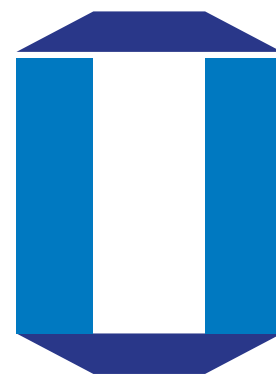


岡山大学

OKAYAMA UNIVERSITY

ENVIRONMENTAL
REPORT



OKAYAMA
UNIVERSITY

GLOBAL GATE FOR LEARNING



OUT LINE 2016

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Scope of this Environmental Report (Research and Education Activities in the Areas Listed Below)

Tsushima Campus/Shikata Campus/Kurashiki Campus (The Institute of Plant Science and Resources) /Misasa Campus (The Institute for Planetary Materials)/ Attached Schools (Higashiyama Campus: Kindergarten/Primary School/Junior High School/Hirai Campus: School of Special Needs Education)
(Cases that include areas that are not listed above are described therein.)

Period and Issuance of the Report

Period: April 2015 to March 2016

Issued: September 2016 (Planned date of next issue: September 2017)

1. Okayama University at a Glance

University Name : National University Corporation Okayama University

Address : 1-1-1 Tsushima-naka, Kita-ku, Okayama 700-8530 Japan

Foundation : April 1870

President : Kiyoshi MORITA

Students and Staff : 18,474 people

Name of Campus : Tsushima Campus/Shikata Campus/Higashiyama Campus/Hirai Campus /Hachihama Campus /Tsudaka Campus /Kurashiki Campus /Misasa Campus /Honjima Campus /Ushimado Campus /Haga Campus etc.

Classification	Breakdown	Classification	Breakdown
Executives 10 people	President (1) Directors (7) Inspectors (2)	Graduates 2,951 people	Master's Course (1,658) Doctor's Course (1,192) Professional Degree Course (101)
Faculty and Administrative Staff 3,984 people	Professors (475) Associate Professors (381) Senior Assistant Professors (123) Assistant Professors (513) Research Associates (10) Teachers(102) Clerical Employees/Technical Employees (2,380)	Children 1,381 people	Primary School (622) Junior High School (557) School of Special Needs Education (59) Kindergarten (143)
Undergraduates	10,148 people	Total	18,474 people

2. Message from the President



Kiyoshi MORITA
President, Okayama University

It is now more than 60 years since Okayama University was founded under the new school system through the integration of Okayama Medical University, the Sixth High School, and other schools under the former system. Throughout this time, the university has played a role as the center of town development in a harmonious balance of intellect, nature, people, and the environment. We recognize consideration of the environment as an especially important aspect of our social responsibilities and contributions.

Okayama University now offers programs in 11 faculties and 7 graduate schools, including programs in the Faculty of Environmental Science and Technology and the Graduate School of Environmental and Life Science. In addition to the Environmental Management Center, we also established the Environment Health & Safety Intelligence Department in January 2015 to thoroughly and comprehensively address risks, perform safety and health management, and take responsible measures for the entire institution.

We recognize the importance of improving our approaches to the environment at the university, and returning the results of our research to society as our responsibility and contribution to the society we serve.

Maintaining our relevance as an international base for research and education requires us to pursue environmental preservation with full awareness of its importance for society and the planet we inhabit. In line with this, we strive to create a beautiful campus surrounded by green through a commitment to continued progress in a wide range of projects, projects such as the planting and care of trees, the effective utilization of water, and the saving of energy through greening campaigns throughout the campus.

In view of current environmental circumstances, Okayama University recognizes that these efforts are more important than ever. Pressing global issues such as reduction of greenhouse gas emissions that Japan faces along with other countries, restoration after the Great East Japan Earthquake, and anti-pollution measures have been increasing. Our awareness and concern for environmental issues surrounding universities have come to a significant and serious turning point.

This report includes very meaningful content. I hope that everyone at Okayama University places a priority on addressing these environmental issues in an ongoing manner.



