



New developments for Mn

By

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INTERNATIONAL MANGANESE
INSTITUTE

32nd ANNUAL CONFERENCE

June 11 - 13, 2006



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June 2006

Potential of new technology in smelting of HCFeMn



Key criteria

- Electrical energy
- Coke
- CO₂ emissions



*BASELINE: Typical HCFeMn smelter
in South Africa*



- 200 000 tpa HCFeMn
- Constant Mn recovery (85%)



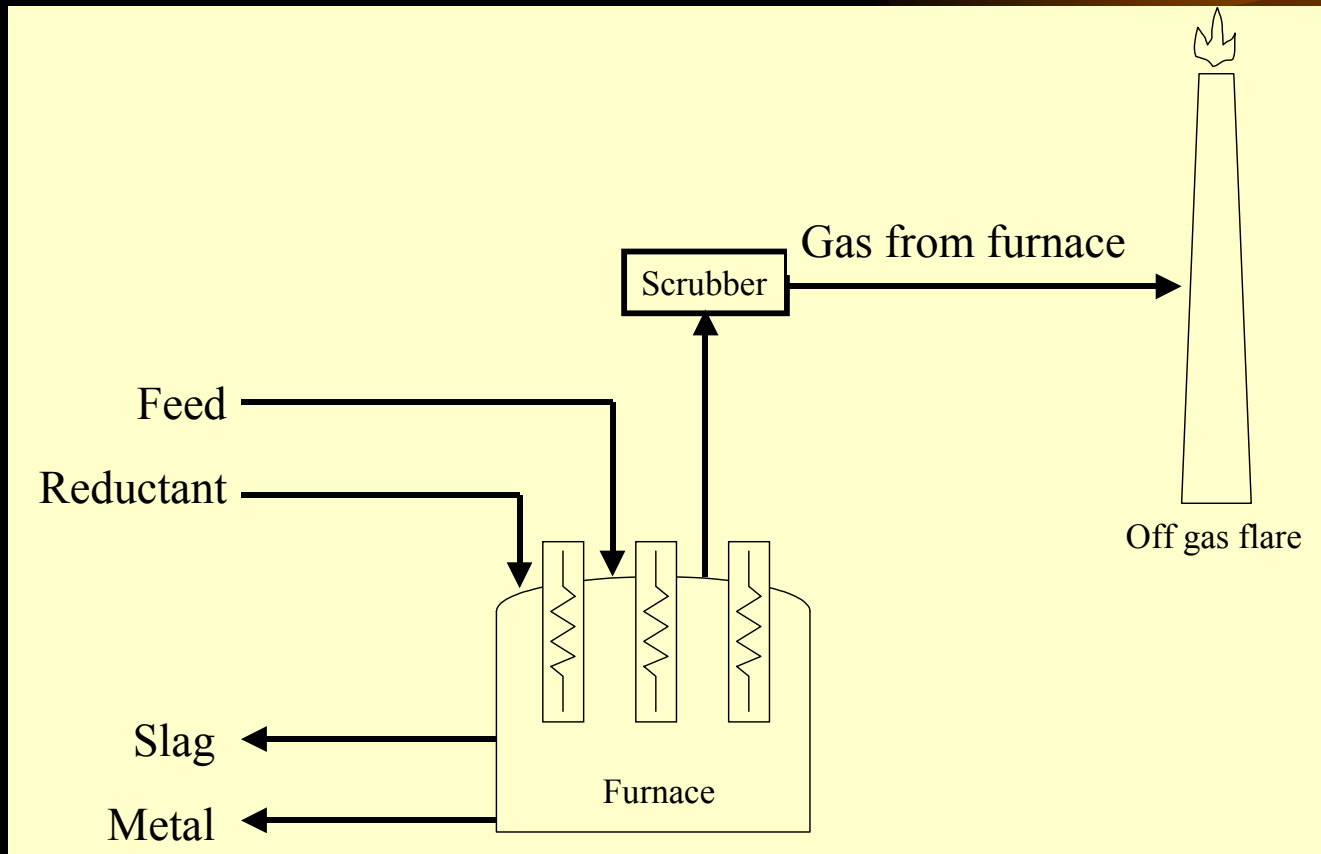


Some technology scenarios

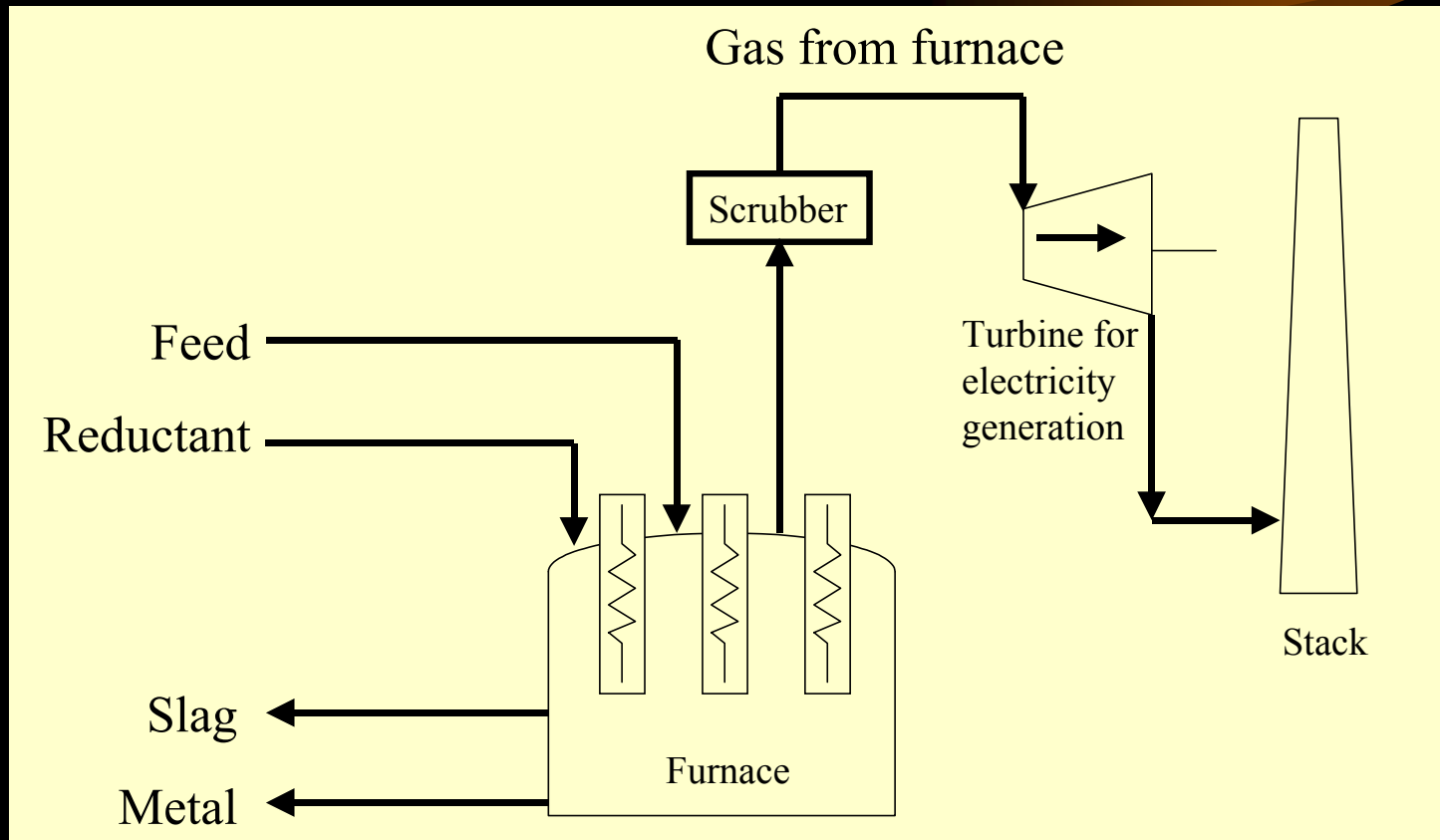
- Baseline
- Power generation from furnace off gas
- Pre-heating of feed to 600°C
- Pre-reduction at 1000 °C
- Pre-melting of ore at 1400 °C



