Decarbonization & Energy Management Services

360° Approach to support digital transformation to green steel production

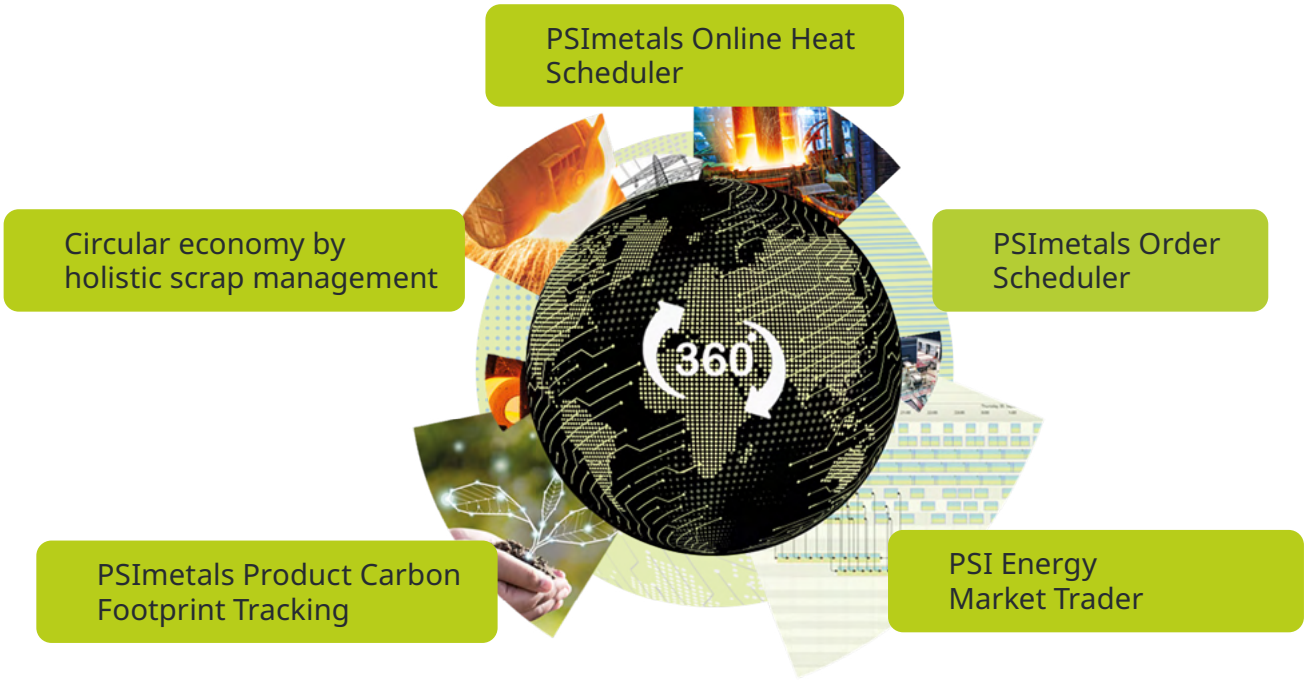
PSI

PSI - Software excellence for steel & aluminum producers

Step on your green digital transformation journey with PSImetals!

360° view on green production management

PSI supports digital transformation to green production management



Discover our product portfolio for sustainable production management

Classical Planning & Scheduling services

- PSImetals optimizes and balances process flows and resource usage.
- PSImetals uses efficiency KPIs as optimization targets.
- PSImetals enhances cost effectiveness which increasingly implies sustainability.

With PSImetals, we are setting a new impulse

- PSImetals supports various requirements with a flexible infrastructure that can run services in any environment as needed.
- Following the concept of edge computing, services can be shifted between environments.
- Comprehensive Charge & Alloy optimization and internal production scrap tracking.

