

# Striking while the iron's hot

Night falls at an ENERGIRON DRI plant at Emirates Steel, Abu Dhabi, UAE (credit: Tenova)



With the demand for alternative iron products by North American steelmakers growing, it is widely believed that there is a need for continued investment in additional domestic direct reduced iron (DRI) and hot briquetted iron (HBI) – and possibly even pig iron – production capacity. By **Myra Pinkham\***



"I believe that the long-term future for alternative metalics is very bright as both demand and production is only poised to increase in the years ahead," said Ronald Ashburn, executive director of the Association for Iron & Steel Technology (AIST), with demand growing not just in North America, but globally.

In fact, he said that driven by societal and market demands for greener steel, worldwide DRI output has grown by approximately 25.6% over the last five years with billions in capital being invested in greenfield facilities throughout Europe and North America. This, he said, is even the case in a world where steelmaking is dominated by the classic blast furnace (BF)/basic oxygen furnace (BOF) route.

But while in most regions of the world about 75% of their steel is produced using blast furnaces, Thais Terzian, CRU's principal steel metalics analyst, noted that it is a

different situation in the US where electric arc furnace (EAF) steelmakers currently have a 72% market share and where that share is expected to increase to about 75% of domestic steelmaking by 2029.

Philip Gibbs, a senior equity research analyst for KeyBanc Capital Markets, said that it is that proliferation of EAF steelmaking, particularly of EAF sheet and coil steelmaking, that has resulted in the use of alternative iron by US steelmakers to grow materially over the past decade or so, maintaining that it was the growth in the EAF steelmaking share that had, and continues, to result in that calculus to change.

That said, while US demand for alternative irons has been growing, it hasn't been doing so excessively, Francesco Memoli, Tenova Inc's president and chief executive officer, said, explaining, "One reason is that supply remains limited, both

due to geopolitical reasons and other factors."

Memoli said that he sees the Covid pandemic as the turning point, as before that expectations for US steelmakers to use more alternative iron weren't achieved – at least not in volumes that were previously predicted. "However, over the past few years we have started to see a new beginning," he said.

"And I believe that is a trend that is here to stay," Timothy van Audenaerde, managing director and global metals lead for Accenture, said, especially if, as is expected, the share of US steel produced by blast furnaces continues to be reduced.

Audenaerde observed that currently scrap accounts for about 64% of US steelmaking raw materials with the DRI/HBI share being about 10% and the rest being pig iron. He said he expects that by 2050 the US DRI/HBI share will increase to 23% at the same time

as the scrap share increases to about 72% resulting in an even lower need for primary metal.

Clearly in 2024 there had been mixed performance in relation to pig iron, DRI and HBI, CRU's Terzian said, although she pointed out that that was more related to supply than demand, explaining that due to the war in Ukraine, getting pig iron from Russia is no longer an option for the US and imports from Ukraine are uncertain.

But despite that, Alexander Kershaw, a senior Fastmarkets analyst, said that, supported by Brazilian material, US pig iron imports were actually up 10.6% year-to-date through November, and could continue to grow as new EAF steelmaking capacity comes online.

According to Philip Bell, president of the Steel Manufacturers Association (SMA), about 17 million short tons of new US EAF capacity is expected to come online by 2027. And at the same time as this is occurring, Audenaerde noted that more

EAF steelmaking capacity is coming online elsewhere in the world.

KeyBanc's Gibbs noted that one big concern with all of this new EAF steelmaking capacity coming online has been where will the steelmakers get the raw materials they need to feed those plants – not just pig iron but also scrap, DRI and HBI. In fact, Terzian said that DRI consumption has been growing at a greater rate partly due to limited pig iron availability.

But at the same time there are questions about the availability of other steelmaking raw materials.

One frequent concern is whether there will be enough availability of prime scrap, which, Gibbs said, has been one of the motivating factors in the investment into certain scrap sorting technologies, including those converting shredded scrap into a more usable, higher quality grade by separating out non-ferrous metalics such as copper from the scrap.

Actually, it isn't the scarcity, or a potential scarcity, of scrap that has been driving steelmakers to use more alternative iron products, Tenova's Memoli said, stating that it has been quality-driven, including by such high-quality end-use markets as the automotive sector. "The higher quality that the steel grade is, the higher percentage of alternative iron or virgin iron units that steelmakers will use as opposed to scrap given the impurities that are contained in scrap," he explained.

Memoli said that another driver is the push for greater decarbonization or sustainability. While at this time there isn't any legislation mandating companies to produce steel with low emissions, he said that is something that is likely to materialize eventually. "Once it does, we could see increased production of green, low carbon emissions virgin iron units that don't exist today, such as DRI, HBI and pig iron produced using direct reduction and hydrogen."

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Automakers and other steel consumers have increasingly been asking for more sustainable steel, Audenaerde pointed out, and as long as that continues, companies should be motivated to invest in more DRI and HBI production. He, however, admitted that this could be influenced by future environmental regulations and governmental incentives, which are things that are hard to predict.

“But it is more of a necessity than a desire for steelmakers to use more alternative iron,” KeyBanc’s Gibbs, said, explaining, “There is a need to find new raw material sources if they want to keep their supply chain flexible given that the only place they can get pig iron in a reasonable amount of time is from Brazil, and even that lead time is much longer than those for scrap.”