3. Okayama University Environmental Policy

Basic Principle

Based on the recognition that protecting and passing down the bounty of nature in the global environment to the next generation should be a fundamental pursuit, Okayama University strives to do its part in contributing to the realization of a sustainable recycling-oriented society and reducing environmental load through its research and education programs, and in a wide range of other activities throughout the university with the goal of creating a sustainable campus. In addition, we have also worked with the city and its communities to establish a new university town designed to serve as a base for international research in collaboration.

Basic Policies

Okayama University leverages the characteristics of its 11 faculties and seven graduate schools, related research laboratories, attached hospital and schools to promote the following activities:

1. Research and education related to the global and regional environments and biodiversity, the cultivation of human resources that exhibit a high degree of comprehension applicable to environmental areas both at home and abroad, and research that contributes to the preservation and improvement of the environment.
2. Extension courses and symposiums on the environment, collaboration with regional society, and contributions to the environment.
3. Compliance with laws, regulations, agreements, and voluntary standards regarding the environment.
4. Global environment preservation activities in business activities:
 - (1) Promotion of energy saving
 - (2) Measures against global warming
 - (3) Measures for resource saving
 - (4) Waste reduction, recycling, and the proper processing of hazardous waste
 - (5) Promotion of green purchasing
 - (6) Thorough management of chemical substances
5. The continual improvement of environmental preservation activities by faculty, students and everyone else at Okayama University.

April 1, 2016
Kiyoshi MORITA
President, Okayama University



4. Environmental Education

Environmental Education Courses

Okayama University provides a wide variety of environment-related programs in both general education and major subjects at each faculty. We have set the goal of becoming a sustainable university and hope that many students take an active interest in enrolling in these environment-related programs.

“Environment and community – Learnings from Mizushima, Kurashiki City”: Practical environmental education through social collaboration

Center for Regional Research (AGORA)

Assoc. Prof. Kanae ISHIMARU, Researcher Ikuko TAKANO

In FY 2016, after two years of development time, Okayama University executed “community based learning”, a series of courses that provide students with an opportunity of learning from a combination of classroom lectures and practical experiences in local communities. The purposes of this courses are to cultivate students’ ability to identify the problems of today’s society, and to foster human resources capable of realizing a wellbeing society then pass it down to the future. As a part of environmental education programs, this course, focusing on Mizushima, an area where experienced air pollution from industrial complex, features the contents that encourage students to cultivate habits of learning from the reality of the local community and of motivating themselves to think on their own.



Student group work

In the first semester of FY2015, the course paid attention to the interrelation between “environment” and “local community” in the context of industrial pollution that occurred in Mizushima, through the three field work trips, lectures by people from outside the university and workshops in the classroom. After each class, group sessions were held to provide students to exchange and review the ideas they have gained in the class, and individual study sheets filled out by the students were returned with feedbacks by the lecturers. This system was introduced to help students develop the ability of critical thinking and the sense of ethics that is needed to achieve sustainable society.

Environmental education at the school of special needs education attached to Okayama University

The practical learning provided at the high school attached to Okayama University was established to give students opportunities to learn the essentials required for future work and becoming independent members of society. Specifically, we focus on recycling and cleaning activities associated with the environmental education described below.

For the Aluminum Can Recycling Activity, we placed aluminum can collection boxes at Higashiyama Community Center and the high school, collected them with the help of residents, parents, and university staff. Students were assigned to four recycling processes, separation, washing, removal of pull-tabs, and crushing. Continuing the activity twice each week, we collected and prepared 379 kg of aluminum cans by the end of February. Students loaded the cans on the truck and let out a big cheer as they were driven off to be recycled.

First-year students at the high school noticed weeds at a park near the school and thought about a cleanup project. They made a plan to clean parks in the community with a focus on weeding. Students were happy with the activity when they saw how beautiful the parks looked after they had finished. Elementary school students and others living around the parks were very happy and thanked the high school students for their efforts.



