

The background of the top half of the page is a photograph of a steel mill. A large, dark, cylindrical industrial component is being lowered or moved by a crane. Bright orange molten metal is visible at the bottom of the component, with sparks and light reflecting off it. In the background, there are steel structures, walkways, and a worker in a hard hat and safety gear. A blue line graphic curves across the image, framing the title text.

ARCELORMITTAL USES DATA AND ANALYTICS TO PURSUE ENERGY EFFICIENCY

As part of a consortium with Capgemini Engineering and with the financial support of the French Environment and Energy Management Agency, ArcelorMittal utilizes new models and analytics to review waste heat at its industrial sites as well as potential solutions to recover this lost energy

TARGETING WASTE HEAT

Energy efficiency has never been a more critical topic. Now more than ever before, individuals and businesses have necessarily become incredibly conscious of waste related to energy consumption, while also becoming increasingly eager for creative solutions. For ArcelorMittal, an international leader in steel manufacturing, the question of energy efficiency had become critical both for its impact on the environment and for the performance of industrial locations.

Client: ArcelorMittal

Region: France

Industry: Manufacturing

Client Challenge:

Aligned with its environmental strategy and journey to net-zero, ArcelorMittal wants to drastically reduce its waste heat across its manufacturing processes.

Solution:

ArcelorMittal and Capgemini Engineering developed new physical and techno-economic models as well as data analysis processes in order to identify the primary sources of waste heat and review potential recovery solutions

Benefits:

- Greater clarity into sources and amount of waste heat
- Clear decision-making guidance based on data and analytics
- Thorough review of potential solutions

“Energy efficiency is a huge challenge for the entire industry that ArcelorMittal has been focused on for a long time,” explains Gérard Griffay, Head of Energy team at ArcelorMittal Maizières Process Research Centre. “In 2017, the French government’s Environment and Energy Management Agency (ADEME) released an estimation that waste heat – in other words, heat that is not consumed by industrial processes and is recoverable – was equivalent to 10% of electricity production in France.

“But unfortunately, it’s not so simple as just deciding to recover more waste heat. The methods that already existed for measuring waste and testing recovery solutions weren’t suited to our industrial sites, which rely on new, faster, and more flexible tools. It wasn’t just a matter of altering our processes in order to capture waste heat. First, we needed to create new models to measure those energy losses and identify opportunities for efficiency gains.”

Once its primary goals were established, ArcelorMittal created a consortium with Capgemini Engineering and financial support from ADEME to launch the ANALyse Globale de Recuperation d’Energie (ANAGREEN) project with the intention of developing physical and techno-economic models to guide energy efficiency decision-making in the future.

BUILDING A NEW WAY TO REVIEW WASTE HEAT RECOVERY

In order to develop the various models necessary to recover waste heat within industrial sites, the consortium needed a comprehensive understanding of the existing challenges and opportunities. ArcelorMittal selected a single location that would serve as the basis for investigation and testing and, together, the partners began to review the site’s performance.

The consortium developed a comprehensive knowledge base concerning the physical and chemical properties of fluids and materials, which would enable the formalization of physical models – heat equations and balances, for example – and the thorough review of technological processes. In-depth knowledge of thermal energy storage solutions and other integrable technologies, such as heat exchangers, heat pumps, and organic Rankine cycles, enabled ArcelorMittal and Capgemini Engineering to design a critical techno-economic model that made key data more accessible to better clarify costs and potential savings for every solution being studied.

“Once we had built our new models, we then needed a way to analyze the results that were being generated,” says Mr. Griffay. “With so much information, we needed to identify what was really critical to understanding our waste energy and how to process it.”

Global behavior analyses provided insight into the groups of data that represented significant and necessary information, thereby decreasing the volume of information that required review and reducing the amount of time needed for analytic processes to complete. The partners drew from measurements of process operating parameters, simulations, and design data, which were then processed and conditioned to provide input for mathematical calculation methods.

Mr. Griffay elaborates: “We also used parametric optimization to calculate the total investment costs and annual savings from different technology configurations. So then we were able to provide answers to critical questions. How long would it take to achieve a return on our investments? What was the total amount of CO₂ emissions we could expect to avoid? And what percentage of recoverable energy could we really reclaim?”

“In the end, this approach made it possible to sort potential solutions based on use case priorities and even classify them in line with reasonable expectations.”



CHARTING A PATH TOWARDS ENERGY EFFICIENCY

To test and validate the models, ArcelorMittal and Capgemini Engineering applied the methodology to real test cases, further refining these new tools while ensuring that the ANAGREEN project produced a comprehensive and reliable solution to support energy integration at industrial locations. Through thorough analysis of gathered data, the project will strengthen the capacity of existing solutions and technologies to support energy recovery.

“The ANAGREEN project has led to innovation on two levels,” explains Mr. Griffay. “First, it produced the new methods and models that we’re using to find different ways to drive energy efficiency. And then it has further bolstered those solutions with additional decision-making guidance.”

With an improved dynamic model for measuring waste heat and identifying opportunities for recovery, ArcelorMittal and Capgemini Engineering then further refined the approach to reduce the time required for a return on investment. This will empower the partners to more

effectively develop the strategy for any given process and accelerate the pursuit of energy efficiency. Already, the models developed estimate an annual recovery potential of 2.4 TJ (or 0.67 TWh) of energy for steel plants in France, which is roughly equivalent to 1% of the total waste heat of the entirety of French industry.

“Through ANAGREEN, we’ve now got an expert decision support system in place that will evolve our strategy based on the most critical data,” says Mr. Griffay. “The potential positive impact of this is incredibly broad. We’ll be able to use recovered waste heat for preheating during manufacturing, which will reduce the amount of total energy required.

“Everyone knows that energy has never been a more important topic. ANAGREEN is a substantial first step towards making industry more efficient so that we can continue essential work while minimizing our impact on the environment. I’m optimistic about a future in which European industry uses this as the basis for innovations that will contribute to the ongoing efforts to become more sustainable.”

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