Manage the complexity of hybrid steel plants

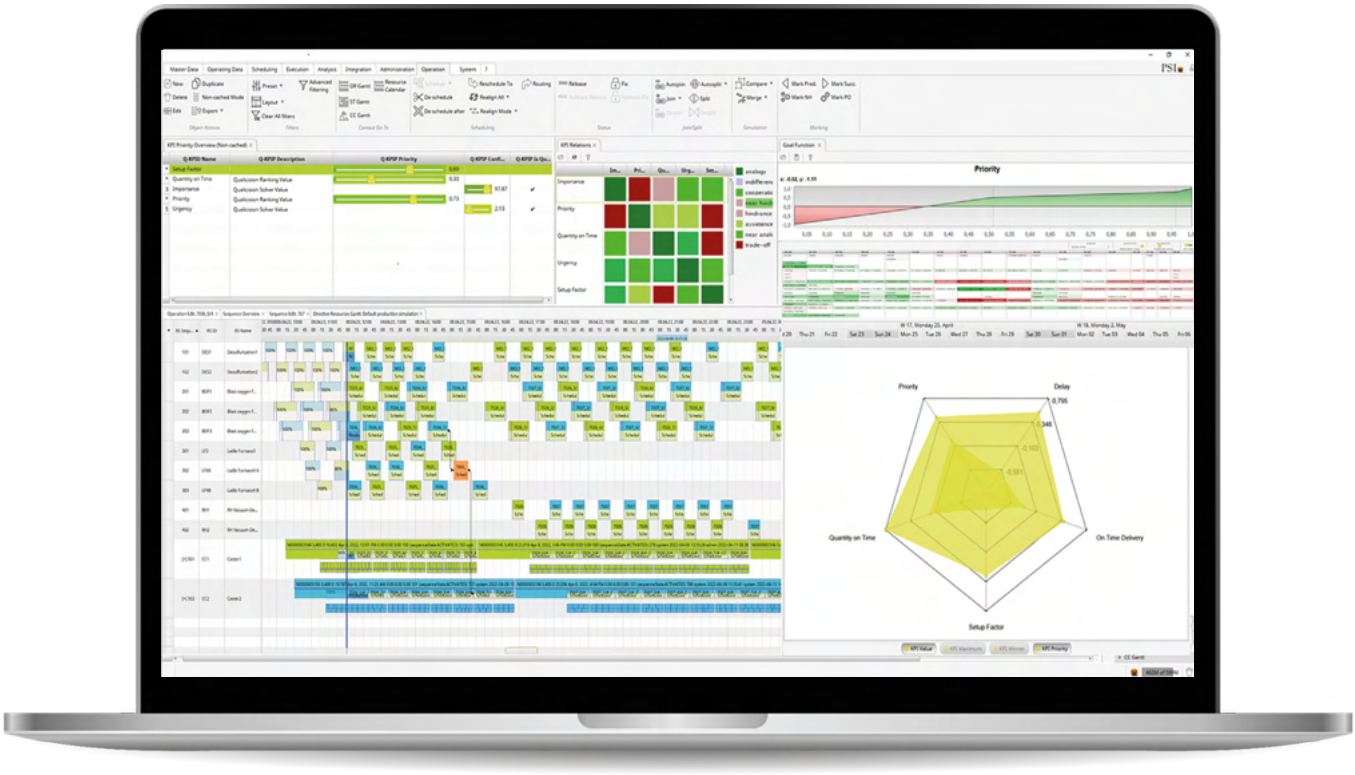
A hybrid steel plant allows gradual transition to green steel. However, by combining the blast furnace (BF) and basic oxygen furnace (BOF) with Direct Reduced Iron (DRI), Smelters and Electric Arc Furnace (EAF) technology to produce steel in one plant, it becomes complex to operate with conflicting KPIs. Producing steel with this new technology requires careful material allocation and energy management, which can be managed with PSImetals Online Heat Scheduler.

Online Heat Scheduling – forecasts in PSImetals Virtual Factory

Key facts & benefits of PSImetals Online Heat Scheduler

- **Offers transparent graphical overview** of heat schedule, hot metal, DRI and energy demand.
- **Aligns schedules and routes** depending on energy, resource availability and flow.
- **Manages scenarios** to analyze and compare schedules with different KPI settings.

Applying KPI-driven optimization in Online Heat Scheduling



PSImetals Online Heat Scheduler – KPI-Driven optimization and display of scheduling results to the user

Scheduling principles in PSImetals Online Heat Scheduler

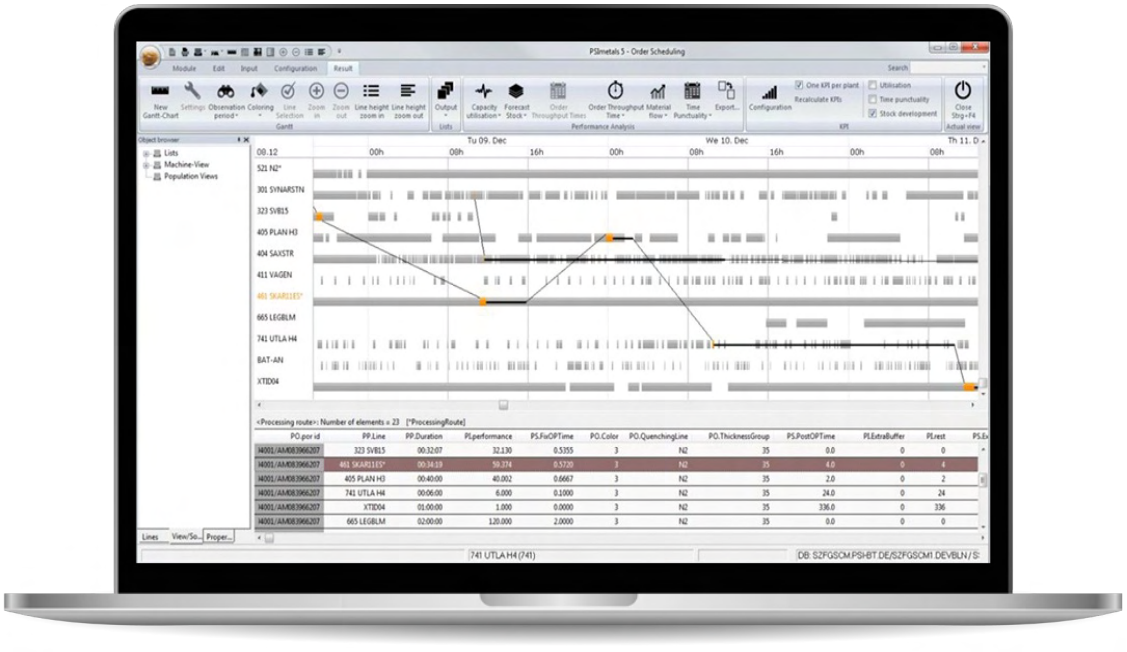
- Influence the optimization result by different weightings of defined KPIs.
- Overwrite the proposed optimizer results by manual interactions in simulation mode.
- Get an overview of KPI achievements of the proposed and simulated solutions.
- Access energy demand forecasts for energy procurement and/or consider sending them to the energy provider.

