Operational Practice and Prospect on Treatment of Steel Mill Residues of CSC in Taiwan

Speaker: Shiau, Gang-Herng

Scientist

Ironmaking Process Development Section

Iron& Steel R&D Dept. CSC, Taiwan

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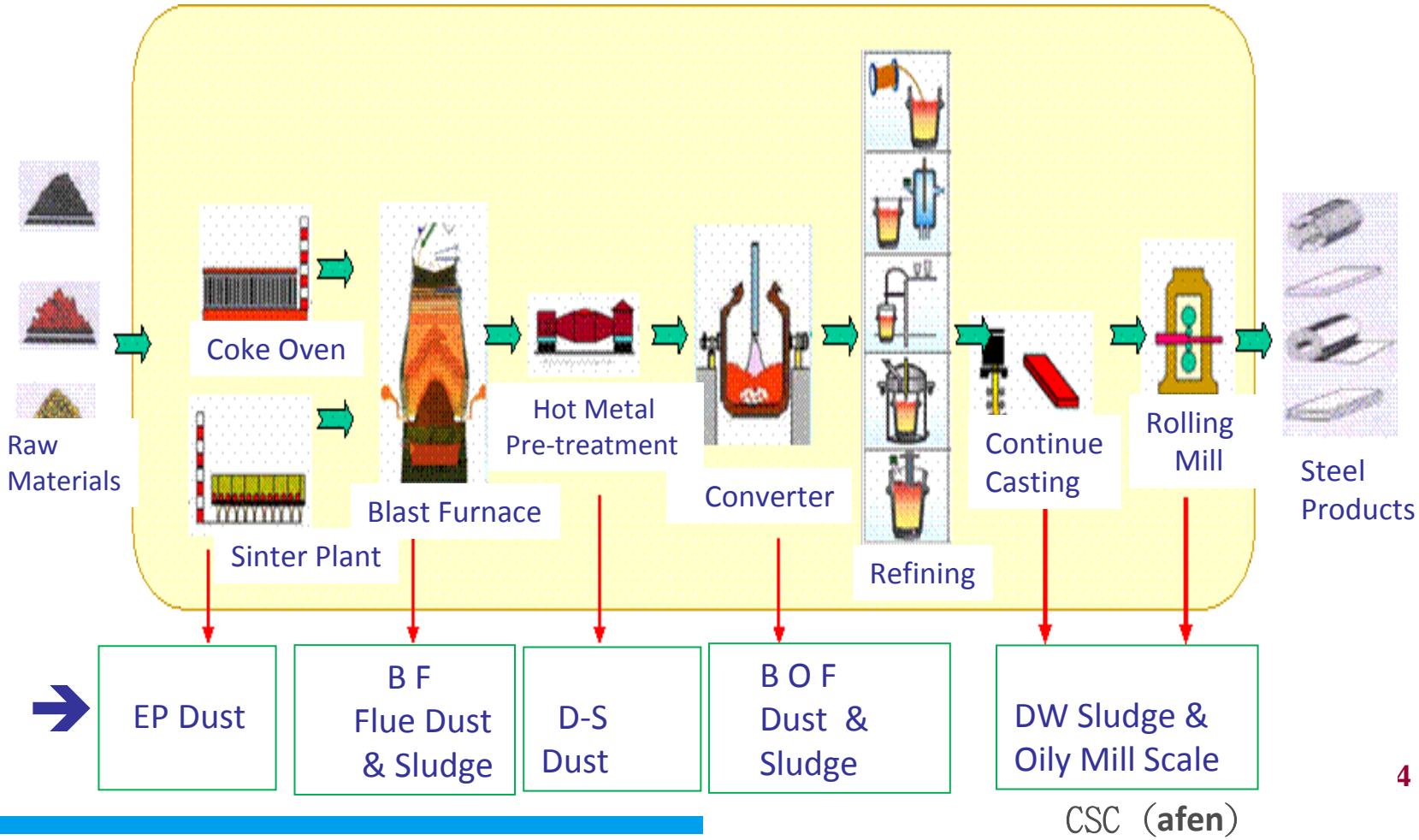
1、Introduction

- Inevitable
- Clean Production
- Zero Waste
- Recovery of Fe, C, Zn、、

2、Residues ?

