

Our company manufactures ferronickel, the main raw material of stainless steel, as our main product, and has established ourselves as Number 1 in Japan for ferronickel manufacturing. Utilizing the world's top-level smelting technology, we carry out efficient production using the world's largest electric-fired furnaces.

Efforts are underway to reduce the environmental impact, such as reducing the amount of energy used by using high temperature exhaust gas from electric furnaces in the ore drying process and recycling by smelting waste together with nickel ore.

Ferronickel manufacturing process

INPUT	Main raw materials		Total energy	
	Nickel ore (wet)	259 10k tons	1,858	10k GJ
	Secondary ingredients	33 10k tons	669	10k m ³
			Industrial water	
			669	10k m ³



Ore transportation and drying process

Raw ore is transported by ship and held in stockpile. Ore and other materials are transported from the storage site to the Works by conveyor and dried in a drying furnace.



Ore Conveyor: The ore that has been unloaded is transported via 2.4 km long conveyor to the plant.

Calcination process

Dried ore is heated in a roasting kiln (rotary kiln) to remove moisture (adherent water, water of crystallization).



Rotary kiln: A calcining furnace machine, over 100 m in total length that thermally processes dried ore by heating it to approximately 1,000 degrees Celsius.

Smelting process

Efficiently smelting ferronickel with the world's 3 largest electric furnaces. The high temperature exhaust gas from the electric furnace is used as a heat source in the drying process to reduce energy consumption.



Ferronickel smelting electric furnace: The world's largest class of electric furnace, which smelts ferronickel by melting ore at a temperature of about 1,500 degrees Celsius.

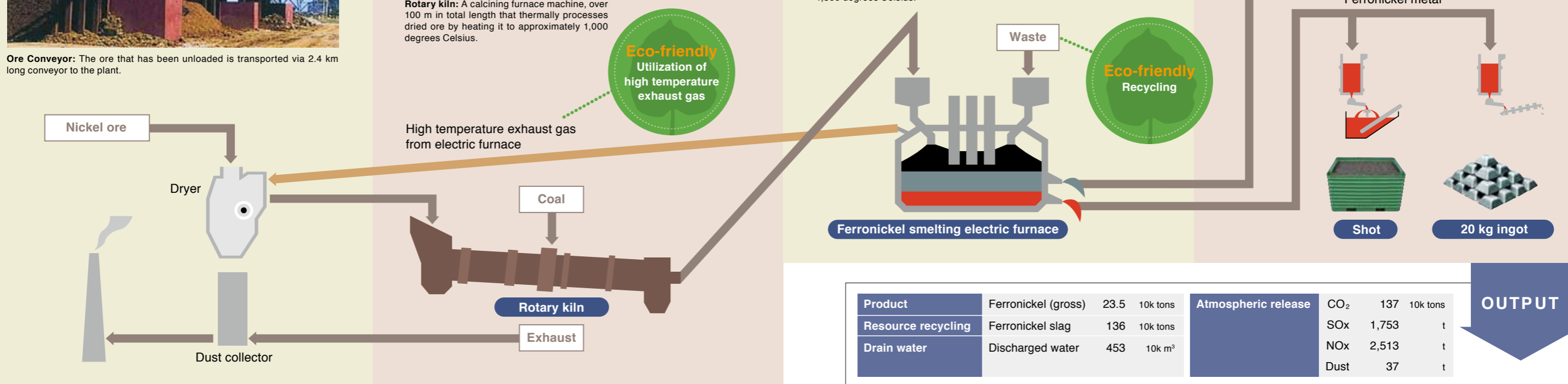
Casting process

Smelted ferronickel (molten metal) is molded into 20 kg ingots and granular shots.



Shot casting: Molten metal is rapidly cooled with water in a water tank and finished into small particles.

Ingot casting: Molten metal is poured into molds and finished into 20 kg ingots.



Product			Atmospheric release		
Ferronickel (gross)	23.5	10k tons	CO ₂	137	10k tons
Resource recycling	Ferronickel slag	136 10k tons	SOx	1,753	t
Drain water	Discharged water	453 10k m ³	NOx	2,513	t
			Dust	37	t

Eco Products That Contribute to Reduced Environmental Impact

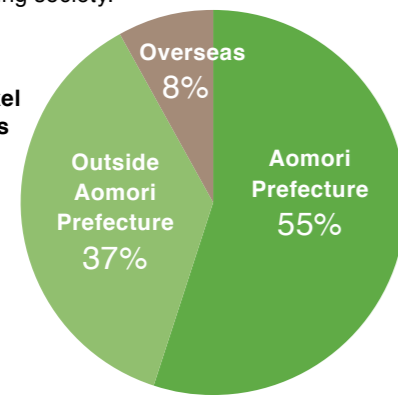


Effective use of by-products

Ferronickel slag obtained in large quantities as a by-product of the ferronickel manufacturing process is cooled by the slow cooling method, and then the entire product is recycled according to the intended use and sold as an attractive product that can be used in a wide range of applications. Our recycling technology has attracted attention as it is environmentally friendly and contributes to energy conservation.