Gibbs noted that with the growing US EAF market share, some domestic blast furnace capacity pivot to also producing pig iron. Memoli added that pig iron is not only a marketable product, but it also allows mills to be less dependent upon imported pig iron. “That supply, however, would have an expiration date given that US blast furnaces are old and will eventually come to the end of their life.” Also, he said that pig iron production tends to have high carbon

emissions.

But AIST’s Ashburn noted that there have been a number of forecasts predicting that DRI demand could potentially outstrip supply with DR-grade iron pellets becoming the ‘chokepoint’ of steel industry decarbonization. However, he pointed out that one roadblock to greater long-term DRI production has been access to either cleaner burning natural gas or green hydrogen at a time when a viable green hydrogen market is materializing much slower than had been hoped.

However, Ashburn noted that during AIST’s recent European Steel Forum there were also considerable discussions about the potential decoupling of ironmaking from steelmaking. Ashburn said that this is based on the premise that in the future steelmaking would occur close to end-use markets while ironmaking will take place in regions with efficient access to iron ore and clean energy.

Therefore, he said that such a decoupling would bode well for North America, which has quality iron ore reserves and clean energy with regional access to nuclear, wind, solar and hydroelectric resources in addition to abundant reserves of natural gas.

Memoli pointed out that the share of how much alternative iron a steelmaker uses – and what kind of alternative iron they use – depends upon the product quality they are trying to achieve. For example, automotive steel grades – particularly those for exposed automotive applications – tend require a very clean raw material mix.

As for the various alternative iron products, Memoli said that HBI is often seen as being subpar when compared with pig iron, which tends to be considered the gold standard because of its quality and reliability. He said in between the two are low carbon cold DRI (CDRI), high carbon CDRI and high carbon hot DRI (HDRI) with the preference being for a high carbon product.

Memoli said he believes that there is potentially more interest in producing pig iron using new, less carbon-intensive technologies, such as ENERGIRON, a DRI technology jointly developed by Tenova and Danieli, which he said is well-suited to produce high quality alternative iron at a low cost, pointing out that Nucor uses this technology at its Louisiana DRI facility. Despite the slower than expected ramp up of that facility, he noted that Nucor is

currently producing a high carbon CDRI there at a record rate of 330.3 tons per hour.

With the US projected to see strong steel production growth later this year – about 13% year-on-year for steel produced via EAFs and about 4% year-on-year via blast furnaces as new EAF production capacity comes online – CRU’s Terzian said there is definitely a need for more domestic alternative iron production capacity to come online, hopefully at least an additional 3Mt/yr DRI or HBI production plant.

Gibbs noted that despite this, very little US alternative iron capacity has come online over the past 12-18 months – other than US Steel’s 500kt Gary Works pig iron project. However, he added that given that there are several projects that are potentially in the hopper, it is possible that there could be an incremental increase of up to 4-5Mt of US alternative iron production capacity within the next five years.

Most of those projects, however, are in early stages and won’t come online for a while, CRU’s Terzian said, with the first likely to be Mesabi Metallics’ direct reduction (DR) iron ore pelletization project in Minnesota, which is slated to come online in 2026.

Also, in connection with the new EAF being installed in its AM/NS joint venture Calvert, AL, mill, Arcelor Mittal and Nippon Steel are reportedly considering doubling HBI production capacity at the Corpus Christi, TX, plant, but Terzian said that is very preliminary, describing it as more of a plan at this time than an actual project.

In addition, there are several projects that have been proposed that could be at least partially paid for through the US Department of Energy’s (DOE’s) \$6 billion Industrial Demonstrations Programme, which is funded by the Infrastructure Investment & Jobs Act (IIJA) bipartisan infrastructure bill and the Inflation Reduction Act (IRA).

For example, Cleveland-Cliffs is in negotiations with the DOE for a \$500 million grant to replace its Middletown, OH, blast furnace with a 2.5Mt/yr hydrogen-ready DRI plant and two 120-megaWatt electric melting furnaces (EMF) to feed molten iron to the existing infrastructure already on-site, including the BOF, caster, hot strip mill, and various finishing facilities. With this, the mill will continue to have approximately three million net tons per year of raw steel production capacity but

will no longer use coke for iron production.

Accenture’s Audenaerde, however, noted that questions remain over the availability of green hydrogen for these projects given the need to have affordable renewable energy to effectively produce hydrogen.

That said, Memoli pointed out that there has already been a successful hydrogen-based DRI pilot plant in Sweden and that Tenova has built two plants in China that are producing more than 1Mt of DRI using over 70% hydrogen. “So, hydrogen-based DRI is no longer just a new developing technology,” he said. “It is now a reality.”

He said that the next new technology to be developed is one for producing pig iron

using direct reduction. That, he explained, would mean that it doesn’t have to be produced using a blast furnace and would be cheaper, as well as resulting in very low carbon emissions.

While it might not be in a straight line, Audenaerde said there will continue to be growth in alternative iron use and investments in production capacity.

Gibbs agreed, noting that there are already a lot of projects on the drawing board and that more are likely to be added as more US EAF production capacity comes online. “But only time will tell how many new plants will come online, over what time period.” ■

