Hitz
Hitachi Zosen

2022 Environmental Data Sheet

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Hitachi Zosen Corporation

Environmental Accounting

Category		Investment (Million yen)		Operating Expenditure (Million yen)		Content
		2020	2021	2020	2021	
HZC Business Sites (Offices and Factories)	Pollution Prevention (Prevention of pollution of air, water, soil, noise etc)	7.0	34.1	107.3	71.0	＊Maintenance of environmental protection equipment ＊Training to prevent spills of hazardous substances Investment increased in FY2021 to renew facilities to prevent air and water pollution.
	General Environmental Projects (including emission control of green house gas, energy saving etc.)	394.5	255.7	198.7	51.6	＊ Inspection of facilities ＊Renewal of energy-saving facilities. ＊Promotion of energy saving by replacing mercury /fluorescent bulbs with LED and replacing transformers. 90% of expenses in FY2020 was for maintenance of the drainage facilities of the dock in Sakai works. 90% of expenditure in FY2021 is for maintenance of electricity facilities of the crane.
	Resource management and waste (Control of waste, recycling and proper disposal)	0.0	0.0	69.8	61.1	＊R&D for 3R's ＊Green procurement (e.g. purchasing of products with recycled materials) Investment for waste management (e.g. provision of waste segregation receptacles) is minor. Almost all expenditure is for transporting and disposing waste.
Upstream / Downstream Activities		—	0.0	—	35.5	Building repairs of factory to enable better materials storage and more efficient production: As this improves indirect impacts for production, this is classified as upstream costs.
Environmental Management (Environmental management system, disclosing environmental information and environmental education)		—	0.5	5.4	15.2	＊Maintenance of the Environmental management system. ＊Accumulating and information sharing of environmental data. FY2020 value was lower than normal due to COVID19 pandemic
R&D (R&D into environmental products)		57.8	346.7	3,012.4	2,315.8	＊R&D into environmental products. Installation of new equipment for methanation in FY2021.
Community and Additionality Projects		—	0.1	1.0	2.5	＊Support for regional environmental protection Tree planting around our Sites.
Environmental Legacy / Levies		0.0	0.0	6.2	58.9	＊Levy for air pollution ＊Disposal of PCBs (58 million yen spent on disposal of PCBs in FY2021)
Total		459.3	637.1	3,400.8	2,611.5	

Material Balance

2021 INPUT

Energy		
heavy oil	2,077	KL
gasoline	100	KL
diesel	113	KL
kerosene	51	KL
city Gas	445	K㎥
LN Gas	78,715	t
electric power	45,740	Mwh
solar power	2,205	Mwh

Water		
industrial water	920	K t
tap water	120	K t

Material		
steel	19,962	t
paint	207	t
solvent	323	t
other	533	t

2021 OUTPUT

Green effect gas and others		
CO_2	24.9	Kt・CO_2
NO_x	26.1	t
SO_x	2.2	t
PRTR substance	52.3	t
wastewater	560	K t
CO_2 emisson from shipping	2.6	Kt・CO_2

Electricity sales		
sales	540,891	Mwh
CO_2	206	Kt・CO_2

Industrial waste		
metal recovery etc	5,306	t
waste	4,125	t
recycling	3,479	t
landfill	248	t

2020 INPUT

Energy		
heavy oil	2,399	KL
gasoline	84.5	KL
diesel	188	KL
kerosene	79	KL
city Gas	445	K㎥
LN Gas	80,390	t
electric power	48,546	Mwh
solar power	2,341	Mwh

Water		
industrial water	920	K t
tap water	130	K t

Material		
steel	24,362	t
paint	336	t
solvent	790	t

2020 OUTPUT

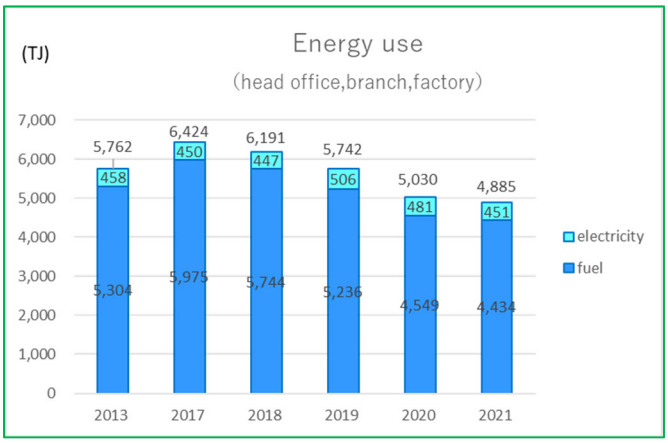
Green effect gas and others		
CO_2	31.2	Kt・CO_2
NO_x	28.3	t
SO_x	2.6	t
PRTR substance	63.0	t
wastewater	571	K t
CO_2 emisson from shipping	3.1	Kt・CO_2