Cleaning a community park

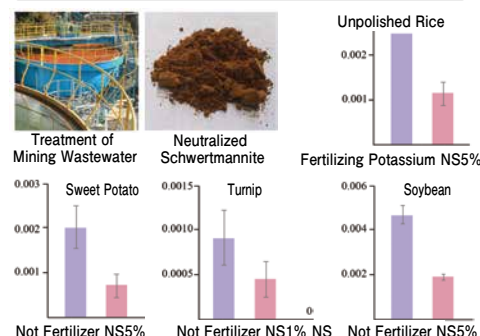
5. Environmental Research

Radioactivity transport control technology for agricultural products utilizing neutralized schwertmannite

Graduate School of Education Assoc. Prof. Teruhiko ISHIKAWA, Senior Asst. Prof. Taro HARADA

Since the accidents at the Fukushima No.1 Nuclear Power Plant, radioactive contamination has created many issues. Radioactive transport from soil to agricultural products is one of these. Experiments and research are being carried to establish measures to address the problem. We discovered that absorption of radioactive cesium by agricultural products is significantly reduced by the use of neutralized schwertmannite (NS), which is a by-product of wastewater treatment at the abandoned Yanahara Mine in Okayama Prefecture (Figure). Fukushima Prefecture already uses potassium chloride as fertilizer; however, NS is also effective for soil with high-exchangeable potassium concentration. NS has already been certified for use in agriculture, and the reserve is tremendous, which makes use for vast areas of contaminated agricultural land possible.

Transfer Coefficient of Radioactive Cesium (Cs) = $\frac{\text{Radioactive Cesium (Cs) Concentration in Farm Products (Bq/Kg)}}{\text{Radioactive Cesium (Cs) Concentration in Soil (Dried Soil, Bq/Kg)}}$



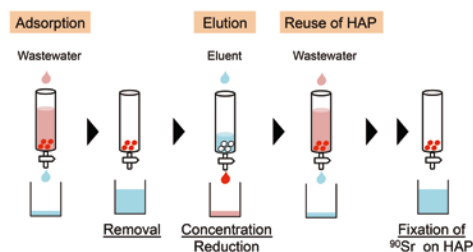
Results of tests conducted in Fukushima City (FY2014-FY2015). Lower limit of measurement: 1Bq/Kg. The vertical axis shows the transfer coefficient of radioactive cesium (Cs).

Removal of radiostrontium from wastewater by bone component

Advanced Science Research Center Prof. Toshiro ONO

Large amounts of radioactive nuclides were released into the environment due to the Fukushima Daiichi Nuclear Power Plant accident on March 11, 2011. Among them, long-lived radioactive nuclides, such as ^{134}Cs , ^{137}Cs , and ^{90}Sr , are of great concern in terms of environmental contamination. The γ -emitter ^{137}Cs has been used to evaluate the environmental monitoring and decontamination, because it is easily detected using various instruments. However, the pure β^- -emitter ^{90}Sr requires a complicated extraction and purification process for analysis. Therefore, few studies on ^{90}Sr release have been performed so far.

The author developed an effectively removal system of ^{90}Sr from aqueous solution by hydroxyapatite (HAP) column procedure. HAP is a main mineral constituent of bone and tooth and has an outstanding biocompatibility. HAP is a possible sorbent for heavy metals in wastewater due to its high adsorption capacity and low water solubility. The present HAP column technique is useful to remove ^{90}Sr from the wastewater as well as natural water in the environment. Concentrated ^{90}Sr adsorbed onto HAP could be thus stored securely as the dry solid waste, which savings in disposal spaces and costs.



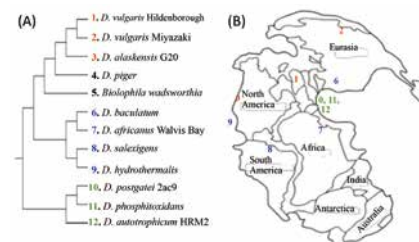
Concentration and volume reduction of wastewater and fixation of ^{90}Sr on HAP particles for the storage as dry solid waste.

Ancient earth remembered in the DNA of environmental microorganisms

Graduate School of Environmental and Life Science Prof. Takashi TAMURA

Recently, one environmental microorganism genome sequence after another has been decoded. This has produced a trend of discussing the system of microorganisms and their geographical distribution on a global scale.

The author focused on [NiFeSe] hydrogenases, a hydrogen-metabolizing enzyme in sulfate-reducing bacteria that have lived on the earth for more than 200 million years. Identifying the source of isolation of the strains of these strictly anaerobic bacteria as the Pangea Continent, which existed 2.5 million years ago, suggested that a common ancestor that was isolated into three strains moved to its current habitat through continental break-up and drift (Figure). This study established a new system of analysis for environmental microorganisms integrating microorganism genomes and geoscience.



