Environmental Performance
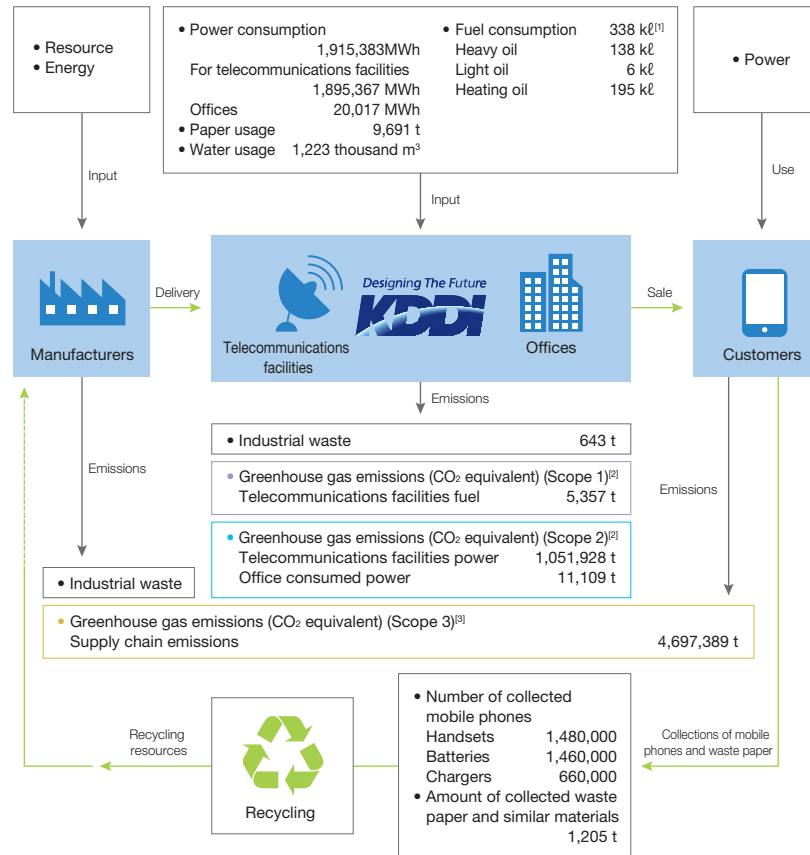
Activity and Results   KDDI

Environmental Impact of Business Activities

Most input energy is electric power for telecommunications facilities. Heavy oil, light oil, heating oil and other fuels are input when test running emergency power generation facilities. Most water usage is generated by everyday business activities in the offices. Greenhouse gas emissions were calculated in three areas, Scope 1, Scope 2 and Scope 3 (all items), and third-party verification was received.

Environmental Impact of FY2016 Business Activities (Coverage: KDDI)

Resource / Energy

- Power consumption 1,915,383 MWh
  - For telecommunications facilities 1,895,367 MWh
  - Offices 20,017 MWh
- Paper usage 9,691 t
- Water usage 1,223 thousand m³

- Fuel consumption 338 kℓ[1]
  - Heavy oil 138 kℓ
  - Light oil 6 kℓ
  - Heating oil 195 kℓ

Power

Input → Manufacturers → Delivery → Telecommunications facilities / KDDI / Offices → Sale → Customers → Use

Emissions:
- Industrial waste 643 t
- Greenhouse gas emissions (CO_2 equivalent) (Scope 1)[2]
  - Telecommunications facilities fuel 5,357 t
- Greenhouse gas emissions (CO_2 equivalent) (Scope 2)[2]
  - Telecommunications facilities power 1,051,928 t
  - Office consumed power 11,109 t
- Greenhouse gas emissions (CO_2 equivalent) (Scope 3)[3]
  - Supply chain emissions 4,697,389 t

- Industrial waste

Recycling → Recycling resources → Manufacturers

- Number of collected mobile phones
  - Handsets 1,480,000
  - Batteries 1,460,000
  - Chargers 660,000
- Amount of collected waste paper and similar materials 1,205 t

Collections of mobile phones and waste paper

[1] Used for air conditioning of telecommunications facilities and for emergency generators.
[2] CO_2 emissions are calculated using a conversion coefficient of 0.555kg-CO_2/kWh for the power consumption and the emission coefficients for fuel consumption applied to the calculation, reporting, and disclosure systems based on the "Act on Promotion of Global Warming Countermeasures."
[3] CO_2 emissions are calculated using emission factors indicated in the Ministry of the Environment's "Overview of Basic Conversion Guidelines Related to the Calculation of the Greenhouse Effect through the Supply Chain."

