Pioneering Sustainability in Steel Production

ArcelorMittal Takes a Novel Approach to Reducing Carbon Emissions and Creating New Business Opportunities

Across its global operations, the company is continually exploring new methods for improving sustainability

Every industry has a part to play in contributing to carbon reduction and environmental sustainability. The signing of the Paris Agreement in 2015 helped underline this fact and set a clear framework for reaching the ambitious target of net-zero by 2050.

In heavy industries, such as steel production, the goal of net-zero carbon is especially important, with the industry being responsible for 7 to 8% of global CO_2 emissions – often as unavoidable by-products from the conventional means of production.

Seemingly unavoidable problems tend to attract creative solutions and global steel producer ArcelorMittal has devised a particularly ingenious one. In collaboration with sustainability company LanzaTech and digitalisation specialist Rockwell Automation, it has taken significant steps towards setting the industry standard for sustainability in the sector by embracing the circular economy and recycling otherwise harmful by-products into new business opportunities.

Confronting Common Problems

It would be a mistake to think that the steel industry lacks the self-awareness to understand the importance of its leadership role in tackling sustainability. The topic has been high on the agenda for many of the sector's executive teams for some time now. In the case of ArcelorMittal, it's been a strategic priority for more than a decade.

Challenge

The self-directed goal of reducing carbon emissions by 30% before 2030, in line with the industry-wide need to meet the ambitious target of net-zero carbon by 2050.

Solutions

PlantPAx 5.0 distributed control system

Results

Reduced waste
Turning potentially harmful carbon by-products into a new set of chemical products with high market demand.

Business innovation
Diversify business revenues with a new line of products.

Building an ecosystem
Partnering with similar-minded, environmentally aware organisations to align on business and sustainability goals.

Improved compliance
Positioning the business to meet the goals set in the Paris Agreement

The fact that this project can dramatically cut our carbon emissions while helping to diversify our business model is really a win-win

Rockwell Automation

The company is a leader in the steelmaking sector. Its operations span 17 different countries and produce around 71.5 million tonnes of steel each year for a broad list of purposes, such as construction and automotive.

In recent years the company has been seeking to improve standards around a specific part of its operations – the carbon emanating from its blast furnaces. In these blast furnaces, iron ore and coal are used, in the form of sinter and coke. The coke reduces the sinter to hot metal, which is then converted into liquid steel in the steel shop. During the reduction of sinter, CO and CO_2 are formed.

Across its global operations, the company is continually exploring new methods for improving the sustainability of its operations, either directly through carbon reduction measures or indirectly through enhanced production efficiency.

One person leading this effort is Wim Van der Stricht, ArcelorMittal's CTO, with specific responsibilities for Technology Strategy, CO_2 and Circular Economy. Since becoming CTO in 2013, Wim has been driving sustainability operations at the company's steel plant in Ghent, Belgium, with an overarching goal of reducing carbon emissions across the company's European operations by 30% compared to 2018 figures.

"For as long as I've been with the company, sustainability has been an important priority. The metals sector is at a turning point and we aim to help set the standard for how steel production can be done in an environmentally sustainable way," Wim said.

Taking a Novel Approach

To address the blast furnace issue and help lower net carbon emissions, Wim looked for inspiration beyond his own region and found an intriguing approach being trialled in the Asian-Pacific market. LanzaTech, a New Zealand-founded biofuels firm and long-time collaborator of ArcelorMittal, had developed an innovative microbial biomass material that had been shown in clinical trials to turn carbon into bio-ethanol. The company was working with ArcelorMittal's China operations to establish a proof of concept for whether the approach could be applied to steel production in order to create a bio-ethanol product called 'Steelanol'.

According to Wim, "What immediately struck me with LanzaTech's approach was its resourcefulness. We know that carbon is an unavoidable by-product of blast furnace operations, but what if that carbon could be turned into something that doesn't have the same harmful impacts?"

After seeing the effectiveness of the process himself, Wim was convinced this approach could be applied to the company's Ghent operations. He and his team set about designing a system that could reinvent the role of carbon within the plant. In order to get this design right, the team leaned on the domain expertise of its partner network. LanzaTech supported in designing the carbon capture mechanism, while Rockwell Automation advised on and supplied a full automation platform, including drives, process control, networks and visualisation. Together, they laid out a flow where the biomass would be applied to the blast furnace before undergoing treatment in order to produce the bio-ethanol product.

"The beauty was in the design's simplicity. It gives us a repeatable process for removing carbon from the equation entirely. Our testing showed us that it could be done at scale and with the right economics to make it sustainable as a long-term practice."

The project idea gained approval of the ArcelorMittal executive team, including the CEO, who view it as an

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important step forward in becoming a sustainability leader. It also attracted the approval at a governmental level, including the backing of the European Investment Bank, which has contributed important funding to this realisation.

"It's been really encouraging to see such broad buy-in to the project. Both inside ArcelorMittal and externally, people have been amazed at what the process can achieve. This support has really helped us to drive the project forward over the eight years since we first started exploring the opportunity," Wim added.

"We also couldn't have got here without the support from LanzaTech and Rockwell Automation. Having LanzaTech's guidance on the use of the biomass matierials and Rockwell Automation's team of specialists consulting on the plant design and engineering have really helped to shape and direct our efforts."

This sentiment has been echoed by LanzaTech, which has been encouraged to see another inventive use case for its chemical process. According to Babette Pettersen, LanzaTech VP for Europe, "Our entire business has been built on challenging the status quo. Making real progress in sustainability simply can't be achieved by following past practices – we need a new generation of business leaders who are willing to take the chance on ground breaking technologies and processes. It isn't easy being the pioneer, but we're confident that ArcelorMittal's case will show that it pays to lead."

Looking Ahead to Net-Zero Carbon

Currently in assembly, the redesigned plant has attracted a total investment of €165 million and is due to go into production in 2022, with full capacity expected to be reached by 2023. It is estimated that the operations will produce around 80 million litres of sustainable ethanol per year with no discharge to the environment.

Once live, the project opens up some exciting possibilities for ArcelorMittal. The ethanol-based product is in high demand and is used for all manner of use cases including in the production of disinfectants, cleaning products and plastics. ArcelorMittal will be able to connect into these sectors and others as a supplier, creating a potentially profitable and self-sustaining new business line.

"The new product will allow us to plug into the circular economy and work with partners who share our ethos. The fact that this project can dramatically cut our carbon emissions while helping to diversify our business model is really a win-win."

> ***Rockwell Automation's team of experts consulting on the plant design and engineering have really helped to shape and direct our efforts***

The project has also had a further, unexpected benefit. "It's not only companies with a demand for ethanol that have taken interest in the project – we've had inbound enquiries from multiple prospective employees who want to be part of the change. It just goes to show that bringing greater sustainability into the business acts as a magnet for bright, socially-aware talent," Wim added.

Funding was obtained from various sources, including the Flemish government and the European Union's Horizon 2020 research and innovation program under grant agreement No 656437.

ArcelorMittal now has plans to use the blueprint and learnings from the Ghent plant to implement the practice into other plants. "Our goal is continuous innovation, and sustainability plays an important role in that," Wim concluded.

Additional Information

www.rockwellautomation.com

The results mentioned above are specific to ArcelorMittal and LanzaTech's use of Rockwell Automation products and services in conjunction with other products. Specific results may vary for other customers.

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