Phyletic relationship of sulfate-reducing bacteria (A) extracted from [NiFeSe]-Hydrogenase and related gene clusters, and the source of isolation (B) attributed to the Pangea Continent (250 million years ago)

6. Environmental & Social Contributions

Public lecture hosted by the Okayama University Faculty of Environmental Science and Technology: “Creating regional opportunities through science based on harmony between human activity and the natural environment”

On Saturday, August 1 and Sunday, August 2, 2016, Okayama University held extension lectures along the theme of “Creating Regional Opportunities through Science Based on Harmony between Human Activity and the Natural Environment.” Six faculty members gave presentations on the subjects listed below, including the most advanced research results achieved by the Faculty of Environmental Science and Technology.

More than 60 people, ranging in age from teens to octogenarians participated in the extension lectures held over two days. A questionnaire given to participants after the lectures showed that the content was quite satisfying.

Saturday, August 1

- Development of Safe and Secure Towns
- Ecology and Preservation of Aquatic Animals Seen in Okayama
- What is the Heavy Rain Fall Seen Once Every 100 Years?

Sunday, August 2

- Protecting Life from Foundation Disasters
- Issues at the Boundary of Mountains and Towns Seen from Animal Damage
- Deterioration and Restoration of Soil – The Largest Storage of Carbon Dioxide on Land



At the lecture

Asst. Prof. Takayuki SHUKU
 Assoc. Prof. Kazuyoshi NAKATA
 Prof. Hidetaka CHIKAMORI

Senior Asst. Prof. Toshifumi SHIBATA
 Assoc. Prof. Yasuaki KUKI
 Assoc. Prof. Yasushi MORI

“Seeking harmony between the environment and human activity” – Extension lecture organized by the Environmental Management Center, Okayama University

On Saturday, November 7, 2015, the Okayama University Environmental Management Center provided extension lectures in Room 101 on the 1st floor of the building of the Faculty of Environmental Science and Technology. Along the theme, “Seeking Harmony between the Environment and Human Activity,” we explained the history of environmental issues closely associated with resources, waste, and the circulation of materials and energy, and introduced research and development related to these environmental issues conducted by Okayama University.

Environmental Management Center Director Katsuya KAWAMOTO (Professor) gave a presentation entitled “History of Environmental Issues – Developing New Ideas Based on the Study of the Past”; Associate Professor Yasushi MORI gave a presentation entitled “Establishment of a Sound Regional Material-Recycling Society”; and Associate Professor Yasuhiko BENINO gave a presentation entitled “Glass Materials and Environmental Issues.”

After the each presentation, participants asked many questions. We had 31 participants this year, an increase over the previous year. According to the questionnaire given after the presentations, participants were quite satisfied with the content.



At the lecture

Okayama University Environmental Management Center Extension Lecture “Risk associated with global warming and climate changes”

On Saturday, June 20, 2015, the Environmental Management Center held extension lectures with 113 attending.

Seita EMORI from the National Institute for Environmental Studies gave a presentation entitled “Risk Associated with Climate Changes and Choice of Humanity~From the Latest Report of IPCC~”; Professor Shinichi NISHIMURA of Okayama University’s Graduate School of Environmental and Life Science gave a presentation entitled “The Mechanism of and Countermeasures for Foundation Disaster Caused by Heavy Rainfall”; and Yoshio TSUDA from the National Institute of Infectious Diseases gave a presentation entitled “The Relationship among the Environmental Changes, Mosquitos, and Mosquito-Borne Infections.” After each presentation, participants asked many questions.



