Environmental Load Accompanying Kyushu Electric Power's Business Operations

Calculation Methods and Supplementary Explanations (see p. 7)

The following are the calculation methods and supplementary explanations used to calculate expected reductions in environmental load accompanying in business operations, as detailed on p.7.

Calculation methods for expected reductions in environmental loads accompanying business operations

CO₂ Emission Reductions

Power Generated and Purchased

- Calculated using CO₂ emissions (post-adjustment) per electricity sales volume for Kyushu Electric Power in FY2017 and compared against a baseline which assumes all power is produced via renewable energy (excluding pumping for hydroelectric).
- Facilities efficiency improvement: Calculated using thermal efficiency and power transmission and distribution loss rate for FY2013 as a baseline.
- Starting in FY2016, the calculation factor for CO₂ emission reduction volume due to nuclear power generation was changed from the thermal power CO₂ emissions factor (excluding internal combustion power) to the total power supply average CO₂ emissions factor (changed to the calculation approach used by the Federation of Electric Power Companies of Japan).

Introduction of Low Pollutant Company Vehicles

• Calculated using a baseline which assumes electric vehicles (including plug-in hybrids), hybrid vehicles, and fuel-efficient vehicles are not introduced.

SF₆ Recovery Amount

· Calculated using a baseline which assumes SF₆ is not recovered from machinery into which it is injected during inspection and removal.

SO_x Reduction Amount

• Calculated using a baseline which assumes no desulfurization is performed and no low-sulfur fuels are used at power stations.

NO_x Reduction Amount

• Calculated using a baseline which assumes no denitrification is performed at power stations.

Supplementary Explanation

- The input amount for "fuel for nuclear power generation" is the amount of uranium and plutonium required (converted from calorific value).
- The input quantity for "water for power generation" does not include seawater used for water for non-power-related use or cooling water, or water circulating in the power station.
- "Purchased, etc." in corporate operations includes FIT purchased power and power used for sending and receiving interchange power to or from other companies.
- For corporate operations, a baseline is used which assumes an environmental load level resulting from the use of no environmental load mitigation measures, and the numerical difference between this and the actual environmental load level is calculated.
- For corporate operations, the CO₂ emissions reduction from the introduction of low pollutant company vehicles and amount of in-house power consumed of the greenhouse gas emissions in our environmental impact reductions is calculated using CO₂ emissions (post-adjustment) per electricity sales volume for Kyushu Electric Power in FY2016.
- For corporate operations, the reduction in volume of low-level radioactive waste achieved by incinerating, compressing or otherwise disposing of the low-level radioactive waste generated is converted into an equivalent number of 200-liter drums.
- For ozone-depleting substance emissions, the individual fluorocarbon ozone depletion factors were used to convert into the equivalent CFC-11 weight.
- For air pollutant emission environmental load, "total exhaust gas multiplied by concentration in exhaust gas" for each thermal power station (including internal combustion power) was converted into a weight value and combined for the total value.
- For discharged water environmental load, concentrations and discharged water volumes were used to calculate the load for each water pollutant contained in the discharged water treated by the discharged water treatment equipment at thermal (including geothermal) and nuclear power generation plants, and these loads were multiplied by Kyushu Electric Power's own weighting factors, converted into COD (chemical oxygen demand) weight equivalents and totaled.
- For COD emission environmental load, the figure is a sum total of COD (chemical oxygen demand) contained in discharged water treated by the discharged water treatment equipment at both thermal (including geothermal) and nuclear power generation plants.
- The net volume of low-level radioactive waste in the environmental load generated is the volume reduction subtracted from the actual volume generated, converted into an equivalent number of 200-liter drums.

Amount of CO₂ Emission Reductions by Renewable Energy Facility (FY2017)

Note: Calculated using CO₂ emissions per electricity sales volume in FY 2017 (see p. 20)

Geothermal Power Facilities								Unit: kW	CO₂ emission reductions (existing facilities)	
			Existing fa	cilities (approx	k. 218,000)				Planned (2,000)	Geothermal total
Power Station	Otake (Oita Pref.)	Hatchoubaru (Oita Pref.)	Yamagawa (Kagoshima Pref.)	Ogiri (Kagoshima Pref.)	Takigami (Oita Pref.)	Hatchoubaru Binary (Oita Pref.)	Sugawara Binary*1 (Oita Pref.)	Yamagawa Binary* ¹ (Kagoshima Pref.)	Otake*2 (Oita Pref.)	
Output	12,500	110,000	30,000	25,800	27,500	2,000	5,000	4,990	+2,000	520,200 t
FY2017 CO ₂ Emission Beductions	36,600 t	257,700 t	48,100 t	62,900 t	96,900 t	700 t	15,700 t	1,600 t	(as of July 31, 2018)	