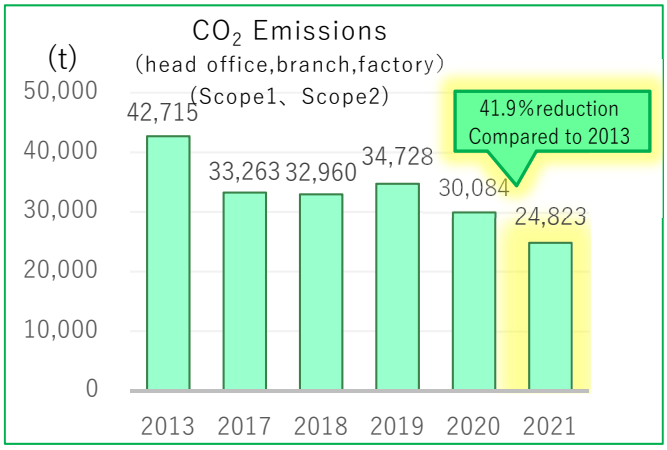
Electricity sales		
sales	547,069	Mwh
CO_2	219.5	Kt・CO_2

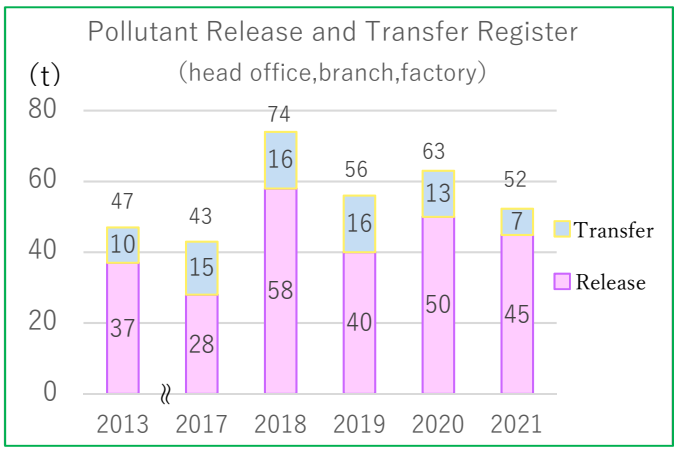
Industrial waste		
metal recovery etc	5,094	t
waste	4,060	t
recycling	3,660	t
landfill	400	t

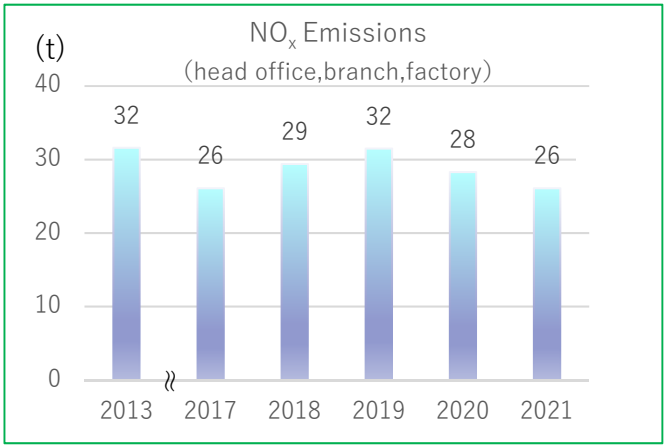
Note The data below is for HZC Offices and Factories based in Japan

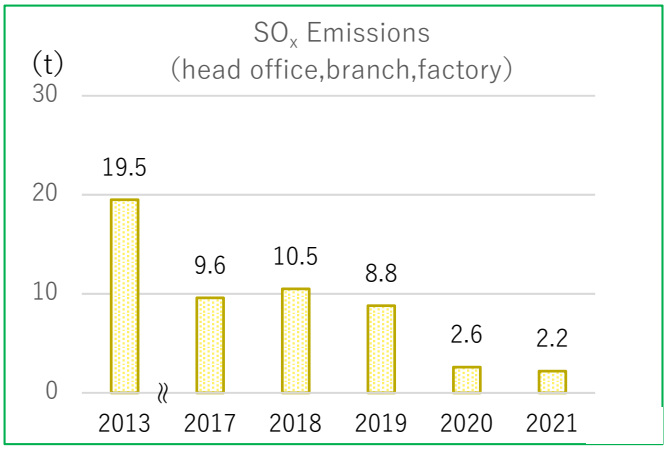
Environmental Data (Head Office, Branches and Factories in Japan)

