Workshop IEA
Global Sustainable Technology Roadmap for Iron & Steel

BioCoke Production

São Paulo, 22 de agosto

Location of Gerdau's Coke Plant

GERDAU OB:

4,5 Mt Steel/year

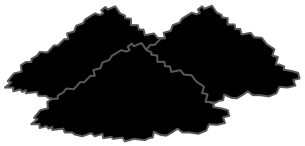
1,7 Mt Coke/year

2 COKE PLANTS, Top Charging, 6m.

Coke plant 1 – 1986 – 1100 kt/year

+

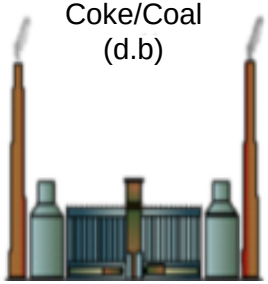
Coke plant 2 – 2008 – 600 kt/year



Mineral Coal

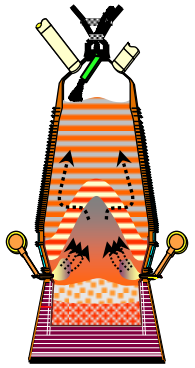
2,3 Mt COAL/year

81% Yield Coke/Coal (d.b)



Coke plant

Coke



What are our Drivers?

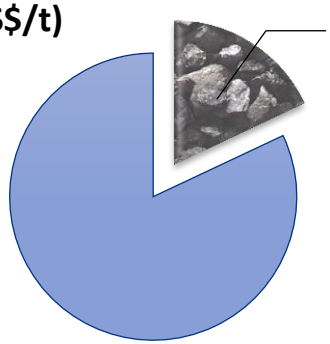
Scenario of high competition in the steel market

Steel Capacity Production
+ 550Mt/year Ahead of demand* +25%

Capacity → 50Mt/year
Current Production → 34Mt/year +30%

High Impact of Coal on the Cost of Steel

Steel Cost (US$/t)



Coal Blend
~ 30%

Limited Investment Capacity in the short term.

In the long term: Stamp Charging – Jumbo - Scope 21

Need for higher efficiency

and differentiation

Alternative materials

Keeping the High Quality of Coke

SURVIVAL IN THE MARKET

*(World Steel, 2016) (IABr,2017)

What are our Drivers?

Sustainability

Dec/2015 → **COP21**

United Nations Climate Change Conference

Global Climate Agreement:
Global warming of 2°C

NDC: Reduction of GHG (GreenHouseGas)
37% - By 2025 **43%** - By 2030

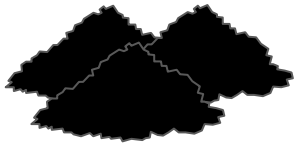
2016/17 → EPE

The government encourages proposals and measures to be adopted by the industry,
including Steel Plants → Focus on energy efficiency.

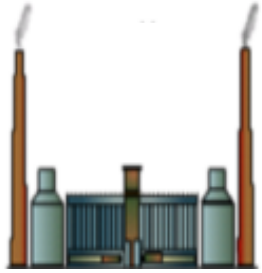
GERDAU How can we contribute?

Scenery Environmental

Coal Route:

