Scrap Supplements and Alternative Ironmaking 7

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Importance of Understanding Raw Material Value-in-Use for Steelmaking

iima
INTERNATIONAL
IRON METALLICS ASSOCIATION

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Agenda

1. Introduction to IIMA
2. What is “Value-In-Use”
3. Historical perspective of VIU
4. What parameters are Important?
5. Development of a VIU model
6. Application of VIU to real-life steelmaking operations
7. Understanding the dynamic nature of VIU

Introduction to IIMA

The International Iron Metallics Association (IIMA) was established by the Hot Briquetted Iron Association (HBIA) and the International Pig Iron Association (IPIA).

Provides a unified voice for the ore-based metallics industry, which includes companies involved in or related to production and sales of; Pig Iron, Hot Briquetted Iron (HBI), Direct Reduced Iron (DRI) or Iron Nuggets.

What is Value-In-Use?

Value-in-use as applied to steelmaking raw materials is a methodology that attempts to capture the true contribution and penalties associated with the use of a particular material in the steelmaking process

Historical Perspective Conventional Scrap Models

- Usually aimed at providing least cost scrap charge to meet specified residual levels
- Do not take into account process parameters, environmental considerations and other important scrap characteristics
- Do not capture true “value in use”
- Not set up for feedback from process data – “real time” slag analysis

Value-In-Use Calculations

- The price of scrap is just the tip of the iceberg
- How that scrap's characteristics affect your manufacturing cost is its Value-in-Use (VIU)
- $/Fe Unit is the simplest VIU Calc
- Another big issue is
  - "What is the stuff that is not Fe and how does it affect your cost?"

Scrap - Hidden Costs

- Extraneous materials – affects yield
- Low metallic iron content – energy and reductant required to recover Fe units
- Low yield – more material required to make a ton of steel
- Environmental issues
- Large fluctuations in slag chemistry – instability of operations, greater flux requirement, higher yield losses

Value-in-Use

- Everything in the scrap affects cost
  - – $/Fe Unit
  - – Slag Generation Rate
  - – Flux Consumption
  - – Yield
  - – Alloy costs
  - – Electricity and Energy Consumption
  - – Productivity
  - – Electrode consumption
  - – Requirements for dilution scrap
- THESE COSTS ARE **<u>REAL</u>** AND CAN OVERTAKE PRICE DIFFERENCES!

VIU Important Parameters

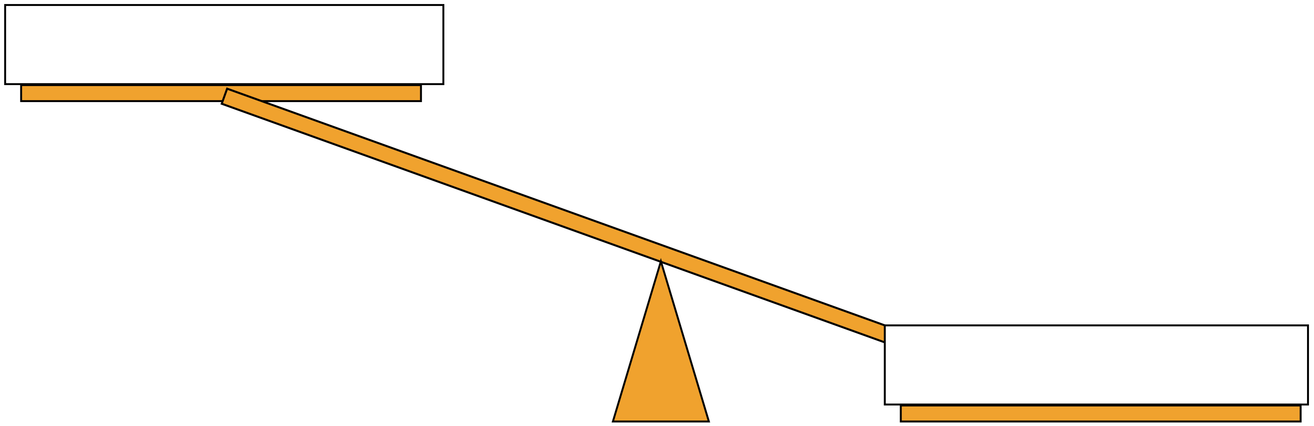
- Consider the following:
  - Total Fe – impacts yield
  - % metallized Fe (we want this as high as possible)
  - % FeO (this can be recovered but takes reductant and energy)
  - % C, Si (Carbon provides reductant and can reduce charge and inj. C – Si can provide energy when oxidized but increases slag volume – impacts energy and yield

VIU Important Parameters

- % H_2O – respresents a yield loss and impacts energy consumption
- % fines – some fine materials will be lost to the off-gas system (yield loss)
- % gangue (SiO_2, Al_2O_3) – will impact on slag generation and impacts energy and yield
- May assign additional value due to lack of Cu and other residuals
- May consider % P if over a target level
- % S in some cases

Caution: Residual Effects

- Virgin iron units alone are more costly, but combined with obsolete scrap can lower melt cost more than simply using prompt scrap (See previous IIMA study)



Key Breakdown of VIU

- Trying to determine the value of the commodities under consideration
- Frequently carried out as a head-to-head exercise
- Used to compare OBMs since chemistry is well defined
- Most basic models only consider $ per Fe unit
- More complex models may optimize the whole scrap charge and may take into account more factors

Development of a VIU Model

- Compares difference in % metallized Fe
- May apply a recovery factor for FeO and will need to consider additional energy required as well as reductant (probably C)
- May consider fines losses (DRI, HBI, PI)
- May consider moisture content and affect on energy requirements
- Applies value to lack of Cu

VIU Process Model

- Will consider C content and effect on Charge C
- Will consider gangue content and effect on flux requirements to maintain a desired slag basicity – could also consider effect of higher slag volume on Fe yield losses
- May consider additional lime required to deal with higher Phosphorus

VIU Process Model

- Model totals up all of the costs and benefits for each material and determines an equivalent cost of a ton of steel based on the price of each commodity and the various cost benefits/penalties associated with each scrap type.
- Can compare equivalent cost head-to-head or calculate the break-even price of one commodity against the other

Real-Life Effect of OBM Parameters

- **HSW results - increase of 4 % metallization resulted in $20 savings in the meltshop**
- **HYL model predicts $5 / % metallization**
- **At HSW, 1% silica = $8.28/ton cost increase**
- **HYL model predicts $15 cost increase per 1 % silica, 1 % alumina = $7.50 cost increase per tonne**
- **Coal based DRI can have up to 7.4 % gangue**

Dynamic Nature of VIU

- Raw material costs and compositions are constantly changing.
- As a result, VIU calculations should be run often.
- In addition, new materials may become available that provide a better VIU
- Raw material composition database should be updated regularly

Conclusions

- Need to move away from classifying metallics primarily based on price and instead understand the value as used within a specific operation
- New IIMA VIU model allows for quick comparison of raw materials on a head-to-head basis
- Need a more universal set of scrap evaluation parameters that can be applied to all types of metallic feed for EAF operations

Thank you

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