10. Infrastructures

1. Introduction

Facility management is focused on securing the safety, stability, and reliability of equipment and systems at each experimental facility. It must provide an efficient and effective delivery of support services not only to domestic academia, research institutes, and industry but also to foreign entities because SPring-8/SACLA offers world-leading, highly brilliant X-rays. We efficiently control and provide 24/7 support to all facilities.

We manage the construction and maintenance of the facilities and their systems, such as electrical equipment, cooling units, experimental drainage, telephones, and hygienic air conditioning, on a five-year plan. This plan includes daily systematic monitoring and periodic inspections. In addition, we have implemented a plan to improve the overall research environment through initiatives to address aging equipment and improve energy savings.

2. Management of utilities (lighting, heating, and water)

2-1. Electricity

Electricity is provided by Chubu Electric Power Miraiz Solution's duplicate lines. The receiving voltage is 77 kV. The total contracted power is 33,000 kW. (The industrial power for facilities is 31,500 kW, and the nonindustrial power for administrative/sitting rooms is 1,500 kW.) The electric power consumption in FY2021 was 177 GWh. Figure 1 and Table 1 show the trends of electric power use over the past five years.

For the periods of peak electric power demand, measures are implemented to ensure that the total consumed power remains below the contract limit. These measures include the increased monitoring of overall use, the adjustment of air-conditioning settings, and the implementation of energy conservation measures.

Additionally, facility management was responsible for supporting researchers' needs and their related organizations and divisions regarding electric power quality/stability enhancements toward upgrading/diversifying research.

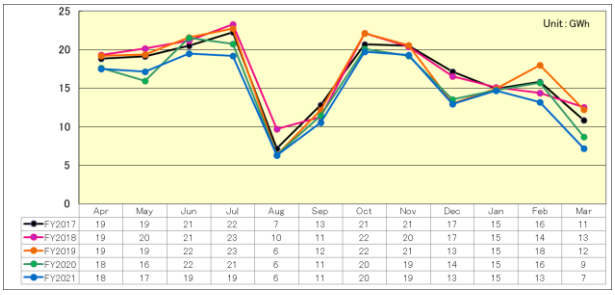

Fig. 1. Electricity consumption trends (at the Harima Campus).

Table 1. Electricity consumption.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Industrial power	193.4	198.9	195.4	178.6	170.0
Nonindustrial power	7.3	7.0	6.9	7.0	7.3
SPring-8 as a whole	200.7	205.9	202.3	185.6	177.3
Comparative (±)	13.5	5.2	-3.6	-16.7	-8.3

[Unit: GWh]

2-2. Water and sewage

Tap water from the Chikusa River is provided by the water sewage office Harima highlands wide-area administration association. The usage flow rate of tap water in FY2021 was 235 km^3, while the amount of sewage discharge was 88 km^3. Figure 2 and Table 2 show the water consumption trends over the past five years, while Figure 3 and Table 3 show the sewer discharge trends over the past five years.

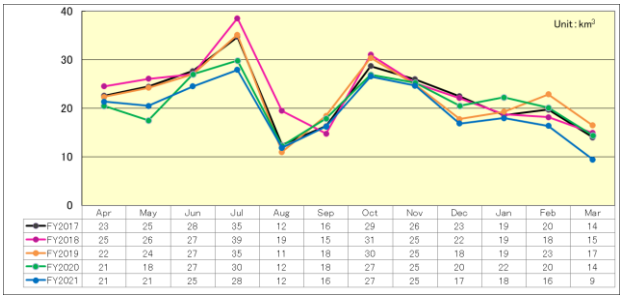

Fig. 2. Amount of water used (at the Harima Campus).

Table 2. Amount of water used.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Shared facility	197.0	204.1	194.6	178.3	156.2
RIKEN facility	70.9	76.5	75.5	76.4	78.3
SPring-8 as a whole	267.9	280.6	270.0	254.7	234.5
Comparative (±)	5.5	12.7	-10.6	-15.3	-20.2

[Unit: km^3]

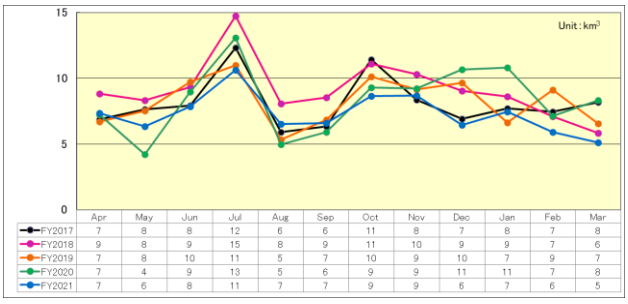

Fig. 3. Amount of sewer discharge (at the Harima Campus).

Table 3. Amount of sewer discharge.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
SPring-8 as a whole	97.0	109.8	98.4	99.8	87.5
Comparative (±)	-11.9	12.8	-11.4	1.4	-12.3

[Unit: km^3]

2-3. Gas

Town gas (13A) is provided by the West Harima Station of Osaka Gas. The FY2021 usage flow rate was 242 km^3. Figure 4 and Table 4 show the trends of gas use over the past five years.

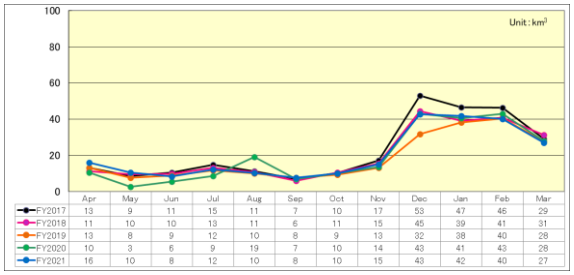

Fig. 4. Amount of town gas used (at the Harima Campus).

