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.**

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**Danieli Corus Scope**

- Gas Cleaning System
- Dry Cleaning
- Wet Cleaning
- Coke
- Ore

**Air Products Utility Island Scope**

- Electrostatic Precipitator
- Fuel Gas Compressor
- CO₂ Removal
- Shift Reactor

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**PCI System**

- Hot Metal/Slag

**Hot Blast Stoves**

- Oxygen

**Air Blower**

- Condensate

**Boiler**

- Steam Turbine

---

**Air Separation Unit**

- Power
**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**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Currently Installed Technology</th>
<th>BF Plus Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal Injection Rate [kg/Tonne Hot Metal]</td>
<td>120–200</td>
<td>220–260</td>
</tr>
<tr>
<td>Coke Rate [kg/Tonne Hot Metal]</td>
<td>300–360</td>
<td>270–290</td>
</tr>
<tr>
<td>Blast Oxygen, %</td>
<td>21–29</td>
<td>40</td>
</tr>
<tr>
<td>Blast Temperature, °C</td>
<td>1050–1250</td>
<td>850–1050</td>
</tr>
<tr>
<td>Max. Hot Metal Production, %</td>
<td>100%</td>
<td>109%</td>
</tr>
<tr>
<td>Top Gas Calorific Value, MJ/Nm³</td>
<td>3.2–3.9</td>
<td>4.5–5.0</td>
</tr>
<tr>
<td>Net Export Power Production – MWh/Tonne Hot Metal Produced</td>
<td>-0.15</td>
<td>-0.42</td>
</tr>
<tr>
<td>CO₂ Apportioned to Iron-Making Kg CO₂/Kg Hot Metal</td>
<td>1.30</td>
<td>not practical</td>
</tr>
<tr>
<td>If CCS* Is Applied With Shift + CCS</td>
<td>0.52</td>
<td>approaching zero</td>
</tr>
</tbody>
</table>

*CCS = Carbon Capture and Sequestration

**Complementary Capabilities**

<table>
<thead>
<tr>
<th>Capability</th>
<th>Air Products</th>
<th>Danieli Corus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-gas handling and power project development and operating capabilities</td>
<td>Blast furnace engineering and operating technologies</td>
<td>Focus on low hot metal costs at high productivity and equipment availability</td>
</tr>
<tr>
<td>Combined cycle development and operational expertise</td>
<td>Oxygen supply and integration capabilities</td>
<td>Fuel injection systems and burden distribution models</td>
</tr>
<tr>
<td>CO₂ removal technologies and experience</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**For More Information**

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

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