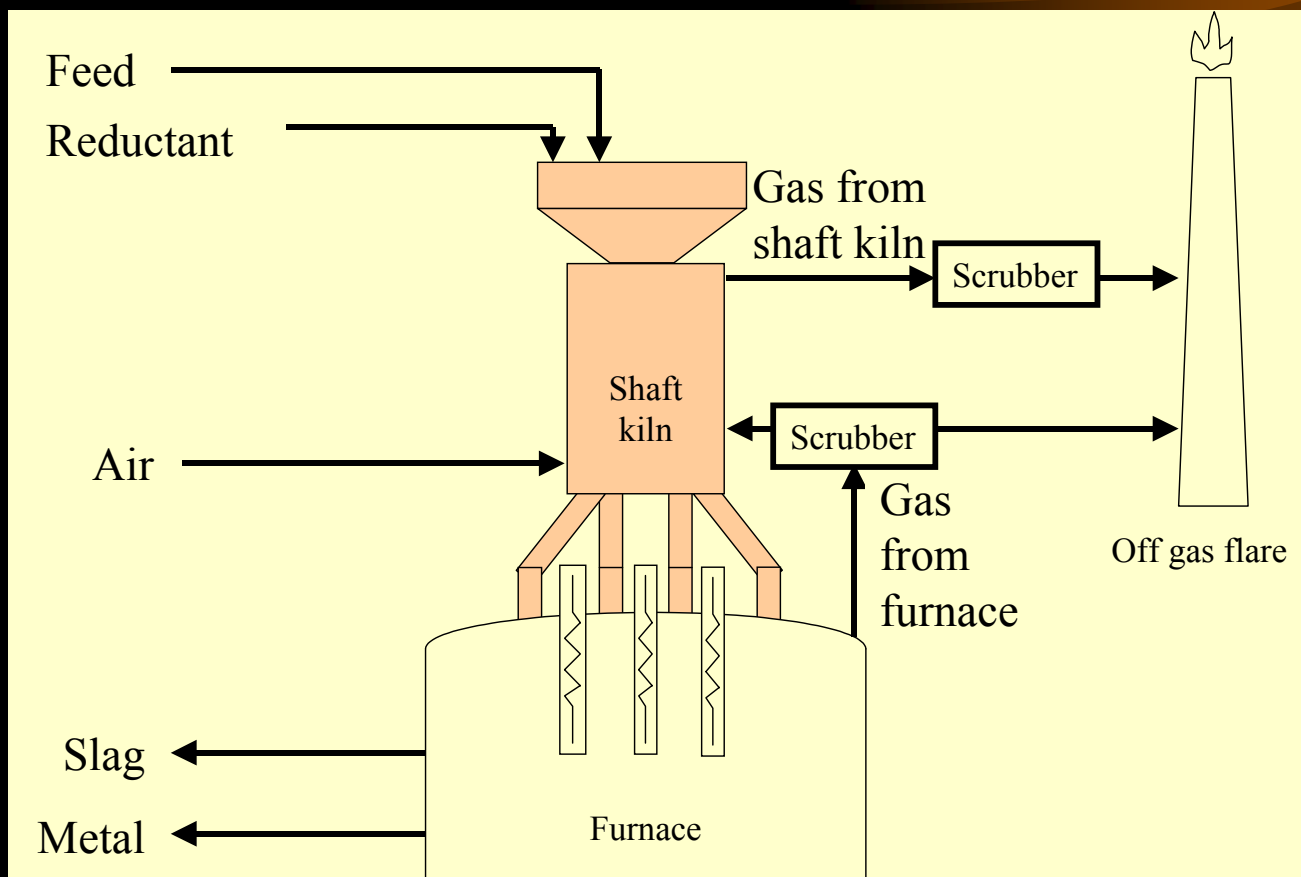
Baseline Case



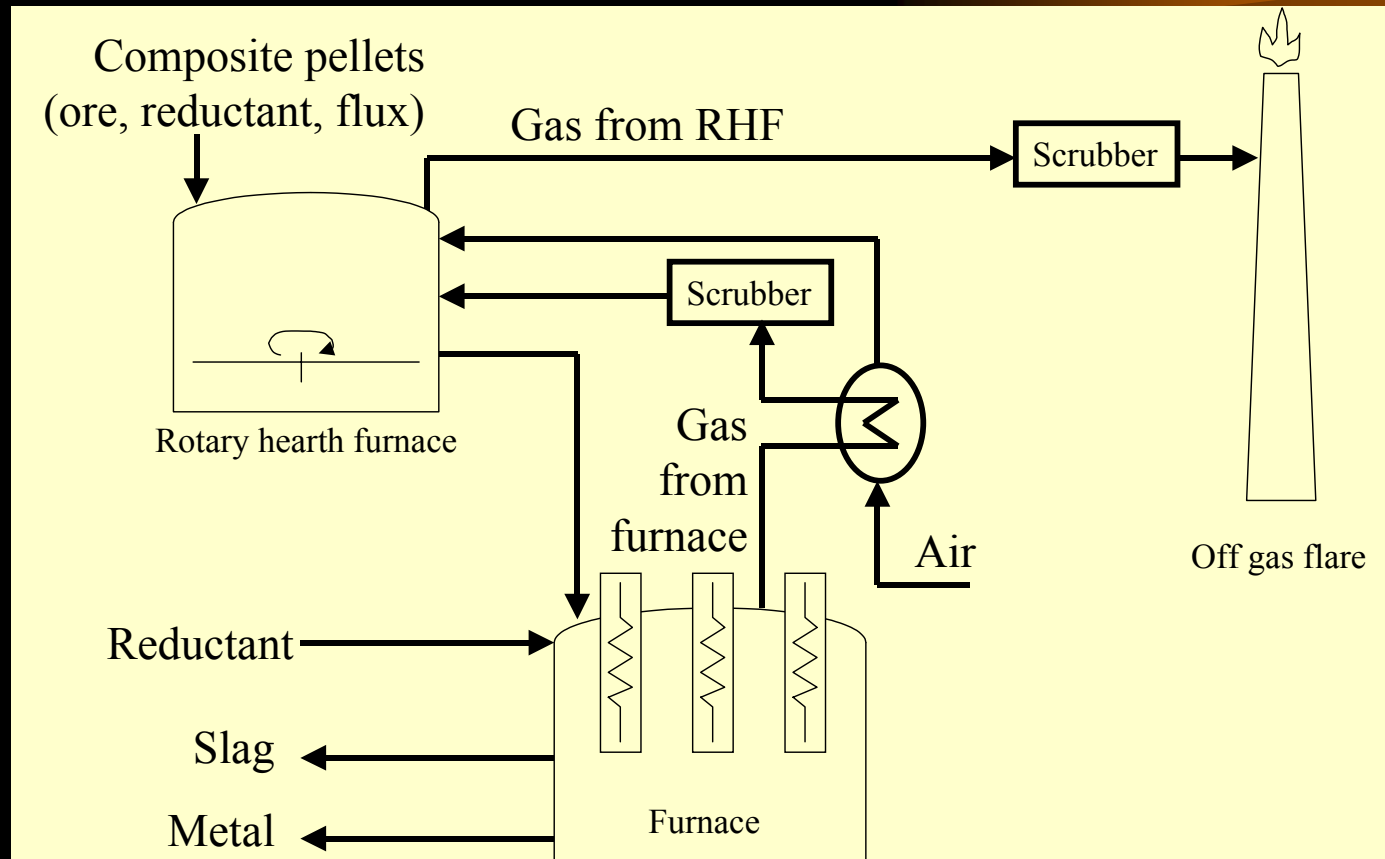
Power generation



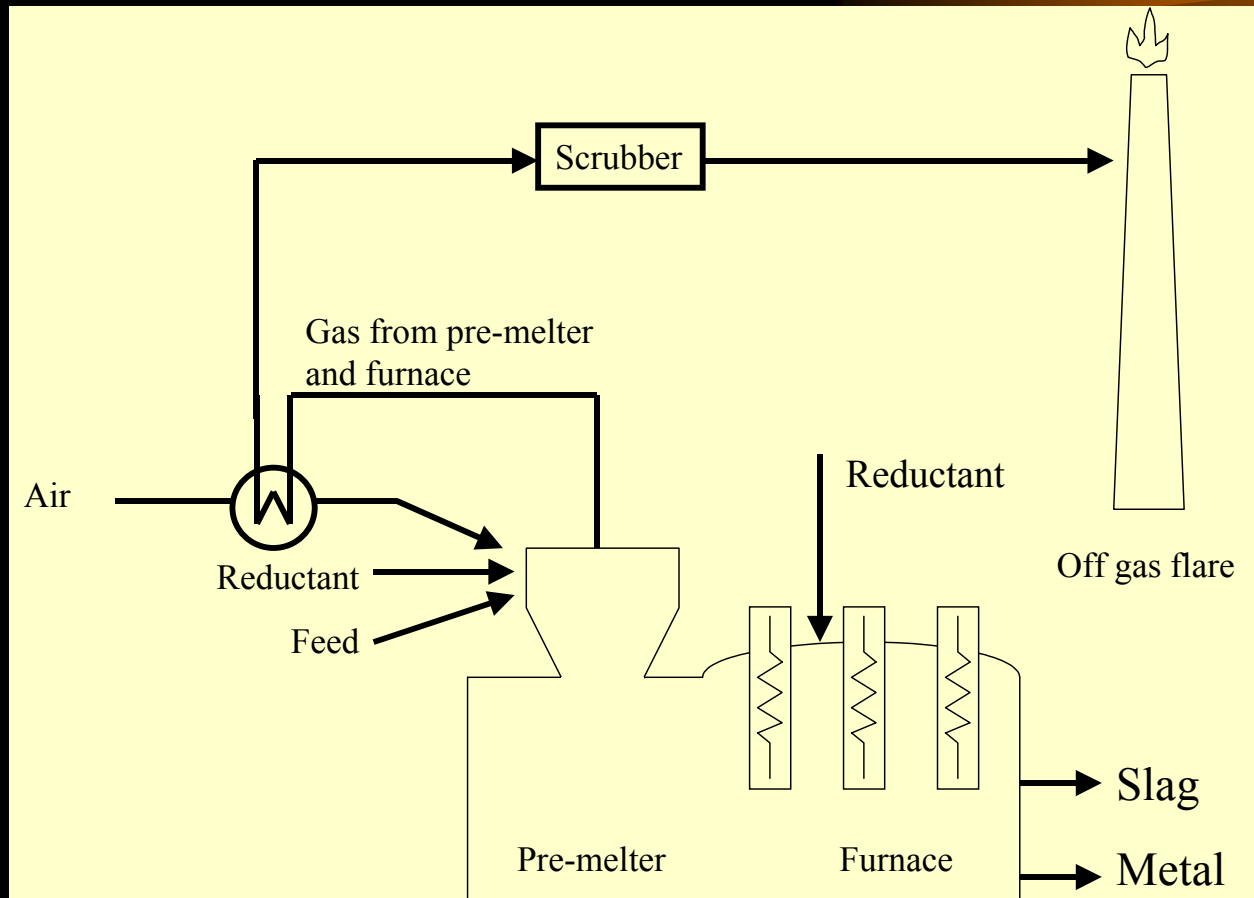
Pre-heating to 600°C



