

BF Plus offers steelmakers the complete package . . . lower costs, improved iron-making productivity and a cleaner environment

- **Dramatic production cost savings, on the order of \$20/tonne hot metal**
- **Increased hot metal productivity**
- **Optimized power generation via integration with blast furnace**
- **Decreased CO₂ emissions**
- **Minimal capital outlay for steelmaker**
- **Payback as short as 18 months**



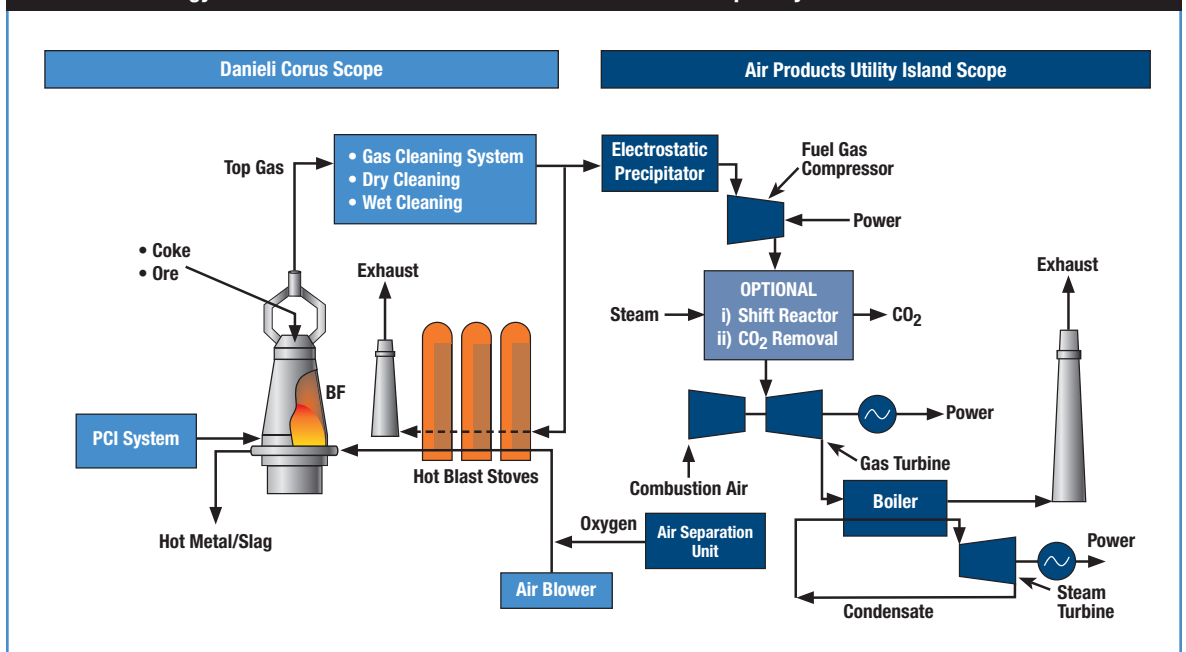
Reducing operating costs and improving the environmental footprint are high priorities for steel producers today. Blast Furnace Plus (BF Plus), a new technology offered by Air Products and Danieli Corus, accomplishes this by transforming the blast furnace into a combined iron-maker and fuel producer for high-efficiency power production. This patent-pending technology reduces blast furnace operating costs while raising the calorific content in the top gas, enabling combined cycle energy production. Elevated hydrocarbon and oxygen injection rates minimize coke consumption and raise hot metal productivity. The resulting higher calorific top gas is used for high-efficiency combined

cycle power generation to help maximize energy recovery. In addition, the cycle design facilitates efficient CO₂ capture.

Unlike many other advanced iron-making development programs, this technology is available today through the process development and project integration capabilities of Air Products and Danieli Corus. Air Products would build, own, and operate the oxygen and power generation equipment to minimize the steelmakers' capital outlay.

High performance, real economy and a better environment . . . BF Plus Technology offers the total package with payback as short as 18 months.

BF Plus Technology – Air Products and Danieli Corus offer a full service capability.



Air Products' Experience

Air Products pioneered the first on-site gas supply concept over 50 years ago with the steel industry. As a leading industrial gas supplier, we provide gases (oxygen, nitrogen, argon, hydrogen) and technologies for all types of iron and steel processes. From the hot end to the rolling mill, we've helped customers reduce their costs, improve their quality and productivity, save energy, and achieve environmental compliance.

Additionally, Air Products has an impressive and proven record in owning and operating large-scale facilities critical to the safe and reliable operation of our customers. This experience includes combined cycle power production, air separation units, and hydrogen production plants integrated with customers' facilities worldwide.

Danieli Corus' Experience

Danieli Corus' technologies have their origins in over 90 years of history at the state-of-the-art Corus IJmuiden steelmaking plant. They are operations-based technologies developed and engineered for operators by operators. Our design philosophy is based on maximizing reliability and minimizing cost of final product through optimized stability and maximized campaign life.

The success of this philosophy has been proven at steelmaking plants around the globe for over 30 years. And being iron-makers, Danieli Corus will stand by you in good times and bad. We are plant builders you can rely on.

Technology Comparisons		
	Currently Installed Technology	BF Plus Technology
Coal Injection Rate [kg/Tonne Hot Metal]	120–200	220–260
Coke Rate [kg/Tonne Hot Metal]	300–360	270–290
Blast Oxygen, %	21–29	~40
Blast Temperature, °C	1050–1250	850–1050
Max. Hot Metal Production, %	100%	109%
Top Gas Calorific Value, MJ/Nm ³	3.2–3.9	4.5–5.0
Net Export Power Production – MWh/Tonne Hot Metal Produced	~0.15	~0.42
CO ₂ Apportioned to Iron-Making Kg CO ₂ /Kg Hot Metal	1.30	1.13
If CCS* Is Applied	not practical	0.52
With Shift + CCS	not practical	approaching zero

*CCS = Carbon Capture and Sequestration

Complementary Capabilities	
Air Products	Danieli Corus
Off-gas handling and power project development and operating capabilities	Blast furnace engineering and operating technologies
Combined cycle development and operational expertise	Focus on low hot metal costs at high productivity and equipment availability
Oxygen supply and integration capabilities	Fuel injection systems and burden distribution models
CO ₂ removal technologies and experience	
Combined	
Technology and commercial skills, thoughtful integration schemes, and a willingness to co-invest to help realize the vision.	

For More Information

Visit our website or call to learn how you can benefit from BF Plus Technology.

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