Detailed Line Scheduling task

Plant managers have to balance available resources with demand from the amount of open customer orders. This requires that for each production step of the order book, the best starting time is calculated, considering the production targets from the flow planning and campaigns.

Key facts & benefits of PSImetals Order Scheduler

- Adjusts campaigns according to the material flow.
- Balances workload between production resources, production flow and efficiency targets.
- Projects completion date of all production orders based on detailed production line schedules and production status.



Cross-Plant Order Scheduling with PSImetals

Aligning production to available energy - PSImetals Order Scheduler

Forecast of overall electrical enery demand color-coded by contribution of the individual production lines

Energy management benefits with PSImetals Order Scheduler

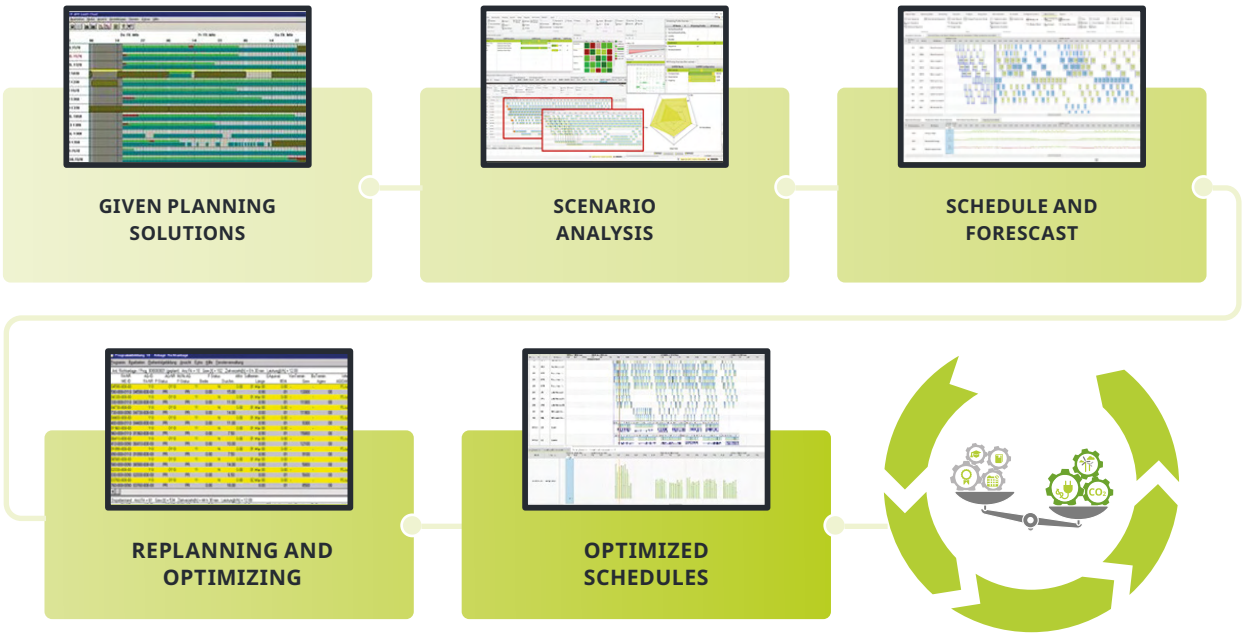
- Predict overall energy demand based on specific energy demand by product, production step and resource.
- Apply statistical methods to derive a more accurate energy forecasting for planned schedules.
- Compare projected energy demand to energy availability, costs and possible limits to adjust the scheduled production accordingly.
- React on actual production deviations with transparency of impact on energy consumption.

Green KPIs to optimize Planning & Scheduling cycle

To optimize production, maintain quality standards, balance cost-effectiveness and environmental considerations, all facilities on the different routes must be synchronized in such a way that both already established KPIs and the green KPIs can be set and managed in PSImetals planning and scheduling solutions.

Key facts and benefits of integrated PSImetals Planning and Scheduling scenario:

- Close and reactive integration of planning and scheduling is inevitable.
- Production needs to be re-planned/re-scheduled to react to short-term impacts.
- Customer demands and due dates for green products depend on planning/scheduling green energy prices.
- Planning and scheduling need to be synchronized to tackle challenges like fluctuating energy prices and green energy availability.



