# Technology Pathways to Achieving Net Zero in Steelmaking



**Global Research and Development** 

# Dofasco is part of the world's leading integrated steel and mining company – ArcelorMittal

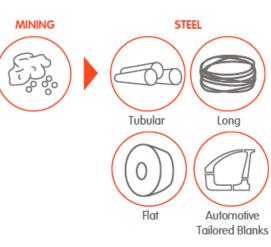


Steel manufacturing in	Customers in	Employees in 2022
16	155	154,352
countries	countries	
	,	
Million tonnes iron ore mined in 2022	Million tonnes crude steel made in 2022	Steel shipments totalled in 2022
mined in 2022	steel made in 2022	totalled in 2022
45.3	59	55.9
		million tonnes
Research centres	Full-time researchers	R&D programs
11	1500+	100+
		in progress

Trademarked products 200+	Active patent families 700+	New products and solutions launched in 2022
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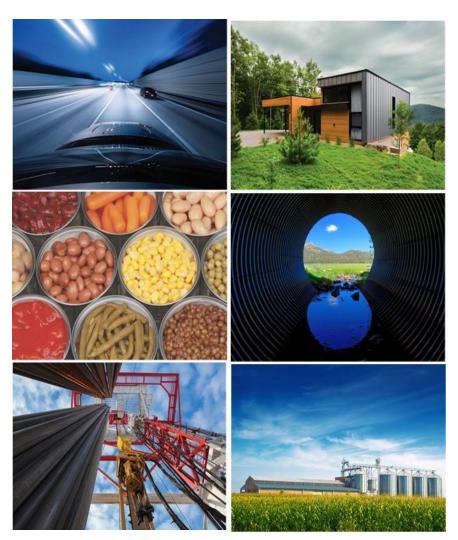


# In Canada





Construction



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## Locations in Ontario

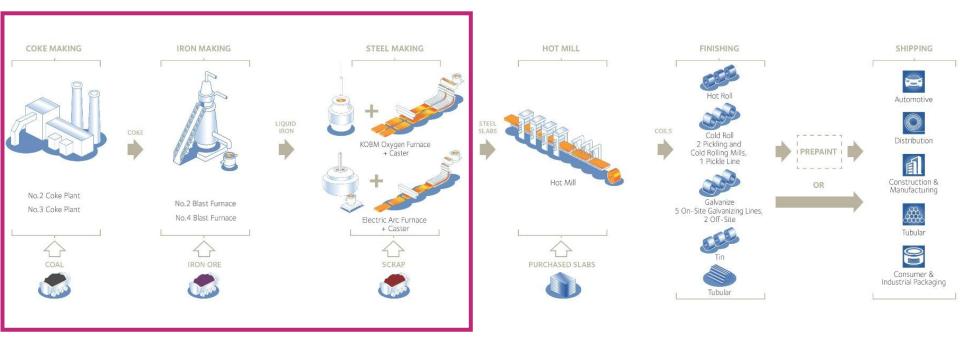


67 2 April 2023

# In Hamilton...

Hamilton's waterfront

### **Current steelmaking at ArcelorMittal Dofasco**



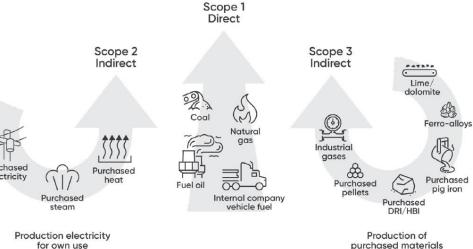


### The path to net zero



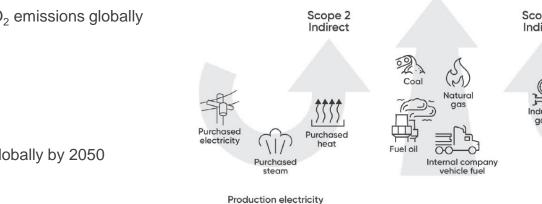
### -25% by 2030

Scope 1 & 2 CO<sub>2</sub> emissions globally



Net zero CO2 emissions globally by 2050

purchased materials



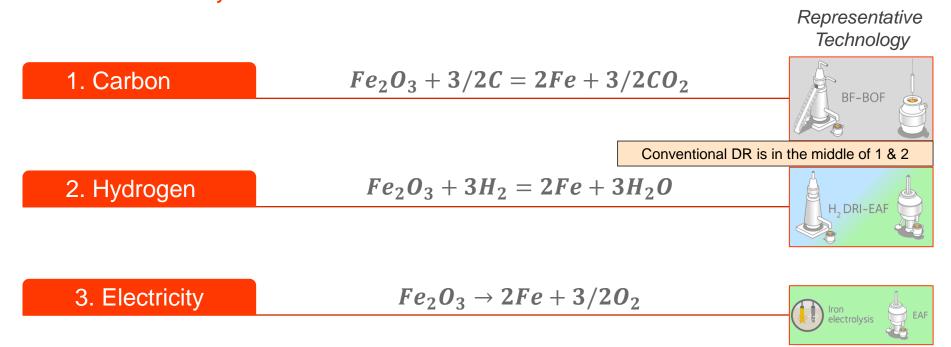
and 3 GHG Protocol Emissions

\* Group target of a 25% reduction in CO<sub>2</sub>e emissions intensity (per tonne crude steel) by 2030. Targets refer to scopes 1+2 CO<sub>2</sub>e emissions, steel + mining