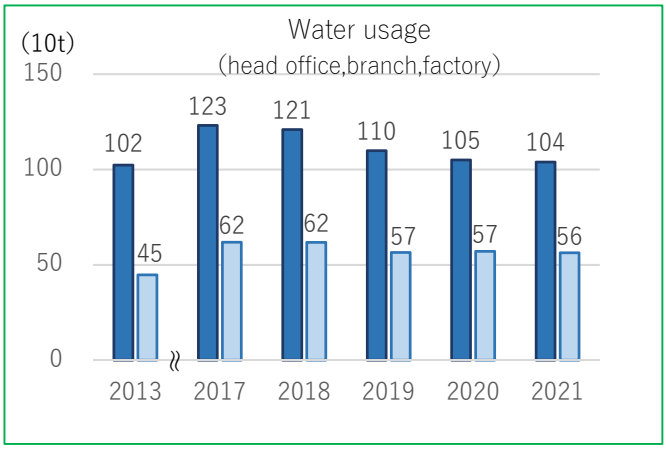


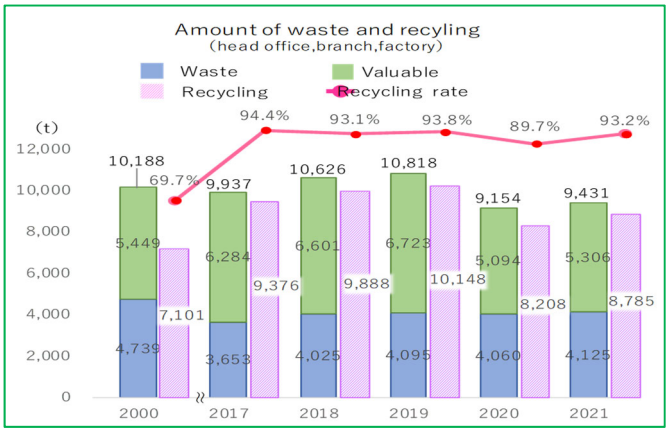


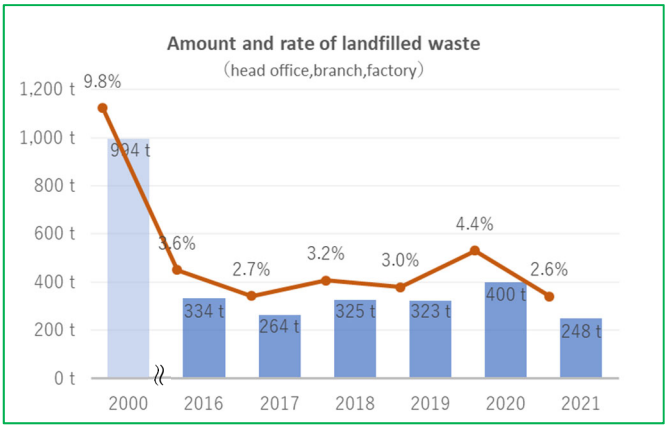












Environmental Data of our Factories in Japan in 2021

Ariake Works

Energy ,CO_2, Water

Energy comsumption		203.0TJ
CO_2 Emission		10,062t
Water Comsumption		76Kt
Waste		
Waste	Generation	2,986t
	Recycling	2,677t
	Landfill rate	2.4%

Water quality

Item			Regulation	HZC Target	Measured Value
pH			5.8～8.6	6.0～8.0	7.7
BOD		mg/ℓ	-	-	-
COD		mg/ℓ	20	20	3.3
SS		mg/ℓ	70	60	17
n-hexane extract	Mineral	mg/ℓ	5	3	＜0.5
N		mg/ℓ	120	60	3.3
P		mg/ℓ	16	8	0.96
E.Coli		Body/cm³	3,000	1,000	31

Atmosphere

Item		Regulation	HZC Target	Measured Value
Sox	K Value	17.5	6.5	-
	N㎥/hr	4.2	-	0.005
Nox	ppm	150	100	64
Ash dust	g/N㎥	0.25	0.1	＜0.02

Noise

Item		Regulation	HZC Target	Measured Value
Morning & evening	dB	60	58	54.2
Daytime	dB	65	60	55.8
Night	dB	50	48	44.2

Oscillation

Item		Regulation	HZC Target	Measured Value
Daytime	dB	65	We have confirmed measuration is below regulation by caluclating attenuation of oscillation	
Night	dB	60		

Mukaishima Works

Energy ,CO_2, Water

Energy comsumption		29.6TJ
CO_2 Emission		422t
Water Comsumption		8Kt
Waste		
Waste	Generation	1,766t
	Recycling	1,741t
	Landfill rate	1.4%

Water quality

Item			Regulation	HZC Target	Measured Value
pH			-	(6.0～8.2)	(7.8)
BOD		mg/ℓ	-	-	-
COD		mg/ℓ	-	(75)	(9)
SS		mg/ℓ	-	(80)	(5)
n-hexane extract	Animal Vegetable	mg/ℓ	-	(16)	(0.8)
N		mg/ℓ	-	(60)	(15)
P		mg/ℓ	-	(8)	(2.3)
E.Coli		Body/cm³	-	(1,000)	-

Atmosphere

Item		Regulation	HZC Target	Measured Value
Sox	K Value	As We don't have specified facilites, we are not regulated.		
	N㎥/hr			
Nox	ppm			
Ash dust	g/N㎥			

Noise

Item		Regulation	HZC Target	Measured Value
Morning & evening	dB	70	65	67.8
Daytime	dB	70	65	66.5
Night	dB	60	55	54

Oscillation

Item		Regulation	HZC Target	Measured Value
Morning & evening	dB	65	We have kept below 30dB.	
Daytime	dB	60		

Innoshima Works

Energy ,CO_2, Water

Energy comsumption		44..4TJ
CO_2 Emission		845t
Water Comsumption		11Kt
Waste		
Waste	Generation	855t
	Recycling	778t
	Landfill rate	3.4%

Water quality

Item			Regulation	HZC Target	Measured Value
pH			5.5～9.0	6.0～8.0	7.1
BOD		mg/ℓ	-	-	-
COD		mg/ℓ	20	18	14
SS		mg/ℓ	200	160	11
n-hexane extract	Animal Vegetable	mg/ℓ	20	18	ND
N		mg/ℓ	120	108	23
P		mg/ℓ	16	14.4	4.0
E.Coli		Body/cm³	3,000	2,700	0

Pollution Load

		Regulation	HZC Target	Measured Value
Wastewater	㎥/day	301	-	77.1
COD	kg/day	4.5	-	0.76
N	kg/day	18	-	1.4
P	kg/day	2.4	-	0.2

