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EXPERTISES

Feasibility study of a seawater pumping station for ArcelorMittal Dunkirk's decarbonization program

2034

FRANCE 2030

CFP ZIBAC - Optimization of water uses at the heart of the Dunkirk site's decarbonization program

Context of the study

The ArcelorMittal Dunkirk plant is engaged in a process to reduce its freshwater consumption. This program, spread over 15 years, aims to achieve a 10% reduction in consumption by 2025 and a 25% reduction by 2034, compared with the 2019 baseline.

As part of its decarbonization program, the initial project for the Dunkirk site sought to reduce greenhouse gas emissions by gradually replacing coal, historically used in blast furnaces, with a steelmaking process based first on natural gas and then on a natural gas–hydrogen blend. The new equipment planned for decarbonized steel production (one direct reduced iron unit and two electric arc furnaces, as well as two ladle furnaces) required the installation of additional cooling capacity, which is essential for their proper operation. Taking into account, on the one hand, the reduction in freshwater consumption resulting from the shutdown of historical facilities, and on the other hand, the needs of the new units (with cooling provided by cooling towers), the balance showed an excess consumption of 260 m^3/h compared with the 2025 target, and 380 m^3/h compared with the 2034 target.

In light of this finding, the decision was made to study the possibility of using seawater cooling drawn from the dock basin instead of cooling towers. By eliminating evaporation losses, the site's water consumption targets would be met.

Objectives of the study

Based on a concept of open-loop seawater circulation, the study aimed to define the technical solutions for pumping, quay arrangements, as well as the transport and discharge of seawater drawn from the mineral basin. The objectives were therefore to:

- Identify the main layout and technical options
- Ensure technical feasibility
- Estimate a budget with ±30% accuracy
- Establish a preliminary master schedule for the project

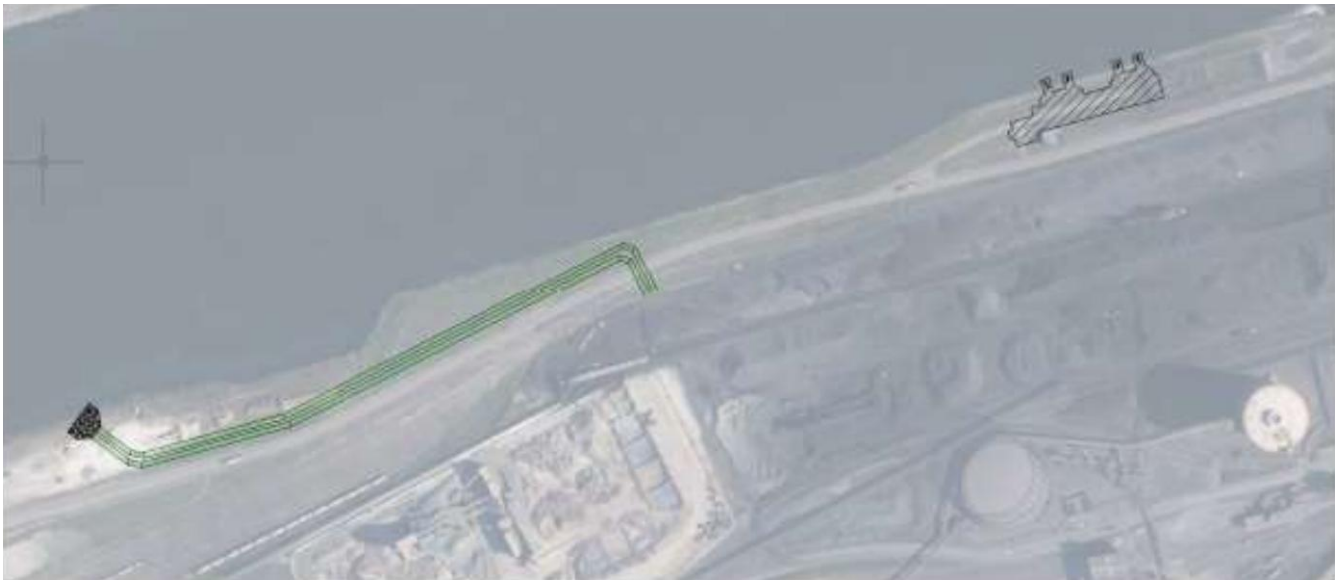
Administrative studies (environmental, ICPE, noise impact assessments) were excluded from this first feasibility phase.

Study details

The feasibility study was entrusted to EKIUM.
The sizing of the seawater pumping system took into account regulatory limits on water temperature, namely a maximum discharge temperature in the dock of 30°C and a maximum temperature difference of 10°C between intake and discharge, as well as the cooling requirements of the new equipment initially planned in the decarbonization project.

Beyond these main input data, the study also considered construction constraints (buried networks, soil type, hydrology, proximity to railway lines), the recommendations of the impact assessment and IOTA reports, design rules (control systems, water treatment, maintainability, strategic backup), and the waste management policy (construction and operational waste).

The discharge zone was chosen at a distance of approximately 800 meters from the intake zone, close to the future location of the decarbonization project, in order to avoid re-circulating warm water. However, a hydraulic study of water movements in the basin will need to be conducted to define the final discharge position.



