the NTT Group, as part of efforts to switch over to renewable energy sources and forest certified paper, which has a low environmental impact. Compared with the adverse effects on ecosystems caused by mining fossil fuels or global warming, renewable energy sources are deemed to have minimal negative impacts. The NTT Group operates services that supply both corporate and private customers with power from renewable energy sources, as it aims to run business activities that reduce the impact that society as a whole has on ecosystems.

### Business Activity

#### NTT DOCOMO

#### Sea turtles returning the favor

As part of initiatives aimed at the conservation and restoration of biodiversity, NTT DOCOMO is involved in establishing and promoting world natural heritage site community initiatives aimed at environmental conservation and regional development around Amami and Okinawa. Together with regional government bodies and local universities as well as local companies, we are also involved in regional contribution and revitalization activities to take advantage of rare species and the natural environment, with the aim of registering world natural heritage sites and establishing a recirculation model for environmental conservation and regional development. Addressing the problem of marine debris is a key environmental conservation initiative in Okinawa Prefecture, and NTT DOCOMO is taking part in activities alongside local organizations. A marine debris collection drone was constructed as part of this initiative, as the collection of floating waste had the potential to assist with cleanup activities and reduce the impact on marine life.

The drone is operated using a smartphone, with a live video feed from a camera installed on the drone providing a more intuitive approach to debris collection. Plastic waste collected from local cleanup activities was recycled by pressing it into plastic sheets for use as the outer shell of the sea turtle.

A seagull-shaped drone has also been made to help search for marine debris from up in the air. A similar camera setup as the sea turtle-shaped marine debris drone provides a live video feed from the air direct to smartphones. This makes it much easier to search over wide areas along the coast that are difficult for people to access.



# NTT Group Disclosures in Line with TCFD Recommendations

In May 2020, the NTT Group declared its support for Task Force on Climate-Related Financial Disclosures (TCFD) established by the Financial Stability Board (FSB), and in its sustainability report of the same year, began disclosing information related to eleven items recommended in the TCFD declaration. The results of scenario analysis conducted on the impact that climate change will have on the NTT Group in the future revealed various risks, particularly those related to policies, regulations and social demand aimed at transitioning toward a decarbonized society. To address these risks, the NTT Group established the new environment and energy vision “NTT Green

Innovation toward 2040” with the aim of reducing emissions by 80% by 2030 and becoming carbon neutral by the year 2040, by increasing development and use of renewable energy sources and rolling out IOWN to significantly reduce power consumption and alleviate the impact of these risks. The NTT Group will be focusing on resilience linked to growing its own businesses, while also helping to resolve social issues caused by climate change and develop a sustainable society by providing services that contribute to carbon neutrality.

Item	Details	
<div><h2>Governance</h2><div><div>a. Supervision system for directors</div><div>b. Role of executives</div></div></div>	<p>The NTT Group recognizes that environmental issues are one of the most important challenges for management, and items of particular importance such as creating environmental targets for the entire group are decided based on discussions held with directors. An example that highlights this is NTT's environment and energy vision "NTT Green Innovation toward 2040" announced in September 2021—this was established following discussions with all directors, including outside directors, held three times throughout the fiscal year. The Board of Directors made the decision in November 2021 to include non-financial KPIs such as GHG emissions into the business plans of each group company, with those attainment levels to be reflected in the compensation of directors as critical indicators. The supervision system for directors consists of the Sustainability Committee (chaired by the President) established in November 2021 directly under the Board of Directors, with the Green Innovation Committee established as an internal unit under the Sustainability Committee. The Global Environmental Protection Promotion Committee had previously managed and implemented environmental activities policies and their progress across the entire group, but these functions will be transferred to the Green Innovation Committee moving forward, to create a system where policies related to sustainability (the Charter and creating and abolishing accompanying policies, particularly deciding critical indicators) will be decided by the Board of Directors via the Sustainability Committee, and other matters will be decided by the Executive Officers Meeting. The role of the senior executives is to identify environmental issues and risks, and promoting businesses while taking into consideration these situations.</p>	
<div><h2>Strategy</h2><div><div>a. Specific risks and opportunities</div><div>b. Impact on businesses, strategy and financial planning</div><div>c. Resilience of strategy</div></div></div>	<div><div><div><div><div>Risks Identified with Scenario Analysis</div><div>■ Increase in costs for decarbonization and renewable energy charges</div><div>■ Criticism related to fewer efforts toward ESG</div><div>■ Increase in natural disasters such as heavy rain and flooding</div><div>■ Increases in air-conditioning and other electricity costs</div></div><div><div>Response measures (Environment and Energy Vision "NTT Green Innovation toward 2040")</div><div><div><div>Green Of ICT</div><div>■ Reduction of power consumption by introducing IOWN technologies</div><div>■ Developing and expanding the use of renewable energy, etc.</div></div><div><div>Green By ICT</div><div>■ Acceleration of DX and promotion of Remote World</div><div>■ New services that contribute to carbon neutrality</div><div>■ Green electricity retail, etc.</div></div></div><div>To business strategy opportunities</div></div></div></div></div>	
<div><h2>Risk Management</h2><div><div>a. Risk identification, assessment processes</div><div>b. Risk management processes</div><div>c. Integration into overall risk management</div></div></div>	<p>The NTT Group strives to minimize the impact of losses that could result from the materialization of risk by anticipating and preventing the occurrence of potential risks, and has established Risk Management Regulations with the aim of defining fundamental policies concerning risk management. The Business Risk Management Committee has also been established, chaired by the representative director and senior executive vice president. The Committee takes a 2-pronged approach by analyzing risks from their degree of influence on business operations and frequency of occurrence, and identifies risks with the potential to have the greatest impact as material risks. The degree of impact that climate change will have is also analyzed by the degree of influence on business operations and frequency of occurrence, and as such, measures to tackle climate change like reducing greenhouse gas emissions were identified as a material risk. Should the NTT Group's efforts to tackle climate change or disclosure of related information be viewed as lacking, there is the possibility that it could affect business management due to an insufficient level of understanding amongst customers, partner shareholders, employees, the local community, and other stakeholders. Furthermore, there could also be an increase in costs if new laws and regulations are enacted or intensified, which has the possibility of impacting business performance and financial conditions. In light of such risks, the NTT Group responded by holding discussions three times throughout the fiscal year involving all directors, including outside directors, to establish the environment and energy vision "NTT Green Innovation toward 2040," by announcing in September 2021 the NTT Group's commitment to measures aimed at addressing environmental issues. Looking ahead, the Green Innovation Committee operating under the Sustainability Committee will manage related processes and progress, and coordinate with the Business Risk Management Committee to integrate efforts with overall risk management and operate a PDCA cycle.</p>	
<div><h2>Metrics and Targets</h2><div><div>a. Metrics</div><div>b. Actual GHG emissions</div><div>c. Targets and actual results</div></div></div>	<div><div><div><div><div>GHG emissions (Scope1,2)</div><div><div><div><div>4.65</div><div>million tons</div></div><div>2013</div><div>Results</div></div><div><div><div>4.61</div><div>...</div></div><div>2019</div><div>Results</div></div><div><div><div>3.99</div><div>...</div></div><div>2020</div><div>Results</div></div><div><div><div>2.9</div><div>million tons</div></div><div>2021</div><div>Results</div></div><div><div><div>38%</div><div>(compared to FY2013)</div></div><div>2.9million tons</div><div>(▲27% year-on-year)</div></div><div><div><div>80%</div><div>reduction</div></div><div>Carbon Neutral</div></div><div><div><div>2030</div><div>Target</div></div><div><div><div>2040</div><div>Target</div></div></div><div>[FY]</div></div></div></div><div><div><div><div>GHG emissions (Scope3)</div><div><div><div><div>2,350</div><div>ten thousand tons</div></div><div>2019</div><div>Results</div></div><div><div><div>2,223</div><div>ten thousand tons</div></div><div>2020</div><div>Results</div></div><div><div><div>2,082</div><div>ten thousand tons</div></div><div>2021</div><div>Results</div></div><div><div><div>Category 1</div><div>455</div></div><div><div>Category 2</div><div>456</div></div><div><div>Category 11</div><div>649</div></div><div><div>Other categories</div><div>523</div></div></div><div>[FY]</div></div></div></div><div><div>*1 Estimated based on the Ministry of the Environment's "Basic Guidelines on Accounting for Greenhouse Gas Emissions Throughout the Supply Chain."</div></div></div></div></div></div>	