At the lecture

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7. Voluntary Environmental Improvement Activities

Measures against Smoking at Okayama University

The impact of the campus-wide no smoking campaign on passive smoking

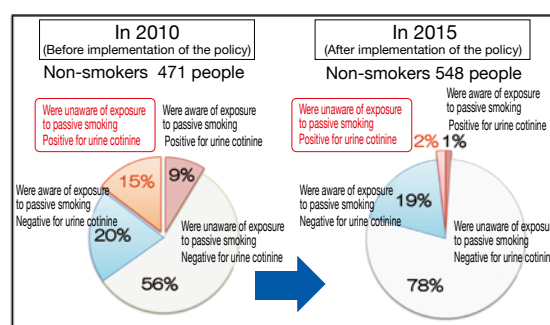
Okayama University has had a campus-wide no smoking policy since April 1, 2014 as a part of its campaign against passive smoking. Did this measure really lead to reduce passive smoking? We examined the impact of the policy in this study by comparing the results of a questionnaire on passive smoking and urine cotinine measurement for university employees at a periodical health examination held in August 2015 (one year and four months after the implementation of the campus-wide no smoking policy) with a questionnaire distributed in August 2010 (three years and eight months before the implementation of the campus-wide no smoking policy).

Urine cotinine is the metabolite of nicotine contained in tobacco smoke. Measurement of urine cotinine is used widely as an index of exposure to passive smoking. The Japan Society for Tobacco Control sets a level of 5ng/ml or more of urine cotinine as indicating the presence of passive smoking. Okayama University conducted the questionnaire and urine cotinine measurement targeting non-smoking university employees who underwent the periodic health examination held at the Tsushima Campus.

Comparison of the two questionnaires showed that individuals who felt they were exposed to passive smoking on campus decreased from 39% before implementation of the policy to 15% after implementation. The rate of passive smoking converted from the urine cotinine levels also decreased significantly from 23.0% to 2.8%.

The figures showed the relationship between the results of questionnaires and urine cotinine levels for three days before each health examination. Before the implementation of the policy, 15% of the university employees who were not aware of their exposure to passive smoking were positive for urine cotinine. A serious issue at that time, we were pleased that the rate dropped to 2% following implementation of the policy. Individuals unaware of their exposure to passive smoking who were negative for urine cotinine, which is a favorable result, also increased from 56% before implementation of the policy to 78% after implementation.

Since surveys were conducted five years apart and social awareness about tobacco has changed during that time, we cannot determine if the good results were the result of the campus-wide no smoking policy alone; however, we believe that it has had a good impact on the prevention of passive smoking among university employees.



Awareness of passive smoking before and after the campus-wide no smoking campaign and state of passive smoking as analyzed by urinary cotinine concentration

Clean Campus 2015

The Okayama University Student Association C.C.C carried out its Clean Campus 2015 Project at the Shikata Campus on October 4, 2015 and the Tsushima Campus on October 11, 2015. C.C.C staff and university employees were divided into teams and assigned to different activities, activities such as picking up garbage on campus and cleaning the log tables around the welfare and recreation facilities. In addition to C.C.C staff, 57 students and employees at the Tsushima Campus and 11 students and employees at the Shikata Campus participated in the activity. As has been done each year, we sought to increase awareness about waste categories by separating garbage into burnable, unburnable, glass bottles, cans, plastic bottles, and tobacco waste. A total of 89.2kg of garbage and 1,959 cigarette butts were collected at the Tsushima Campus, and 17.3kg of garbage and 469 cigarette butts were collected at the Shikata Campus. It was amazing that we collected much more garbage and many more cigarette butts than last year.

C.C.C continues organizing and improving environmental activities to increase student awareness not only about garbage, but also other environmental issues.