- Various Residues Generated from an Integrated Steel Mill



- Quantity and Chemical Composition of Residues

～1450 t/d = 500,000 t/y (Dry Base)

※ DSC (Dragon Steel Corporation)
～300 t/d = 105,000 t/y (Dry Base)

• Main Residual Materials

Basis: 11 Mt/Yr Crude Steel Production

Residual Materials	Production (ton/yr) d.b.	Chemical Composition (wt%) d.b.		Source	Collecting Equipment
		Carbon	T. Fe		
BOF Dust	15,000	11.1	30.3	Steelmaking Units	Bag Filter
BOF Slurry	200,000	1.4	63.8	BOF, OG System	Scrubber
BF Flue Dust	90,000	39.0	31.8	Blast Furnace, Flue Gas	Dust Catcher
BF Sludge	57,000	35.7	28.7	Blast Furnace, Flue Gas	Scrubber and Filter
BF S/H Dust	35,000	3.6	51.5	Blast Furnace Stock House	Bag Filter
SP EP Dust	14,000	4.4	49.1	Sintering Machine Flue Gas	Electrostatic Precipitator
IWI Fly-Ash	6,000	2.6	23.3	Wastes Incinerator, Flue Gas	Bag Filter
Oily Mill Scale	18,000	0.7	73.7	Hot Rolling Mills, Descaling	Settling Basin
Oily DW Sludge	37,000	6.5	49.8	Hot Rolling Mills, Descaling	Thickener and Filter
CRM Sludge	5,000	9.9	28.0	Cold Rolling Mills, Cleaning	Thickener and Filter
Summation	477 Kt/yr	65 Kt/yr	236 Kt/yr		

• Chemical Composition of Residues

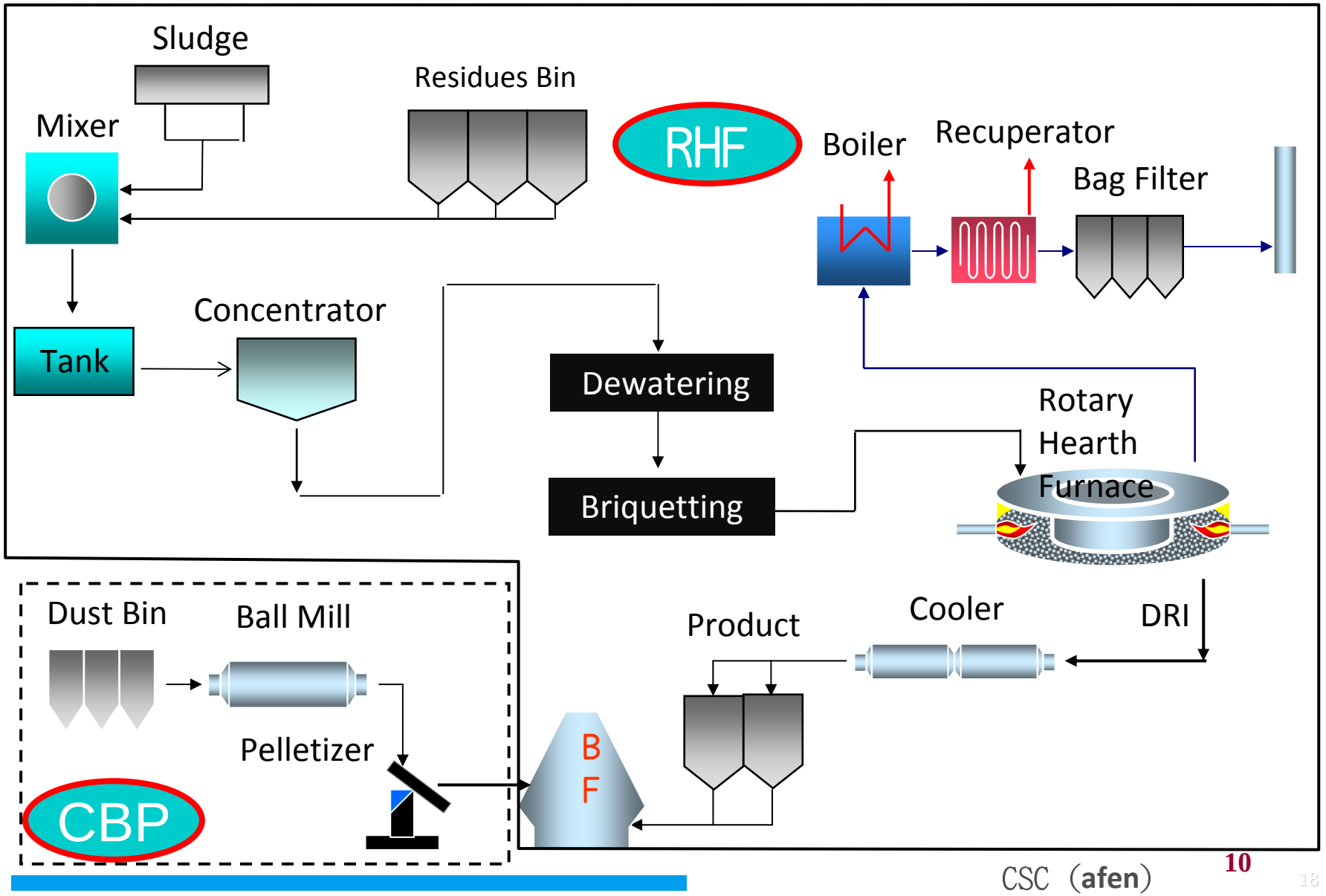
Residues	Chemical Composition (wt%) dry base											
	C	T. Fe	Fe (+2)	Fe (+3)	SiO_2	Al_2O_3	CaO	MgO	Zn	Pb	K	Na
BOF Dust	11.1	30.29	12.2	18.09	4.89	1.38	26.82	4.87	0.83	0.23	0.28	0.23
BOF Slurry	1.4	63.80	56.11	7.11	1.79	0.21	5.07	0.91	0.32	0.09	0.05	0.22
BF Flue Dust	39.0	31.80	3.44	28.36	6.26	2.60	4.47	0.81	0.05	0.02	0.09	0.11
IWI Fly-Ash	2.6	23.34	0.95	22.39	17.55	7.58	21.67	2.87	0.06	0.02	0.99	0.79
BF Hi-Zn Sludge	32.5	30.60	3.51	27.09	6.37	2.35	4.16	0.72	2.84	0.93	0.12	0.23
BF Sludge	35.7	28.67	4.45	24.22	6.13	2.51	6.05	0.85	1.72	0.45	0.12	0.20
Oily Mill Scale	0.7	73.74	53.37	20.27	1.20	0.14	0.08	0.04	0.01	0.01	0.02	0.08
Oily DW Sludge	6.5	49.75	26.98	22.77	2.26	0.49	12.55	0.84	0.16	0.06	0.02	0.10
CRM Sludge	9.9	28.01	4.09	23.92	4.76	0.73	17.67	4.15	0.64	0.02	0.09	0.25