What if you could:

- Forecast energy and resoure demand.
- Get a clear overview of energy availbility and restrictions.
- Align and optimize schedules accordingly.

Benefits of green KPIs to steelmakers:

- Optimizing green KPIs using AI methodology leads to sustainable cost effectiveness.
- Green KPIs align with set KPIs in process optimization, achieving a balance between efficiency and sustainability.
- Smartly connecting cost effectiveness and sustainability through improved KPI measurability should become an entrepreneurial task.
- Green KPIs will increasingly contribute to the control of processes and be intrinsic part of cost effectiveness and green efficiency:
  + AI as optimization technology will have an important stake in it.
  + AI forecast procedures & KPI analysis of business process data will be very helpful here.

Energy Procurement - Typical energy mix

Industrial consumers procure energy based on a mix

Energy Procurement & PSI smart day trader

Meeting the Net Zero target requires 24/7 team work

In the ecosystem of production planning and scheduling with energy trading and procurement, the key stakeholders must collaborate to manage materials production and related energy consumptions efficiently.

Industrial Energy Procurement

1

PSI combines Planning and Scheduling tools with the energy purchasing and trading tools, bringing planning/scheduling and energy trading in one platform.

2

Based on optimized schedules, PSImetals hands over an energy demand to Qualicision Smart Day Trader to trade the short-term energy needs on the energy market.

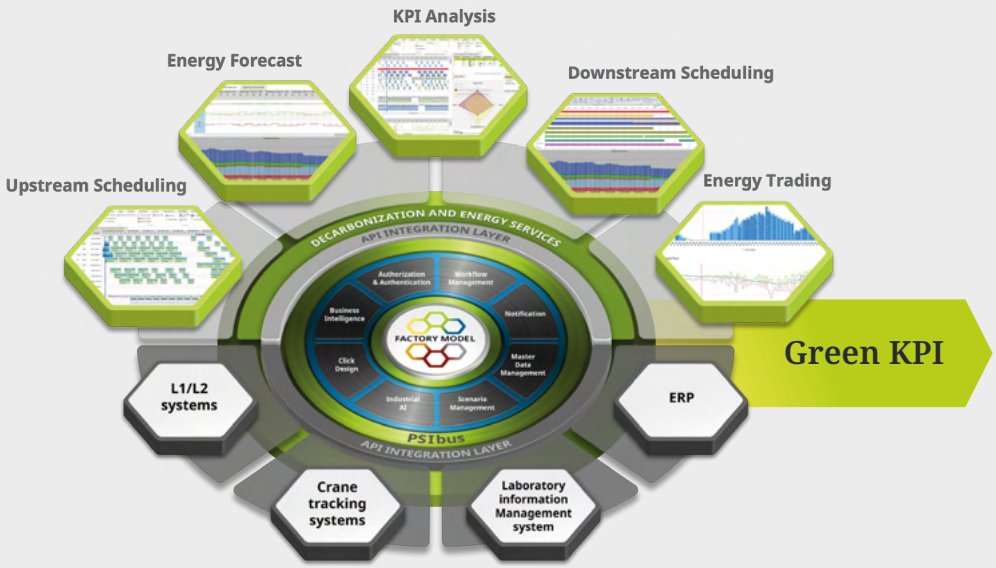
long-term	medium-term	own production	day ahead
			

Planning & Scheduling

- Long-term planning (Sales & Operations Planning)
- Mid-term planning (Order & Material Planning)
- Short-term planning (Line Scheduling)
- Schedule execution