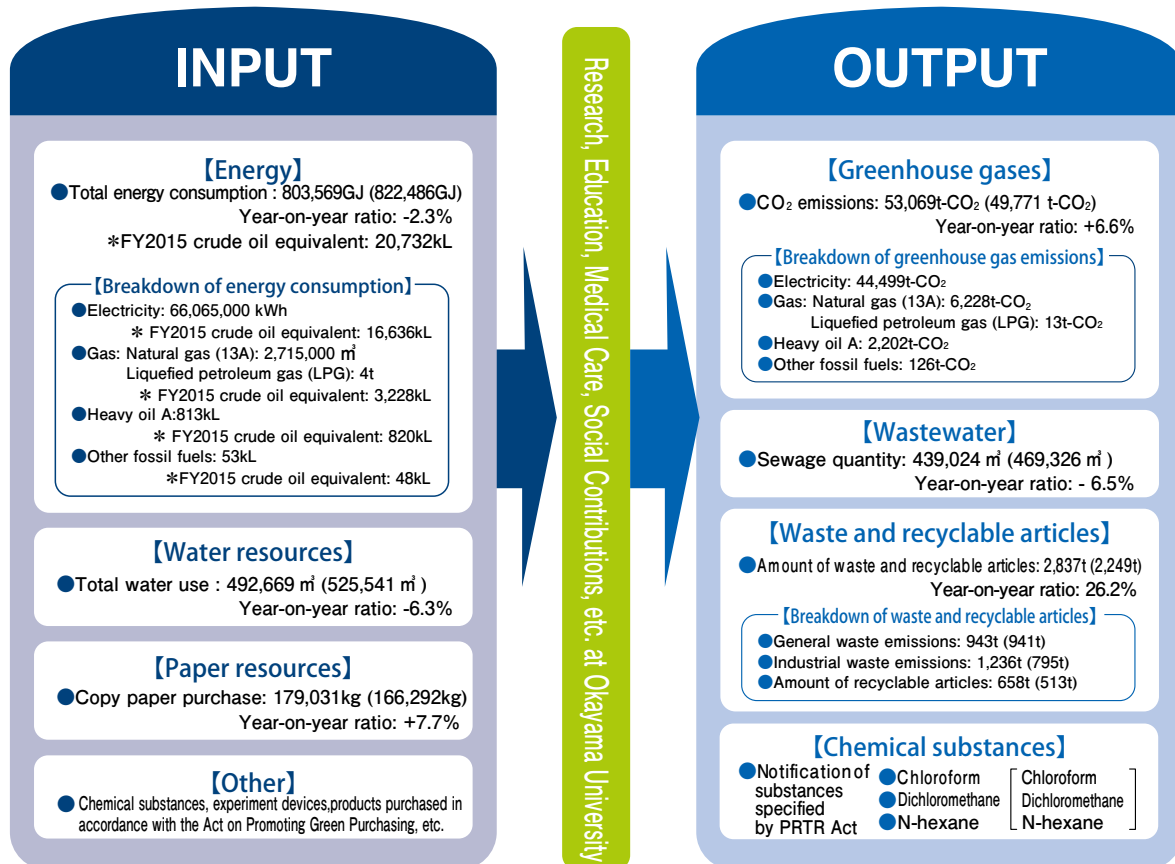


Clean Campus 2015

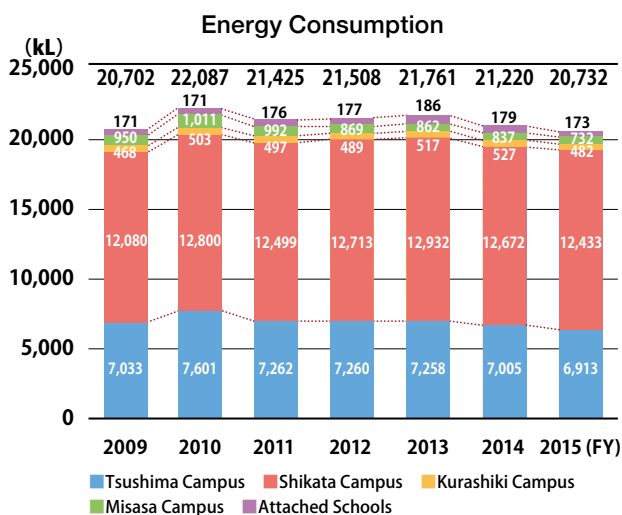
8. Environmental Load

We produce environment load in a wide range of activities in research, education, and medical care at Okayama University. The next figure gives an overview of the FY 2015 Okayama University Material Balance.

Okayama University understands its environmental load, and sets the six priority items described below to reduce it : (1) Promotion of energy saving; (2) Measures against global warming; (3) Measures for resource saving; (4) Waste reduction, recycling, and the proper processing of hazardous waste; (5) Promotion of green purchasing; and (6) Thorough management of chemical substances.