Environmental Performance

Activity and Results **KDDI**

Understanding Environmental Impact

In order to quantitatively understand and share information about our environmental impact, KDDI has calculated our supply chain greenhouse gas emissions (Scopes 1, 2, and 3) in adherence with various guidelines [1] since FY2012.

In our FY2016 business activities, Scope 3 accounted for 81.47% of total greenhouse gas emissions (Scopes 1, 2, and 3). When viewed by category, the percentages of Categories 1 and 2 have continued to grow since the previous fiscal year. Additionally, in order to ensure the reliability of calculations, the results of Scopes 1 and 2 were subjected to independent third party verification by Lloyd's Register Quality Assurance Limited, while the results of Scope 3 were subjected to third party verification by Waseda Environmental Institute Co.,Ltd.

KDDI also conducts life-cycle assessments (LCA) to evaluate the environmental impact by calculating CO_2 emissions in every step in the life of its products and services, from manufacturing to use, disposal, and recycling [2], as well as conducting regular LCA for "au HIKARI" and "au".
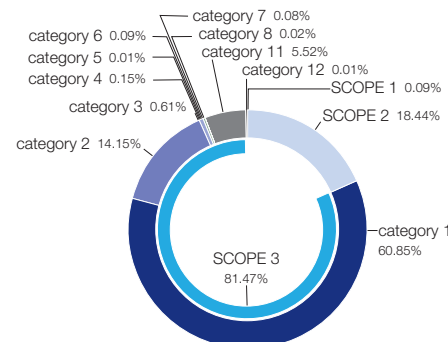
[1] Green Value Chain Platform
[2] Environmental load at the disposal and recycling stage includes environmental load at the manufacturing stage.

GHG Emissions and the Proportions of Each Category

Category			FY2012		FY2013		FY2014		FY2015		FY2016	
			$t\text{-}CO_2$	%	$t\text{-}CO_2$	%	$t\text{-}CO_2$	%	$t\text{-}CO_2$	%	$t\text{-}CO_2$	%
SCOPE 1		All direct GHG emissions	2,857	0.05	3,505	0.06	4,680	0.08	5,344	0.10	5,357	0.09
SCOPE 2		Indirect GHG emissions from consumption of purchased electricity, heat or steam	1,046,565	20.08	935,996	16.08	1,039,677	17.97	1,076,209	19.54	1,063,038	18.44
SCOPE 3	category 1	Purchased goods and services	2,733,364	52.45	3,343,506	57.44	3,306,863	57.16	3,236,999	58.78	3,507,745	60.85
	category 2	Capital goods	952,799	18.28	1,093,184	18.78	1,053,203	18.21	776,711	14.10	815,893	14.15
	category 3	Fuel- and energy-related activities	34,439	0.66	31,480	0.54	34,967	0.60	35,379	0.64	34,913	0.61
	category 4	Upstream transportation and distribution	8,261	0.16	4,994	0.09	7,003	0.12	7,370	0.13	8,706	0.15
	category 5	Waste generated in operations	921	0.02	588	0.01	500	0.01	681	0.01	583	0.01
	category 6	Business travel	5,154	0.10	5,080	0.09	4,590	0.08	4,831	0.09	5,314	0.09
	category 7	Employee commuting	3,497	0.07	2,671	0.05	5,031	0.09	4,574	0.08	4,642	0.08
	category 8	Upstream leased assets	1,751	0.03	1,519	0.03	1,367	0.02	1,309	0.02	1,209	0.02
	category 9	Downstream transportation and distribution	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	category 10	Processing of sold products	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	category 11	Use of sold products	419,922	8.06	397,324	6.83	325,364	5.62	356,359	6.47	318,023	5.52
	category 12	End-of-life treatment of sold products	1,451	0.03	819	0.01	1,606	0.03	886	0.02	363	0.01
	category 13	Downstream leased assets	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	category 14	Franchises	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	category 15	Investments	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
			4,161,559	79.86	4,881,165	83.86	4,740,493	81.95	4,425,098	80.36	4,697,389	81.47
TOTAL			5,210,981	100.00	5,820,666	100.00	5,784,851	100.00	5,506,651	100.00	5,765,785	100.00