Our ferronickel slag products are stable and have the same or better quality than natural resources. Therefore, they not only save natural resources but also contribute to the formation of a recycling society.

■ FY2018 ferronickel slag products sales performance (by region)



PAMCO Crushed Stone-5



PAMCO Crushed Stone 0-40



Road using PAMCO Crushed Stone roadbed material

● PAMCO Crushed Stone for civil engineering materials

PAMCO Crushed Stone is a product obtained by crushing ferronickel slag cooled by the slow cooling method and regulating the particle size. Its benefits include no harmful substances and high degree of safety, and it is often used for civil engineering materials as a substitute for mountain sand and crushed stone.

Easily incorporate into roadbeds, with a high bearing capacity after compaction and excellent frost-heaves suppression, it is suitable for road materials in cold regions.

LCA for ferronickel slag products

Our ferronickel slag products are environmentally friendly and safe because they do not contain harmful substances and have attracted attention as contributing to reducing environmental impact.

The LCA^{*1} evaluation also showed that, compared to quarried products^{*2}, ferronickel slag products manufactured by our company can reduce CO₂ emissions and contribute to the environment^{*3}.

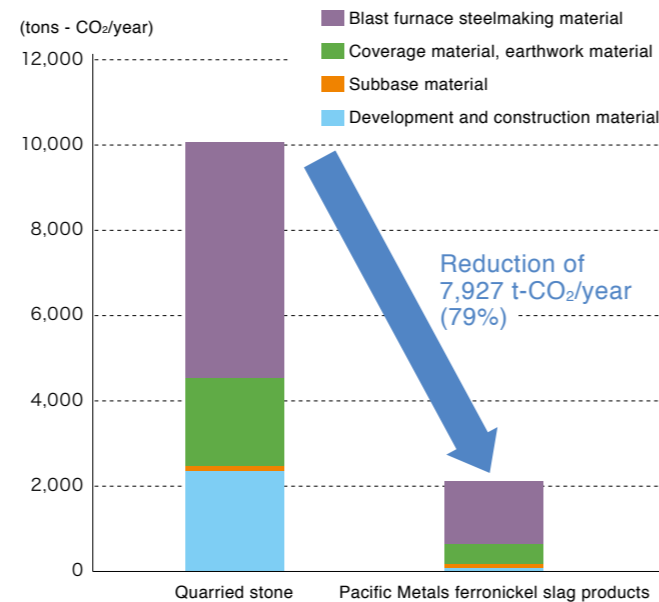
*1: Abbreviation for Life Cycle Assessment. A method for quantifying the environmental impact of a product over its life cycle (resource extraction, production, use, disposal).

*2: Products produced by extracting and mining naturally occurring stone

*3: Evaluation results for ferronickel slag products manufactured in FY2018

■ Environmental contribution of ferronickel slag products

Applications of ferronickel slag products	CO ₂ emissions(t-CO ₂ /year)		CO ₂ reduction rate
	Quarried stone	Pacific Metals ferronickel slag products	
Slow cooling - development and construction materials	2,360	44	98%
Slow cooling - subbase materials	115	32	72%
Slow cooling - coverage materials, earthwork materials	2,059	571	72%
Slow cooling - blast furnace steelmaking materials	5,518	1,477	73%
Total	10,052	2,124	79%