3、Recycling Principles

- Conform to the environmental protection laws and regulations completely
- Avoid the second pollution
- 100% in-plant recycling
- No influence of operation efficiency and product quality
- Space and investment concern

4、Recycling Processes and Strategies

- ✓ RHF (Rotary Hearth Furnace) : 130,000 t/y
  - — Carbothermic reduction
  - — 100% removal of Zn 、Pb
  - — 80% removal of K 、Na
  - — Low DXNs emission
  - — Recovery of Fe 、Zn
  - — Technology matured ，Low risk
- ✓ CBP (Cold Bonded Pellet): 80,000 t/y
  - — Recycling of high C- contain coarse residues i.e. BF Flue Dust


Sludge
Residues Bin
Mixer
RHF
Boiler
Recuperator
Bag Filter
Tank
Concentrator
Dewatering
Rotary
Hearth
Furnace
Briquetting
Dust Bin
Ball Mill
Product
Cooler
DRI
Pelletizer
B
F
CBP

• Operational Data of RHF

RHF Performance Test			Targeted Value	Operational Data (Average:2008.Oct 04~08)
Item		Unit		
Operation Performance	Treatment Capacity of Residual Materials	(dry ton/hr)	≧ 17.3	17.8
	COG Consumption	(Nm^3/dry ton)	≧ 220	217.1
	Steam Production	(ton/hr)	≧ 14	15.5
Product Quality	Metallization Degree of DRI	(%)	≧ 50	63.1
	Compressive Strength of DRI	(kg_f/piece)	≧ 70	100.2
	Fine Ratio of DRI	(wt%)	＜17	15.8
	Zinc Removal Ratio	(%)	≧ 90	90.6
	ZnO Content of Crude Zinc Oxide Powder	(wt%)	≧ 50	75.4
Pollutants Emission of Exhaust Gas	NOx Concentration	(ppm)	＜60	21.84
	SOx Concentration	(ppm)	＜40	26.11
	DXNs Concentration	(TEQ-ng/Nm^3)	＜0.1	＜ 0.02