NTT Group Disclosures in Line with TCFD Recommendations

# Environmental Management

The NTT Group recognizes that environmental issues are one of the most important challenges for management, and items of particular importance are decided based on discussions held with directors. An example that highlights this is the new environment and energy vision “Green Innovation toward 2040” announced in September 2021—this was established following a decision made by the Board of Directors involving discussions with all directors, including outside directors, held three times throughout the fiscal year.

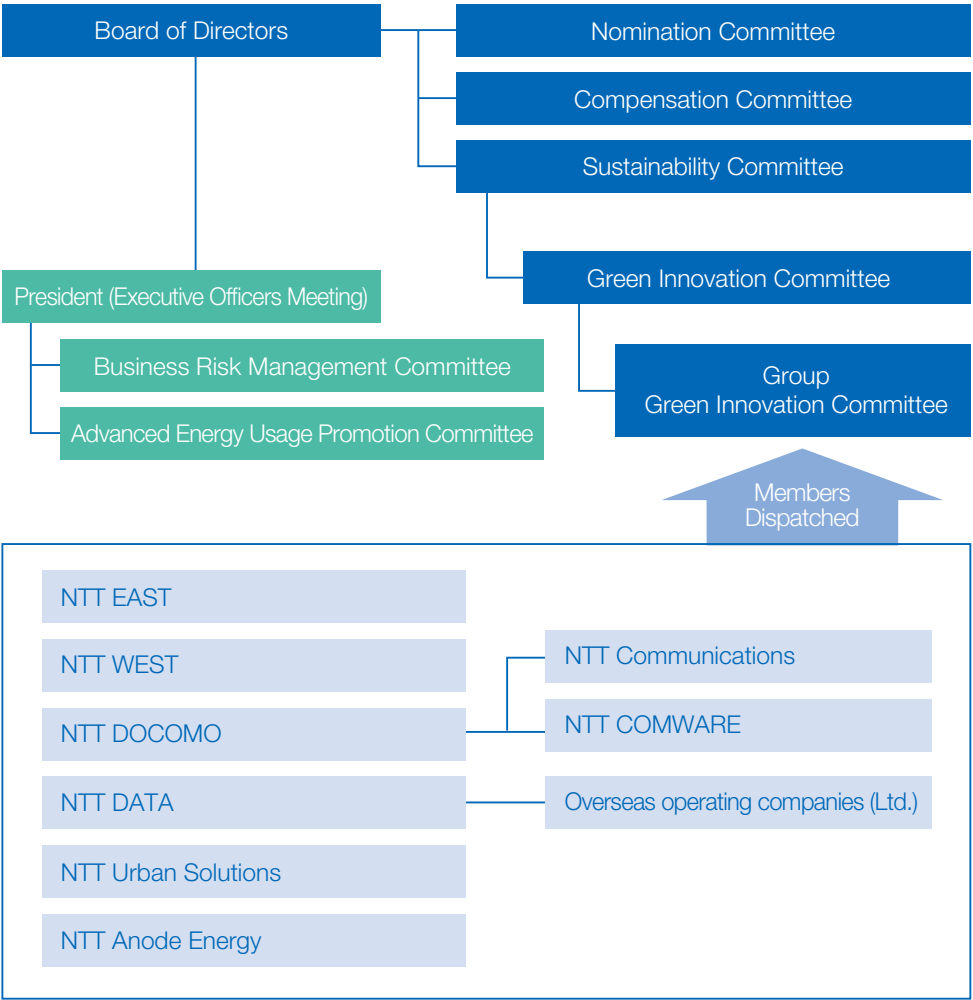
In addition to incorporating greenhouse gas emissions into the business plans of each group company, attainment levels will be reflected in the compensation of directors as critical indicators.

>> Non-financial KPI performance evaluations

The supervision system for directors also consists of the Sustainability Committee (chaired by the President) established in November 2021 directly under the Board of Directors, with the Green Innovation Committee established as an internal unit under the Sustainability Committee. The Global Environmental Protection Promotion Committee had previously managed and implemented environmental activities policies and their progress across the entire group, but these functions will be transferred to the Green Innovation Committee moving forward. Under this system, policies related to sustainability (the Charter and creating and abolishing accompanying policies, particularly deciding critical indicators) will be decided by the Board of Directors via the Sustainability Committee, and other matters deemed important will be decided by the Executive Officers Meeting. The role of the senior executives is to identify environmental issues and risks, and promoting businesses while taking into consideration these situations.

The NTT Group’s Green Innovation Committee covers initiatives aimed at addressing environmental problems across various Group companies, and is chaired by the Head of Research and Development Planning, with membership comprising the heads of the environmental departments at major Group companies. The Committee meets more than twice a year to raise suggestions for the basic policy related to environmental conservation such as developing the Environment and Energy Vision, as well as manage targets, monitor progress and promote further efforts. A decision was made at the Committee’s March 2022 meeting to set greenhouse gas reduction targets that have a direct impact on NTT Group executives’ performance evaluations.

As electricity usage accounts for more than 90% of the NTT Group’s greenhouse gas emissions, the committee also coordinates efforts with the Advanced Energy Usage Promotion Committee (chairperson: Vice President), responsible for managing the NTT Group’s energy conservation activities (Total Power Revolution [TPR] campaign), to develop plans for reducing electricity consumption as well as managing implementation and progress.





## NTT Group Disclosures in Line with TCFD Recommendations

## Scenario Analysis

The NTT Group formulated the medium-term management plan “Your Value Partner 2025” to resolve social issues by advancing digital transformation through the Group’s business activities. Under the keywords “Your Value Partner,” we are working to achieve this plan by utilizing the Group’s management resources and capabilities, such as R&D, ICT infrastructure, and personnel as well as collaborating with partners. In accordance with TCFD recommendations, we used two scenarios to identify risks and opportunities involved in the Group’s operations based on climate change: the first scenario limiting the increase in average temperatures at below 2°C from before the industrial revolution (2°C Scenario); and the second scenario where temperatures will increase by almost 4°C with measures to combat global warming maintained at existing levels (4°C Scenario).

Applying NTT Group’s selection process for identifying key issues to the 2°C scenario revealed transition

risks associated with policies, regulations, and social demand aimed at transitioning to a decarbonized society. The 4°C scenario is also likely to bring about physical risks including those required for responding to frequent or more intense heavy rain and flooding, as well as increasing electricity costs due to severe temperature increases. In contrast, increased demand for cutting greenhouse gas emissions and switching to renewable energy sources as society as a whole moves toward decarbonization is thought to present an opportunity for the NTT Group as it will be able to provide a range of ICT services that help achieve carbon neutrality. Details of each risk and the degree of impact they may have, as well as the results of analysis and assessment of the growth opportunities arising from addressing each of these risks are outlined below.