* CO_2 emissions are calculated using a conversion coefficient of 0.555 kg-CO_2/kWh for the power consumption and the emission coefficients for fuel consumption applied to the calculation, reporting, and disclosure systems based on the "Act on Promotion of Global Warming Countermeasures."

Comparison of GHG Emission Ratio of Each Category (FY2016)

category 7 0.08%
category 8 0.02%
category 6 0.09%
category 11 5.52%
category 5 0.01%
category 12 0.01%
category 4 0.15%
SCOPE 1 0.09%
category 3 0.61%
SCOPE 2 18.44%
category 2 14.15%
category 1 60.85%
SCOPE 3 81.47%

| Disclosure of CSR Information | Top Message | KDDI Business and Strategies | KDDI's CSR | KDDI Code of Business Conduct | CSR Promotion Framework | Stakeholder Engagement | Four Material CSR Issues | Material Issues - Highlights | CSR Initiatives Through Business | CSR Initiatives Supporting Operations | External Assessment | CSR Data |

Environmental Performance

Activity and Results

KDDI

Environmental Impact Data

		FY2012	FY2013	FY2014	FY2015	FY2016
Greenhouse gas emissions (CO_2 equivalent; unit: t) *		5,210,981	5,820,666	5,784,851	5,506,651	5,765,785
Electric power consumption (unit: MWh)		1,885,703	1,686,480	1,873,293	1,939,115	1,915,383
Electric power consumption per subscriber (unit: MWh)		464.7	385.4	398.9	390.4	363.5
Fuel consumption (unit: kℓ)		308	260	254	258	338
Paper usage (unit: t)		17,924.0	43,429.2	13,303.0	11,853.0	9,691.1
Water usage (unit: 1,000m³)		1,638	1,864	2,206	2,159	1,223
Industrial waste emissions (unit: t)		1,401.1	1,445.7	1,283.0	1,399.0	643.1
Number of mobile phones and other devices collected by KDDI (unit: 10,000 devices)	Mobile phones	181	154	163	141	148
	Batteries	182	161	182	143	146
	Chargers	83	72	79	65	66
Amount of waste paper and similar materials collected for recycling (unit: t)		2,394	2,235	2,531	1,695	1,205
Equipment-related energy usage at centers (unit: MWh)		685,885	664,798	747,016	779,504	778,224

* CO_2 emissions are calculated using a conversion coefficient of 0.555 kg-CO_2/kWh for the power consumption and the emission coefficients for fuel consumption applied to the calculation, reporting, and disclosure systems based on the "Act on Promotion of Global Warming Countermeasures."
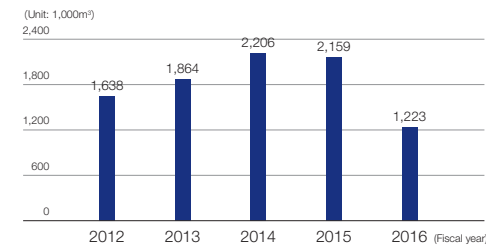
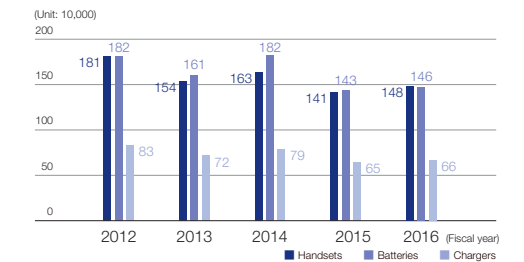### Greenhouse Gas Emissions
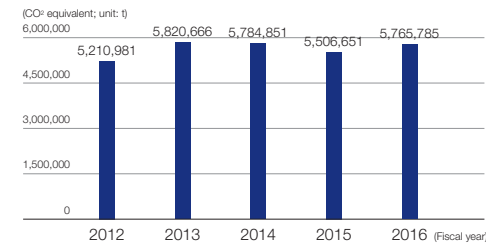
Electricity Consumption and Electricity Consumption per Subscriber
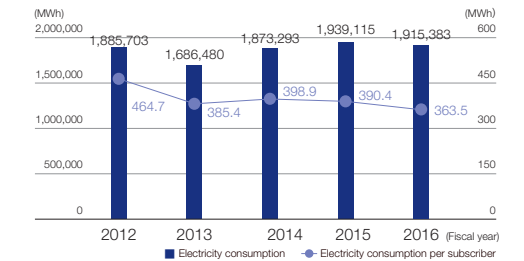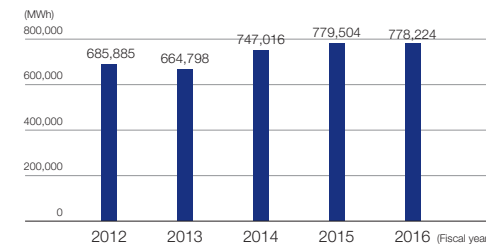