Table 4. Amount of town gas used.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Shared facility	252.5	227.2	204.3	216.0	225.4
RIKEN facility	15.3	15.3	15.3	15.5	16.3
SPring-8 as a whole	267.8	242.5	219.6	231.5	241.7
Comparative (±)	20.1	-25.3	-22.9	11.9	10.2

[Unit: km^3]

2-4. Energy conservation

The following measures were implemented in FY2021 to reduce CO_2 emission and save energy.

(1) Existing air conditioners were updated to “top runner” packaged air conditioners (a set of energy efficiency standards for energy initiative) at the following facilities: Experimental Animal Facility and Experimental Drainage Treatment. These efforts eliminated 13 tons of CO_2 per year.

(2) The substation equipment was updated at the following facilities: Structural Biology Facility and Substation Facility of Energy Center. These efforts eliminated 2 tons of CO_2 per year.

(3) All the lighting in the following facilities was updated with LEDs: Medium-length Beamline Facility (shared space lighting), Exterior lights throughout the premises. These efforts eliminated 30 tons of CO_2 per year.

(4) Transformer Facility No. 2 was shut down owing to the change of the injection method

from X-ray Free Electron Laser SACLA. These efforts eliminated 147 tons of CO_2 per year.

(5) Operations of an injection system and a machine cooling system at the Storage Ring were temporarily suspended during inspection adjustment periods in the summer and winter, and at the fiscal year-end. These efforts eliminated 1,720 tons of CO_2 per year.

(6) The machine cooling equipment, which was a recirculating piped water system used to remove waste heat at the Storage Ring, was upgraded to a more energy-efficient one. The new equipment uses cold outside air in the winter and a refrigerating machine in the summer. These efforts eliminated 144 tons of CO_2 per year.

(7) The partial operation of the air handling units (AHUs) in the Experimental Hall at the Storage Ring during the summer/winter maintenance periods and at the fiscal year-end eliminated 721 tons of CO_2 per year.

(8) The partial operation of outdoor AHUs and air-exhaust ventilators of the tunnels for the injector and accelerator at the Storage Ring during the summer/winter maintenance periods and at the fiscal year-end eliminated 51 tons of CO_2 per year.

(9) The partial operation of air conditioners in the Experimental Hall at the RI Laboratory during the summer/winter maintenance periods and at the fiscal year-end eliminated 25 tons of CO_2 per year.

(10) The partial operation of the fan coil units (FCUs) in the tunnels for the injector and accelerator at the Storage Ring during the summer/winter maintenance periods and the fiscal year-end eliminated 26 tons of CO_2 per year.

(11) The partial operation of the humidifying function of the outdoor air handling units (OHUs) in the tunnels for the injector/accelerator and in the Experimental Hall at the Storage Ring eliminated 72 tons of CO_2 per year.

(12) The use of air-conditioning units during the night was suspended between 19:00 and 07:00 at the research building of the Medium-length Beamline Facility.

3. Environmental conservation

3-1. Industrial waste

Wastes discharged from operating activities were mainly experimental equipment, office automation equipment, scrap metal, waste plastics such as packing material/filters, and sludge in water treatment. Wastes containing poisonous and deleterious substances, such as experimental waste liquid and lead-acid batteries, used in operations and maintenance were collected and stored as specially controlled industrial waste. Additionally, because tools such as sterilized syringe needles and scalpels are difficult to distinguish from medical waste, they were collected and stored for specially controlled industrial waste. Then, we hired a contracted waste management company to dispose of them.

Although animals used for laboratory experiments can be disposed of as general waste, we buried them in an animal cemetery to express our sympathy for the loss of the laboratory animals, following the guidance of the local municipality.

Because cooperation from employees and users is necessary to properly conduct garbage separation, explanatory sessions on waste disposal were held and warning notices were issued via emails and

posted announcements to employees not properly handling waste. Tables 5–7 show the amounts of waste over the past five years.

Table 5. Waste types and amounts in general industrial waste.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Sludge	12,518	6,029	2,337	4,405	2,165
Waste oil/slush	3,041	3,390	7,892	3,560	5,024
Waste alkali	73	231	123	44	90
Waste acid	202	86	81	92	14
Waste plastic	21,354	12,211	11,141	8,898	9,454
Waste wood	7,569	3,937	2,886	1,949	1,653
Waste/scrap metal	121,964	110,199	93,505	60,779	113,255
Waste/cullet glass	1,093	1,079	710	628	511
Wastes other than above (concrete, stone, etc.)	1,027	212	75	44	925
Biochemically stable waste mixture*2	-	2,427	9,560	2,797	3,156
Biochemically unstable waste mixture*2	-	33,558	8,376	3,062	4,458
Waste plastic*2 (containing asbestos)	-	220	0	0	0
Mercury-containing product industrial waste*2	-	934	1,074	710	711
Dry batteries*2	-	130	301	210	50

[Unit: kg]

*1Since a concrete shielding wall (covered by an iron plate) was disposed of, there was an increase in waste metal.

*2In accordance with the waste reclassification, new items were added in FY2018.

Table 6. Amount of specially controlled industrial waste.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Waste acid	807	183	2,694	489	250
Waste alkaline	708	423	428	430	475
Waste oil	182	279	237	305	187
Sludge	372	173	134	93	174
Infectious waste	16	12	7	10	10
PCB	—	—	—	—	—

[Unit: kg]

Table 7. Amount of general waste.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021
Laboratory animals	410	566	444	36	158

[Unit: kg]

Harima Administrative Division, RIKEN

Harima Safety Center, RIKEN