Atmosphere

Item		Regulation	HZC Target	Measured Value
Sox	K Value	17.5	-	＜0.019
	N㎥/hr	14.7	10	＜0.016
Nox	ppm	170	100	32
Ash dust	g/N㎥	0.25	0.1	0.016

Noise

Item		Regulation	HZC Target	Measured Value
Morning & evening	dB	60	55	-
Daytime	dB	60	58	57.1
Night	dB	50	50	-

Oscillation

Item		Regulation	HZC Target	Measured Value
Daytime	dB	65	63	We have kept below self regulation
Night	dB	60	58	

Sakai Works

Energy ,CO_2, Water

Energy comsumption		59.6TJ
CO_2 Emission		817t
Water Comsumption		40Kt
Waste		
Waste	Generation	871t
	Recycling	798t
	Landfill rate	8.3%

Water quality

Item		Regulation	HZC Target	Measured Value
pH		5.8～8.6	6.0～8.0	7.2
BOD	mg/ℓ	25	20	3.7
COD	mg/ℓ	25	20	7.8
SS	mg/ℓ	40	20	3.5
n-hexane extract	Mineral mg/ℓ	4	2	N.D
N	mg/ℓ	60	20	11.5
P	mg/ℓ	8	5	1.3
E.Coli	Body/cm³	3,000	1,500	870

Pollution Load

Item		Regulation	HZC Target	Measured Value
Wastewater	㎥/day	139.6	-	115.1
COD	kg/day	2.61	2.09	0.46
N	kg/day	2.4	1.9	0.65
P	kg/day	0.261	0.209	0.09

Atmosphere

Item		Regulation	HZC Target	Measured Value
Sox	N㎥/hr	As We don't have specified facilites, we are not regulated.		
Nox	ppm	150	90	37
Ash dust	g/N㎥	0.05	0.03	＜0.01

Noise

Item		Regulation	HZC Target	Measured Value
Daytime	dB	-	(70)	(68.3)

Chikko Works

Energy ,CO_2, Water

Energy comsumption		87.7TJ
CO_2 Emission		1,112t
Water Comsumption		47Kt
Waste	Generation	817t
	Recycling	773t
	Landfill rate	5.4%

Water quality

Item		Regulation	HZC Target	Measured Value
pH		5.8～8.6	6.0～8.3	8
BOD	mg/ℓ	25	20	19
COD	mg/ℓ	25	20	11
SS	mg/ℓ	65	30	11
n-hexane extract	Mineral mg/ℓ	4	3	<3
N	mg/ℓ	37.5	35	30
P	mg/ℓ	8	3	1.9
E.Coli	Body/cm^3	-	-	(72)

Pollution Load

Item		Regulation	HZC Target	Measured Value
Wastewater	㎥/day	297.7	-	101.8
COD	kg/day	7.2	-	0.81
N	kg/day	11.4	-	1.38
P	kg/day	1.2	-	0.07

Atmosphere

Item		Regulation	HZC Target	Measured Value
Sox	N㎥/hr	As We don't have specified facilites, we are not regulated.		
Nox	ppm	150	130	10
Ash dust	g/N㎥	0.05	0.01	<0.001

Noise

Item		Regulation	HZC Target	Measured Value
Daytime	dB	-	(63)	(64.9)

Maizuru Works & Wakasa Works

Energy ,CO_2, Water

Energy comsumption		56.7TJ
CO_2 Emission		2,256t
Water Comsumption		14Kt
Waste	Generation	1,103t
	Recycling	1,074t
	Landfill rate	0.5%

Water quality(Maizuru Works)

Item		Regulation	HZC Target	Measured Value
pH		5.8～8.6	5.8～8.6	7.6
BOD	mg/ℓ	90	40	-
COD	mg/ℓ	90	40	2.8
SS	mg/ℓ	120	40	1
n-hexane extract	Mineral mg/ℓ	5	3	1
N	mg/ℓ	120	40	4.50
P	mg/ℓ	16	10	0.31
E.Coli	Body/cm^3	3,000	2,000	55

Atmosphere (Wakasa Works)

Item		Regulation	HZC Target	Measured Value
Sox	N㎥/hr	11.5	7	-
Nox	ppm	150	120	25
Ash dust	g/N㎥	0.2	0.16	＜0.01

Noise (Wakasa Works)

Item		Regulation	HZC Target	Measured Value
Morning & evening	dB	-	(50)	(48)
Daytime	dB	-	(55)	(54)
Night	dB	-	(50)	-

Oscillation (Wakasa Works)

Item		Regulation	HZC Target	Measured Value
Daytime	dB	65	-	＜25
Night	dB	60	-	-

Ibaraki Works & Miyanosato Works

Energy ,CO_2, Water

Energy comsumption		4345.6TJ
CO_2 Emission		214,429t
Water Comsumption		818Kt
Waste	Generation	848t
	Recycling	847t
	Landfill rate	0.1%

Water quality

(Value of Miyanosato Works is written in the bracket.)