[>> Key Issues Identification Process](#)

## STEP1 Scenario Definitions

Scenario	Overview	Reference Methodology for Scenario
Transition Risk Scenario	Scenario in which the decarbonization of society is achieved rapidly .....a future in which the target increase of below 2°C (1.5°C) has been attained	IEA World Energy Outlook 2021
Physical Risk Scenario	Scenario in which physical risks materialize .....a future in which the average temperature has risen by 4°C	IPCC Sixth Assessment Report, Summary for Policymakers (SPM): Climate Change 2021, 2021

## STEP2 Risks and Opportunities Identified with Scenario Analysis (Overview)

Overview	Scenario*1		Type	Timeframe*2	Response
	1.5°C	4°C			
Increase in costs for decarbonization and renewable energy charges	Loss ▼	—	Transition risk (policies, regulations)	Long-term	<ul style="list-style-type: none"> <li>Initiatives for realizing the IOWN concept</li> <li>Introducing and expanding the use of renewable energy</li> <li>Promotion of energy conservation, high-efficiency data centers</li> </ul>
Social criticism related to fewer efforts toward ESG (drop in market share)	▼	Minor	Transition risk (market, criticism)	Long-term	<ul style="list-style-type: none"> <li>Proactive disclosure of information on environmental initiatives</li> </ul>
Expanding sales of services that help reduce society’s environmental impact	▲ ▲	Profit ▲	Opportunity (products and services, energy)	Long-term	<ul style="list-style-type: none"> <li>Creating new services that contribute to carbon neutrality</li> <li>Increase in green electricity retail</li> </ul>
Achieve the IOWN concept	▲ ▲	▲	Opportunity (investment toward R&D)	Long-term	<ul style="list-style-type: none"> <li>Acceleration of DX and promotion of Remote World</li> <li>Reduction of greenhouse gases across the entire supply chain</li> </ul>
Disasters caused by heavy rain and typhoons	—	▼	Physical risk (acute)	Short-term	<ul style="list-style-type: none"> <li>Provide disaster response and disaster prevention training</li> </ul>
Increased air-conditioning costs due to increasing temperatures	—	▼	Physical risk (chronic)	Long-term	<ul style="list-style-type: none"> <li>Promoting energy conservation</li> </ul>

\*1 Degree of impact with 2°C scenario and 4°C scenario in FY2030 \*2 Timeframes refer to Short-term (less than 3 years), Medium-term (3-6 years), Long-term (6 years or more). Degree of impact expressed in 3 levels (▲, Low; ▲▲, Medium; ▲▲▲, High)

\*Estimated impact on annual profits:

- ▲¥16 billion if carbon pricing introduced
- Increased cost of renewable energy charges and implementation of renewable energy (approx.▲¥10 billion)
- Disasters caused by heavy rain and typhoons (FY2019: approx. ▲¥8 billion, FY2020: approx. ▲¥5 billion, FY2021: approx. ▲¥0.2 billion)
- Higher air conditioning costs as temperatures rise (▲¥0.6 billion if outdoor temperatures rise 1 degree)

[Assumptions and basis for calculations]

- Carbon pricing (\$130/t-CO<sub>2</sub>) × FY2030 target emissions (reduction of 80% in FY2030 based on actual Scope 1 + 2 emissions of 4.65 million tons in FY2013)  
<Carbon pricing: Estimated unit price for FY2030 on IEA World Energy Outlook 2021, Advanced economics: USD 130>
- Renewable energy charges in FY2030: ¥4.1/kWh, FY2021: ¥3.36/kWh, estimate assumes certificates cost ¥1.0/kWh
- Estimated impact from repairs to damage caused by heavy rainfall and typhoons from FY2019 to FY2021
- Estimated air conditioning costs increase based on domestic electricity consumption in FY2021

# Strategy

## STEP3 Response to Risks and Growth Opportunities (1.5°C Scenario)

Risk Outline	<b>Increase in costs for decarbonization and renewable energy charges</b>	
Type	Transition risk (policies, regulations)	
Timeframe	Long-term	
Risk Details	<p>The NTT Group uses more than 8 billion kWh of electricity each year to operate its telecommunications facilities in Japan, and this figure is expected to increase moving forward as data-driven society gains momentum. As society approaches decarbonization, renewable energy charges due to greater use of renewable energy and carbon tax systems will have a significant impact on the NTT Group's businesses. The Act on Special Measures concerning the Procurement of Renewable Electric Energy by Operators of Electric Utilities, which came into force in July 2012, stipulates that renewable energy charges due to the feed-in tariff will be recovered from users through a surcharge on electricity charges. Electricity prices were also raised in October of the same year on the use of all fossil fuels as part of measures to combat global warming. Carbon taxes aimed at achieving decarbonization of society as a whole are also already being introduced by governments in many countries and regions, and there are concerns about ever-increasing prices, as highlighted by the ten-fold increase in prices within the EU in five years.</p>	
Response to Risks and Growth Opportunities	<p>In September 2021, the NTT Group unveiled the new environment and energy vision, "NTT Green Innovation toward 2040" aimed at achieving zero environmental impact while continuing economic growth, by reducing the environmental impact of our business activities and creating breakthrough innovation. In accordance with this Vision, the following initiatives will be implemented with the aim of reducing emissions by 80% by 2030 and becoming carbon neutral by the year 2040*1, to alleviate the impact of carbon taxes and associated risks.</p> <p>Key initiatives toward becoming carbon neutral by 2040</p> <ul style="list-style-type: none"> <li>(1) Increase the use of renewable energy, to reduce greenhouse gas emissions by 45%</li> <li>(2) Lower energy consumption with IOWN technologies, to reduce greenhouse gas emissions by 45%</li> <li>(3) Reduce greenhouse gas emissions by 10% with ongoing energy conservation initiatives</li> </ul> <p>Meanwhile, increasing demand for switching to renewable energy sources as society as a whole moves toward decarbonization will present an opportunity for the NTT Group.</p> <p>In addition to reducing our own environmental impact (Green by ICT), the Environment and Energy Vision also covers initiatives to reduce the environmental impact of society (Green by ICT) by providing services that help to achieve carbon neutrality. An example that highlights this is the planned green electricity retail, where renewable energy sources developed by NTT Group are not only used within the company but also made available to customers. As companies seek to cut their greenhouse gas emissions, they will switch from on-site data centers to cloud-based data centers that have a higher energy efficiency. This is expected to increase demand for such services, and the increased use of high-efficiency data centers is another area that presents an opportunity for the NTT Group.</p>	

>> [\[Feature 1\] Environment and Energy Vision  
NTT Green Innovation toward 2040](#)

>> [Business Activity 3  
Developing and expanding the use of renewable energy](#)

>> [Business Activity 2  
Reduction of power consumption by introducing IOWN technologies](#)



>> [Business Activity 4  
Providing new services that contribute to carbon neutrality](#)

>> [Business Activity 1  
Promoting energy conservation](#)

\*1 Compared to FY2013 (GHG Protocol: for Scope 1 and 2)

