



July 2026

AgiFlex

Newsletter #3

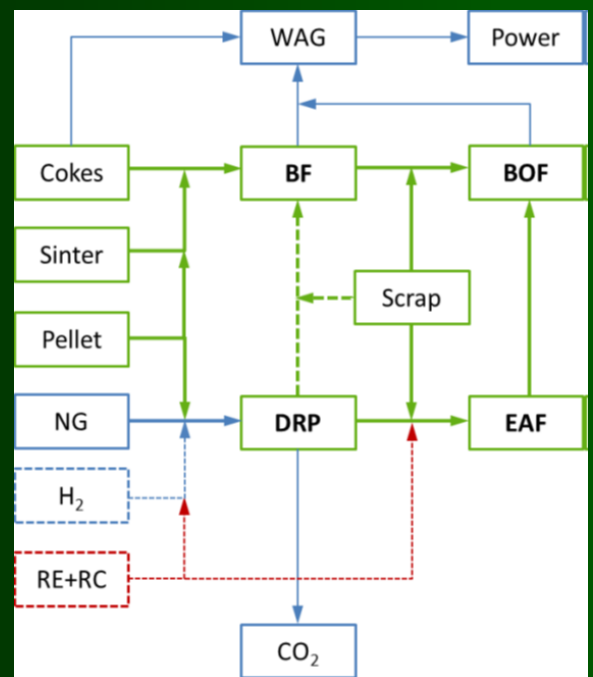
The AgiFlex project is progressing towards the implementation of its Multi-Agent Platform, translating concepts developed during the first reporting period into a functional software framework.

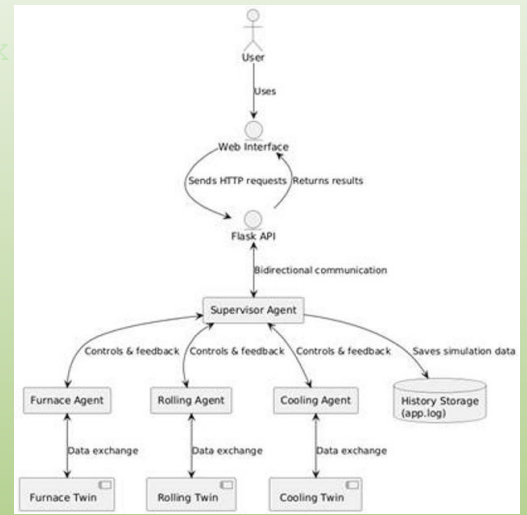
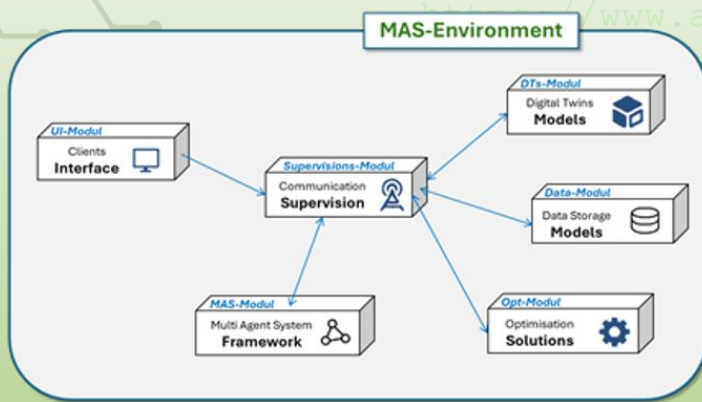
This newsletter presents the main components of the platform, including its multi-agent architecture, the integration of Digital Twins and the optimization strategies under development. By combining distributed intelligence, optimization and Artificial Intelligence techniques, AgiFlex aims to provide a scalable decision-support tool for future low-carbon steelmaking.

Digital Twins and Agents

At the core of the AgiFlex framework lies the interaction between Digital Twins and Smart Agents. Digital twins reproduce the behaviour of industrial units such as blast furnaces, direct reduction plants, rolling mills, power plants, etc. These virtual models continuously evaluate process performance, estimating quantities such as energy consumption, CO₂ emissions, material utilizations, and economic indicators.

Smart agents represent the decision-making layer of the platform, analysing the information generated by the digital twins and autonomously for proposing operational or investment adjustments whenever production targets, economic objectives or environmental constraints are not satisfied. This interaction creates an iterative decision loop where alternative operating operational conditions or plant setup can be explored and compared in simulated scenarios.





A modular and scalable approach

The AgiFlex platform has been designed as a **modular software ecosystem**, allowing new processes, models and optimization strategies to be incorporated with minimal modifications. The architecture consists of several interconnected modules:

- User Interface Module for interaction
- Data Module for storage and management of process information
- MAS Module coordinating intelligent agents
- Digital Twin Module hosting process models
- Optimization Module for decision support
- Communication layer enabling interoperability through industrial protocols such as OPC-UA, MQTT, REST APIs and TCP/IP

Key Performance Indicators

Intelligent agents assess the impact of their decisions through a collection of Key Performance Indicators (KPIs), enabling the platform to compare alternative operating conditions and identify improved solutions.

KPI	Objective
CO ₂ emissions	Minimize
Energy efficiency	Maximize
Circularity	Maximize
Economic performance	Maximize
Raw material and energy use	Minimize
Overall cost	Minimise

From centralized to distributed optimization

One of the main objectives of AgiFlex is to move from traditional centralized optimization approaches toward distributed optimization strategies. To achieve this, AgiFlex investigates coordination techniques based on the **Alternating Direction Method of Multipliers (ADMM)**, allowing agents to optimize their own subsystems while collectively satisfying plant-wide objectives. Distributed optimization offers:

- Improved scalability
- Parallel computations
- Faster response to disturbances
- Easier integration of new production units
- Increased robustness against system complexity