Item		Regulation	HZC Target	Measured Value
pH		5.8～8.6	6.0～8.5	8.6(8.4)
BOD	mg/ℓ	10(20)	10	2.4(11)
COD	mg/ℓ	-	-	-(27.3)
SS	mg/ℓ	20(30)	20	9.6(5.0)
n-hexane extract	Mineral mg/ℓ	5(10)	3(2)	0.5(0.5)
N	mg/ℓ	-	-	-(-)
P	mg/ℓ	-	-	-(-)
E.Coli	Body/cm^3	3,000	2,000	86(16)

Atmosphere

Item		Regulation	HZC Target	Measured Value
Sox	K Value	13	6	0.14
Nox	ppm	180	150	65
Ash dust	g/Nm^3	0.3	0.15	0.002

atmosphere [Miyanosato Works]

Item		Regulation	HZC Target	Measured Value
Sox	K Value	17.5	1.0	0.1
Nox	ppm	150	100	69
Ash dust	g/Nm^3	0.3	0.15	0.005

Noise

(Value of Miyanosato Works is written in the bracket.)

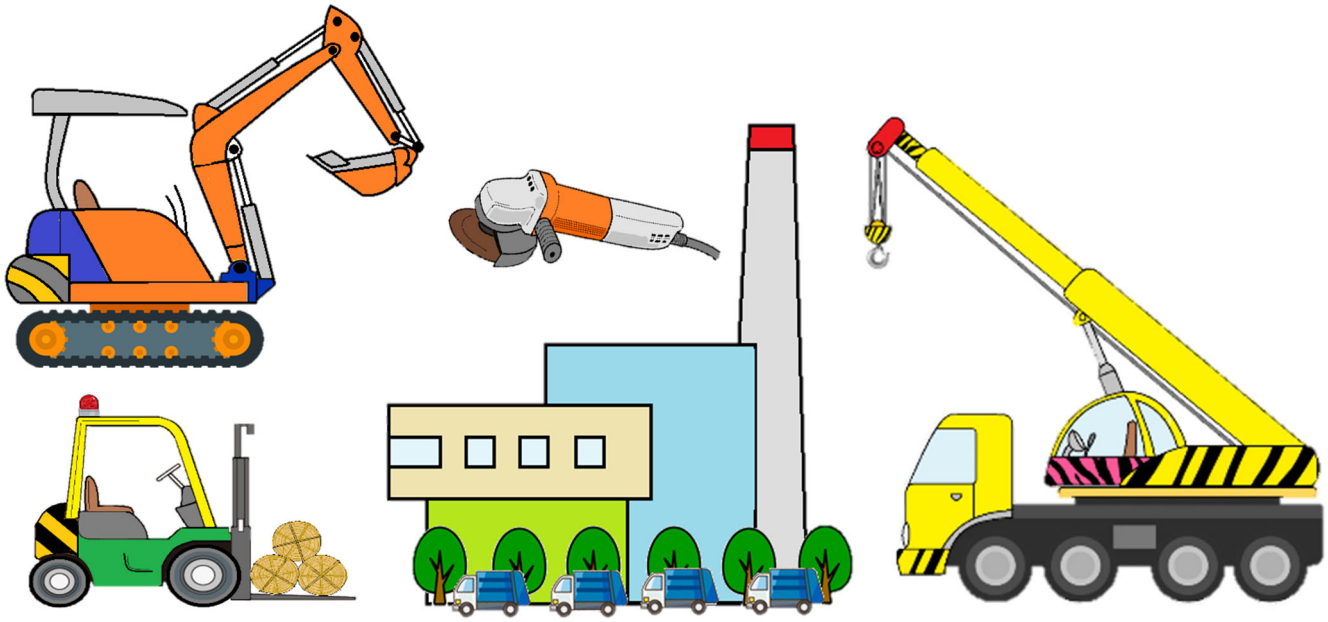
Item		Regulation	HZC Target	Measured Value
Morning & evening	dB	75(75)	70(70)	69.3(59.3)
Daytime	dB	75(75)	70(70)	59.8(57.2)
Night	dB	60(60)	60(60)	58.2(59.2)

Environmental data of factories in Japan

① Table above show some of key measurements and results taken over the reporting period.
② For items measured regularly such as water quality, the highest measurement is shown.
③ For the pollutant load, the average is shown
④ Items with "-" are items with no measured values or no target facilities, and items with "( )" are control values that are not regulated and are measured voluntarily.
⑤ Data of group companies that conduct business activities within the premises of each factory are also included.

Aggregating CO_2 emissions for the construction and operation of waste incineration plant

Since 2022, we started collecting a baseline of Scope 1 and 2 CO_2 emissions from the construction and operation of our Energy from Waste Plant to enable reduction targets to be set.



HZC Group Overseas

Hitachi Zosen Inova (HZI)

Scope 1 and 2 CO_2 Equivalent Emissions including from Biogenic Sources (from 1st April 2021 to 31st March 2022)

(from Assets within the scope of the HZI HSE Management System. Figures adjusted to reflect joint ventures)

Category	Energy source	HZI			Notes
		Consumption	CO_2-equivalent emissions (t)	Estimated from Biogenic Source (t)	
Head office, Branch, and Construction of EfW plants	Diesel Fuel	7,556 KL	20,585	-	Consumption by EfW Construction and Operations
	Natural Gas	1,297,320 kg	3,293	-	
	Cars	71,344 km	22	-	Cars owned by HZI
	Electricity Consumption	8,387.24 kWh	3,179	-	Location based emissions factor used. 75% of electricity consumed comes from renewable sources.
		Subtotal	**27,080**	**-**	
Commissioning and Operation of EfW plants	Stack Emissions	-	934,084	541,769	Emissions from Commissioning and Operations of EfW Plant burning on waste
	Flaring	1,193,860 Nm^3	2,268	2,268	Flaring from operations of an Anaerobic Digestion (AD) Plant
	Landfill Gas	385,274 Nm^3	79	79	Gas recovered from neighbouring landfill used for heating at AD Plant
		Subtotal	**936,431**	**544,116**	
		TOTAL	**963,511**	**544,116**	

The above figures are for 7 Major Sites (Construction and Operating Plant) and 2 Offices.