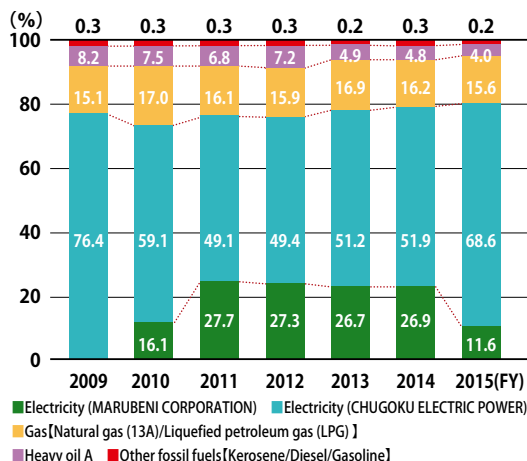


Environmental Load of Okayama University for FY2015. Parentheses denote environmental load for FY 2014.



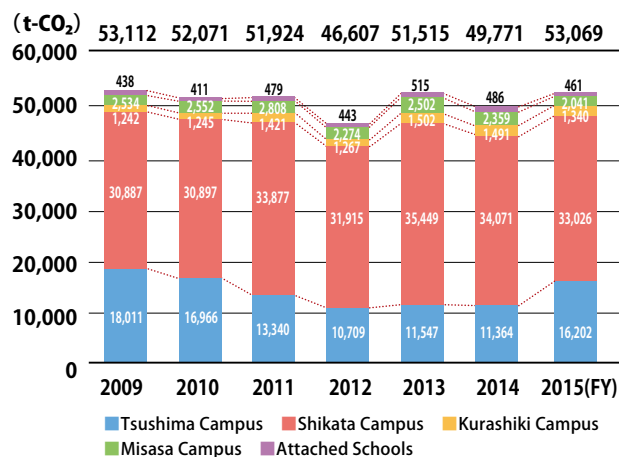
Total energy consumption by Okayama University in FY 2015 was the crude oil equivalent of 20,732 kL, a 2% of decrease from the previous year. The decrease was mainly the result of decreased air conditioner use due to a milder summer (July – September) and winter (December – March) compared with past Okayama City averages.

Energy Consumption by Source



Looking at total energy consumption by Okayama University, the ratio of heavy oil consumption is on the decrease in the medium- and long-term run while electric power consumption is on the increase. This suggested a greater need to enhance our approaches to energy saving, including improvement of facilities, and electricity saving by employees and students at the university.

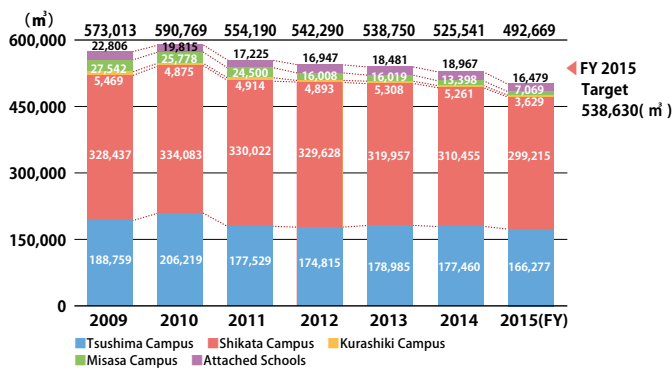
Greenhouse Gas (CO₂) Emissions



Okayama University is working on the reduction of greenhouse gases, especially CO₂ emissions from energy consumption, as one of its measures against global warming.

CO₂ emissions in FY 2015 totaled 53,069 tons, a 7% increase from the previous year. Since total energy consumption has decreased, this increase resulted mainly from an increase in the coefficient along with changes of factors applied in the conversion of electricity to CO₂ equivalents.

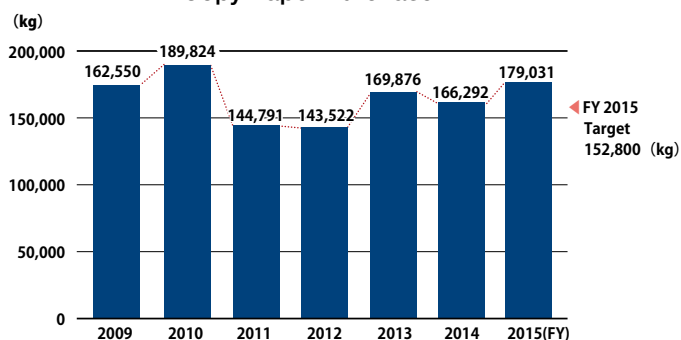
Water Use



Total water use in FY 2015 was 492,669 m³, a 6% decrease from the previous year. We achieved the FY 2015 target specified by the Environmental Objectives (Mid-term Targets), a 6% reduction from FY 2009 to 538,630 m³.

