## Construction of the world's largest HBI plant in Corpus Christi, Texas, now in full swing

# Go West!

Fig. 1: Schematic view of the Midrex direct-reduction plant for the production of hot-briquetted iron under construction in Corpus Christi, Texas, U.S.A.

**Siemens VAI and consortium partner Midrex are building a 2 million t/a hot-briquetted iron (HBI) MIDREX® direct-reduction plant in Texas for the Austrian steel producer voestalpine. Known as the "Go West project," the plant's environmentally friendly process will reduce iron ore using competitively priced American natural gas. The ground-breaking ceremony took place in April 2014 and the plant is due to begin operations in late 2015 (Figure 1).**

***"With Siemens and Midrex, we have by our side highly competent partners with proven technology."***

***Wolfgang Eder, CEO and Chairman of the Management Board of voestalpine AG***

Capitalizing on the low natural gas costs in the United States, voestalpine is participating in the reindustrialization of North America by building the world's largest Midrex HBI plant. This ironmaking facility will produce a value-added metallic briquette that will be used in the company's own blast furnaces and which will also be available as a high-quality metallic product for markets worldwide.

In July 2013, Siemens Industry, Inc., USA, and consortium partner Midrex Technologies, Inc. received the order from voestalpine Texas LLC to build the direct-reduction plant in the U.S., and quickly named it the "Go West project." At the contract signing, Wolfgang Eder, CEO and Chairman of the Management Board of voestalpine AG, said, "With Siemens and Midrex, we have by our side highly competent partners with proven technology."

When it commences operation at the La Quinta Trade Gateway site in San Patricio County, near the city of Corpus Christi in late 2015, the Midrex plant will produce 2 million tons of HBI per year. voestalpine is investing about €550 million, which also covers comprehensive infrastructure improvements and upgrading of the existing port facilities on the Gulf of Mexico. The direct-reduction plant will provide voestalpine's Austrian steel production sites in Linz and Donawitz with access to cost-effective and environmentally friendly HBI. About half of the plant's annual production will be shipped to Austria; the remaining half will be sold to partners

*HBI is still the only recognized way to safely ship DRI by sea, according to the International Maritime Organization (IMO).*

interested in longer-term supply contracts. In August 2014, Altos Hornos de México (AHMSA), Mexico's largest steel manufacturer, signed a five-year agreement with voestalpine for an annual supply of 400,000–650,000 tons of high-quality HBI from the new voestalpine location.

Core technology, engineering, mechanical equipment and electrical systems for the direct-reduction plant are being delivered by a consortium comprising U.S.-based Midrex Technologies, Inc. and Siemens Industry, Inc. Midrex has been the leading innovator and technology supplier of iron ore direct-reduction solutions for more than 40 years.

### Direct reduction – safer and cleaner ironmaking

Most commercially mined iron oxides occur in the form of hematite ($Fe_2O_3$) and magnetite ($Fe_3O_4$), both with an iron content in the range of 65% to 67%. The direct-reduction process removes the bonded oxygen from pelletized iron ore at elevated temperatures by means of a reducing gas that is generated from natural gas. Reduction takes place in a sealed, low-pressure reduction shaft, which is not vented to the atmosphere. The iron oxide pellets are charged into the reduction shaft through feed pipes, reduced to metallic iron and finally discharged from the furnace cone.

Instead of using coke as the main reducing agent as in traditional blast furnaces, the new direct-reduction plant will use only natural gas, which is much more environmentally friendly. Carbon dioxide ($CO_2$) emissions will be considerably reduced, thus lowering the carbon footprint of voestalpine's steelmaking operations. This represents an important step toward the achievement of the Group's energy-efficiency and climate-protection objectives.

Despite its high furnace-exit temperature of approximately 700°C (1,300°F), the direct-reduced iron (DRI) is not in a molten state. The highly metallized DRI is immediately briquetted into palm-sized, pillow-shaped HBI and then cooled for easier and safer transportation (Figures 2 and 3). This briquetting step reduces the danger of product handling compared to traditional blast furnaces where hot metal is tapped at temperatures in the range of 1,500°C (2,700°F).

### HBI benefits for blast furnace operation

The electric steelmaking production route is not the only consumer of DRI/HBI. Conventional wisdom has always held that DRI is not suitable as a significant feed material for a blast furnace. However, more and more integrated steel producers today are considering the use of HBI for their blast furnaces on a regular basis, rather than just on occasions when one blast furnace is down in order to increase the hot metal output of their other furnaces. The reasons for the increased interest of HBI as an iron carrier for blast furnace operations are as follows:



## Project specifics and advantages for the local community

Roads:
**540,000 sq. ft. (50,200 m²)**

Reinforced concrete:
**1.6 million cu. ft. (45,300 m³)**

Mechanical equipment:
**13,000 short tons (11,800 metric tons)**

Structural steel:
**20,000 short tons (18,150 metric tons)**

New jobs:
**150**

Construction jobs:
**800**

• **Higher productivity:** Primary reduction work has already taken place outside the blast furnace in a direct-reduction shaft furnace. More reduction gas is thus available within the blast furnace to reduce the remaining burden, which results in increased blast furnace productivity. A rule of thumb is that for each 10% increase in burden metallization, production output rises by 8%.

• **Lower coke consumption:** When less reduction gas is required to reduce the burden at the same productivity level, coke consumption is lowered. Again, a rule of thumb is that for each 10% increase in burden metallization, the coke rate decreases by 7%.

• **Reduced $CO_2$ emissions:** Iron ore reduction in a Midrex plant is based on the use of natural gas, which is processed by a reformer to generate a reduction gas that consists of approximately two-thirds $H_2$ and one-third CO. During the reduction process, CO is converted to $CO_2$ and $H_2$ to $H_2O$. The reduction of iron ore by means of hydrogen gas creates no $CO_2$ at all. In a blast furnace, the major source of the reduction gas is coal, which produces mostly CO and $CO_2$, and very little $H_2$.

**Fig. 2: Conveyor transport of HBI**

## Safer transport and storage of HBI

Another important benefit of HBI is that it can be shipped more easily and safely. According to the International Maritime Organization (IMO), HBI shipments remain as the only recognized way to safely transport DRI by sea. IMO transportation guidelines for HBI briquettes are considerably less stringent than those for DRI. Ships with DRI cargoes must have their holds inerted with a non-reactive gas such as nitrogen. Maintaining the required nitrogen gas level can be costly over long voyages, such as during ocean crossings.

The insurance cost for HBI cargoes is also considerably less than those for DRI shipments. HBI can be stored at almost any location, much like scrap steel. Contrary to this, DRI must be kept not only out of the rain but also off the ground in order to prevent contact with moisture, which could lead to oxidation and combustion.

## Go West, Go Forward

The Go West project thus offers an impressive example of a cleaner and safer form of ironmaking that takes advantage of lower-cost American natural gas. With its new direct-reduction facility, voestalpine can reduce its carbon footprint and simultaneously profit from the increased global demand for HBI.

voestalpine Texas LLC:
Matthias Pastl, Head of Corporate Communications & Environmental Management

Midrex Technologies:
Christopher Ravenscroft, Manager Global Marketing/Communications

Siemens VAI:
Christian Böhm, Head of Sales, Smelting and Direct-Reduction Plants
Johannes Rothberger, Technical Sales Manager for Direct-Reduction Plants
Erwin Unterauer, Commercial Sales Manager for Direct-Reduction Plants

For more information, please refer to:
**www.voestalpine.com/texas**
**www.midrex.com**

**Fig. 3: Close-up view of HBI product**