Aerial view showing the location of the pumping station and the discharge area

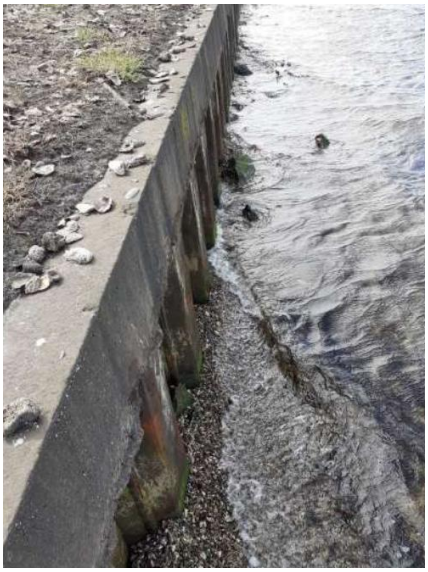


Photo of the quay at the pump intake

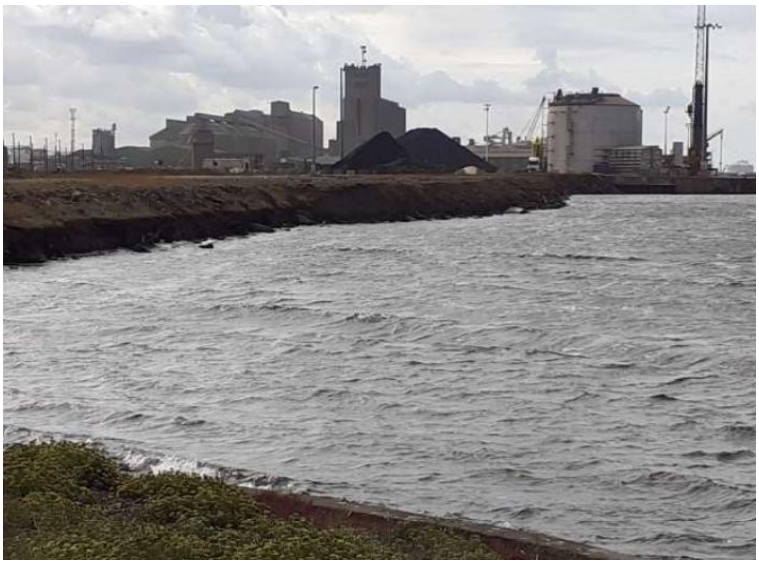


Photo of the quay at the discharge point

The feasibility study includes the description of:

- The seawater pumping station, including:
    - Pump-motors with electric or thermal drive
    - Civil works, intake and discharge channels
    - The building and its associated facilities
- Process equipment:
    - Seawater filtration: bar screen, rotary filter
    - Water treatment: storage tank, mixing, injection, control
    - Isolation cofferdams
- Quay and shore facilities, including:
    - Earthworks and sheet piling
    - Foundations
    - Base slab
    - Zone reinforcement
    - Vehicle traffic areas (concrete zone on quay, asphalted road nearby)
    - Fire protection systems (fire hydrants)
    - Fire water collection basin
    - Protective measures and fencing
- Seawater piping:
    - Above-ground pump discharge pipes to manifolds, including accessories
    - Manifolds (collectors)
    - Buried networks (2 supply lines and 2 return lines), including excavation and reinforcement if needed
    - Cathodic protection
    - Pipe supports
    - Valves
    - Control and monitoring instrumentation
- Electrical and automation systems, including:
    - High-voltage supply
    - HV/MV and HV/LV transformers
    - Variable speed drives (for electric pump-motors)
    - HV, LV, and extra-low-voltage distribution
    - Fire detection
    - Control PLC

- I/O to the general supervision system (the latter is outside the study)
- UPS and uninterruptible network
- Access control
- Video surveillance

- Miscellaneous utilities:

- Diesel storage tank and transfer pumps for thermal engines
- Cooling circuit for variable speed drives, bearings, and motor (chiller circuit)
- Compressed air production and distribution (instrument air and operating air: bubble pipe and maintenance outlets)
- Ventilation of the premises
- Inerting of the electrical rooms

Study conclusion

The study conducted by EKIUM validated the technical feasibility of a seawater pumping system to provide cooling for the new decarbonization equipment initially planned at the ArcelorMittal Dunkirk site, and estimated its budget with ±30% accuracy.

However, the very high cost of this solution, exceeding €150 million, led ArcelorMittal to consider alternative solutions to achieve the same objectives.

RÉSUMÉ

The ArcelorMittal Dunkirk plant is committed to reducing its freshwater consumption. This 15-year program aims for a 10% reduction by 2025 and 25% by 2034, compared to 2019. Additionally, as part of its decarbonization program, the Dunkirk site plans to reduce its greenhouse gas emissions by implementing new decarbonized steel production equipment, which will require additional cooling capacity.
The assessment of future cooling needs indicates an overconsumption of freshwater, even as the plant must achieve water savings. In response, ArcelorMittal decided to explore the possibility of using seawater drawn from the dock for cooling, instead of conventional air-cooled towers, for its new decarbonization equipment. By eliminating evaporation losses, the site's water consumption targets could be met.
The feasibility study for a seawater pumping system, supported by Ademe, demonstrated technical feasibility but also highlighted a prohibitive cost for the decarbonization project.

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