We continue working on saving water through the implementation of equipment and enlightenment activities.

Copy Paper Purchase

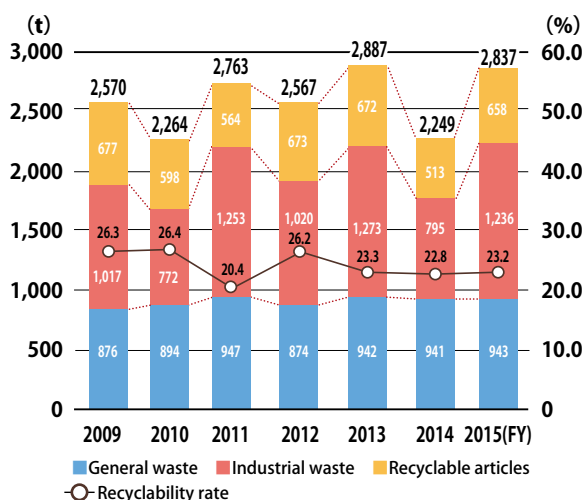


Okayama University works on reducing the use of paper, especially copy paper.

Copy paper purchased in FY 2015 totaled 179,031 kg, an increase over the previous year and in excess of the base year, FY 2009. Unfortunately, we were unable to achieve the FY 2015 target specified by the Environmental Objectives (Mid-term Targets).

We promote reduced paper use by tracking individual copy machine use, the increased use of tablets and encouraging two-sided printing. We analyze copy paper use to establish resource-saving measures.

Waste and Recycled Object Emissions



All emissions have been increasing, while the ratio of the recyclable articles against the total waste (recyclability rate) of FY 2015 decreased from the previous year.

University employees and students are engaged in waste separation. Checks have continued at waste collection sites on campus, and paper waste collection for recycling is well known throughout the campus.

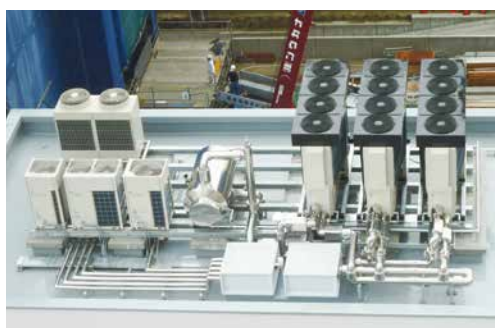
We continue to promote waste separation, and the reduction and recycling of waste.

Facility Improvement Considering the Environment

Okayama University has been expanding facilities with an emphasis on sustainability in consideration of energy and resource saving, and the reduction of environmental load.

In FY 2015, in order to promote saving energy, we have implemented sprayed insulation on exterior walls, multi-layered glass, rooftop waterproofing with heat insulation, LED lighting, high-efficiency transformers, high-efficiency air conditioners, total heat exchange ventilators, recycled piping material, and other devices complying with the Act on Promoting Green Purchasing. In order to promote resource saving and reduction of our environmental load, we continue working on reducing by-products generated at university construction sites, recycling and resource recovery. We also consider the environment surrounding university construction sites through the implementation of gas emission countermeasures and the utilization of low-noise type construction machinery.

We continue to develop facilities in consideration of the global environment and the reduction of maintenance costs.



Roof of the clinical lecture building
(High-efficiency air conditioner)



Auditorium in the clinical lecture building
(LED lighting & multi-layered glass)

Appropriate Management of Chemical Substances

Okayama University handles a wide range of chemical substances in its research, education, and medical care activities. In order to promote the appropriate management of these chemical substances, we instituted the Chemical Substance Management Regulations and Implementation Guidelines on April 1, 2014. The regulations clarify the management system, scope, and target substances, which facilitated the reinforcement of the university's chemical substance management system.

We also promote increased employee and student awareness about chemical substances through chemical substance management seminars, education and practice prior to experiments, and audits of chemical substance management.



Chemical substance
management seminar



University Mark

OKAYAMA UNIVERSITY ENVIRONMENTAL REPORT 2016

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