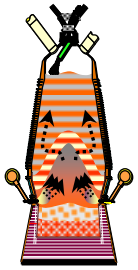


Mineral Coal

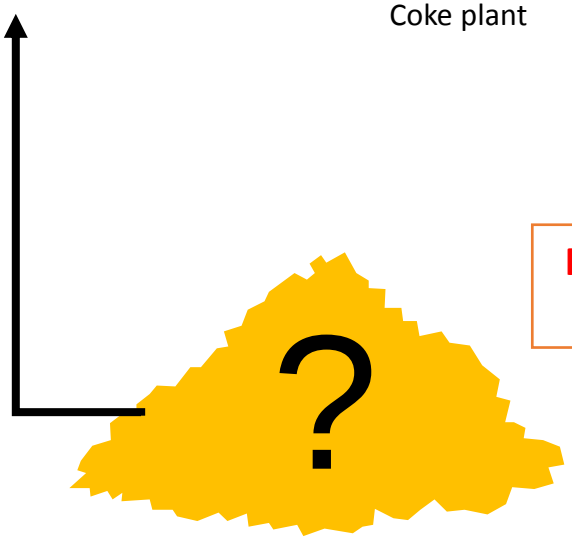


Coke plant

Coke



1.88t CO_2 Emissions/t CS



Reduce the cost of coke

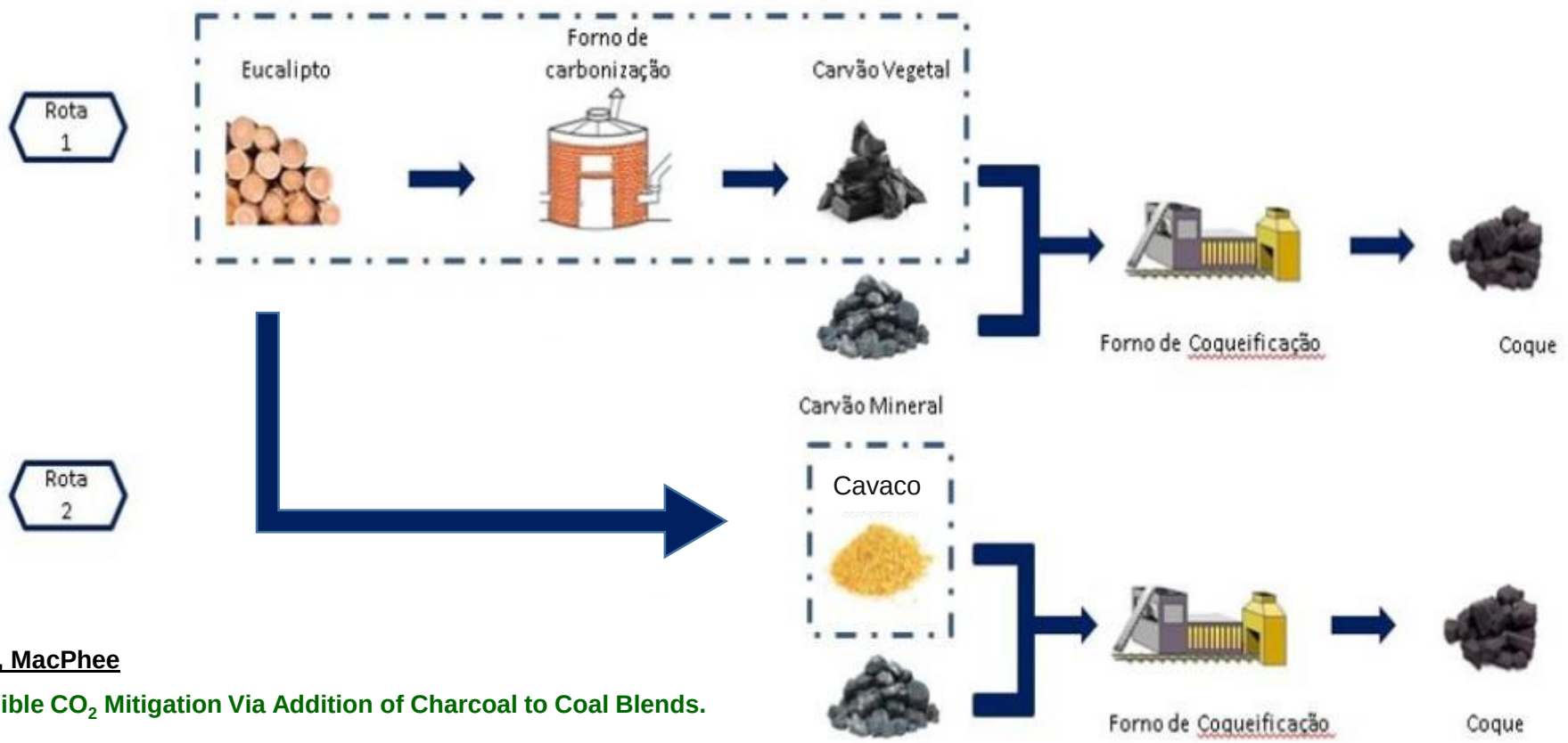
+

Mitigate the environmental effect

CO_2 Emissions/t HM

*Source: WSA

Biomass Routes in Coke Plant



2009, MacPhee

Possible CO_2 Mitigation Via Addition of Charcoal to Coal Blends.