Water Usage

Number of Mobile Phones Collected by KDDI

Equipment-Related Energy Usage at Centers

Environmental Performance

Policy   KDDI Group

KDDI's Approach (Low-Carbon Society)

Greenhouse gas emissions, which are considered a cause of global warming, are increasing year-by-year, and reducing them has become a social issue shared by all humankind.

The utilization of ICT leads to greater efficiency of business activities such as production and consumption, and is expected to contribute to the reduction of customers' CO_2 emission. In addition to expanding utilization, there are fears of an increase in environmental impact caused by the data center and base stations, so that consideration for energy use with regards to the development and introduction of facilities and devices has become an issue.

In order to actualize an affluent low carbon society, KDDI is providing new ICT services to contribute to the reduction of CO_2 emissions in society.

Activity   KDDI Group

Green by ICT

The Environmental Eco Label is provided to services that contribute to reducing the environmental impact of customers and society (reducing CO_2 emissions) through the use of ICT services offered by KDDI.

■ KDDI Cloud Platform Service

KDDI conducts the operation and maintenance of the platform through "KDDI Cloud Platform Service", enabling customers to increase and decrease server capacity remotely from their own office, without having to travel to the data center where the servers are located.

Furthermore, customers can reduce the amount of CO_2 that they generate by moving the servers that they install, operate, and maintain by themselves (on-premises environment) to the "KDDI Cloud Platform Service".

With the "KDDI Cloud Platform Service", server operations are performed with an economy of scale unique to a telecommunications carrier, enabling an approximately 38% reduction in CO_2 emissions per server per year in comparison to when customers operate their servers individually.

■ TELEHOUSE Data Center Services

The TELEHOUSE data centers provided by KDDI are located in 48 bases in 24 cities around the world, including in Japan. They are equipped with high-capacity electric power and incorporate the latest in energy- saving facilities, such as highly efficient and reliable power supply equipment, energy-efficient air conditioning, LED illumination, and outdoor lighting that uses wind and solar power, in an effort to reduce power consumption, achieve low PUE*, and provide significantly lower CO_2 emissions than conventional data centers.

The TELEHOUSE LONDON Docklands North Two fully opened in November 2016, and adopts an indirect external air cooling system and other cutting-edge environmental technologies to achieve PUE 1.16, the highest-level energy efficiency for a data center operator. In Japan, TELEHOUSE TOKYO tama3 also employs the latest in energy-saving facilities and LED illumination, achieving PUE of 1.31 (design value).

TELEHOUSE LONDON Docklands North Two was recognized for achieving highest-level energy efficiency in the 2017 Data Centre Solution Awards.

* PUE is an index representing the energy efficiency of data centers and other IT facilities. It is calculated from average power consumption and design values.

■ FY2016 Products "MATOMETE KURUMATICS"

"MATOMETE KURUMATICS" is a next generation vehicle operation management service that combines telecommunications that enable checking operating conditions in real time with cloud technologies.