Dubai, UAE

Energy from waste plant

Throughput: 1,890,000t/a

Thermal power: 5×124.6MWth

Commencement: 2024

Conceptual drawing

Mid-construction image as of October,2022

Istanbul, TUR

Energy from waste plant

Throughput: 1,000,000t/a

Thermal power: 3×86.8MWth

Commencement: 2021

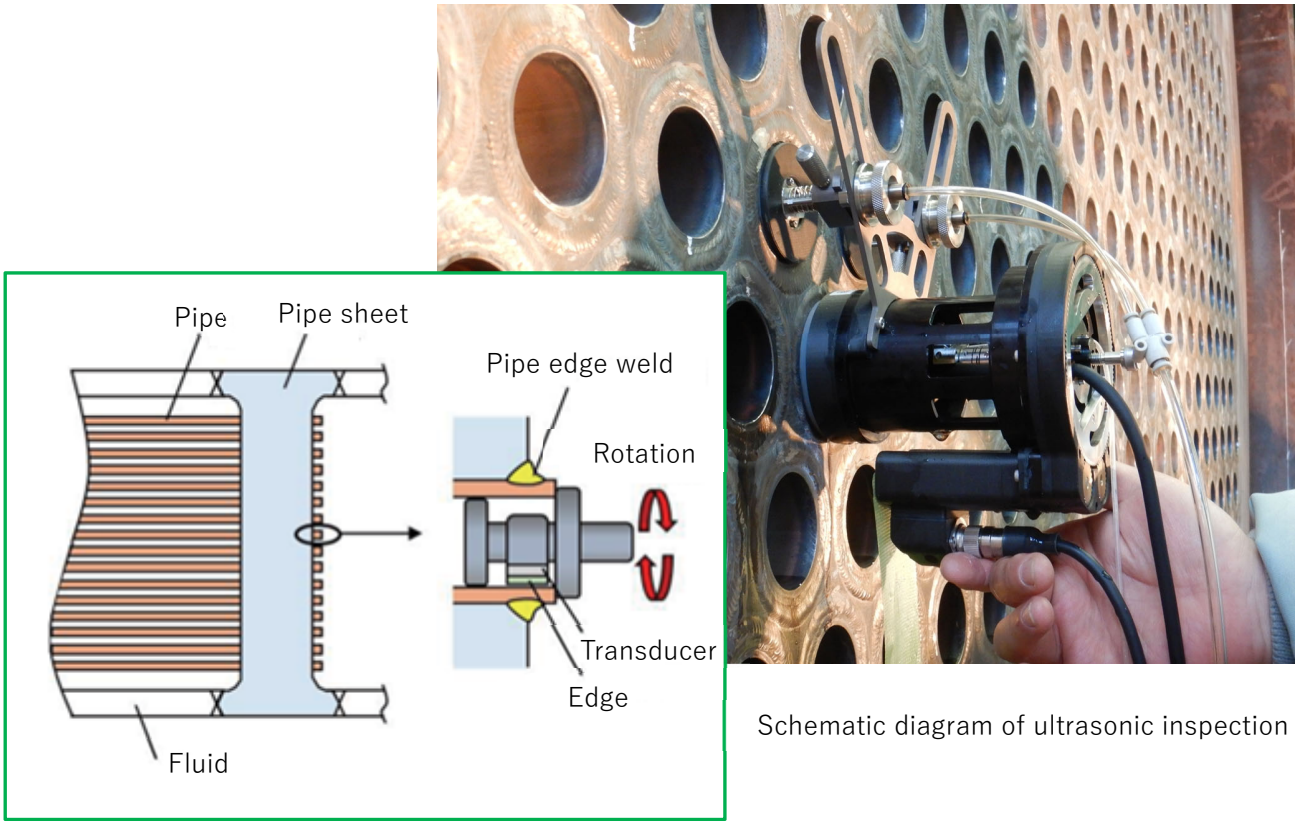
Environmental Product Development

Phased array ultrasonic testing system for welds「kantanPAUT®」

We have developed a phased array ultrasonic inspection system for inspecting welds between tubes and sheets of the multi-tube heat exchangers used in high-temperature and high-pressure environments. This equipment, which exchanges heat between two fluids, is mainly used in chemical plants and power plants and is designed to withstand harsh operation. However, if over time the welded part has deteriorated, the internal fluid may leak, causing an emergency shutdown of the plant. Emergency shutdowns have a significant negative impact on customers' production plans and energy loss, so an accurate understanding of equipment status is required to maintain steady operation.