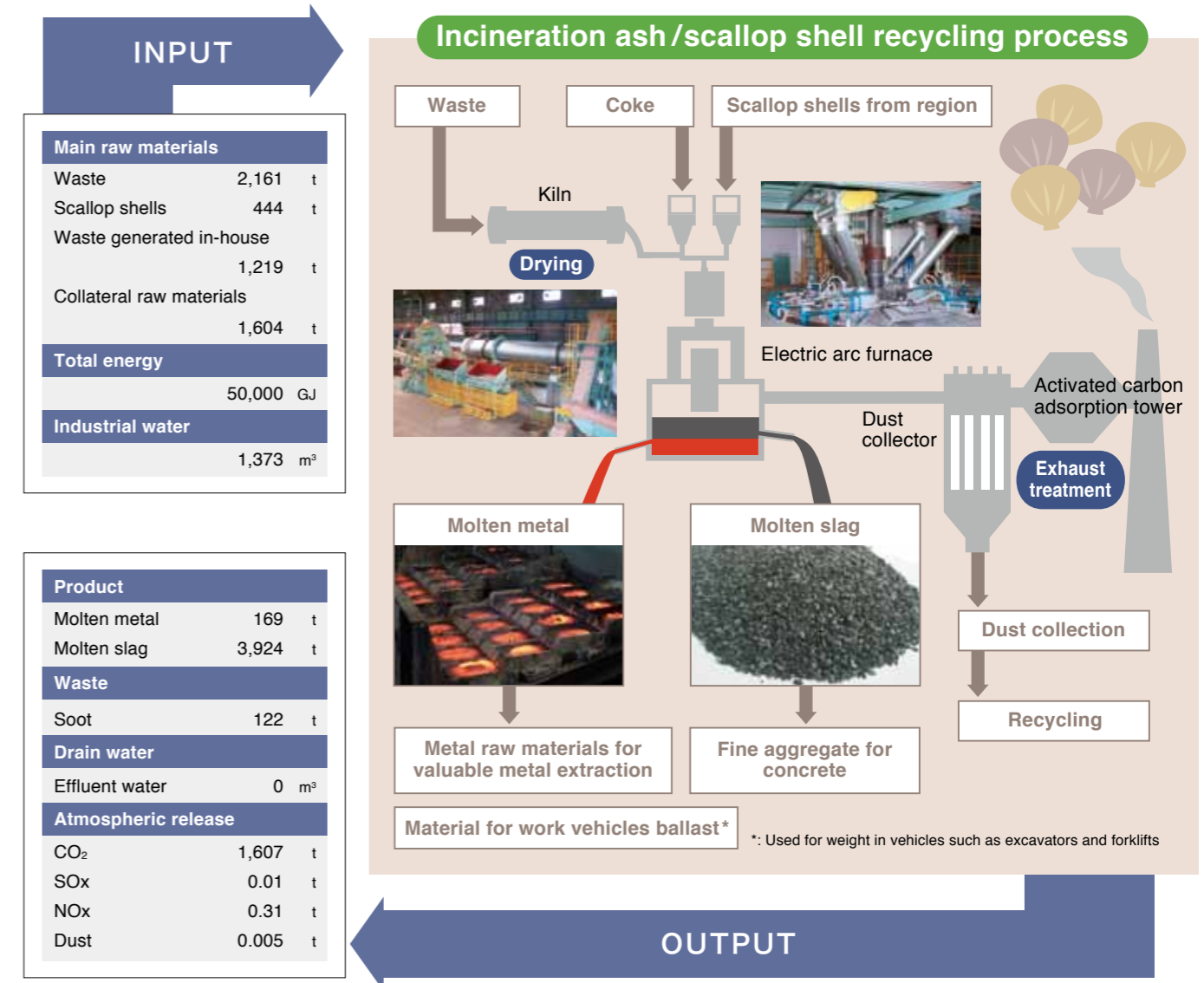
[Click here for product information](https://www.pacific-metals.co.jp/products/kras.html) https://www.pacific-metals.co.jp/products/kras.html

Services That Contribute to the Environment –Waste Recycling Business–



We use advanced technology developed in ferronickel smelting to conduct a waste recycling business. At the Incineration Ash and Scallop Shell Recycling Facility, incineration ash and industrial waste generated in municipalities in the prefecture, and scallop shells whose

processing is a challenge in Aomori Prefecture, are melted in a direct current electric furnace for use in metal raw materials and concrete and recycled into fine aggregate (artificial gravel).



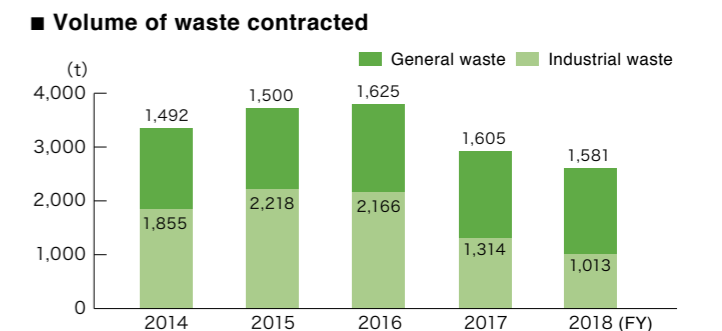
INPUT

Main raw materials	
Waste	2,161 t
Scallop shells	444 t
Waste generated in-house	1,219 t
Collateral raw materials	1,604 t
Total energy	50,000 GJ
Industrial water	1,373 m³

Product

Molten metal	169 t
Molten slag	3,924 t
Waste	
Soot	122 t
Drain water	
Effluent water	0 m ³
Atmospheric release	
CO ₂	1,607 t
SO _x	0.01 t
NO _x	0.31 t
Dust	0.005 t

The Company makes effective use of industrial waste as a secondary raw material and fuel at ferronickel manufacturing facilities and as a main raw material at the Incineration Ash and Scallop Shell Recycling Facility. In FY2018, the contracted amount of general waste and industrial waste was 2,594 tons. The treatable industrial wastes, the volume of disposal, the status of maintenance, and other information are posted under "Public Disclosure Related to Industrial Waste Treatment" on our website.



[Click here for information on industrial waste disposal](https://www.pacific-metals.co.jp/environment/waste.html) https://www.pacific-metals.co.jp/environment/waste.html