Link Website   MATOMETE KURUMATICS (Japanese)

■ Other Eco-Efforts

Initiatives	Details
Participate in the project to achieve an energy-saving society with active robot and drones	Develop an operation management system that utilizes drones for security and operation management functions
Participate in Ministry of Economy, Trade and Industry's virtual power plant launch test project	Promote initiatives for management of power supply and demand utilizing storage batteries for ordinary households and IoT Link Page_52 Virtual Power Plant Construction and Demonstration Project
Provide KDDI IoT Cloud ~Toilet Water-Saving Management~	Monitor water data in each restroom utilizing IoT to reduce water use by between 40 and 50%* Link Page_53 Other Exemples of Environment Innovation

* Expected values calculated from performance values of bulb manufacturer

Environmental Performance

Activity   **KDDI**

Green of ICT

■ Reducing Power Consumption in Base Stations and Undertaking Disaster Measure Initiatives

The au mobile phone base stations account for 60% of the total energy consumed by KDDI, reducing the power that base stations consume, which is one of our topmost priorities. Furthermore, 77% of the base stations that ceased to operate in the aftermath of the Great East Japan Earthquake that struck in 2011 did so because of power outages. This shows that disaster preparedness measures that address power outages are a pressing topic.

In regard to these issues, KDDI has promoted Tribrid Base Station initiatives* and extending the life of base station batteries to 24 hours.

* Base stations utilizing tribrid electric power control technology to efficiently supply three kinds of electric power: ordinary commercial power, power generated by solar panels, and midnight power saved in storage batteries

	Numbers as of the end of March 2017
Tribrid base stations	100 stations in Japan
Extending life of base station batteries to 24 hours	Around 2,200 stations in Japan

<Portable Batteries>

In FY2013, KDDI introduced and utilizes portable batteries with reduced environmental impact at 5 maintenance bases throughout Japan as a substitute for the mobile power supply vehicles used in the past to power mobile phone base stations during electricity outages.

Portable Battery Trial Test Results (FY2012)

Mobile power supply vehicles	8.2 L diesel fuel consumed per time	CO_2 emissions: 21.5 kg
Portable batteries	10 kWh of power consumed per time	CO_2 emissions: 4.1kg

A reduction of 17.4 kg of CO_2 emissions per time
* With an approximately 10-hour base station power outage and 1 kW wireless device power consumption

■ Renewable Energy (Internal use)

In order to actualize even better energy conservation and CO_2 emissions cuts at KDDI, a portion of the electric power used at large scale communications stations and tribrid base stations are utilizing natural energy sources such as solar power. In addition, almost all electrical power at eight mobile telephone base stations in Japan come from natural energy sources.

The amount of natural energy produced by each Tribrid Base Station is approximately 4.2 kWh per day*, accounting for 18% of the power used by every device. Furthermore, by utilizing midnight power, we predict that CO_2 emissions will be reduced 20 to 30%.

* Includes values researched by KDDI where average energy production is predicted from 6 solar batteries installed in test stations during clear skies

■ Renewable Energy (solar power generation business)

KDDI launched its solar power generation business in November 2013 with the aim of contributing to reduction of CO_2 emissions. We constructed solar power generation facilities on idle land owned by KDDI in three locations around Japan, and we sell the power generated to electric power companies based on the Feed-in Tariff Scheme for Renewable Energy.

Unit: MWh

	FY2013	FY2014	FY2015	FY2016
Total Power Generated (Total Generated Power Sold)	3,034	14,403	13,674	14,288

Results   **KDDI**

External Assessment

🔍 Link Page_117   Winner of the Minister of the Environment Gold Award in Low Carbon Cup 2017

Policy   **KDDI**

KDDI's Approach (Recycling-Oriented Society)

In order to reduce our environmental impact from waste produced through business activities, we effectively utilize our resources to contribute to the formation of a recycling-orientated society.

Results   **KDDI**

Reducing Waste and Promoting Recycling

KDDI promotes reuse activities that regenerate and effectively employ retired telecommunication facilities. We also use material recycling to effectively employ equipment, components and materials that have become unnecessary.