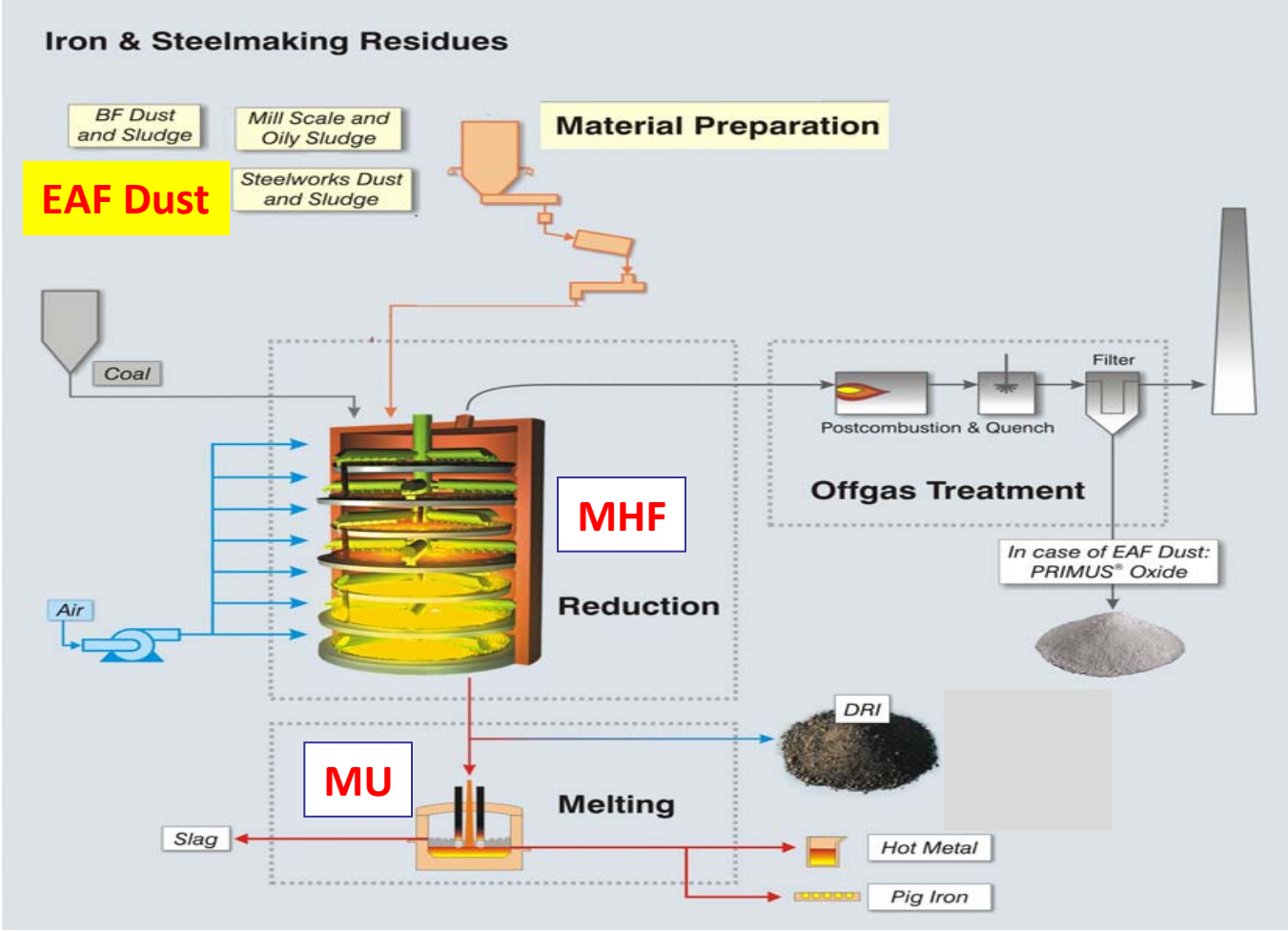
• Operational Data of CBP

CBP Performance Test		Targeted Value	Operational Data (Average:2008.Dec 09~13)
Item	Unit		
Treatment Capacity of Residual Materials	(dry ton/hr)	≧ 10.5	13.07
Availability	(hr/day)	> 18.27	19.48
Cleaning Time	(hr/day)	< 3.7	1.4
Compressive Strength of CBP (after 10 days aging)	(kg_f/piece)	≧ 70	180