Energy Procurement

- Mid-term energy procurement
- Spot market/day ahead market
- Intraday market



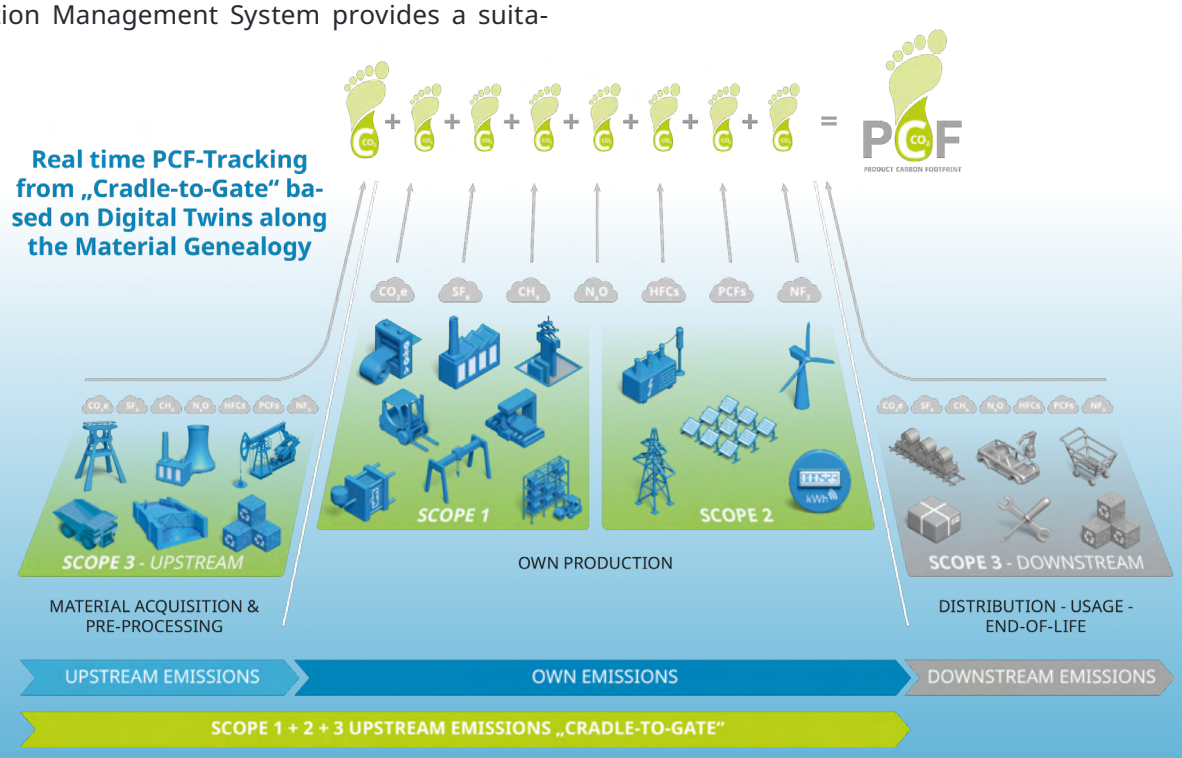
Transparent calculation and tracking of emissions on piece and product level

The Product Carbon Footprint (PCF) Tracking approach based on PSImetals Quality Process Snapshot is the next step to track CO_2 emissions along the entire production chain.

The market is increasingly demanding reliable carbon footprint calculations and related certificates for various metals products. The PSImetals Product Carbon Footprint Tracking approach provides transparent calculations based on configurable Quality Process Snapshots and tracking of energy consumptions and CO_2 emissions on piece and product levels along the entire production chain. It tracks all emission-relevant process data and calculates scope 1, scope 2, and upstream scope 3 CO_2 emissions in real-time.

Real-time PCF-Tracking from „Cradle-to-Gate“ along the Material Genealogy:

In the future, this type of data will be treated like today‘s quality data. It will be part of the product certificate and will also be checked against tolerances during the production process. Thus, Quality Process Snapshot (QPS) integrated into PSImetals Production Management System provides a suitable approach for PCF tracking, as it calculates, tracks and visualizes the CO_2 equivalent emissions along the Material Genealogy, taking into account scope 1, 2, and 3 contributions according to the GHG Protocol Corporate Standard.



Key facts & benefits of PSImetals Carbon Footprint Tracking:

- Reliable PCF-calculations and certificates for various metals products.
- Real time PCF-Tracking from „Cradle-to-Gate“ along the Material Genealogy.
- Transparent calculation and tracking of emissions on piece and product level.
- CO_2 emissions and Energy Demands as Green KPIs for Optimized Planning, Scheduling and Execution.
- PCF data like today‘s quality data – easy to implement & easy to use.
- Business and Intelligence readiness – statistical evaluations and hence transparency on decarbonization progress.

From data to decisions with hybrid intelligence for smarter steelmaking

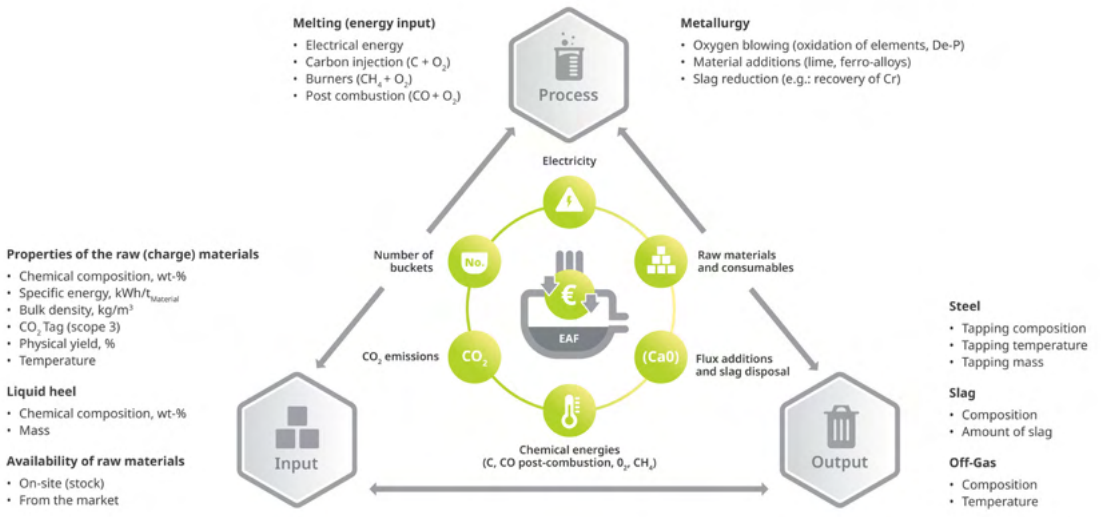
A comprehensive hybrid charge and alloy optimization model developed by PSI's partner qoncept technology has been integrated into PSImetals as third party services (qontrol maps) on PSI's service platform (SP). The hybrid model goes beyond the capabilities of the conventional approach.