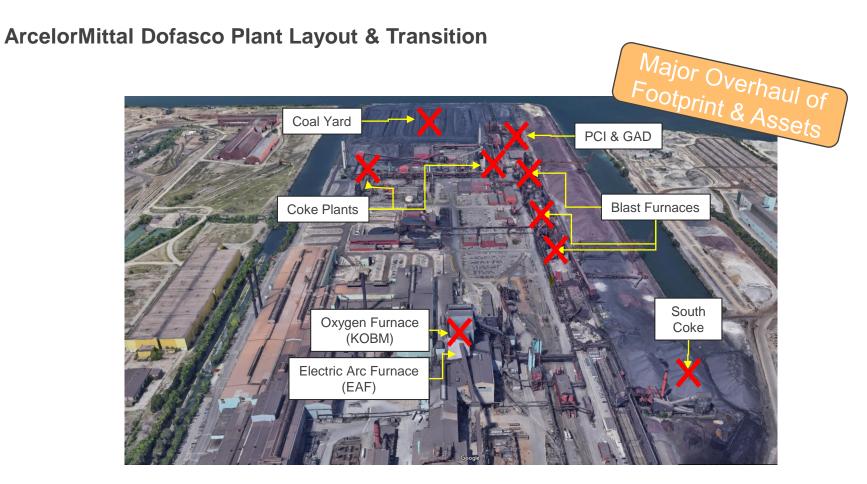
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#### Three Options for Iron Production from Iron Ore The need for economically viable chemical reductants



Source: ArcelorMittal Climate Action Report 1 (2019)







#### ArcelorMittal Global Climate Goals

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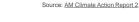
#### Company wide 25% reduction in $CO_2$ emissions by 2030 (35% in Europe), and Net Zero by 2050

Scope 1 Offsetting Carbon Scope 2 Scope 1 Scope 2 removal Carbon in the -7.5% 100% -1.6% atmosphere Steelmaking transformation -5.1% -1.5% Energy -7.4% transformation -2.1% 0 Increased A: Steelmaking transformation Scrap use 75% 1. 2. 3. 4. 4.1 5. Sourcing Carbon Announced Announced Further Project in Further Sourcing C clean **B:** Energy transformation sequestered projects projects projects in NAFTA to be projects in clean electricity Offsetting development electricity Innovative Smart development announced (CCUS, hydrogen, bioenergy) D residual DRI-EAF Carbon + in Europe ex-Europe emissions gas injection Bioenergy/ C: Increased scrap use A,C В A.B.C A.B.C A.B.C D CCS with steelmaking as carbon **D**: Sourcing clean electricity removal 0 E: Offsetting residual emissions -

The waterfall chart 2030-2050 breakdown is for illustrative purposes only

2050 Net-zero

2018



2030

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#### ArcelorMittal Global Climate Goals

#### Company wide 25% reduction in CO<sub>2</sub> emissions by 2030 (35% in Europe), and Net Zero by 2050

Offsetting Carbon Scope 1 Scope 2 Scope 1 Scope 2 removal Carbon in the 100% -1.6% atmosphere Steelmaking transformation -5.1% -1.5% Energy -7.4% transformation -2.1% 0 Increased A: Steelmaking transformation Scrap use 75% 1. 2. 4.1 5. Sourcing Carbon Announced Announced Further Project in Further Sourcing C clean **B:** Energy transformation sequestered MFTA to be projects in projects projects projects in clean electricity Offsetting Innovative Smart development announced development electricity (CCUS, hydrogen, bioenergy) D residual DRI-EAF Carbon + in Europe ex-Europe emissions gas injection Bioenergy/ C: Increased scrap use A.C В A.B.C A, B, C D А, Б CCS with steelmaking as carbon **D**: Sourcing clean electricity removal Α CO. E: Offsetting residual emissions Μ 2030 2050 2018 Net-zero

