>> Byproducts as Resources

A. Output of byproducts and recycling

CSC has committed to reduction, internal and external recycling of its process residues for a number of years. It also works closely with the academic sector towards the goal of Cleaner Production.

Reduction of Process Residues

CSC is dedicated to use of high-grade raw materials and higher production efficiency. Amount of process byproducts generated for each tonne of crude steel produced has decreased from 660 kg in the early stage to present 524 kg (wet basis).

Byproducts of Process Residues in 2004

Type of residues	Description	Generation (10,000 tons)	% of total residues
BF slag	Byproducts of BF after smelting or raw materials	288.1	48.9
BOF slag	Byproducts of the basic oxygen furnace (BOF) after refining of steel	119.1	20.2
De-S slag	Byproducts of the hot metal desulfurizing process	24.3	4.1
Dust	Particulates collected from de-dusting system	34.9	6.0
Sludge	Solid cakes or mud from wastewater treatment after condensing and dehydrating	42.6	7.2
Mill scale	Rust of steel products or semi-products	26.3	4.5
Spent refractory	Used refractory from high temperature processes	4.2	0.7
Civil materials	Residual soil, concrete, etc.	33.5	5.7
Limestone cake	Filter cake from limestone washing water	4.6	0.8
Others	Waste oil, waste packaging materials, refuse, etc.	11.1	1.0
Total		**588.8**	**100**

B. Recycling

Process residues generated in 2004 have been 100% recycled, 20.1% internally and 79.9% externally.

Type of residue	Recycled internally (%)	Recycled externally (%)	Recycled externally Applications	DisposalSolid or Landfill
BF slag	3.1	96.9	To be water-quenched to produce slag powder or air-cooled to be used as aggregates	0
BOF slag	3.6	96.4	Blast furnace flux, slag pot base material, land reform, temporary roads, backfill materials for South Star project, cement making after recovery of entrapped metal	0
De-S slag	0.0	100.0	Land reform, temporary roads, soil conditioning and cement making	0
Dust	98.3	1.7	Mixture of fly ash and sludge as cement making material	0
Sludge	75.2	24.8	Cement making material	0
Mill scale	95.0	5.0	Sales	
Spent refractory	84.8	15.2	For steel and refractory making, or for land reform after metal recovery	0
Civil materials	0	100.0	Landfill at the South Star Project	0
Limestone cake	0	100.0	Admixture of civil material	0
Others	97.3	2.7	Reverse recycling, sales, etc.	0
Total	**20.1**	**79.9**		**0**

C.Zero Waste

CSC has been promoting "zero waste" by turning byproducts into useful resources through outstanding management and technology. CSC has also established an "industrial ecology system" which benefits players in the network, i.e. CSC, transportation companies, processing companies and end-users.

1. Sludge used to be piled or solidified before turning into useful materials. In July 2001, the zinc and oil sludge recycling rate has increased from 75.8% to 100%, marking a milestone for the "Zero Solidification and Landfill" initiative. Iron oxide sludge is used internally and for cement making; zinc-enriched sludge is exported for zinc smelting materials.
2. Increased Ratio of Water-Quenched BF Slag from 74.7% to 96.7%: Water-quenched BF slag can replace traditional cement in construction after being dried and ground, bringing high value for slag producers, slag processors and users. This method conserves natural resources and energy used to make traditional cement, as well as reduces CO_2 emissions. Furthermore, the replacement of open-type air-cooling by closed-type water quenching for BF slag treatment reduces fugitive emissions and improves air quality in the factory site.
3. Spent refractory recycling rate up from 41% to 100%: With proper classification and management, reverse recycling, use of new materials and technology, and development of internal/external secondary reuse technology, generation of spent refractory is lessened, temporary piling greatly eased, and all spent refractory becomes raw materials for recycled refractory, iron and steel smelting, land reform and protective base material for slag pots.

D. Stabilization and Development of BOF slag

1. Develop BOF slag stabilizing technology and finalize operation procedure for indoor hot forming. This is advantageous to industrial safety and environmental protection. CSC is currently experimenting with hot water dipping and aging pit stabilization, which may help solve problems associated with volume expansion of BOF slag.
2. Aggregates produced in the BOF slag stabilizing process can be used for light construction material, cement raw material, concrete flux, etc. after testing. Work is currently underway to confirm this technology and its potential applications.

E. Recycling of Iron Byproducts

1. CSC makes great efforts to recycle iron-containing byproducts generated in the iron and steel smelting process. Such byproducts, including BF dust, BOF dust, sinter dust, incinerator fly ash, incinerator slag, BOF grit, etc. are all collected as smelting materials for the sintering process inside CSC plants. On-site iron recycling lessens external iron supply, cuts down production cost, and also prevents environmental risks or disputes when treatment or reuse takes place externally.
2. In 2004, internal recycling of iron and steel making process dust amounted to 349,000 tonnes; BF sludge, BOF sludge, direct-water sludge, cold rolling sludge and iron oxide sludge amounted to 426,000 tons; incinerator slag and BOF grit amounted to 84,746 tonnes, totaling 859,746 tonnes. Due to an international price hike of iron and steel materials, CSC has prioritized recycling of scrap steel and has made each department set recycling targets. The outcome has been satisfactory with 430,867 tonnes of scrap steel recycled in 2004, saving NT$4.2 billion in scrap steel procurement and preventing the secondary environmental pollution that may occur if otherwise treated externally.

F. Water-Quenched Slag and BF Cement

In 2004 the output of water-quenched slag reached 2,785,371 tonnes. The market for BF slag powder has expanded from the private construction industry to the government sector in public and civil engineering projects. Since the price of domestic cement has increased in recent years and can even be NT$1,000 higher per tonne than BF slag powder, there has been growing demand for BF slag powder and fly ash in the ready-mixed concrete industry. However, Taiwan's High Speed Rail and Kaohsiung City's mass transit railway projects have successively been completed from the third quarter of 2004, so the need for BF slag powder in public construction projects is expected to go down. The next major market will be the Kaohsiung Dome Stadium, Pu-Wu Express Road, and the Lu-chu Science-based Park outbound road system.