In FY2016, KDDI recycled a total of 2,400.8 tons of the materials in old deteriorated rechargeable batteries installed in telephone exchange stations used in test environments, to effectively utilize their resources. We will continue to make proactive efforts to reuse and

Environmental Performance

recycle the retired equipment generated during regular upgrades of communications equipment for base stations and other facilities in the future.

Activity and Results   **KDDI**

Promotion of Mobile Phone Recycling

Used mobile phone handsets that have been collected from customers at au shops are manually disassembled, separating out substrates, displays, cameras, plastics, screws, iron, antennas, motors, speakers and other items, in a secured room. Gold, silver, copper, palladium and other resources are extracted from the substrates, while screws and antennas are recycled into steel products and plastics are recycled into plastic products. When a machine is used to disassemble a mobile phone, plastics are burned up in the incineration process and so cannot be used as a recycled resource. In addition, recycling eliminates the need to conduct new mining and refining of mineral resources such as oil, iron, gold, silver, and copper, while also reducing the amount of carbon dioxide that is generated through the mining and refining processes. KDDI performs all disassembly manually to prevent recyclable resources from being wasted.

Performance in FY2016

Collection Performance*	Recycling Rate
3.59 million	99.8%

* Includes main body, batteries, and chargers

	Link Website	au shop Locator (Japanese)
	Link Page_80	Expanding Employment Opportunities and Advancement of Persons with Disabilities

Activity and Results   **KDDI**

Reduction of Paper Resources

Initiatives	FY2016 Result
Reduction of paper by putting bills on the Web	3,892 t

Basic flow for Recycling of Mobile Phones

Turned into next products and provided to customers — Customers

Used mobile phone handsets

1. Personal information leakage prevention through formatting and circuit board destruction using specialized machines.

2. Disassembly conducted by hand to facilitate material recycling.

Different recycling processes employed for different materials.

Iron products ← Domestic steelmakers ← Iron
Aluminum products / Copper products ← Domestic producers of non-ferrous metals ← Non-ferrous metals (copper/aluminum)
Plastic products ← Recycling plant ← Plastic

To KDDI-designated recycling plant

KDDI Challenged and other recycling plants

To promote material recycling, disassembly is performed by hand in secure rooms at KDDI Challenged and other recycling plants

Environmental Performance

Policy　　　　　　　　　　KDDI

Approach to Water Use

There are fears of losing water resources from population increase on a global scale and the reduction of useable water caused by climate change. Disputes concerning water distribution and pollution have broken out in various locations around the world, making efficient water use an issue. KDDI is making efforts to provide products and services to reduce water use from business activities and contribute to efficient water use.

■ **Providing KDDI IoT Cloud ~Toilet Water-Saving Management~**
In office and public restrooms, toilets with only one setting when flushing are usual, leading to excessive water use. "KDDI IoT Cloud ~ Toilet Water-Saving Management~" detects users with a sensor set in toilet stalls, optimizing control of the amount of toilet water while the user is present.

　　Furthermore, by understanding the water amount data in individual stalls utilizing IoT, we can monitor and remotely maintain precise water amounts, saving 40 to 50%* water and reducing costs compared to before.

* Expected values calculated from performance values of bulb manufacturer. Value may be lower depending on the location installed.

Policy　　　　　　　　　　KDDI

KDDI's Approach (Biodiversity)

KDDI has established the KDDI Action Guidelines on the Preservation of Biodiversity to multilaterally assess our contributions toward the preservation of biodiversity. In these guidelines, we defined the 3 principles of Preserving Diversity in Business Activities, Collaboration and Cooperation with Related Organizations, and Promoting Recycling of Resources. Using this policy, we pinpoint various opportunities to promote activities.

KDDI Action Guidelines on the Preservation of Biodiversity

Preserving Diversity in Business Activities
When formulating business plans, we take into consideration the impact on the related ecosystems and local community.
Collaboration and Cooperation with Related Organizations
We strengthen collaboration and cooperation with administrative authorities, NPOs and other organizations, and undertake CSR activities using ICT.
Promoting Recycling of Resources
To prevent the depletion of bioresources and minimize degradation of the natural environment, we continuously and proactively engage in recycling of resources.