The waterfall chart 2030-2050 breakdown is for illustrative purposes only

#### Primary Footprint Transformation

#### Net Zero Transformation

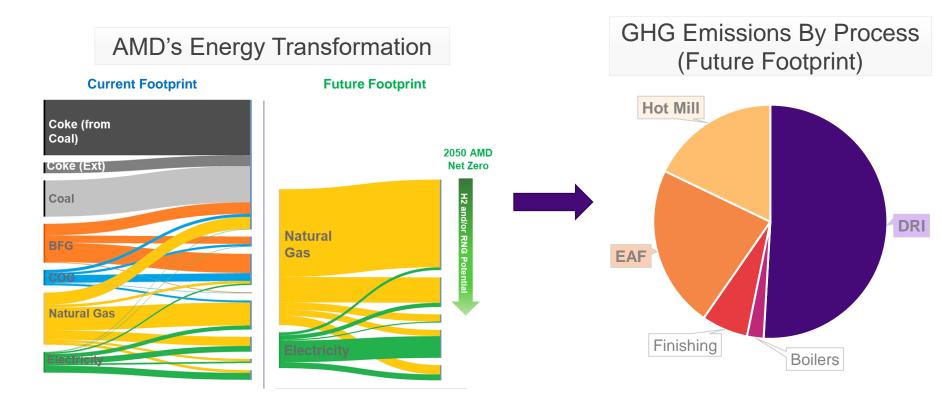
AM Climate Action Report 2 (2021)



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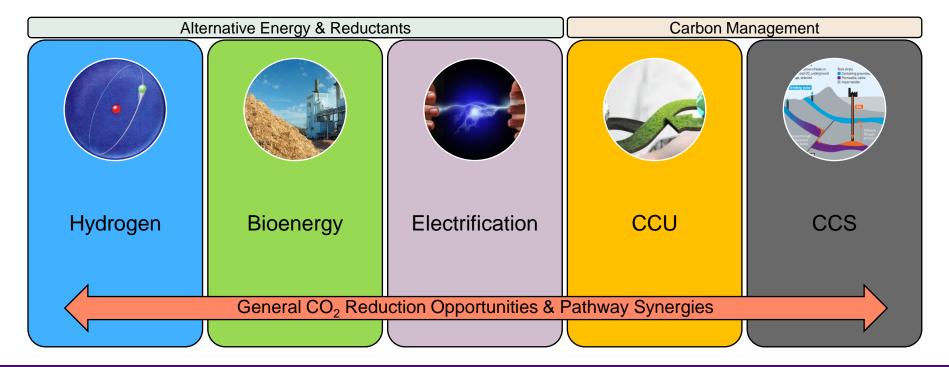
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#### ArcelorMittal Dofasco's Decarbonization Project Impact on Energy





#### **Net Zero Strategy Pillars – Complementary Pathways**

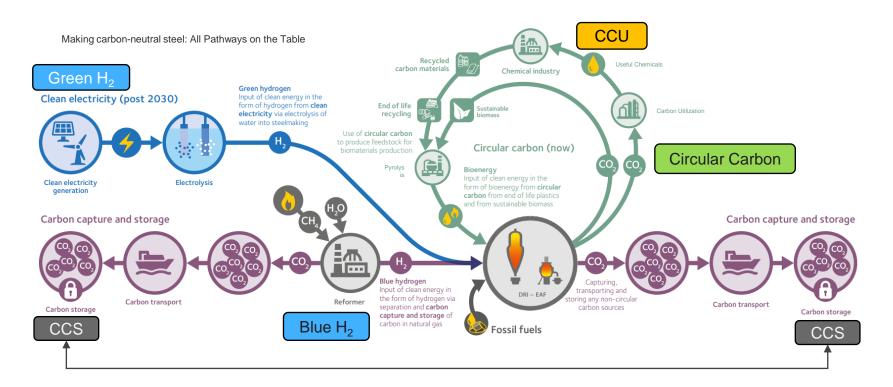


#### There are several pathways to decarbonize with varying scopes and timelines



### The Future of Ironmaking & Steelmaking

Many Routes to Achieve Steel Decarbonization





Source: Modified from AM Climate Action Report 2

#### On the Significance of Net Zero Thinking

There are many solutions that allow for decarbonization, there are few that can achieve Net Zero emissions

- Net Zero Mountain serves as a useful visualization of net zero thinking:
- Dead Ends should be avoided
  - i.e. A new coke plant and blast furnace
- Flexible Solutions that offers more than one pathway forward are valuable
  - i.e. DR with H<sub>2</sub> or CCS
- **Pathways** may hold many projects, and are not exclusive to any single piece of work
- **Competition of paths** can result in inefficiencies
  - i.e. CCS for DR w/ H<sub>2</sub> injection
- Synergistic paths can lead to better outcomes
  - i.e. negative emissions by CCS of bioenergy

Currently, there is no "right answer" Single right answers may not exist.







"At ArcelorMittal, our goal is to help build a better world with smarter steels. Steel made using innovative processes which use less energy, emit significantly less carbon and reduce costs. Steels that are cleaner, stronger and reusable." Aditya Mittal, CEO ArcelorMittal



Smarter steels for people and planet