# Strategy

## STEP3 Response to Risks and Growth Opportunities (1.5°C Scenario)

Risk Outline	Social criticism related to fewer efforts toward ESG (drop in market share)								
Type	Transition risk (market, criticism)								
Timeframe	Long-term								
Risk Details	<p>The NTT Group provides a comprehensive range of ICT services, including NW services and data centers. It is focusing efforts on cutting greenhouse gas emissions through increased use of ICT services, such as accelerating efforts toward DX for business operations, promoting Remote World including TV conference systems, and other forms of energy management systems.</p> <p>As awareness of issues related to climate change increase and there societal preferences toward companies making efforts to tackle climate change, there is the risk of decreased revenue and profits due to a drop in market share if the company is seen as lagging behind its competitors with respect to climate-related awareness. And should greenhouse gas emissions increase as a result of expanding business faster than energy-efficiency initiatives can cut down those emissions, stakeholders may view the NTT Group as lacking in its motivation to cut emissions and negatively affect their valuation of the company. This presents a financial risk caused by lower revenue and falling share prices as customers move to other companies.</p>								
Response to Risks and Growth Opportunities	<p>NTT Group will help develop a sustainable society by implementing the following initiatives to achieve carbon neutrality by 2040:</p> <p>(1) Expanding the use of renewable energy</p> <p>(2) Reduction of power consumption by introducing IOWN technologies</p> <p>(3) Ongoing energy conservation initiatives</p> <p>The NTT Group is also proactive in disclosing information to stakeholders, with proactive disclosure of information on environmental initiatives and through general meetings of shareholders and engaging in dialogue with stakeholders. In fiscal 2020, the NTT Group acquired the highest A List rating by CDP, the Carbon Disclosure Project.</p> <p>It also announced its environment and energy vision, "NTT Green Innovation toward 2040" in September 2021, outlining a specific target for achieving carbon neutrality. Approval of that target as the 1.5°C level was received by SBT in December 2021.</p>		<p>NTT Group's greenhouse gas emissions reduction target based on 1.5°C level approved by Science Based Targets initiative</p> <div><p><b>Tokyo, Japan - December 3, 2021</b> - NTT Corporation (NTT) has revised its greenhouse gas (GHG) emissions reduction target in the new environment and energy vision "NTT Green Innovation toward 2040". The Science Based Targets (SBT)<sup>1</sup> initiative approves NTT Group's FY2030 GHG reduction target based on limiting global temperature rise to no more than 1.5°C.</p><p>The NTT Group formulated the new environment and energy vision "NTT Green Innovation toward 2040" on September 28, 2021. The NTT Group aims to reduce GHG emissions by 80% (carbon neutrality for mobile and data centers sectors) by FY2030 and to be carbon-neutral by FY2040.</p><p>With respect to Scope 1 (direct emissions by businesses, such as fuel combustion) and Scope 2 (indirect emissions from the use of electricity, heat and steam supplied by other companies), we have raised the NTT Group's FY2030/31 GHG emissions reduction target from 30% (Well-below 2°C level, approved in 2020) to 80% (1.5°C level), and is approved by the SBT initiative.</p></div> <div><p>SCIENCE BASED TARGETS</p><p>DRIVING AMBITIOUS CORPORATE CLIMATE ACTION</p></div> <table><tr><th colspan="2">NTT Group's GHG emissions reduction targets</th></tr><tr><td>Scope 1 and 2</td><td>80% reduction by FY2030/31 from a FY2018/19 base year (1.5°C level)</td></tr><tr><td>Scope 3<sup>2</sup></td><td>15% reduction by FY2030/31 from a FY2018/19 base year</td></tr></table> <p>For the benefit of society, the NTT Group will step up its efforts to achieve carbon neutrality to society and contribute to the Japanese government's targets of reducing GHG emissions by 46% in FY2030 from FY2013 levels and achieving carbon neutrality by 2050.</p> <p><sup>1</sup> Scientifically based greenhouse gas emission reduction targets for corporates in accordance with the Paris Agreement. The SBT initiative, a climate change initiative led by the United Nations Global Compact (UNGC), the CDP (formerly the Carbon Disclosure Project), the World Resources Institute (WRI), and the World Wide Fund for Nature (WWF), designates the targets.</p> <p><sup>2</sup> NTT Group's New Environment and Energy Vision "NTT Green Innovation toward 2040" <a href="https://group.ntt/en/newsroom/2021/12/03/20211203sbti.html">https://group.ntt/en/newsroom/2021/12/03/20211203sbti.html</a></p> <p><sup>3</sup> Scope 3: Indirect emissions other than Scope 1 and Scope 2 (emissions in the supply chain related to business activities)</p>	NTT Group's GHG emissions reduction targets		Scope 1 and 2	80% reduction by FY2030/31 from a FY2018/19 base year (1.5°C level)	Scope 3 <sup>2</sup>	15% reduction by FY2030/31 from a FY2018/19 base year
NTT Group's GHG emissions reduction targets									
Scope 1 and 2	80% reduction by FY2030/31 from a FY2018/19 base year (1.5°C level)								
Scope 3 <sup>2</sup>	15% reduction by FY2030/31 from a FY2018/19 base year								



# Strategy

## STEP3 Response to Risks and Growth Opportunities (4°C Scenario)

Risk Outline	<b>Disasters caused by heavy rain and typhoons</b>
Type	Physical risk (acute)
Timeframe	Short-term
Risk Details	The NTT Group supports society and business activities through its telecommunications networks and information systems. In addition, the NTT Group provides a multitude of services that serve as necessary lifelines that ensure people's safety in their everyday lives. Earthquakes, tsunamis, typhoons, floods, and other natural disasters may cause disruptions to business operations, and present a risk in providing reliable services. The NTT Group may also be held liable for related damages, potentially damaging the NTT Group's credibility and corporate image.
Response to Risks and Growth Opportunities	<p><b>Provide disaster response and disaster prevention training</b></p> <p>To reduce the risk of service interruptions due to natural disasters, the NTT Group is working to strengthen the resilience of our equipment and ensure early restoration of telecommunications services by expanding base stations equipped to deal with disasters, deploying and enhancing the functions of mobile power supply vehicles, portable satellite equipment, and other mobile equipment as well as participating in disaster drills held in the respective regions. NTT's telecommunications equipment and buildings are designed to withstand natural disasters. For example, our facilities are equipped with flood doors and other defenses according to their location to prevent the inundation of telecommunications equipment. Customers also face the same risk of natural disasters and system failures, and an increase in demand for BCP-related ICT services is expected as they also will seek appropriate contingencies. The NTT Group is focusing on the development of smart grids based on battery farms, to contribute to local production and consumption of energy.</p>