Pre-reduction at 1000°C



Pre-melting of Mn ore

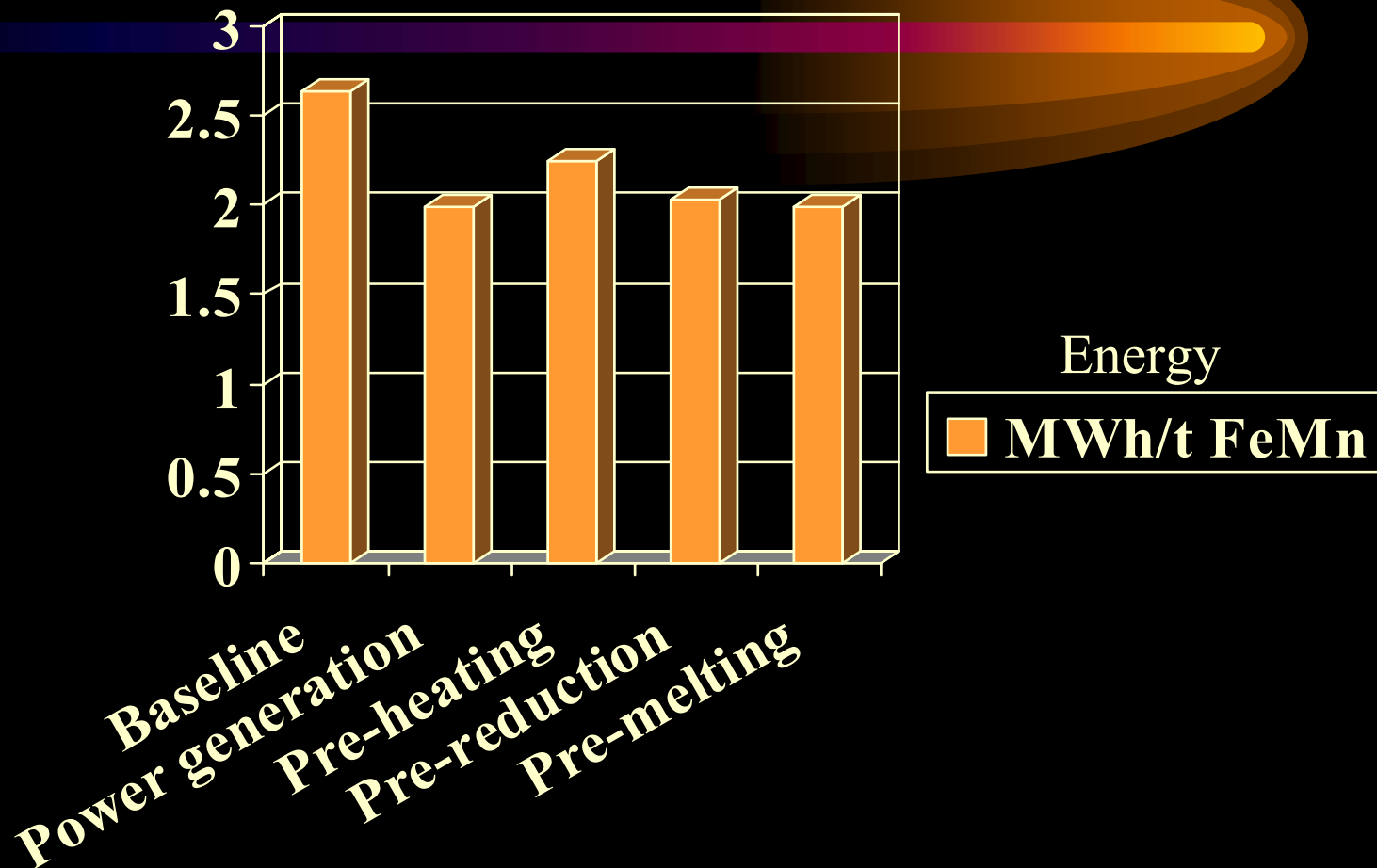




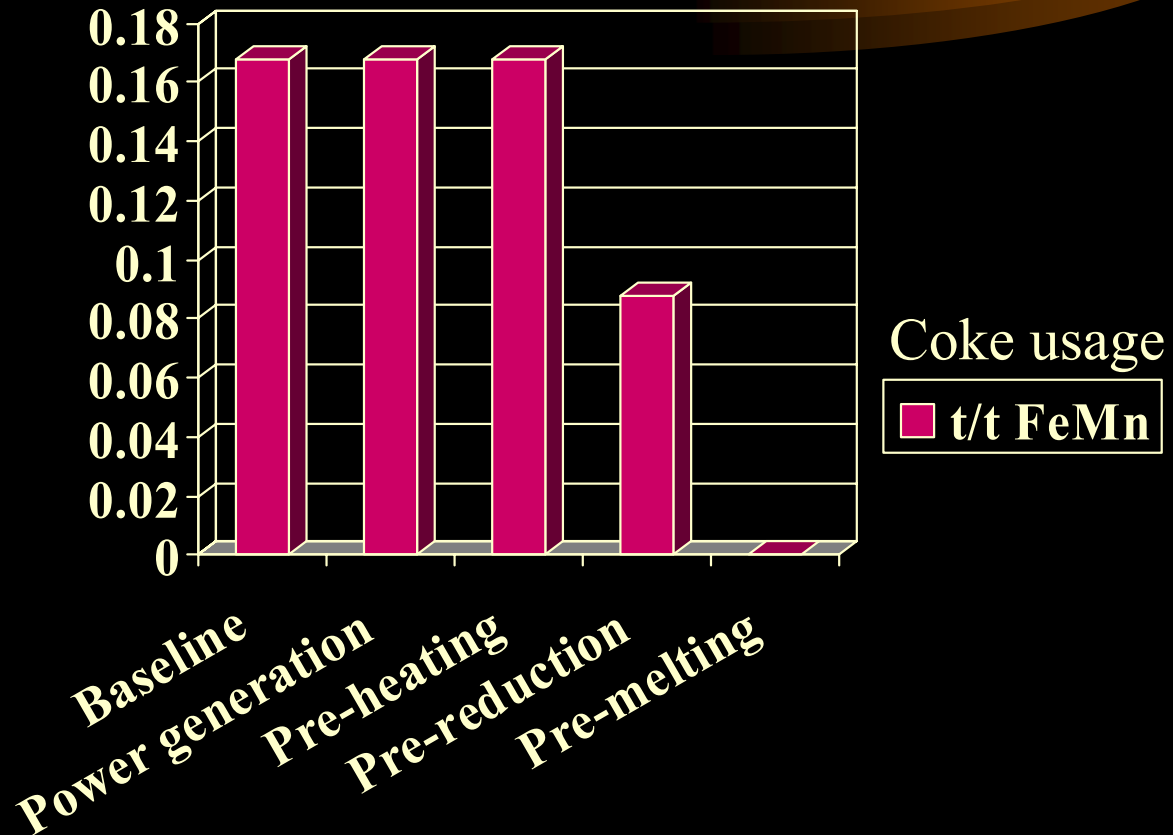
Limitations

- Other new technologies not included, e.g.
 - Fluid bed pre-reduction of Mn ores
 - Kumba's AlloyStream technology
- The pre-melting option is not suitable for silicomanganese production