5、Achievements of RHF+CBP Operation

- Decrease DXNs and CO_2 emissions
- Produce high valued products of DRI and ZnO
- Increase productivity of hot metal
- Save costs for outside treatment
- Have longer lives for BF and SP operation

PRIMUS Process (DSC)



6. Prospect

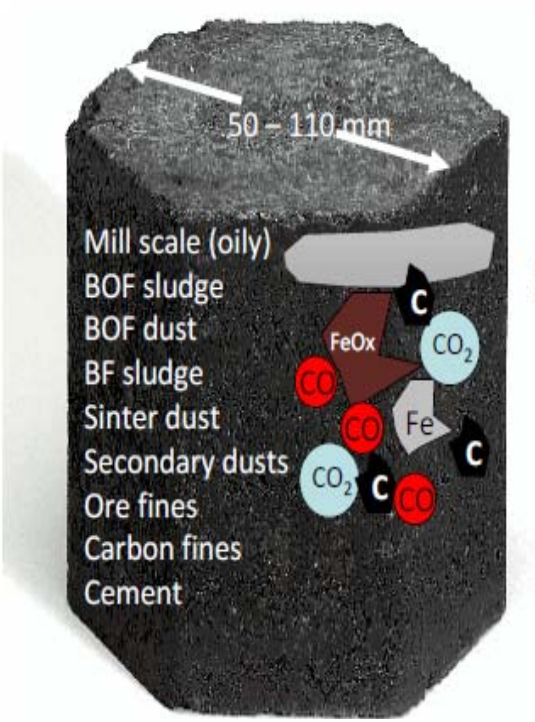
—An alternative recycling process

OxyCup Process :