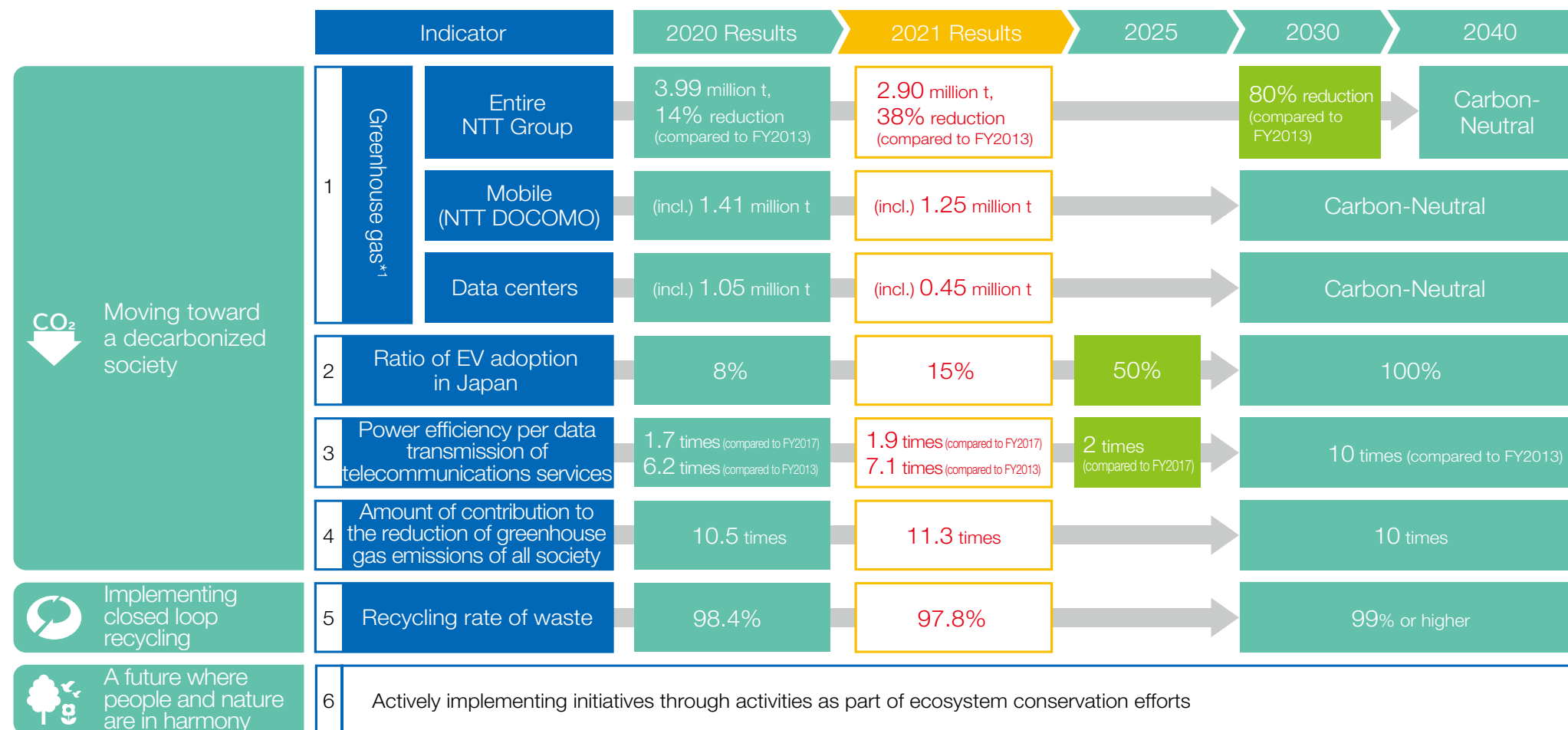
Risk Outline	<b>Increased air-conditioning costs due to increasing temperatures</b>
Type	Physical risk (chronic)
Timeframe	Long-term
Risk Details	The NTT Group owns a large number of communications buildings and data centers in Japan and abroad. The equipment used at our telecommunications facilities and data centers is set to operate within a specific range of temperatures. Those exceeding this range could cause equipment shutdowns and failures. For this reason, we maintain room temperatures within a certain range, including through the use of air conditioners. When ambient temperature rises, the energy efficiency of air conditioners declines and that in turn raises electricity consumption.
Response to Risks and Growth Opportunities	<p><b>Promoting energy conservation</b></p> <p>We have been pursuing measures for reducing electricity usage related to air conditioning equipment to minimize the increase in operating costs. Specifically, we operate air conditioner optimal control systems that save energy. We have installed wireless temperature sensor modules that automatically control the air conditioners in response to temperatures detected by the sensors. We also seek to conserve electricity by maintaining appropriate temperature settings for air conditioners, by installing diffusers and blank panels to release exhaust heat from equipment, and by efficiently laying out double flooring to improve airflow and prevent hotspots.</p> <p style="text-align: right;">&gt;&gt; <a href="#">Business Activity 1 Promoting energy conservation</a></p>

## NTT Group Disclosures in Line with TCFD Recommendations

## Metrics and Targets

In accordance with the NTT Group's selection process for identifying key issues, key performance indicators (KPIs) have been established for verifying the practicality and effectiveness, and monitoring progress of initiatives covered by the three challenges of "Ensuring the positive coexistence of nature and humanity."

>> [Key Issues Identification Process](#)



Disclosure Boundary

Boundary [C]: Greenhouse gas (No. 1), Amount of contribution to the reduction of greenhouse gas emissions of all society (No. 4)

Boundary [B]: Ratio of EV adoption in Japan (No. 2), Resource recycling rate (No. 5)

The telecommunications businesses subject to the calculation for power efficiency per data transmission of telecommunications services are the six domestic businesses of the telecommunications business segment appearing in our Annual Report (NTT East, NTT West, NTT Communications, NTT DOCOMO, and NTT DATA)

\*1 GHG Protocol: for Scope 1 and 2

## NTT Group Disclosures in Line with TCFD Recommendations

## Greenhouse Gas Emissions

The NTT Group's emissions across its entire supply chain in fiscal 2020 was 26.21 million tons, a reduction of 1.89 million tons (7%) compared to the previous year. More than 1.2 billion kWh of renewable energy (approx. 11% of purchased electricity) was made available during fiscal 2020, resulting in Scope 1 + 2 emissions of 3.99 million tons, a reduction of 6.2 million tons (13%) compared to the previous year. Scope 3 emissions for fiscal 2020 were 22.23 million tons, a reduction of 5% compared to the previous year (estimated based on the Ministry of the Environment's "Basic Guidelines on Accounting for Greenhouse Gas Emissions Throughout the Supply Chain").

Due to the very nature of the NTT Group's businesses, greenhouse gas emissions arising from the supply chain (Scope 3) are much higher than direct emissions from the group's own activities (Scope 1+2), and measures will be implemented to reduce such emissions from across the entire supply chain. The NTT Group will revise its own Guidelines for Green Procurement to achieve more effective reductions through fiscal 2021.

>> [Guidelines for Green Procurement](#)

## Amount of greenhouse gas from entire supply chain (Scope 1, 2, 3)

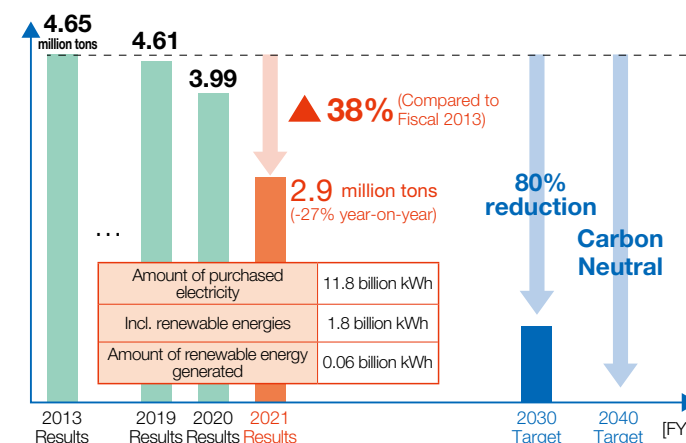
Scope, Category	Scope and method of calculation	Emissions (ten thousand tons)		
		Fiscal 2019	Fiscal 2020	Fiscal 2021
GHG emissions	—	2,811	2,622	2,372
Scope 1 (direct emissions)	—	25	24	14.1
Scope 2 (indirect emissions from energy use)	—	436	375	275.6
Scope 3 (indirect emissions from the value chain)	—	2,350	2,223	2,082
Category 1 Purchased goods and services	Calculation based on the number of units and monetary value of purchases of devices and services sold to customers	599	624	455
Category 2 Capital goods	Calculation based on capital investment costs on telecommunications and other equipment	628	554	456
Category 3 Fuel- and energy-related activities not included in Scope 1 or 2	Calculation based on annual consumption by energy type	60	61	63
Category 4 Upstream transportation and distribution	Calculation based on weight and distance, or number of devices with regard to the transport of devices sold to customers	5	8	8
Category 5 Waste generated in operations	Calculation based on volume of waste by type	1	1	1
Category 6 Business travel	Calculation based on paid expenses for business travel	19	4	3
Category 7 Employee commuting	Calculation based on paid expenses for employee commuting	7	3	4
Category 8 Upstream leased assets*1	Excluded from calculation*1	—	—	—
Category 9 Downstream transportation and distribution*2	Excluded from calculation*2	—	—	—
Category 10 Processing of sold products*3	Excluded from calculation*3	—	—	—
Category 11 Use of sold products	Calculation based on number of service subscriptions, number of devices and monetary value of telecommunications services and devices used by customers	735	668	649
Category 12 End-of-life treatment of sold products	Calculation based on number of service subscriptions, number of devices and monetary value of communications devices used by customers	5	4	4
Category 13 Downstream leased assets	Calculation based on amount of electricity consumption such as equipment by other businesses Calculation based on average use of leased assets	75	74	164
Category 14 Franchises	Calculation based on total floor area of sales franchises	9	8	8
Category 15 Investments	Calculation based on Scope 1 and 2 emissions of investees in proportion to shareholding	207	214	268

\*1 We have excluded Category 8 (upstream leased assets) from the calculation because the fuel and electricity used by leased assets is included in Scope 1 and 2 calculations.

