Climate Action OPEN FORUM

worldsteel ASSOCIATION 2023

CIX, INC. Continuous Improvement Experts

iima International Iron Metallics Association

The Role of Steel Scrap in Decarbonization

Jeremy Jones, CIX/iima

Scrap as a De-Carbonization Lever

- 100 % scrap-based operations utilizing EAF technology already have a very low CO2 footprint
- Footprint can be lowered through improvements in efficiency and Fe yield
- Must understand the properties of scrap to optimize its' Value-in-use
- Increasing levels of scrap residuals (Cu, Sn, Ni, Mo) are a concern and will require varying amounts of ore-based metallics to allow recycle

Scrap Challenges

Scrap Challenges

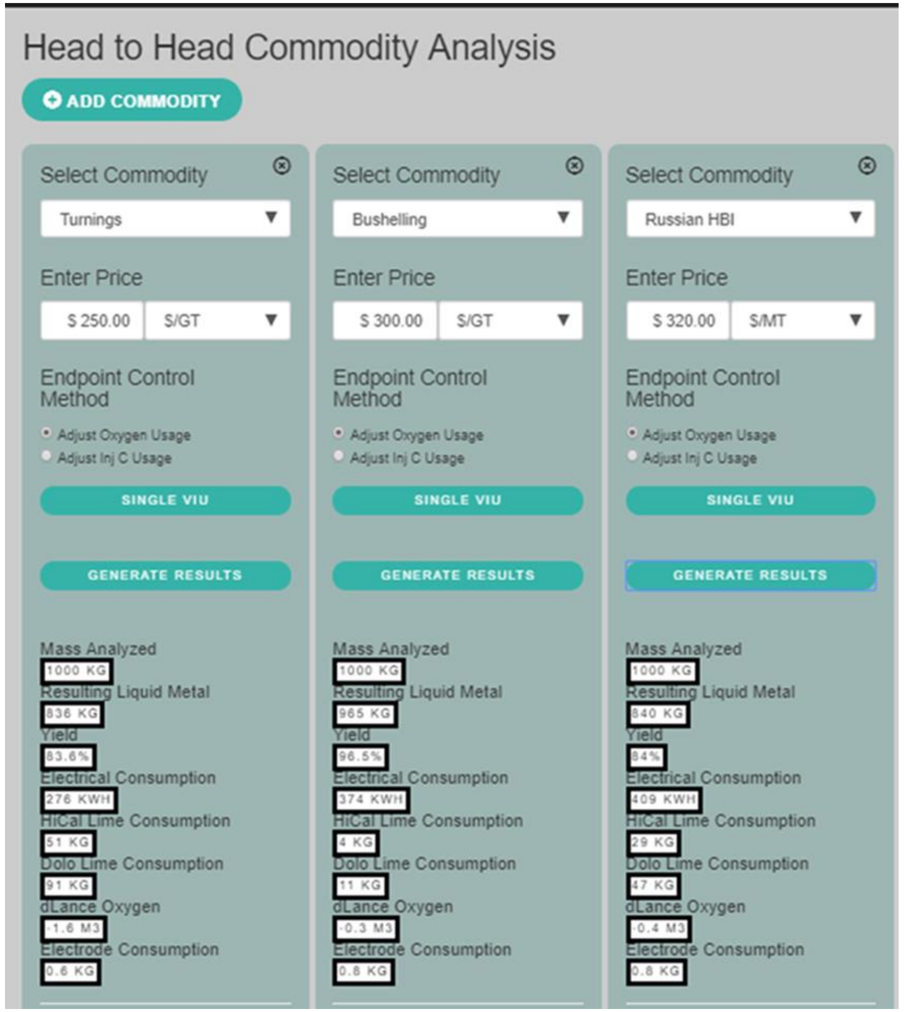
- Steel scrap doesn't have a zero CO_2 footprint
- CO_2 footprint dependent on scrap quality
- CO_2 taxes will drive us to deliver a higher quality scrap product

Impact of 1 % Dirt in the Scrap

SUMMARY FOR A ONE MILLION TON PLANT						
SUMMARY			**difference**			
% Dirt	2%	1%	-1%	wt% of scrap		
Acids	40	20	-20	lbs/ton scrap		
Yield	91.5%	92.5%	1.0%	liq/scrap	$/ton	For 1Mtpy Plant
Scrap Consumption	1,092,483	1,081,081	(11,402)	tons/yr	$500	($5,700,904.89)
Dolo Lime Consumption	29,919	15,704	(14,215)	tons/yr	$200	($2,842,908.24)
HiCal Lime Consumption	20,404	9,556	(10,847)	tons/yr	$200	($2,169,403.30)
Total Flux Consumption	50,322	25,261	(25,062)	tons/yr	Scrap & Fluxes	($10,713,216.43)
CO2 Emissions Summary (in metric)			**difference**			
Transportation CO2eq	17	17	-1	kgCO2/tonne steel		
Melting Electrical CO2eq	156	154	-2	kgCO2/tonne steel		
Slag Electrical CO2eq	31	16	-15	kgCO2/tonne steel		
Calcination of Fluxes CO2eq	51	26	-26	kgCO2/tonne steel		
TOTAL CO2 Equivalency	256	213	-43	kgCO2/tonne steel		

True Scrap Circularity

VIU Analysis to Drive Scrap Requirements



Impact of Average Cu Level in Scrap

Scrap Cu wt.%	% OBM Required in the charge to make various steel products									
0.08	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.10	20.4%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.15	47.3%	33.8%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
0.20	60.6%	50.5%	25.3%	0.0%	N/A	N/A	N/A	N/A	N/A	N/A
0.25	68.5%	60.5%	40.3%	20.2%	0.0%	N/A	N/A	N/A	N/A	N/A
0.30	73.8%	67.1%	50.3%	33.6%	16.8%	0.0%	N/A	N/A	N/A	N/A
0.35	77.6%	71.8%	57.5%	43.1%	28.7%	14.4%	0.0%	N/A	N/A	N/A
0.40	80.4%	75.4%	62.8%	50.3%	37.7%	25.1%	12.6%	0.0%	N/A	N/A
0.45	82.6%	78.1%	67.0%	55.8%	44.6%	33.5%	22.3%	11.2%	0.0%	N/A
0.50	84.3%	80.3%	70.3%	60.2%	50.2%	40.2%	30.1%	20.1%	10.0%	0.0%
0.55	85.8%	82.1%	73.0%	63.9%	54.7%	45.6%	36.5%	27.4%	18.2%	9.1%
0.60	87.0%	83.6%	75.3%	66.9%	58.5%	50.2%	41.8%	33.4%	25.1%	16.7%
	0.08	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
	Product Max Cu Wt. %									

Closing Remarks

- Must drive towards a "cleaner" raw material input to steelmaking
- Steel scrap plays a critical role
- Steps can be taken to improve scrap VIU
- Costs more than offset by reduction in CO2 footprint
- OBMs play important role by enabling greater scrap recycle