Components of the hybrid model:

qontrol materials - Scrap Characterization Model
This component uses AI techniques to continuously evaluate and update the expected chemical composition, metallic yield, and melting energy requirements of each scrap type based on observed melting results.

qontrol maps - Optimization Model
A decision algorithm uses these dynamic scrap properties to calculate the most cost-, energy-, and emission-efficient charge mix, while respecting production constraints such as grade limits, material availability, and real-time pricing.

qontrol maps - Metallurgical Process Model
This thermodynamic module ensures that the calculated charge mixes remain metallurgically valid by modeling key reactions such as decarburization, oxidation, reduction, and slag formation.

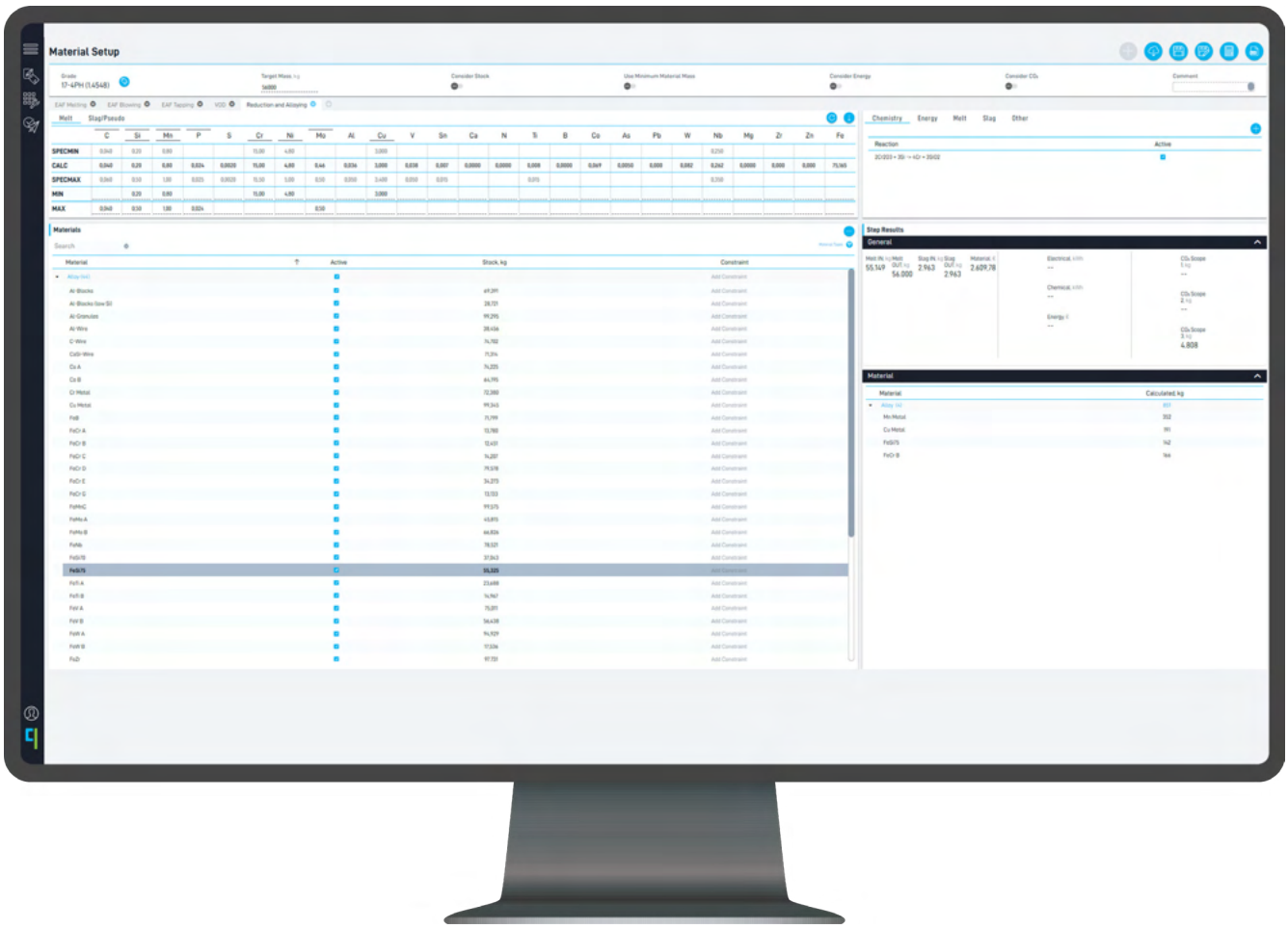


Material input, process conditions and output data of metallurgical model for EAF treatment with considered cost drivers for charge and alloy optimization

Hybrid Charge and Alloy optimization model

Key facts & benefits of hybrid Charge & Alloy optimization model:

- Automatic adaptation of scrap properties.
- Optimization of material inputs across the entire production chain and meltshop.
- Consideration of energy consumption and CO_2 emissions.
- Improvement of heat campaign planning.