*1 Developed by group company *2 The additional 2,000 kW is added output from the refurbishment of the Otake Power Station

Solar Power Facilities

Solar Power Facilities Unit: kW							
	Existing facilities (approx. 90,800)						
Power Station	Mega Solar Omuta (Fukuoka Pref.)	Omura Mega Solar*1 (Nagasaki Pref.)	Sasebo Mega Solar*1 (Nagasaki Pref.)	Installations at business sites, etc.	Other Mega Solar*1		
Output	3,000	17,480	10,000	Approx. 2,600	Approx. 57,700		
FY2017 CO2 Emission Reductions	1,600 t	12,100 t	6,200 t	_	11,700 t*2		
*1 Developed by group com	pany *2 Calculated acco	ording to equity ownershi	p in output of the Kyude	n Group	(as of July 31, 2018)		

Wind Power Facilities

Wind Power Facilities Unit: kW											
	Existing facilities (approx. 68,000)					Existing facilities (approx. 68,000)			Planned (ap	prox. 92,800)	Wind power total
Power Station	Koshikijima (Kagoshima Pref.)	Noma-misaki (Kagoshima Pref.)	Kuroshima (Kagoshima Pref.)	Nagashima* (Kagoshima Pref.)	Amamioshima* (Kagoshima Pref.)	Washiodake* (Nagasaki Pref.)	Kushima* (Miyazaki Pref.)	Karatsu–Chinzei* (Saga Pref.)			
Output	250	3,000	10	50,400	1,990	12,000	64,800	Max. 28,000	38,600 t		
FY2017 CO ₂ Emission Reductions	100 t	800 t	Verification test facility	31,200 t	1,300 t	5,200 t	(8	as of July 31, 2018)			

Unit: kW

*Developed by group company

Biomass Power and Waste Incineration Power Facilities

	Existing facilities (approx. 41,000)				Estimated (approx. 199,000)		
Power Station	Miyazaki Biomass Recycle ^{*1} (Miyazaki Pref.)	Fukuoka Clean Energy* ¹ (Fukuoka Pref.)	Reihoku*² (1.4 million kW) (Kumamoto Pref.)	Matsuura* ² (700,000 kW) (Nagasaki Pref.)	Nanatsujima Biomass Power*1 (Kagoshima Pref.)	Buzen New Energy* ¹ (Fukuoka Pref.)	LLC corporation Shimonoseki Biomass Energy* (Yamaguchi Pref.)
Fuel	Biomass (poultry manure)	General waste	Coal and multi-fuel combustion (wood chips)	Coal and multi-fuel combustion (sewage sludge)	Biomass (PKS, wood pellets, etc.)	Biomass (PKS, wood pellets)	Biomass (wood pellets)
Output	11,350	29,200	(Up to 1% mixed combustion by weight ratio)	(About 700 t/year)	49,000	74,950	74,980
FY2017 CO ₂ Emission Beductions	28,400 t	37,000 t	9,100 t	1,100 t		(as of	July 31, 2018

*1 Developed by group company *2 Existing coal-fired thermal power station PKS: palm kernel shells

Hydroelectric Power Facilities^{*1}

				OTIL: INV
	Existing facilities	Planned	(approx. 76,000	(+7,300))
Power Station	140 sites	Shin Kosa (Kumamoto Pref.)	Tsukabaru (Miyazaki Pref.)	Kamoshishi*² (Kumamoto Pref.)
Output	1,280,151	7,200 (+3,300)* ³	66,600 (+4,000)	1,990
FY2017 CO ₂ Emission Reductions	2,154,600 t			(as of July 31, 2018)

Reductions

*1 Includes facilities developed by group companies (excluding pumped-storage)

*2 Developed by group company *3 Maximum additional output from facility refurbishment



Total

t= metric ton (tonne)

31,600 t

4	9	

Lipit: KM

75,700 t	

Hydropower total

2,154,600 t

Solar power total

Amount of

Kyushu Electric Power's Non-CO₂ Greenhouse Gas Emissions

Sulfur hexafluoride (SF₆)

 SF_{6} is used in electrical equipment for its excellent insulating properties. We minimize atmospheric emissions upon the inspection and removal of equipment.