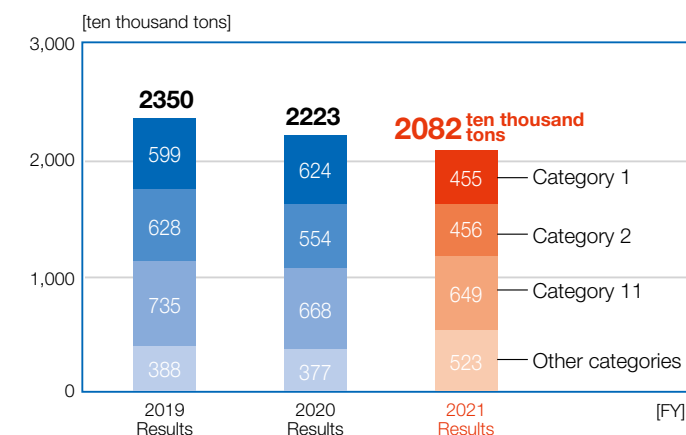
\*2 We have excluded Category 9 (downstream transportation and distribution) from the calculation because these emissions are almost entirely from our own transportation and use in our own facilities (included in Scope 1 and 2) or from outsourced transportation (included in Category 4).

\*3 We have excluded Category 10 (processing of sold products) from the calculation because our main businesses involve no processing of intermediate products.

## Greenhouse Gas Emissions (Scope 1, 2)



## Greenhouse Gas Emissions (Scope 3)



## Change in calculation method

Calculations for Category 1 and Category 2 in FY2019 used emission intensity defined by the Ministry of the Environment, but for FY2020 emission intensity of each company is used for some supplier (calculated from figures released by each company), to factor in reduction efforts by each supplier.



## NTT Group Disclosures in Line with TCFD Recommendations

# Reduction of Greenhouse Gas Emissions across Society and Power Efficiency of the Telecommunications Business

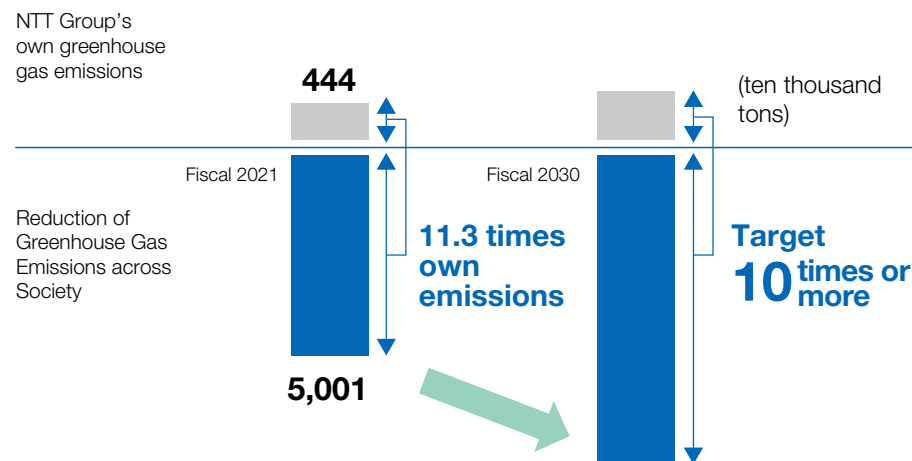
## Reduction of Greenhouse Gas Emissions across Society

The NTT Group has established a target for fiscal 2030 calling for it to contribute to reducing greenhouse gas emissions of society as a whole by at least 10 times more than the NTT Group's own emissions through its services and technologies. This target is intended to contribute to the reduction of greenhouse gas emissions across society by providing ICT services and technologies while curbing greenhouse gas emission amounts from our own business activities. The use of information communication, which is expanding each year through the spread of smartphones and high-speed and large-capacity networks, requires energy. On the other hand, by improving efficiency and reduction of goods through digitalization, the use of information also contributes to the reduction of greenhouse gas emissions across society by reducing environmental load more than the energy consumption it requires.

\* The reduction of greenhouse gas emissions across society quantifies the energy savings effects obtained through ICT services using greenhouse gas volume. The energy saving effect is quantified with references to the Telecommunication Technology Committee (TTC) Standard "Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services (JT-L1410)" and the calculation method specified by the "LCA of Information and Communication Technology (ICT) business organizations" research group of the Life Cycle Assessment Society of Japan.

\* The effects of energy savings obtained through the introduction of ICT services include, for example, reduced electricity usage by homes, companies and factories from energy management, alleviation of traffic congestion using analysis of congestion and operation information, and reduced electricity usage from the streamlining and optimization of transportation schedules.

\* The amount of greenhouse gas emissions for the NTT Group includes the emissions from facilities necessary for other telecommunication carriers and data centers to provide their services.



## Power Efficiency of the Telecommunications Business

The NTT Group has established the target for fiscal 2030 to improve the power efficiency per data transmission in our telecommunications business to at least 10 times higher\*1 than in fiscal 2013\*1. Electricity is essential to the continuity of the telecommunications business and it also accounts for more than 90% of the NTT Group's greenhouse gas emissions. We set this target because improving the efficiency of using electricity both reduces the risk of business disruptions and helps mitigate climate change. We are introducing highly energy efficient equipment and improving the efficiency of network structures based on our Energy Efficiency Guidelines.

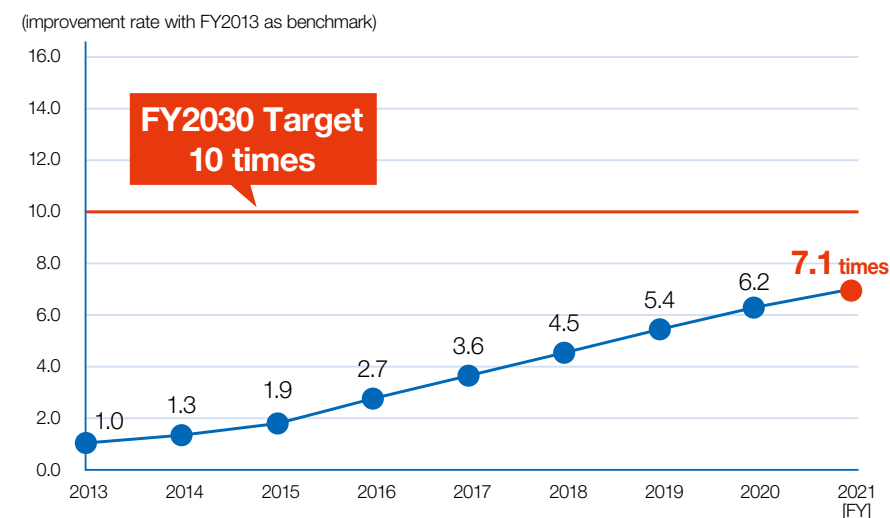
>> Green Procurement Standards

In October 2018, NTT became the first telecommunications carrier in Japan to join the EP100\*2 international initiative on energy efficiency led by The Climate Group. By participating in such an international initiative, we intend to publicly declare the NTT Group's commitment to the environment and express our stance on international environmental issues.

