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By Sonja Elmquist

Dec. 31 (Bloomberg) -- The U.S. shale-gas revolution, which has revitalized chemicals companies and prompted talk of domestic energy self-sufficiency, is attracting a wave of investment that may revive profits in the steel industry.

Austrian steelmaker Voestalpine AG said Dec. 19 it may construct a 500 million-euro ($661 million) factory in the U.S.
to benefit from cheap gas. Nucor Corp., the most valuable U.S.
steelmaker, plans to start up a $750 million Louisiana project in mid-2013. They're among at least five U.S. plants under consideration or being built that would use gas instead of coal to purify iron ore, the main ingredient in steel.

"That technology has been around 30 years, but for 29 years gas prices in the U.S. were so high that the technology was not economical," said Michelle Applebaum, managing partner at consulting firm Steel Market Intelligence in Chicago. "This is how steel will be built moving forward."

The new capacity may signal a turnaround for an industry that has suffered from overcapacity since the financial crisis and collapse in commodity prices four years ago. U.S.
steelmakers have struggled to stay profitable amid sluggish domestic demand, depressed prices and competition from Chinese imports. While global steel output has grown by 14 percent since 2008, U.S. production has shrunk 3.4 percent.

Gas Plunge

The newest group of steel projects are so-called direct- reduced iron plants, which account for the first stage of steelmaking. DRI technology produces iron for about $324 a ton, Nucor said in a November presentation. That's $82 a ton, or 20 percent, cheaper than using a conventional blast furnace, the Charlotte, North Carolina-based steelmaker said.

Foreign competitors are now following Nucor's lead. A joint venture between Australia's Bluescope Steel Ltd. and commodity trader Cargill Inc. plans to build a DRI plant in Ohio, Biliana Pehlivanova and Shiyang Wang, analysts at Barclays Plc in New York, said in a Dec. 18 report. India's Essar Global Ltd. plans one for Minnesota, Barclays said.

Nucor may announce a second DRI plant as soon as 2013, bringing the company's domestic iron-making capacity to 5 million tons per year, according to Aldo Mazzaferro, a steel analyst at Macquarie Capital USA Inc. in New York. Nucor agreed last month to pay Canadian energy company Encana Corp. $3 billion over two decades for a joint venture that will develop gas wells to supply its DRI capacity.

No one at BlueScope and Essar responded to messages seeking comment on the DRI projects. Lisa Clemens, a Cargill spokeswoman, declined to comment about any iron-making expansion at the company's North Star BlueScope joint venture. Katherine Miller, a Nucor spokeswoman, declined to comment about a possible second DRI plant.

Chemical Boom

Hydraulic fracturing of shale rock formations from Texas to West Virginia has boosted supplies of gas and sent prices plunging by as much as half in the past two years. Gas futures reached a decade low of $1.91 per million British thermal units in April in New York trading.

"The shale revolution is triggering an avalanche of industrial expansion plans," Barclays' Pehlivanova and Wang said.

There's been a reversal of fortune for U.S. chemical producers after years of decline. Shares of LyondellBasell Industries NV have more than doubled since it emerged from bankruptcy in 2010. The company is now among chemical producers planning billions of dollars of plants around the Gulf of Mexico to capitalize on cheaper gas. Fertilizer companies including CF Industries Holdings Inc. also are planning to construct gas- fueled plants.

Gas Exports?

"Other companies from around the world that consume gas may be attracted to move their facilities to the U.S. market, which would then provide even more steel consumption and manufacturing capacity," said Macquarie's Mazzaferro. "It could result in a re-industrialization of the U.S."

Still, gas may not get much cheaper from here. Prices are up 82 percent from their April low and will average $3.70 per million British thermal units next year, or about 31 percent more than in 2012, according to the median of 21 estimates compiled by Bloomberg.

That price trend may continue if the U.S. starts exports. A Dec. 5 study by NERA Economic Consulting found that the country would benefit more from shipping liquefied natural gas than using it all domestically. Sempra Energy and Exxon Mobil Corp. are among energy companies seeking export permits.

At the same time, there's no guarantee that steel demand in the U.S. will improve. Domestic steel-industry capacity utilization is at 74 percent, according to data from the American Iron and Steel Institute. Utilization was 91 percent in August 2008, the month before the bankruptcy of Lehman Brothers Holdings Inc.

Vanishing Profits

Steelmakers' earnings haven't recovered. Nucor will post a $504 million net income for this year, according to the average of seven analysts' estimates compiled by Bloomberg. That's less than a third of what the company earned in 2008. U.S. Steel Corp., the country's biggest producer by volume, is expected to post a fourth consecutive annual loss.

The price of hot-rolled steel coil, a benchmark product, has averaged $646 a ton this year, compared with $693 in 2011, according to data from Steel Business Briefing.

Iron is the largest component of steel. While it's the fourth most abundant element in the earth's crust, iron is rarely found in its elemental form and must instead be separated from other minerals, or "reduced" in steel industry terminology.

'Unknown Future'

For steelmakers, the process typically occurs in a blast furnace, in which coal heats and reduces iron ore. That method accounts for 94 percent of global iron output, according to the World Steel Association.

While Nucor will use DRI iron in Louisiana at its electric arc furnaces, the final stage of its steelmaking process, the company will still get most of its raw material from scrap steel. The DRI iron doesn't just provide a cost advantage: It also helps to make smoother, blemish-free steel that's stronger and more ductile. Recycling steel is vulnerable to swings in scrap supply and quality.

“The future is unknown when it comes to raw materials,”
Nucor Chairman and Chief Executive Officer Dan DiMicco said in a Nov. 13 interview. DiMicco is due to stand down as CEO tomorrow after 12 years in the job and become executive chairman, with John J. Ferriola taking over as CEO.

“We said, ‘Hey we should take advantage of this to generate long-term stability,’” DiMicco said, referring to DRI.

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