2011, Ka Wing Ng

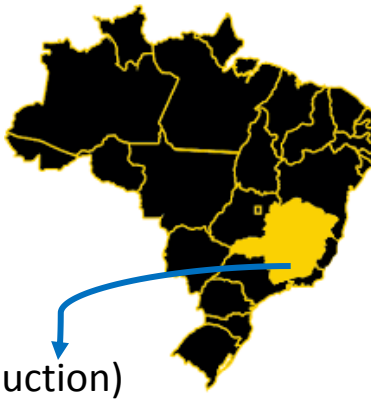
Strategy from Biofuel Ironmaking From a Canadian Perspective

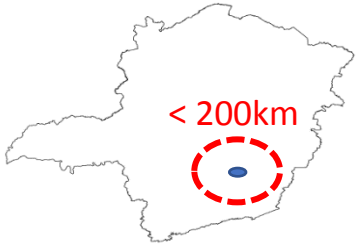
2016, Nippon Steel 2016

Carbonization Behaviour of Woody Biomass and Resulting Metallurgical Coke Properties

Use of Charcoal fines

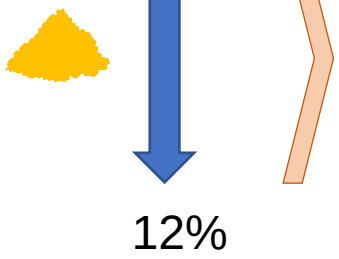
- Brazil: largest charcoal producer
- Forestry technology and soil / climate favorable.
- Eucalyptus' carbonization.
- 12Mt/year → 85% Steelmakers
- MG State is the largest national producer (70% from total Production)