\*1 The telecommunications businesses subject to the calculation for power efficiency are the domestic businesses of the five telecommunications business segment appearing in our Annual Report (NTT East, NTT West, NTT Communications, NTT DOCOMO, and NTT DATA).

\*2 An international initiative comprising companies pledging to double the energy efficiency of their operations (improve energy efficiency by 50%) as participants.

## Power Efficiency of the Telecommunications Business



# Environmental Performance Data (Moving toward a decarbonized society)

			Unit	FY2017	FY2018	FY2019	FY2020	FY2021			
Status of ISO 14001 Certification Acquisition (employee coverage)			%	47.9	45.1	46.5	49.5	46.5			
			Unit	FY2017	FY2018	FY2019	FY2020	FY2021			
								Domestic	Including overseas*		
Direct Greenhouse Gas Emissions (Scope 1)			ten thousand tons of CO <sub>2</sub>	18.5	16.4	13.8	13.1	12.2	14.1		
Indirect Greenhouse Gas Emissions (Scope 2)*2			ten thousand tons of CO <sub>2</sub>	421	329	306	287	236	276		
					(414)	(379)	(357)	(303)	(430)		
CO <sub>2</sub> Emissions from Business Operations*1, *2	Total CO <sub>2</sub> emissions			438	344	319	298	247	289		
					(429)	(392)	(369)	(314)	(443)		
	Breakdown	Use of electricity	ten thousand tons of CO <sub>2</sub>	418.3	325.9	303.1	283.9	233.3	272.8		
		Use of gas and fuel			(411.5)	(376.4)	(354.4)	(300.2)	(427.4)		
		Use of vehicle operation				13.5	11.8	10.1	9.6	9.0	10.5
		Use of heat				3.3	3.1	2.7	2.1	2.0	2.4
				2.7	2.9	3	2.9	2.8	2.8		
Greenhouse Gas Emissions other than CO <sub>2</sub> Emissions (CO <sub>2</sub> emissions-equivalent)	Total GHG emissions other than CO <sub>2</sub>		ten thousand tons of CO <sub>2</sub>		1.6	1.6	1.1	1.4	1.2	1.2	
	Breakdown	CH <sub>4</sub> (methane)			0.3	0.2	0.2	0.2	0.2	0.2	
		N <sub>2</sub> O (nitrous oxide)			0.2	0.2	0.2	0.1	0.1	0.1	
		HFC			0.7	0.7	0.6	0.9	0.8	0.8	
		PFC			0.3	0.4	0.05	0.1	0.1	0.1	
		SF <sub>6</sub> (sulphur hexafluoride)			0.1	0.1	0.04	0.1	0.1	0.1	
		NF <sub>3</sub> (nitrogen trifluoride)			0	0	0	0	0.0	0.0	
Electric Power Consumption	Electricity purchased*2		hundred million kwh	82.3	65.4	65.9	66.7	68.6	79.8		
					(82.4)	(82)	(82.8)	(86.8)	(117.6)		
	Renewable energy, new energy consumption				0.8	0.7	0.7	3.1	13.7	17.8	
Total amount of non-renewable energy used*2, *3			hundred million kwh	92	74.3	73.8	74.1	75.5	94.7		
					(91.3)	(89.8)	(90.1)	(93.7)	(114.2)		

\*1 The CO<sub>2</sub> emissions from business operations exclude emissions of greenhouse gases other than CO<sub>2</sub>.

\*2 The NTT Group provides equipment and the like necessary for other telecommunications carriers and data center providers to carry out their businesses. To date, we have included the fuel and electricity required for this equipment in our disclosed emission and consumption volumes in accordance with reporting methods outlined by the Act on Promotion of Global Warming Countermeasures. However, as calculation methods have been established based on the Ministry of the Environment's Basic Guidelines on Accounting for Greenhouse Gas Emissions Throughout the Supply Chain (Ver. 2.3), we have adopted these for calculating the above CO<sub>2</sub> emissions as Scope 3. Emission amounts calculated using the previous method have been placed within parentheses. Similarly, for amounts of electricity purchased and total amount of non-renewable energy, from fiscal 2018 onward we are excluding the amount consumed by other telecommunications carriers and data center providers, and values calculated using the previous method will be placed within parentheses, and we have adopted these for calculating the above CO<sub>2</sub> emissions as Scope3 from fiscal 2019.

\*3 For the total amount of non-renewable energy used, the volume of fuels such as gasoline and utility gas consumed have been converted into Wh values and added to the amount of electricity purchased.

\*4 Disclosure Boundary [C]

\* Disclosure Boundary: Boundary [B]

# Environmental Performance Data (Implementing Closed Loop Recycling)

		Unit	FY2017	FY2018	FY2019	FY2020	FY2021
Waste and Final Disposal Waste	Total Waste	ten thousand tons	53.1	56.2	74.4	46.9	47.6
	Recycling rate*1	%	98.6	98.9	98.7	98.4	97.8
	Recycling	Total amount of recycling	ten thousand tons	52.4	55.6	73.5	46.2
		Recycled decommissioned telecommunications equipment	ten thousand tons	22.0	17.6	14.6	12.3
		Recycled construction works waste	ten thousand tons	13.3	22.3	32.5	18.5
		Recycled civil engineering works waste	ten thousand tons	12.9	11.5	22.8	10.6
		Recycled office waste	ten thousand tons	3.3	3.0	2.7	2.4
		Others	ten thousand tons	0.8	1.2	0.9	0.7
	Amount of waste reduced by incineration		ten thousand tons	0.1	0.1	0.1	0.1
	Amount of final disposal waste		ten thousand tons	0.6	0.5	0.8	0.6
Final Disposal Ratio*2	All waste	%	1.18	0.91	1.13	1.38	2.02
	Recycled decommissioned telecommunications equipment	%	0.07	0.05	0.06	0.19	0.12
Asbestos Removed from NTT Group Facilities	Total amount of asbestos removed		t	19	6	52	73
	Breakdown	Buildings	t	4	4	19	68
		Bridges	t	15	2	32	6
Use of Water Resources	Water Use*		ten thousand m <sup>3</sup>	1,259.1	1,206.6	1,104.4	993.8
	Water Withdrawal (tap water)		ten thousand m <sup>3</sup>	—	627.5	583.4	514.2
	Volume of recycled wastewater and rainwater	Reused	ten thousand m <sup>3</sup>	49.2	48.9	16.7	35.8
		Reuse rate*3	%	3.9	7.2	2.8	6.5
	Sewage		ten thousand m <sup>3</sup>	—	530.2	504.3	443.9
Virgin Pulp Consumption	Total		ten thousand tons	1.7	1.4	1.2	0.8
	Breakdown	Telephone directories	ten thousand tons	1.2	0.9	0.7	0.4
		Telegrams	ten thousand tons	0.02	0.02	0.02	0.01
		Office paper	ten thousand tons	0.2	0.2	0.2	0.1
		Billing statements	ten thousand tons	0.3	0.3	0.3	0.3
			ten thousand tons	0.3	0.3	0.3	0.2
Paper Consumption Reductions from Web Billing Service	Number of users		ten thousand	3,536	3,371	3,364	3,201
	Paper consumption reductions		t	3,216	3,082	2,981	2,871

\*1 Recycling rate: Recycling/Total waste

\*2 Final disposal ratio: Amount of final disposal waste/Total waste

\*3 The reuse rate shown up to fiscal 2017 corresponds to the total volume of tap water and sewage, recycled water, and rainwater used, while the reuse rate from fiscal 2018 onward corresponds to the total volume of tap water, recycled water, and rainwater.