GUI example of hybrid Charge and Alloy optimization along all production steps from EAF melting to reduction and alloying in VOD line

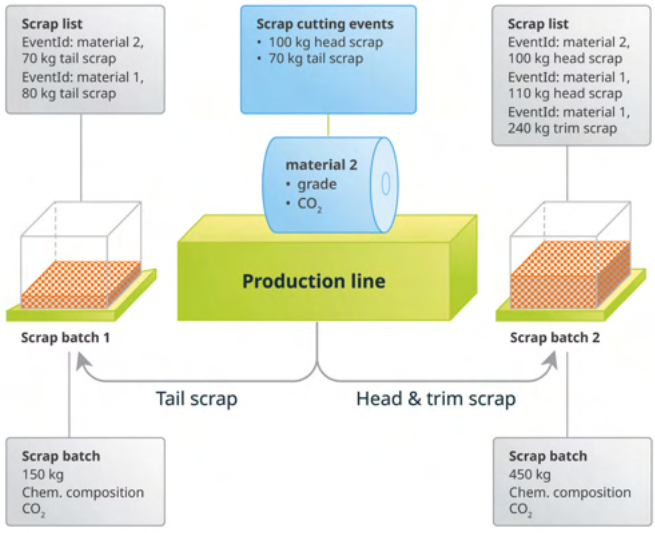
Optimized Scrap Management across the production chain

PSImetals efficiently manages internal scrap generated during downstream production processes by treating it as batch material and automatically capturing essential production data. Scrap from on-site operations—such as trimming or cutting head and tail scrap—is a valuable resource that can be recycled in-house in the meltshop or sold externally.

To facilitate this, scrap is collected in dedicated containers placed at strategic collection points along the production lines. Since containers often contain scrap from multiple campaigns, their contents can be heterogeneous. PSImetals ensures high-grade recycling by automatically tracking total weight and average chemical composition for every batch.

A detailed scrap list per container provides a comprehensive overview of its composition, including individual cut parts and information about their respective mother materials. Additionally, the carbon footprint of each scrap piece is recorded, enabling calculation of the product carbon footprint (PCF) for the entire scrap batch.

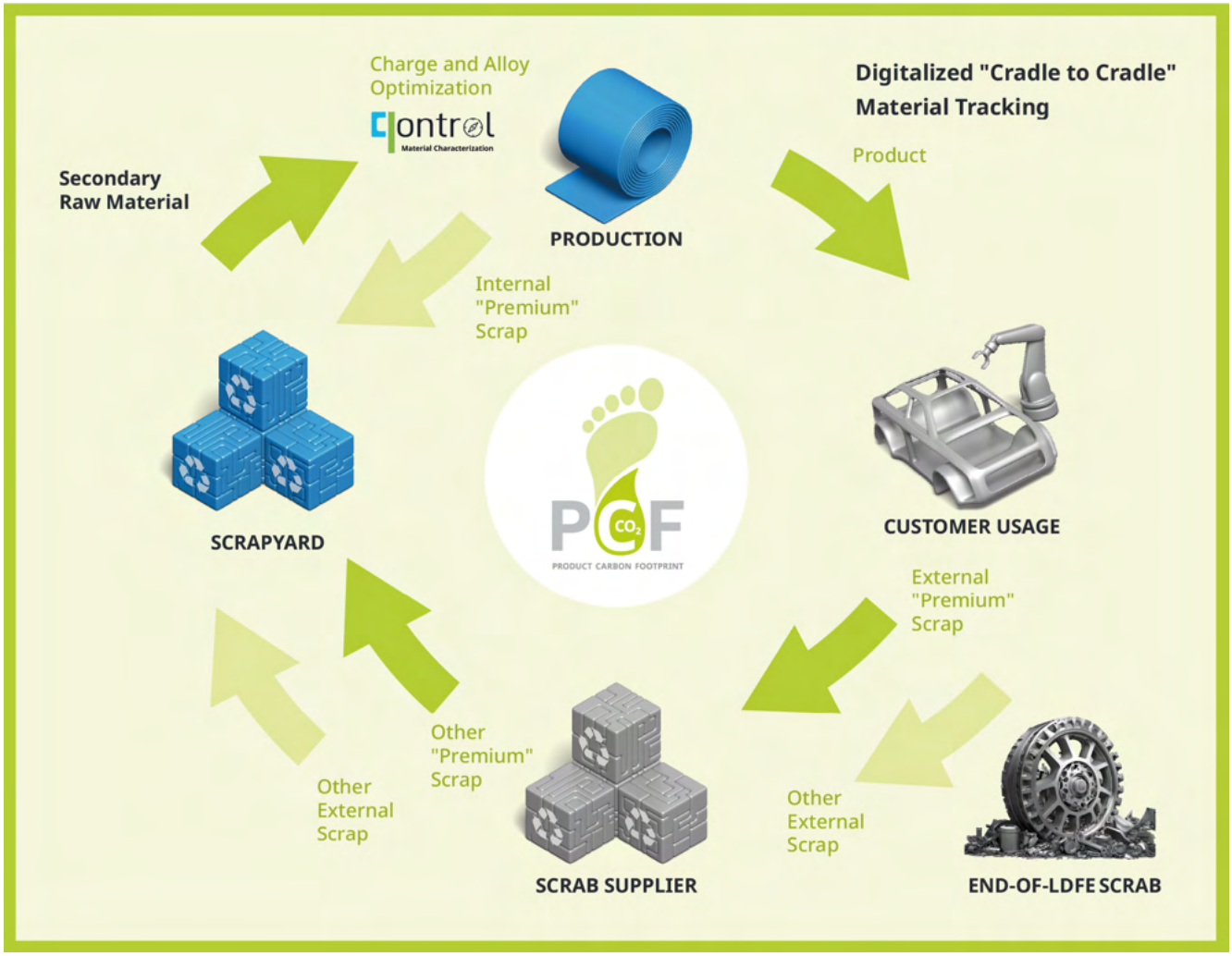
With this holistic approach, you can plan scrap demands, optimize scrap mix and alloy charging, manage internal and external scrap yards, and track scrap consumption across the entire steel production chain, reducing energy use and lowering the product's carbon footprint.