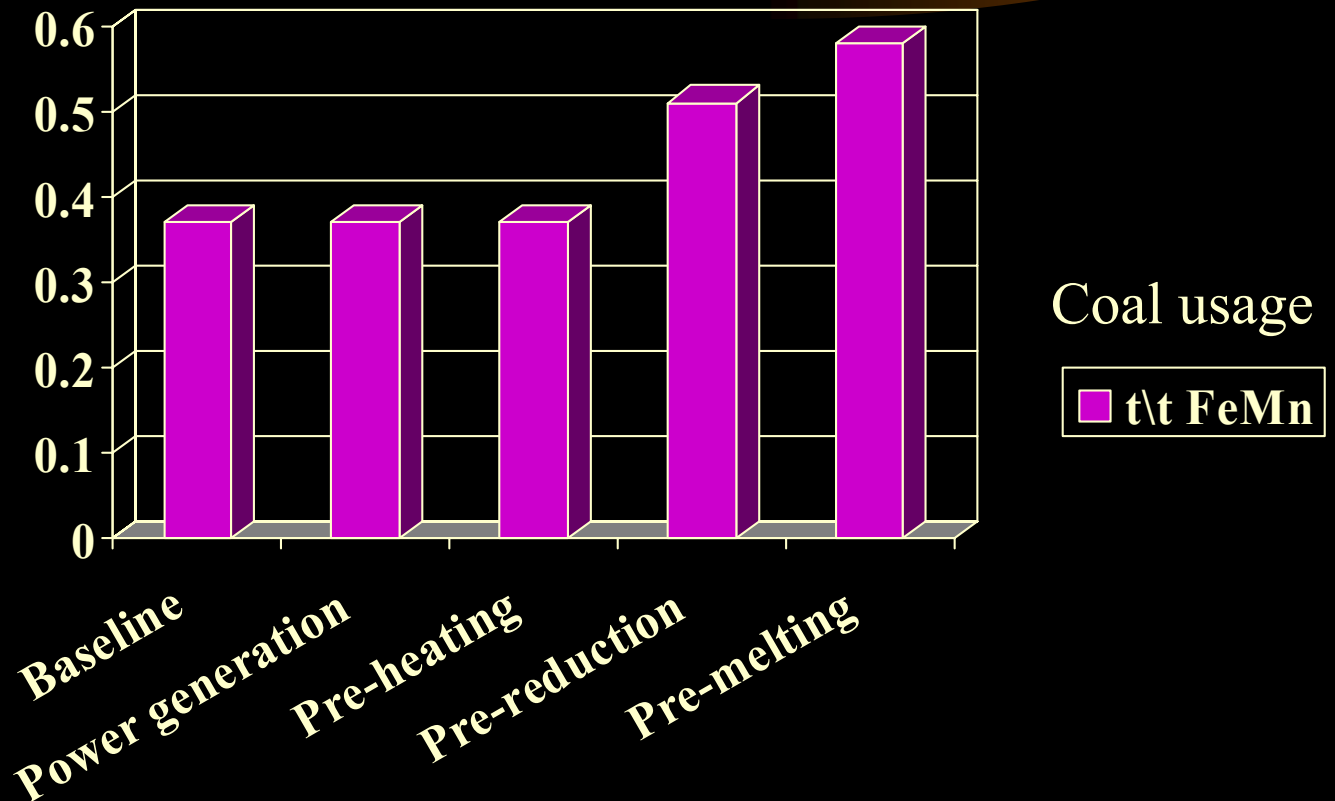
Comparison between scenarios



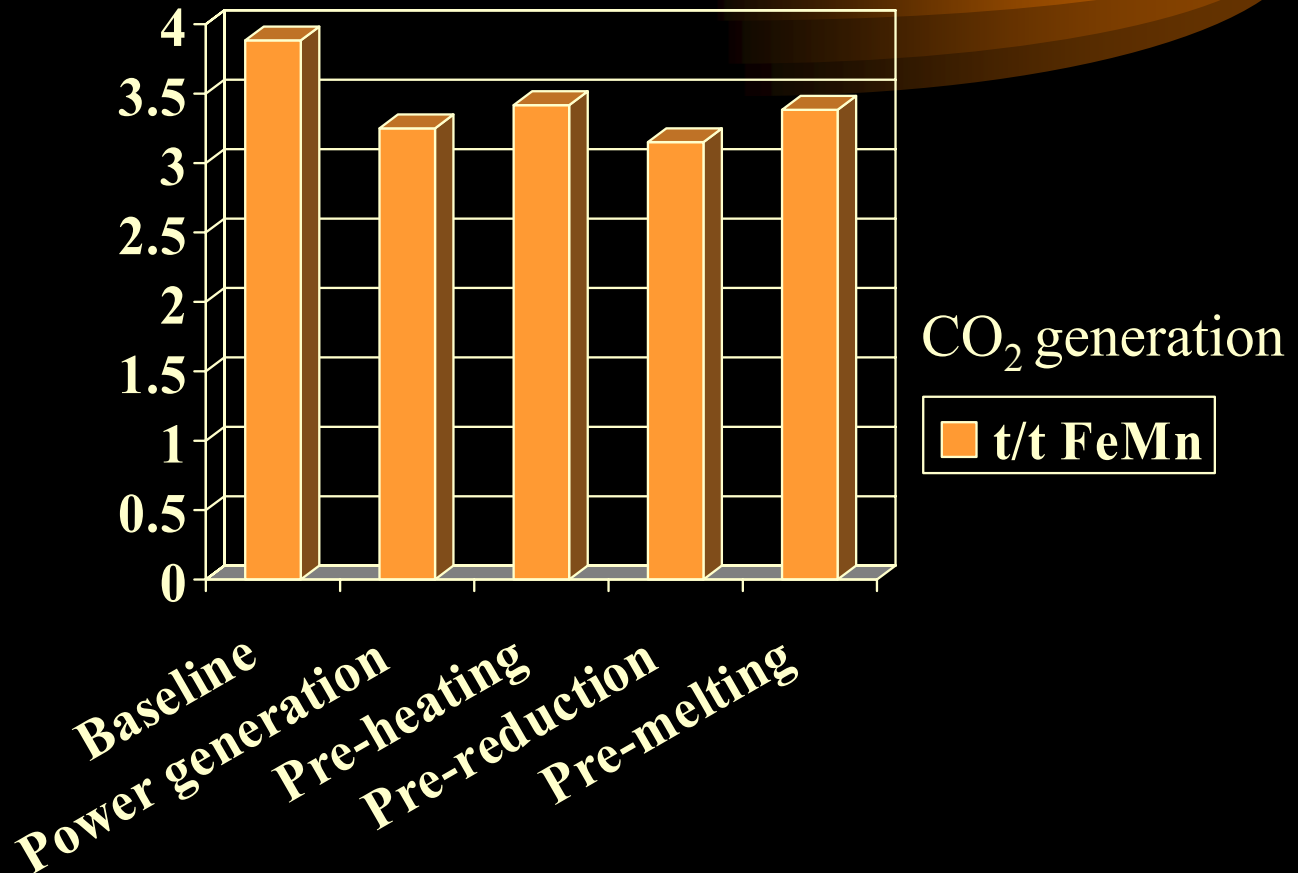
Comparison between scenarios



Comparison between scenarios

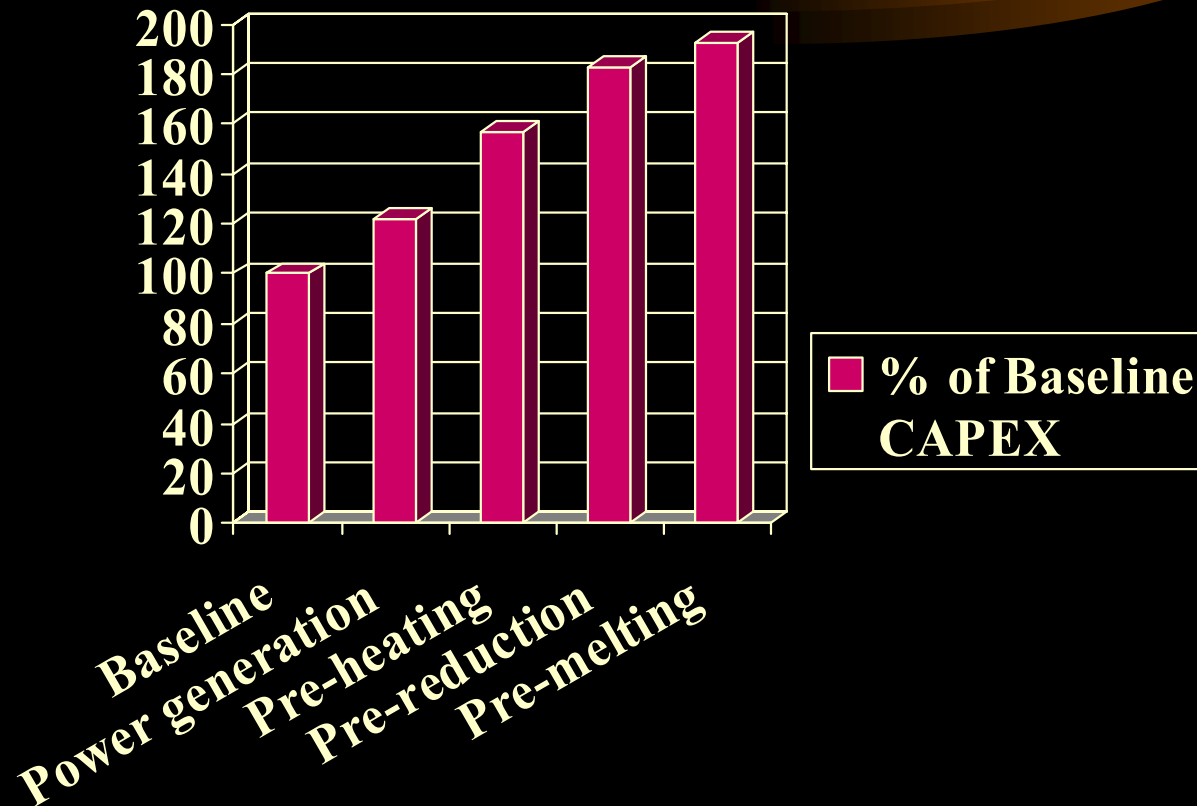


Comparison between scenarios





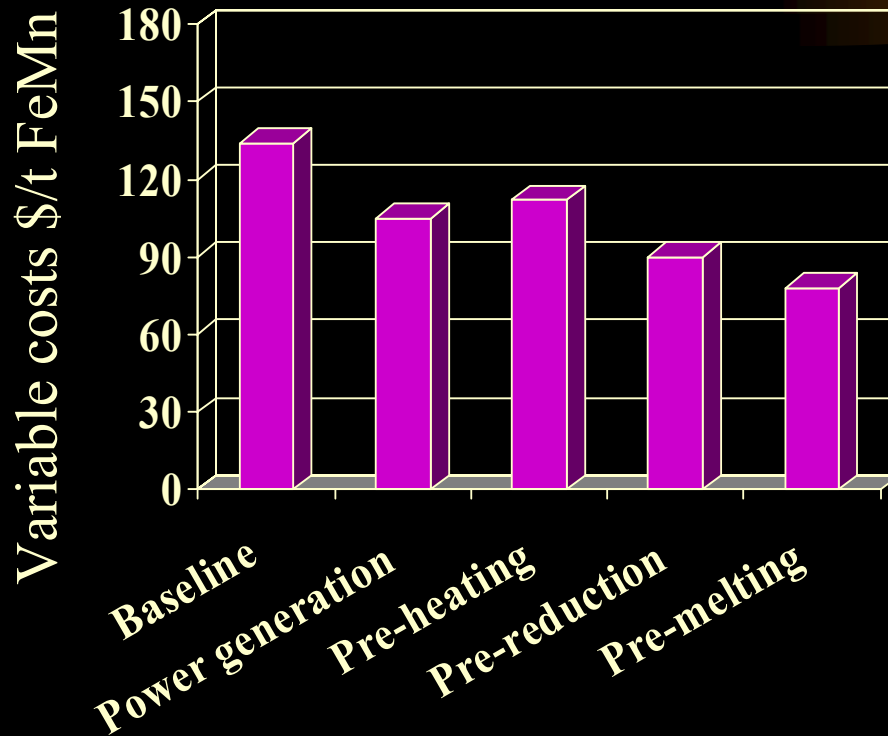
CAPEX comparison





Variable cost comparison

Total of coke, coal, power and CO₂ credits



Coke \$250/t

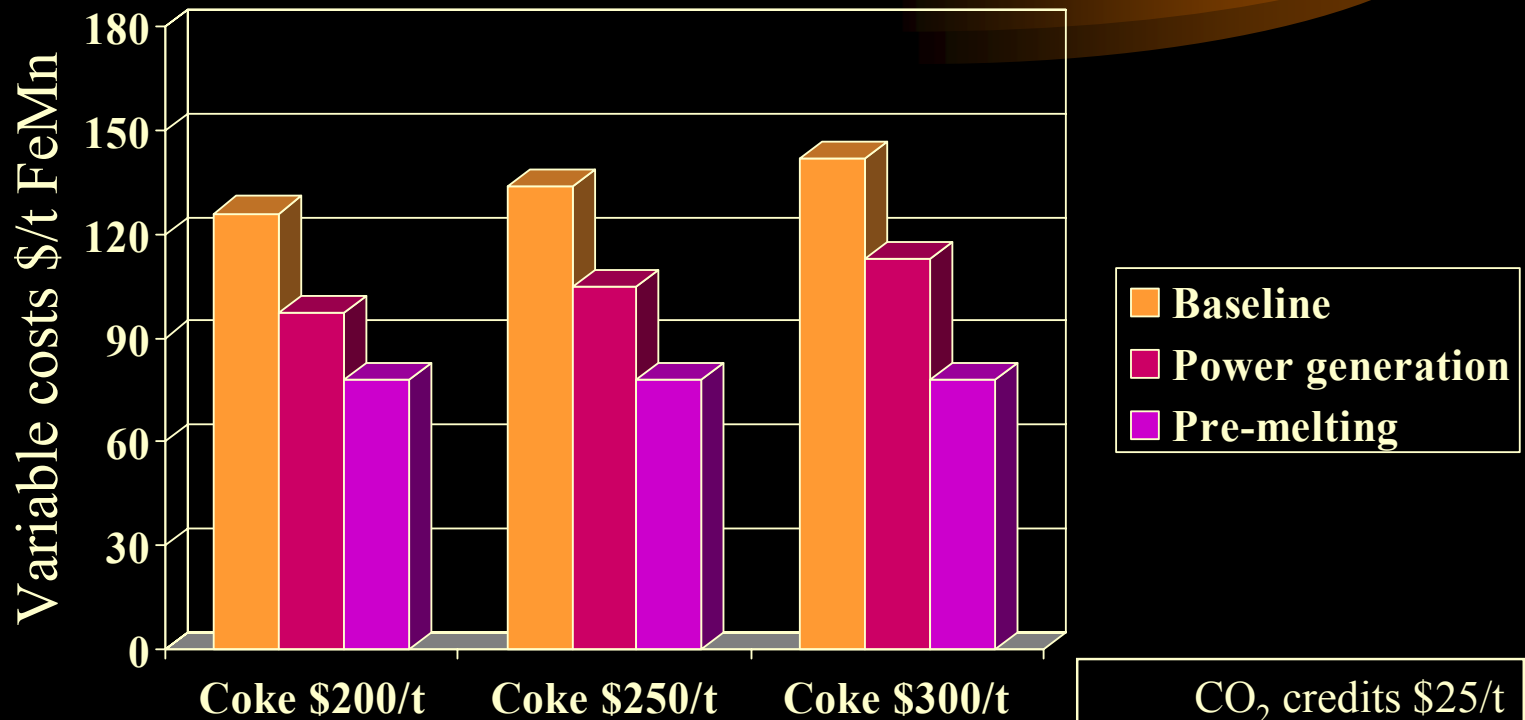
Coal \$70/t