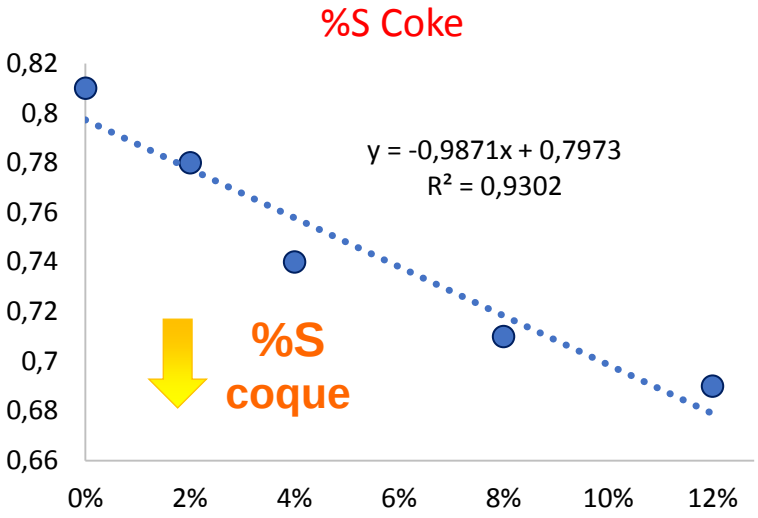


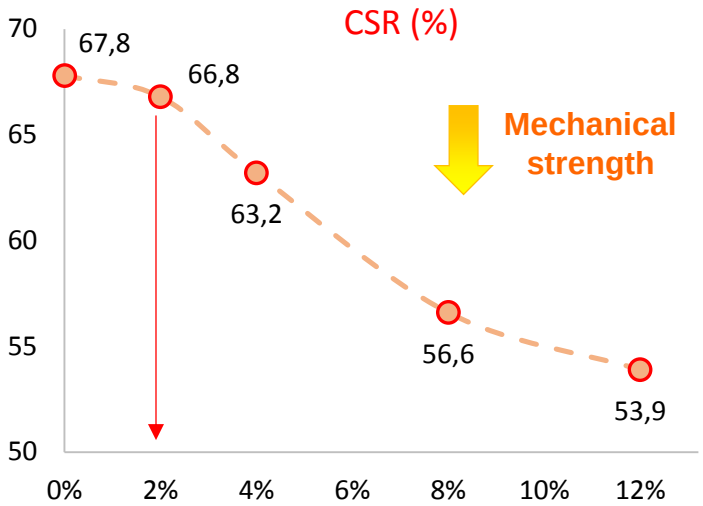


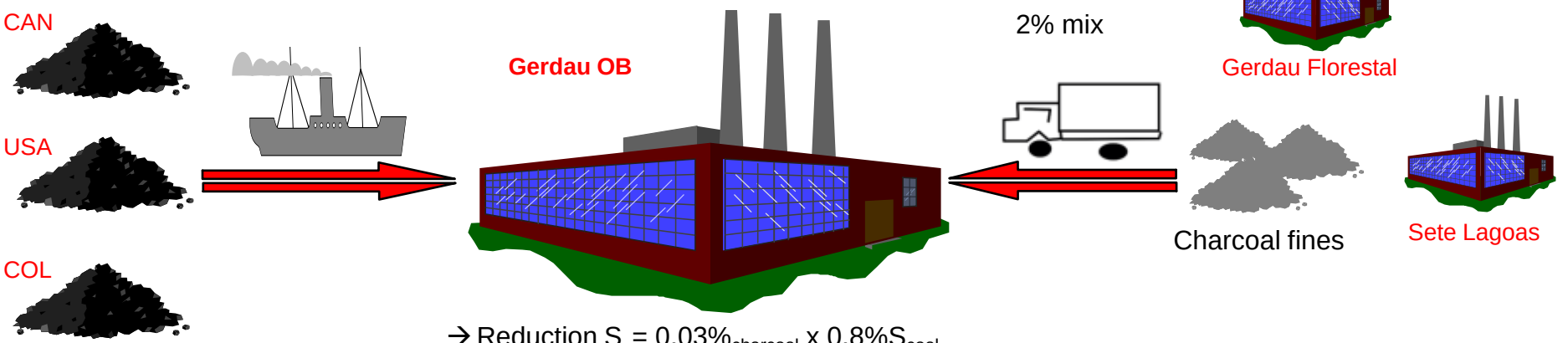
Sources close to the Plant

Use of Charcoal fines









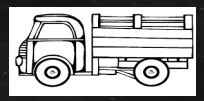
→ Reduction S = $0{,}03\%_{charcoal}$ x $0{,}8\%S_{coal}$

→ Reduction Ash = $5\%_{charcoal}$ x $9\%_{coal}$

→ Reduction of CO_2 Emissions - GHG

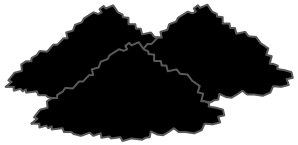
Use of Biomass “Cavaco”

2% in Coal Blend

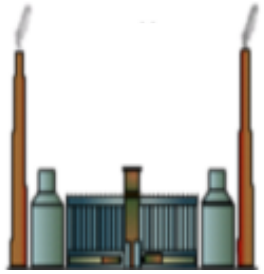


Conclusion

Coal Route:



Mineral Coal



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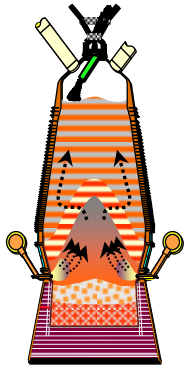

Metallurgical Coal (2017) (t)	Economics of Metallurgical Coal - 2% (t)	Emission Factor (tCO_2/unit)*	Avoided Emission (tCO_2)
2.076.180	41.523,6	3,059	**127.020,69**

CO_2

1,3R$/tHM

* Fator do WSA

Potencial (Integrated Coke): - 889ktCO_2/year

Publications

REDEMAT

REDE TEMÁTICA EM ENGENHARIA DE MATERIAIS

UFOP – UEMG

Tese de Doutorado

"Utilização de Moinha de Biorredutor e Pneu Inservível na Produção de Coque Metalúrgico"

AUTOR: MSc. Eng. Guilherme Liziero Ruggio, da Silva

ORIENTADOR: Dr. Eng. Paulo Santos Assis

CO-ORIENTADOR: Prof. Dr. Victor Zmyla

Dezembro de 2016

Publications

2016

abm
Associação Brasileira de
Metalurgia, Materiais e Mineração

46º Redução
17º Minério de Ferro
4º Aglomeração

abm week 2016

UTILIZAÇÃO DE FINOS DE CARVÃO VEGETAL PARA PRODUÇÃO DE BIOCOQUE METALÚRGICO*

STEEL'S PREMIER TECHNOLOGY EVENT
AISTech2017 8–11 May
Nashville, Tenn., USA • Music City Center

Influence of charcoal fines on the quality of metallurgical coke

Guilherme Liziero Ruggio da Silva[1], Paulo Santos Assis [2], Alfredo Carlos Bitarães Quintas [3], Paulo Henrique Grossi Dornelas[4], Lorena Cristina Amorim [5], Erick Mitchell Henrique Braga [6], Renata Dias Silva e Souza [7], Mauro Euclides[8].

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[2,7]REDEMA- UFOP

Keywords: Emission of CO_2, Coke, Coal, Charcoal, Blast Furnace.

2018

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Associação Brasileira de
Metalurgia, Materiais e Mineração

48º Redução
6º Aglomeração

abm week 2018

UTILIZAÇÃO DE BIOMASSA DE EUCALIPTO NA PRODUÇÃO DE COQUE METALÚRGICO *

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O aço da Gerdau tem a força da transformação.