Automatic scrap tracking based on the standard production and scrap cutting events

Benefits of holistic Scrap Management for circular economy:

- Enhanced scrap sorting and tracking (composition, CO_2 footprint) for more reliable charge and alloy calculations.
- Collaboration with customers to monitor and improve scrap quality.
- Dedicated suppliers process and return scrap with tracked composition and properties.
- Material characteristics shared via Material Genealogy.



PSImetals supports holistic Scrap Management for circular economy

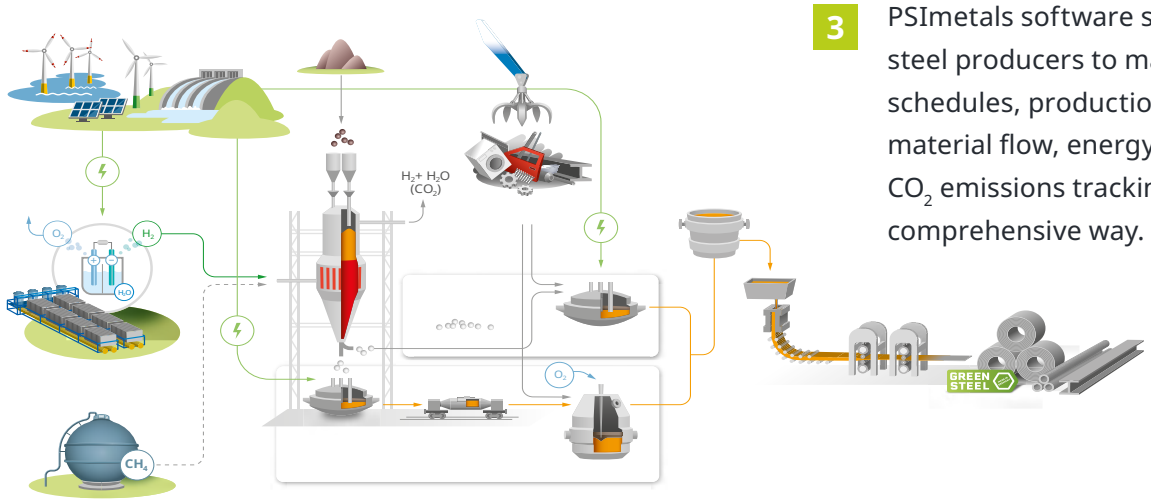
Decarbonization and Energy management for green steel production

It’s time for a radical transformation

1. The steel industry faces the historic task of decarbonizing production to net-zero by latest 2050.

2. To produce carbon neutral steel in the future, we need huge amounts of climate neutral DRI based on green hydrogen and renewable electricity.

3. PSImetals software solutions allow steel producers to manage heat schedules, production routing, material flow, energy usage, and CO_2 emissions tracking in a comprehensive way.



Hydrogen-based DRI: the silver bullet to climate neutrality

Decarbonization - Facts and challenges of today & tomorrow

- “The future is electric” and we have to deal with high and fluctuating energy prices as well as availability of green energy.
- More than ever, energy availability and price impacts on production have to be managed.
- Customers and government regulations are increasingly demanding CO_2-reduced products.
- Classical BF/BOF steelmaking will be replaced by processes using green hydrogen and DRI, smelters and EAF.
- Enormous demand for green hydrogen and renewable electric energy will drive the transformation.
- Hybrid steel plants combining classical and new production routes will be inevitable.

Production management solutions today for generations to come

Our goal is to drive decarbonization — with our production management solutions, you can:

- Integrate renewable energy into your existing system.
- Support decarbonization of industrial processes.
- Contribute to the reduction of emissions in transport and logistics within your plant.

Step on your decarbonization journey with PSImetals

#StepOnIt

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Let's get in touch!

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