Developed by Kuttner GmbH & Co. KG , Germany

• Residues for Recycling

✓ Self-reducing C-brick



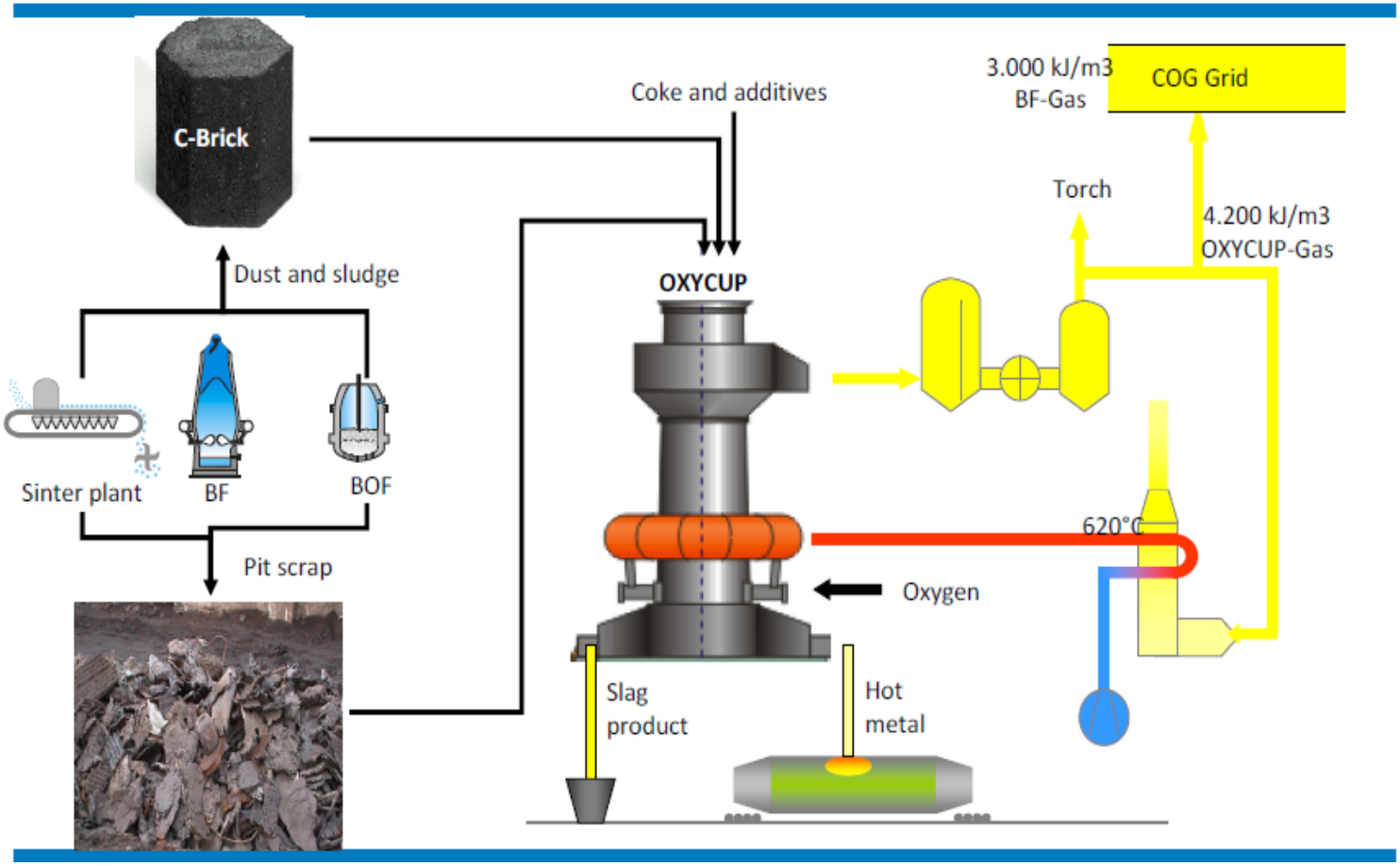
✓ Skulls

- Metallic revert materials of unknown composition
- Steel plant skulls
- Metal from slag processing
- Metal from de-sulfurisation of hot metal
- Ponded pig iron, salamander etc.

• Advantages of OxyCup Process

- ✓ By-products and wastes are turned into hot metal and slag in a single step.
- ✓ All kinds of metallic residual metals, such as skulls, desulphurization metals and metals from slag processing, can be treated.
- ✓ Cost effective de-sulphurization in De-S-plant, not in the converter.
- ✓ Optimization of sinter plant by taking out fine materials.
- ✓ High flexibility in production (up to 100 % scrap, shutdown within 2 minutes).