We provide robust, high-quality equipment and regular after-sales service with a phased array ultrasonic testing inspection system developed for the multi-tube heat exchangers. The inspection data collected by multiple Artificial Intelligence (AI) technologies is used to detect defects in pipe end welds, supporting the judgment work of inspectors. The accuracy of automatic defect detection is 99% or more, and the judgment speed is about 80% faster than the visual judgment by inspectors, making it possible to inspect all welds.

At older plants, there are concerns about a decline in the ability to hand down technology due to old facilities and a shortage of maintenance personnel. This inspection system will contribute to the equipment maintenance using digital technology together with customers who are pursuing greater safety and efficiency.



Schematic diagram of ultrasonic inspection

Environmental Product Development

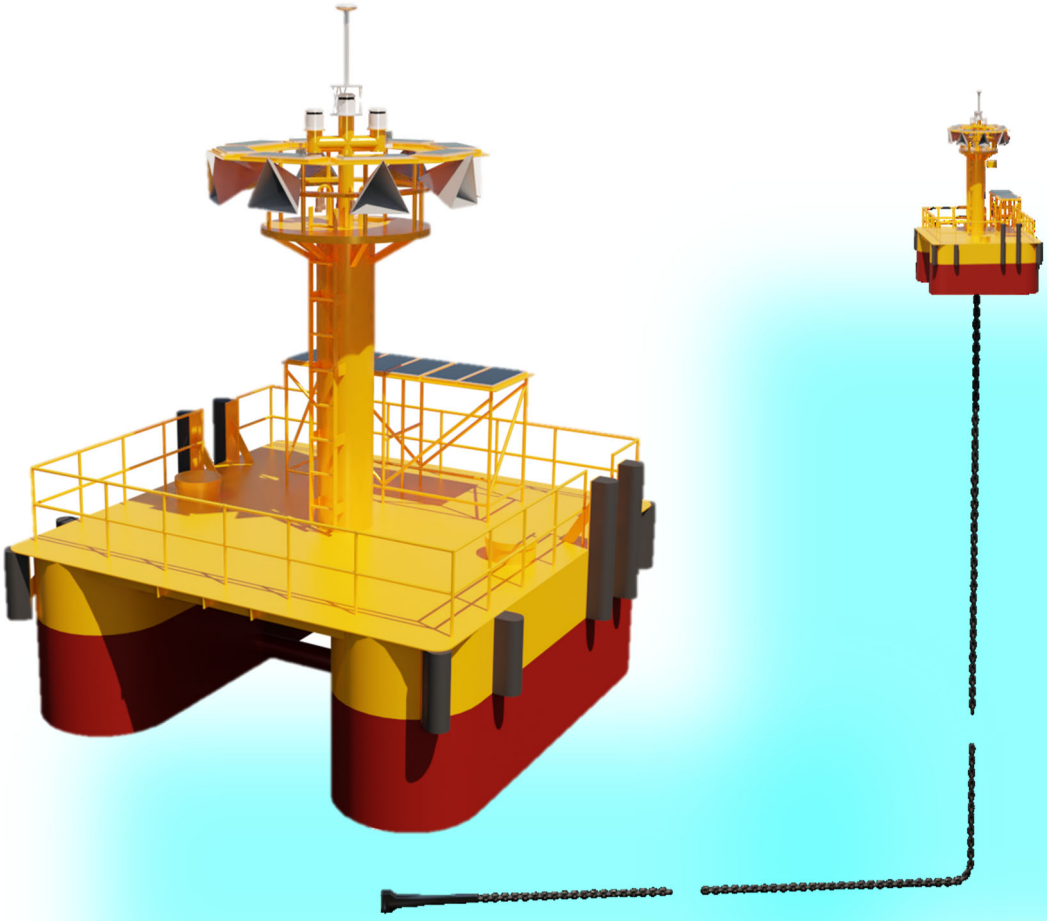
Development of the Catamaran Buoy

As part of our disaster prevention business, we have prototype installed GPS wave observation buoys in coastal areas around Japan. We also produce floating fish reef buoys for local authorities in order to actively develop fishing grounds. All of these floating offshore structures are typically of the most simple design, namely cylindrical.

However, the cylindrical floating body shape is not hydrodynamically advantageous, as it receives a large amount of force from the waves and tidal currents.

Therefore, we have developed a catamaran type buoy to replace the cylindrical type. This buoy consists of two hull-shaped floating bodies. The hull-shape reduces the force exerted by waves and tidal currents from the front of the buoy and the twin hull of the catamaran makes the buoy stable in waves. This makes it possible to reduce the size of the steel mooring ropes used to maintain the catamaran shaped buoy in position compared to the cylindrical type and therefore reduces the amount of steel required.