\* Disclosure Boundary: Boundary [B]

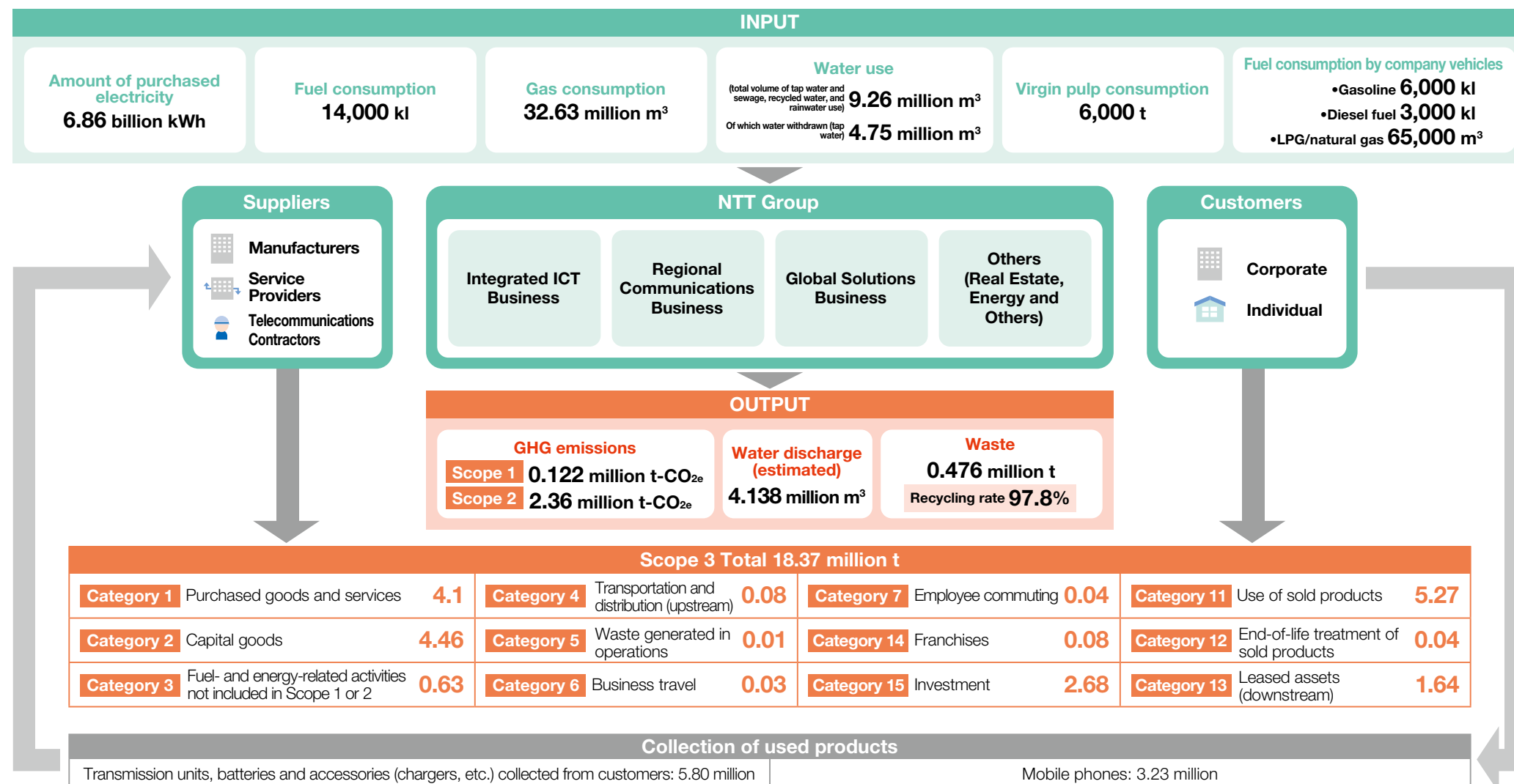
	Unit	FY2017	FY2018	FY2019	FY2020	FY2021
Expenditures on Biodiversity Preservation Projects	Million yen	421.4	544.7	558.0	332	311



# Material Balance of the NTT Group (Fiscal 2021)

Relevant GRI standards: 301-1/302-1/303-3,4/305-1,2,3/306-1,2

To minimize the environmental impacts of our business activities, the NTT Group endeavors to gather and analyze information on the resources and energy that it consumes and the resulting environmental impacts.



\* Disclosure Boundary: Boundary [B]

## NTT Group Disclosures in Line with TCFD Recommendations

# Environmental Accounting

Relevant GRI standards: 102-18/103-2/307-1

The NTT Group introduced environmental accounting in fiscal 2000 to boost the efficiency and effectiveness of its environmental conservation efforts by quantitatively determining the costs of environmental conservation programs undertaken as part of its business activities as well as their effects (economic and material benefits). Moving forward, we aim to implement even more efficient and effective environmental management by continuously carrying out quantitative monitoring and analysis to understand the effects of our environmental activities, clarifying outstanding issues, and sharing information.

- Scope of data

The companies subject to consolidated environment accounting are NTT, NTT East, NTT West, NTT Communications, NTT DATA, NTT DOCOMO and their group companies.

- Applicable period

Data for fiscal 2020 is from April 1, 2020 to March 31, 2021.

Data for fiscal 2021 is from April 1, 2021 to March 31, 2022.

- Accounting method

Accounting is based on the NTT Group Environmental Accounting Guidelines. These guidelines comply fully with the Environmental Accounting Guidelines 2005 issued by the Ministry of the Environment.

Environmental conservation costs are tabulated separately as environmental investments and environmental costs. Personnel costs and depreciation costs are also included in environmental costs.

Reductions in CO<sub>2</sub> emissions through energy conservation measures are calculated by subtracting actual emissions from projected emissions in the event that no such measures were taken.

Category	Environmental investment (100 hundred yen)		Environmental costs (100 hundred yen)		Economic benefits (100 hundred yen)			Material benefits (thousands of tons)		
	FY2020	FY2021	FY2020	FY2021		FY2020	FY2021		FY2020	FY2021
(1) Business area costs	71.3	28.6	225.2	289						
• Pollution prevention costs	2.9	2.5	32.4	25.5						
• Global environmental conservation costs	67.7	25.8	79.8	148.6	Cost reductions through energy conservation	54.2	31.5	Reductions in CO <sub>2</sub> emissions through energy conservation measures	10.2	6.2
• Resource recycling costs	0.7	0.3	113.0	115.0	Revenues from sale of recyclable waste (decommissioned telecommunications equipment, etc.)	59.6	71.1	Recycled decommissioned communications equipment	14.0	12.3
					Waste disposal cost reductions through recycling	1.9	1.1	Recycled construction waste	18.5	18.4
					Cost reductions through reuse of decommissioned telecommunications equipment	140.4	212.1	Recycled civil engineering works waste	10.6	13.0
					Cost reductions through reuse of telecommunications devices	112.1	133.3	Recycled office waste	2.4	2.2
					Cost reductions through reuse of office waste materials	0.0	0.0	Other recycled items	0.7	0.7
(2) Upstream/downstream costs	0.5	1.8	102.0	32.6	Revenues from sale of recyclable waste (subscriber communications devices, etc.)	7.1	12.8	Number of communications devices collected from customers (thousands)	581	580
					Cost reductions in postal expenses through computerization	119.0	275.1			
(3) Administrative costs	2.1	1.5	44.9	64.5						
(4) R&D costs	20	29.5	97.7	127.6						
(5) Social activity costs	0.0	0.1	0.4	0.5						
(6) Environmental remediation costs	0.0	0.0	0.0	0.0						
Total	94.0	61.5	470.1	514.2	Total	494.3	736.9			