TENOVA is a worldwide supplier of advanced technologies, products and engineering services for the iron & steel and mining industries providing innovative integrated solutions. Tenova HYL, the pioneer of modern direct reduction, develops and supplies leading-edge DR technologies leveraging long-standing R&D activities in iron & steel.

DANIELI is one of the world’s leading firms in the iron and steel industry. Taking advantage of its strong experience in turnkey plants and supported by the well-proven R&D potentiality, Danieli is expert in process development, equipment design, manufacturing, erection and commissioning, to supply a DRP standalone or perfectly integrated with downstream plants.

THE PROCESS

The ENERGIRON Process converts iron ore pellets or lumps into metallic iron with a counter-current flow of very hot (950–1100°C) reducing gases at high pressure (6–8bar). The ZR process configuration exploits the catalytic power of the DRI in the shaft furnace, eliminating the need for a reformer. The reduction circuit easily accepts any source of reducing gas (H2 and CO) to produce a highly metallized, high-carbon DRI product. A CO2 removal system captures CO2 from the recycle gas, restoring its full reduction potential. Sulfur is removed together with the CO2, in a process similar to that used in a fluidized bed, to prevent any sulfur buildup in the circuit, and any remaining tail gas goes to the process gas heater as fuel. The process is easily the most energy-efficient and versatile DR technology on the market.

The ZR Process accepts any reducing gas source – direct natural gas, syngas from a coal gasifier, coke oven gas or any other H2/CO source - all with the same flexible process configuration.

ENERGIRON technology provides a compact, highly efficient plant with no technology risk involved, regardless of the energy source. Available plant sizes range from the 200,000 tpy Micro-Module to plants of 2.5 million tpy capacity in a single module. Not just on paper, but proven operations.

THE PLANTS

ENERGIRON technology provides a compact, highly efficient plant with no technology risk involved, regardless of the energy source. Available plant sizes range from the 200,000 tpy Micro-Module to plants of 2.5 million tpy capacity in a single module. Not just on paper, but proven operations.
Other COG: Coal Gasification
• Reformed Gas
• Natural Gas

enerGiron: The innovative DRI technology

Tenova HYL and Danieli have formed a strategic alliance to serve the DRI plant market.

The characteristic high-carbon DRI (>3%) produced by our full turnkey project of any size, from a DRP technology package to a complete plant requires half the blast furnace reduction. The DRB, DRP or DRI plants are available for all gas types.

Tenova HYL and Danieli can support customers for any type of iron ore feedstock. They can tailor the DR plant to suit any size, from an indirect dry-reduction technology to a pressurized hot DRI process. The characteristic high-carbon DRI (>3%) produced by our full turnkey project of any size, from a DRP technology package to a complete plant requires half the blast furnace reduction. The ZR Process enables controlled production of DRI, HBI or Hot DRI for direct feeding to a steel melt shop.

The ProDuct The eCoNomiCS The eNViroNmeNT

The ProDuct

Hot DRI Mechanical system

HYTEMP system

Proven, safe, reliable high-yield technology

DRI/HBI Metallization

Average 92-95% Controlled 92-95%

Greater product quality choice

Lump ore use

30% mix up to 100%

Lower metallic charge cost

Screening

6mm/3mm

3.2 mm

Higher yield, lower fines loss

PNeUmaTiC TraNSP orT SYSTem

An added advantage of the ENERGIRON technology is the Pneumatic Transport System. By transporting and feeding DRI hot to an EAF with the HYTEMP® system, significant savings are obtained in electricity use and environmental impact. Low nitrogen content results in a savings of 27 kWh per ton of hot DRI (mostly in the form of nitrogen in the exhaust gases). For steel producers, the ENERGIRON plant can remove from 60% to 90% of CO2 emissions. In addition to the environmental benefits, there are also significant economic benefits.

The Economics

Capital and operating expenses for ENERGIRON plants are assessed. For expected production capacity of a plant, requires basalt half the blast area necessary for other processes. ENERGIRON offers the process to provide: lower CAPEX and the same OPEX for a given production capacity. Without question, ENERGIRON is the cleanest DR technology available. It requires top-grade DR pellet feed. Can use any pellet, lump or mix, even high sulfur. The inherent low gas and power consumption is similar to top class operation based on 100% high-quality scrap. Operating expenses are low as well, given the flexibility of the process as well as product quality. Equipment sizes are smaller, for even greater savings. For plants adjacent to an EAF shop, the HYL HYTEMP® system is available. For merchant plants, production of HBI is also available. The ENERGIRON steelmaking plant requires barely half the land area needed for other processes. And because the process is pressurized, overall maintenance at all levels is reduced. For plants using the HYTEMP® system, there is virtually no dust or hard carry over, so reliability and performance history of the HYTEMP system. The final industrial system started operation in 1998. To date more than 20 million tons of hot DRI have been transported without incident to European steel producers. The ZR Process enables controlled production of DRI, HBI or Hot DRI for direct feeding to a steel melt shop. The HYTEMP system are currently under construction. For feeding hot DRI to an EAF, no other system matches the ability to incorporate the HYTEMP Pneumatic Transport System.

The Environment

ENERGIRON is the only technology that offers an additional incentive beyond the SO2 (20% reduction), O2, power needed and calcium make-up water system to use lower-cost ores, the inherent low gas and power consumption is similar to top class operation based on 100% high-quality scrap. Operating expenses are low as well, given the flexibility of the process as well as product quality. Equipment sizes are smaller, for even greater savings. For plants adjacent to an EAF shop, the HYL HYTEMP® system is available. For merchant plants, production of HBI is also available. The ENERGIRON steelmaking plant requires barely half the land area needed for other processes. And because the process is pressurized, overall maintenance at all levels is reduced. For plants using the HYTEMP® system, there is virtually no dust or hard carry over, so reliability and performance history of the HYTEMP system. The final industrial system started operation in 1998. To date more than 20 million tons of hot DRI have been transported without incident to European steel producers. The ZR Process enables controlled production of DRI, HBI or Hot DRI for direct feeding to a steel melt shop. The HYTEMP system are currently under construction.

ENERGIRON: The innovative DRI technology

Plants using the ENERGIRON technology produce the highest quality DRI possible, either in the form of DRI, DRP or DRB requiring less than half the blast area necessary for other processes.

Since the carbon is in combined form, the DRI is more stable than traditional DRI. It can tolerate lower reduction conditions and the off-gas with much lower melting times and higher overall productivity.

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