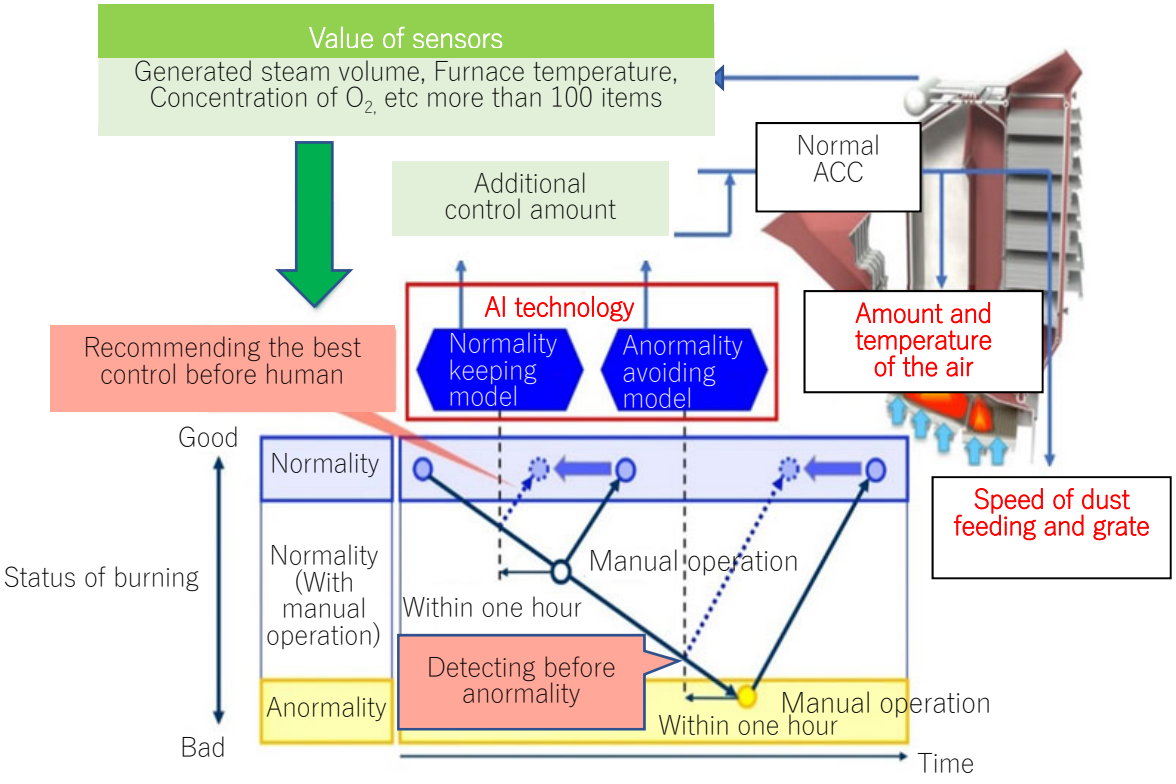
Following these successful tests, we plan to apply this technology to production of products such as GPS wave observation buoys and floating fish reef buoys, as well as continuing product development.



Environmental Product Development

Advanced research and development of control technology for Energy from Waste plants

As Energy-from-waste plants generate a stable source electricity while handling large amounts of waste, it is expected to be one of the Distributed Energy Resources (DER).
Energy-from-waste plants receive different types of waste and it is therefore important for the plant to be able to operate steadily and efficiently on waste fuels with different calorific value and properties.
For developing stable and efficient operation of Energy-from-waste plant with varying waste fuels, we carried out advanced research and development of a new control technology for Suginami plant from 2017 to 2020 with our Client, the Corporation of Cleaning Department Administrative Union.
The "combustion state prediction system" tested in this study combines two AIs with different roles and characteristics to predict combustion state to reduce the need for manual intervention. One of the AI maintains normal operations, whilst the other AI avoids abnormal operations.
Using this new system, stable operation of the furnace and the amount of steam generated and the temperature inside the furnace was achieved for more than one month and fully automated operation was achieved.
Based on these results, we can demonstrate that this system contributes to increased stable operations whilst reducing labour requirements in operation management.
In the future, this new control technology can be incorporated into existing facilitates and incorporated into the design of new facilities.



1) stable operation
This means Neither of "The deviation of the amount of generated steam is less than -10% from the set value" "Furnace temperature is less than 850°C" "Burner is used" happens
2) fully automated operation
This means no one manually intervenes in a total of 25 types of control elements, such as the incinerator's garbage feed system and combustion air system.

Environmental Product Development

Development of Offshore Wind Power "Suction Bucket Foundation"

Offshore wind power generation as a renewable energy source is already widespread in Europe and China (with a cumulative installed capacity of about 35 GW in 2020). In Japan, the introduction of a target of 10 GW generated from wind power by 2030 and 30 to 45 GW by 2040 has been set.
In the seas near Europe and China, much of the seabed consists of thick sedimentary layers, which makes it easy to install relatively inexpensive pile-type wind turbine foundations.
However, in the seas around Japan, the sedimentary layer is thin making it difficult to install pile foundations. This, in addition, to the risk of earthquakes makes the cost of foundations excessive.
We have received a grant from the New Energy and Industrial Technology Development Organization (NEDO), a national research and development agency, to develop a suction bucket foundation as a form of wind turbine foundation suitable for the submarine ground conditions in the waters near Japan.
This foundation is in the shape of an upside-down bucket, and during construction, the inside of the bucket is drained and the bucket is placed on the seabed. The pressure difference from the outside results in the bucket penetrating the seabed. Compared to conventional pile foundations, the amount of penetration is shallower meaning it can be installed in sea areas with thin sediment layers and thus enabling the installation of bottom-mounted offshore wind turbines.
Suction bucket foundations are divided into mono-buckets, which consist of a single bucket, and multi-buckets, which consist of multiple buckets joined together by a steel structure. In 2021, the mono-bucket was tested in real water to evaluate its stability as a foundation. In the future, we will proceed with similar testing for multi-buckets, equipped with larger wind turbines.


Mono bucket


Multi bucket

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