Electricity \$25/MWh

CO₂ credits \$25/t



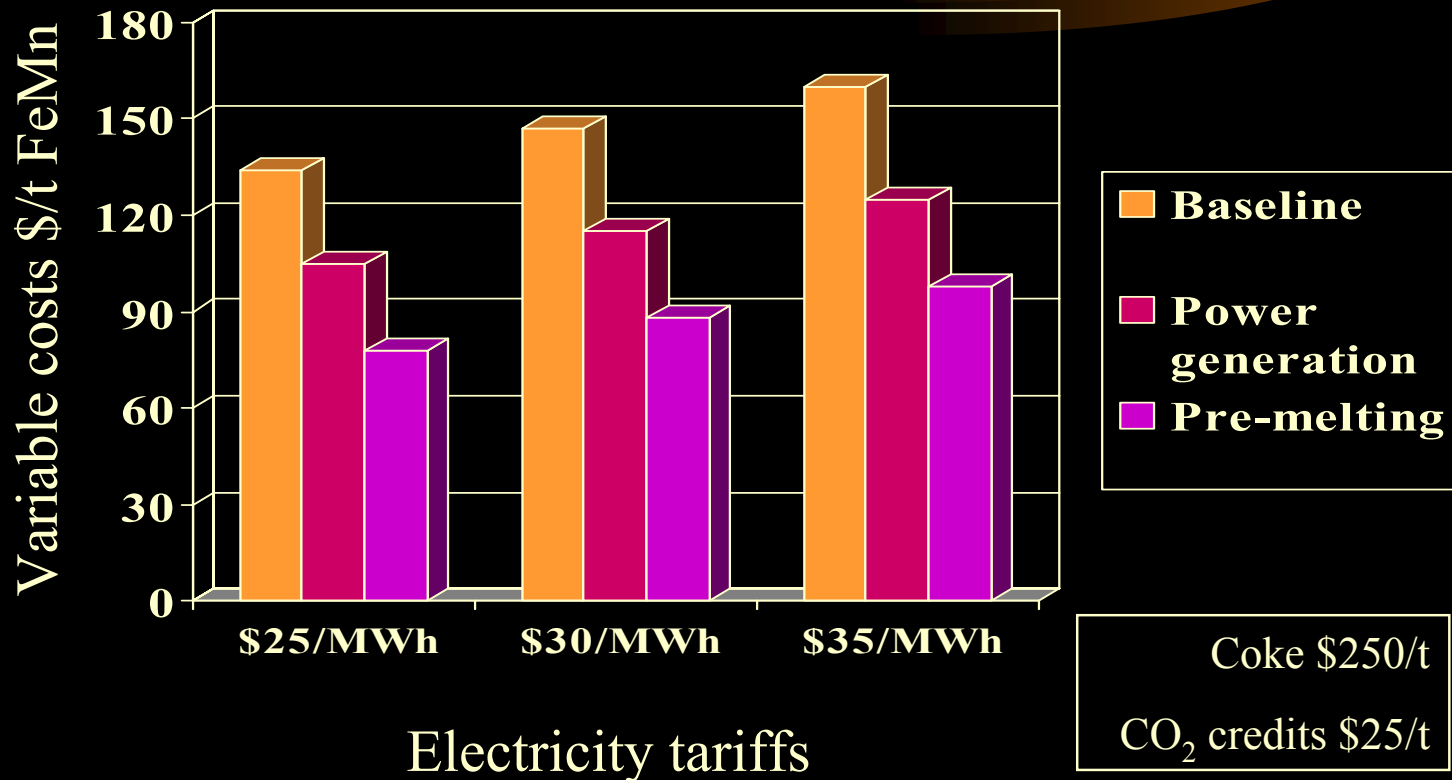
Sensitivity to coke price



CO₂ credits \$25/t
Electricity \$25/MWh

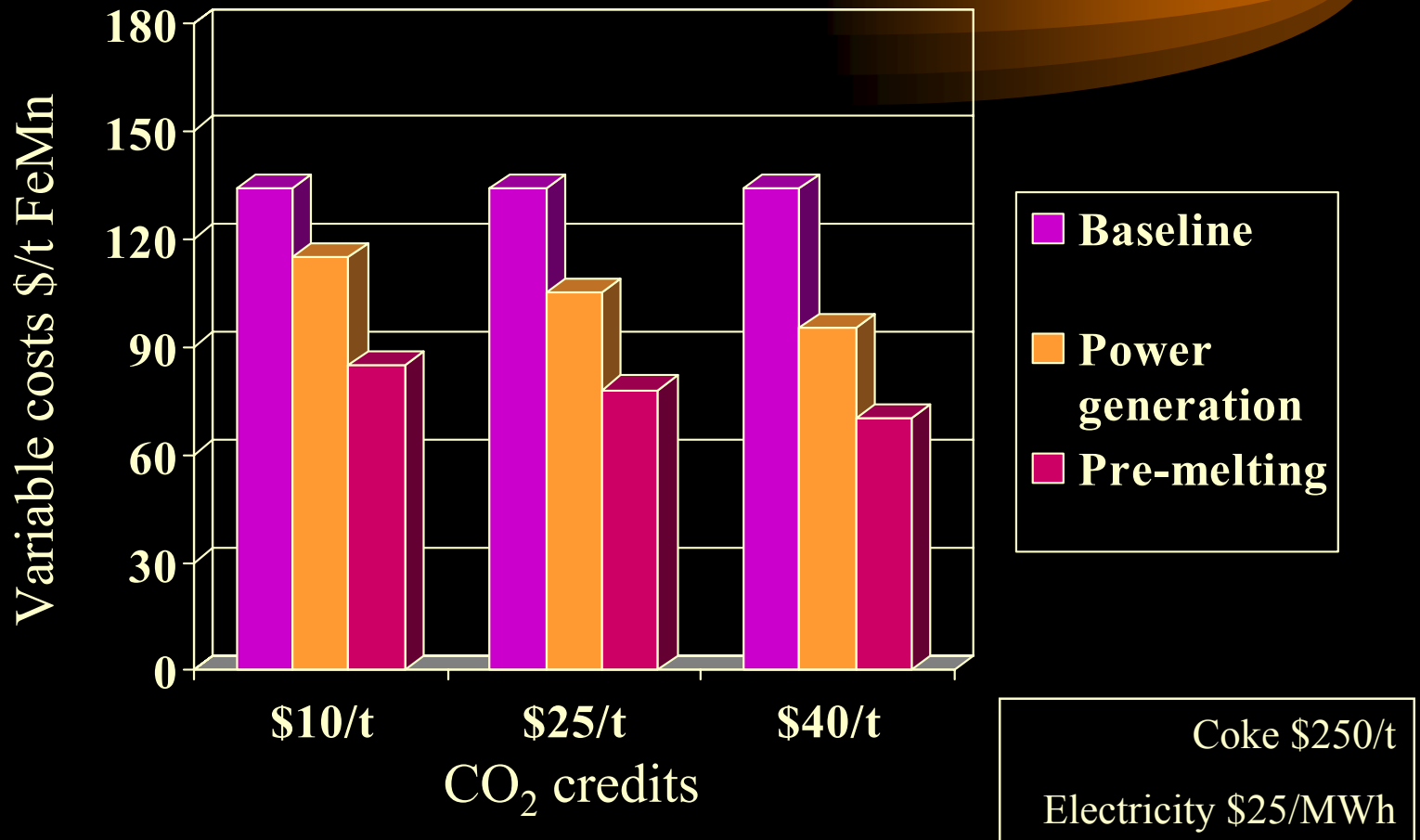


Sensitivity to electricity tariffs





Sensitivity to CO₂ credits



Technology can in principle reduce:



- Electrical energy [MWh/t FeMn] by 15 - 25%
- Coke usage [t/t FeMn] by 50 - 100%
- CO₂ emissions by 10 - 20%

Economics of implementing these technologies



- At current prices variable costs savings of 20 - 50% but CAPEX increases 20 - 90%
- In-plant power generation most attractive, plus low risk
 - but has no impact on coke consumption

Sensitivities to longer term price outlook



- All technologies studied are approximately neutral to electricity prices.
- Pre-reduction and pre-melting are favoured by an increase in coke prices
- An increase in CO₂ credits favours in-plant power generation and preheating scenarios



Conclusions

- In-plant power generation offers a low technology risk method of mitigating the effect of price increases in electrical energy and benefiting from CO₂ credits.
- New metallurgical technologies such as pre-melting and pre-reduction are required to mitigate coke price increases.
- Lead times to implement new metallurgical technologies are typically 10 to 15 years



Acknowledgements

- Mr. D. Wellbeloved
- Mr. K. Bisaka
- Mrs. L. Hockaday