Policy　　　　　　　　　　KDDI

Biodiversity Consideration for Building Base Stations

KDDI is also taking biodiversity into consideration when constructing base stations. This includes cooperation with local governments and environmental conservation associations to delay construction when it falls during nest building and egg laying periods of the Northern Goshawk and the Oriental Stork. Another example is the transplanting and afforestation of rare plants that exist on sites with guidance from the Ministry of the Environment. Furthermore, we select construction methods that do not produce pile driving noise so that the delivery, breeding, and milking of race horses and dairy cattle are not affected by construction noise. Although we have their understanding on the necessity for base station construction, we take great efforts to build reliable relationships with local governments and residents by minimizing the effect that base station construction has on the environment.

Activity　　　　　　　　　　KDDI Group

Research on Behavior of Endangered Ganges River Dolphins

KDDI Research utilizes the acoustic technology cultivated by underwater robots that maintain and inspect submarine cables that connect continents and collaborates with the Institute of Industrial Science, The University of Tokyo, the Kyushu Institute of Technology, the Indian Institute of Technology Delhi, and WWF-India to observe the ecology of the endangered Ganges River dolphin.

　　The researchers catch the ultrasonic waves these dolphins emit to determine their surrounding environment through murky waters using underwater microphones in hopes of surveying the dolphins' behavior underwater. One advantage of using this method is that it enables the

Environmental Performance

observation of large numbers of dolphins without having any effect on their behavior because it does not physically touch the dolphins.

This initiative won the Fujisankei Group Award at the 25th Global Environment Awards.

Activity and Results   KDDI

Green Road Project

■ Participation in Volunteer Survey of Manazuru Forest Reserve of Uotsuki

KDDI participated in the volunteer survey of the Forest Reserve of Uotsuki located in the Manazuru Peninsula. This activity is carried out with the objective of permanently preserving the Forest Reserve of Uotsuki formed from black pines afforested in the Edo period. It forms a part of the Forest Reserve of Uotsuki Conservation Project executed in collaboration between the town of Manazuru and OISCA International. Utilizing tablets loaned out by KDDI and the "G Suite Basic(TM)*" solution service, we cooperated with the citizens of Manazuru to survey the degree of growth of the trees.

* A cloud groupware service that can be used online or offline on smartphone and tablet apps

■ Environmental Conservation Activities by Employees

In FY2016, as in previous years, KDDI conducted environmental conservation activities in regions across Japan. Employees and their families participated in volunteer activities in a variety of settings in each region, ranging from mountains to rivers and beaches.

Environmental conservation activity execution	Total participants
122 times	4,529

Hokkaido Branch
· Countermeasures against forest damage from deer reforestation activities

Northern Kanto Branch
· Conservation activities in Musenyama, KDDI's Forest, a Green Trust conservation location

Hokuriku Branch
· Participation in cleaning activities held by Committee to Beautify Asano River
· Participation in the Greenery and Satoyama Conservation Forest Tree Raising Activities 2016 held by OISCA

Chugoku Branch
· Participation in Daisen Fullscale Fall Cleaning held by the town of Daisen
· Participated in forest conservation activities held by the Hiroshima Afforestation Forum

Kyushu Branch
· Participation in Patchwork Reforestation held by the city of Yame

Shikoku Branch
· Participation in forest conservation activities of the Shoyo Forest Reforestation held by the town of Uchiko
· Participation in Onoseyama afforestation activities held by OISCA

Tohoku Branch
· Planting planted maple saplings as part of satoyama conservation activities

Head Office/Southern Kanto Branch
· Employees and their families participate in thinning pines and cypresses on Mount Takao

Head Office
· Participation in Mount Fuji Reforestation held by OISCA
· Tree growth survey held by the town of Manazuru as a part of the Forest Reserve of Uotsuki Conservation Project

Chubu Branch
· Participation in the Nagano Adopt-a-Forest Promotion for forest conservatio
· Held cleanup activities in Omotehama Network's loggerhead sea turtle nesting grounds

Kansai Branch
· Logging of chinquapin trees to beautify Mount Tennozan