Nitrous oxide (N₂O)

Because N_2O is generated mainly from the combustion of fuel at a thermal power station, the amount of N_2O generated fluctuates, depending on the operational status of the power station, but we are striving to reduce emissions by working on improving the total thermal efficiency and other aspects of thermal power.



Note: N₂O gas volume is converted to CO₂ volume using the global warming potential for N₂O (298 (310 until FY2014))

Hydrofluorocarbon (HFC)

Hydrofluorocarbons are often used as a refrigerant in air conditioning equipment. We thoroughly prevent leaks, and recover and reuse HFCs when installing and repairing equipment.

We conduct thorough inspections of commercial refrigerators and other equipment that use fluorocarbons (including fluorocarbons subject to regulation), based on the Act on Rational Use and Proper Management of Fluorocarbons legislated in April 2015. When replacing or installing new equipment, we introduce equipment that does not use regulated fluorocarbons as a refrigerant.



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HFC (12–14,800 (140–11,700 until FY2014))

Amounts of Fluorocarbons Subject to Regulation Refilled and Emissions at Kyushu Electric Power

We methodically collect fluorocarbons when inspecting or removing equipment that uses fluorocarbons (fluorocarbons subject to regulation), which can lead to the destruction of the ozone layer—equipment that includes air conditioners, refrigeration and air-conditioning equipment, and refrigeration/freezing equipment. When replacing such equipment, we introduce equipment that does not use fluorocarbons subject to regulation.

Since FY2000, emissions of specified fluorocarbons that have a highly negative impact on the ozone layer have been close to zero, except for natural leaks.



(2) Initiatives to Establish a Recycling Society

Our Waste-Related Zero Emissions Initiatives (see pp. 33-34)



Reuse of Materials/Equipment for Power Distribution (FY2017)

Material (unit)	Units removed* [A]	Units reused [B]	Reuse rate [B/A] (%)
Pole-mounted transformers	15,376	15,376	100
Pole-mounted gas valves	543	543	100
Low-voltage voltmeters	152,124	127,800	84
Concrete poles	7,291	7,291	100
High-tension wire (km)	593	593	100
Low-tension wire (km)	944	944	100

*Units that are not reparable or that cannot be reused because of old specifications and model type are excluded

Paper Recycling (FY2017)

	Amount recovered (t)	Main recycling use
Newspapers*1	71	Paper (copier paper, catalog paper, etc.), newspaper
Magazines	23	Cardboard material, paper twine
Cardboard	62	Cardboard material
Confidential documents	876	Paper (copier paper, catalog paper, etc.), toilet paper, cardboard material
Other*2	121	Paper (copier paper, catalog paper, etc.), toilet paper, cardboard material, paper twine
Total*3	1,153	

*1 Includes amount of recovered magazines and cardboard at some sites

*2 "Other" includes copier paper, envelopes, etc.

*3 Totals may not match due to the effects of rounding.

Waste Generation by Power Station, Amounts Recycled, Recycling Rates (see p. 33)

Industrial waster by Thermal Power Station (FY2017)						
	Amount produced (t)	Amount recycled (t)	Recycling rate (%)			
Shin-Kokura	458	458	100			
Karita	122,163	122,163	100			
Buzen	352	352	100			
Matsuura	202,255	201,205	99.5			
Ainoura	384	384	100			
Shin-Oita	974	974	100			
Reihoku	518,261	516,528	99.7			
Sendai	323	323	100			
Total	845,170	842,387	99.7			

*Coal ash, heavy crude oil ash, sludge, scrap metal, etc.

General Waste* by Thermal Power Station (FY2017)

	Amount produced (t)	Amount recycled (t)	Recycling rate (%)
Shin-Kokura	25.8	4.0	15.5
Karita	10.1	10.1	100
Buzen	9.2	5.8	63
Matsuura	300.5	8.8	2.9
Ainoura	2.3	1.5	65.2
Shin-Oita	29.4	10.3	35
Reihoku	11.8	7.7	65.3
Sendai	5.7	5.7	100
Total	394.8	53.9	13.7

*Waste paper, shells, etc.