• OxyCup Process Concept

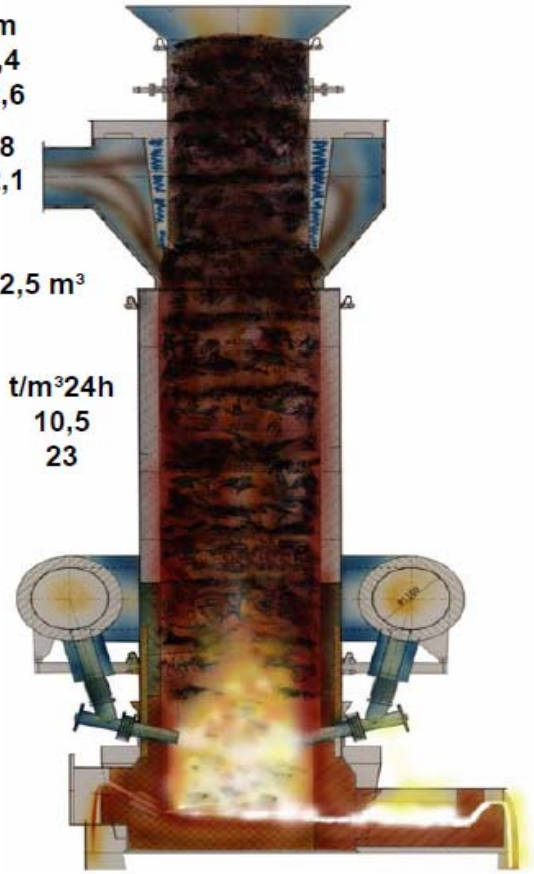


- OxyCup Shaft Furnace

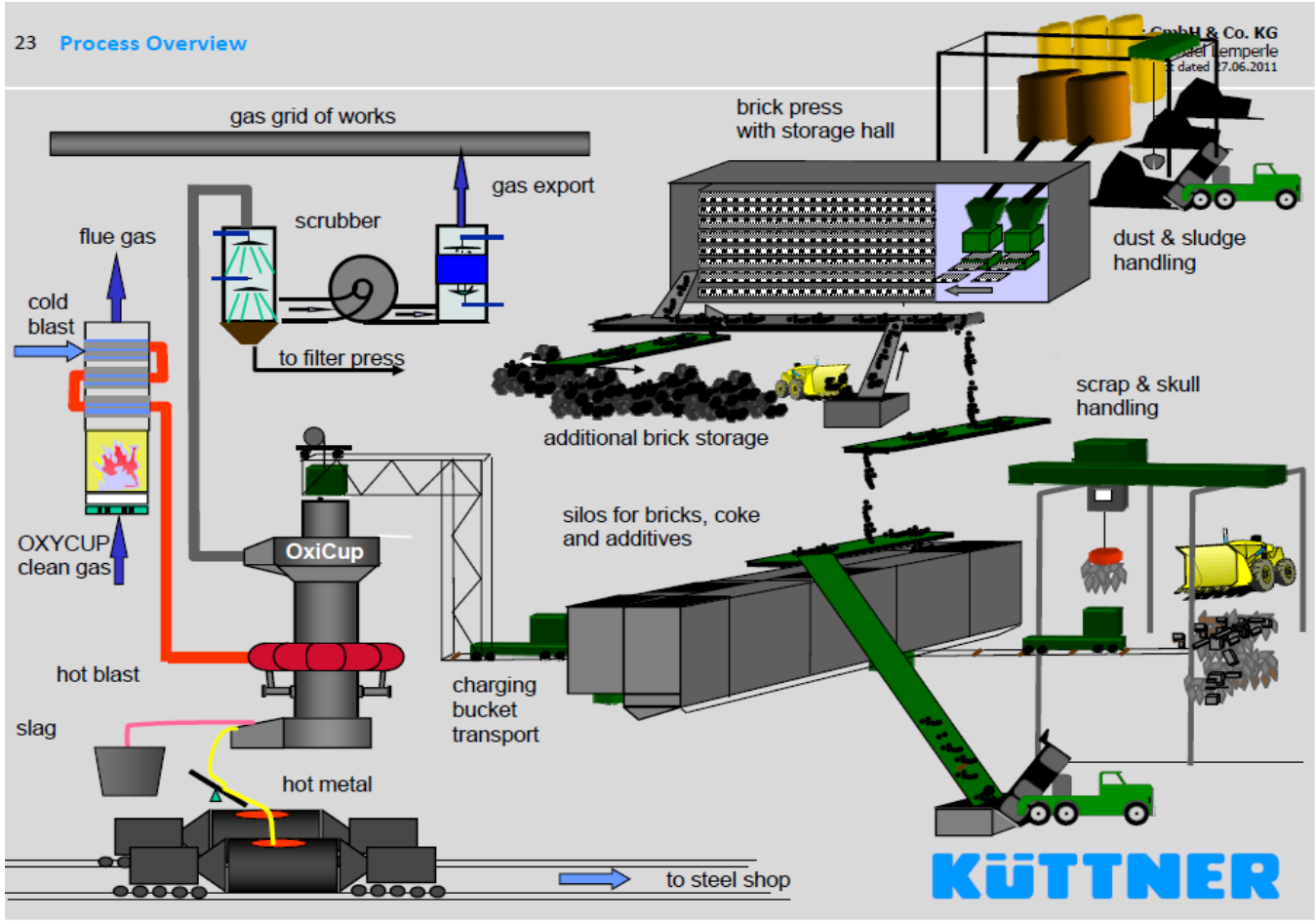
	m
Hearth ø	2,4
Shaft ø	2,6
Height $_{eff}$	8
Height $_{Hearth.}$	2,1

Working Vol. 42,5 m^3

Production:	$t/m^3 24h$
C-Bricks 70%	10,5
Skulls/Scrap	23



• Layout of OxyCup Plant



- OxyCup Shaft Furnace at Hamborn

7. Conclusion

CSC do and will continuously endeavour to

- Establish high performance recycling system of residues
- Provide the higher quality green ecology
- Implement sustainable green production
- Zero pollution emissions
- Convert into resources highly

Thanks for Your Attention ！