



360° Approach to Support Digital Transformation to Green Steel Production

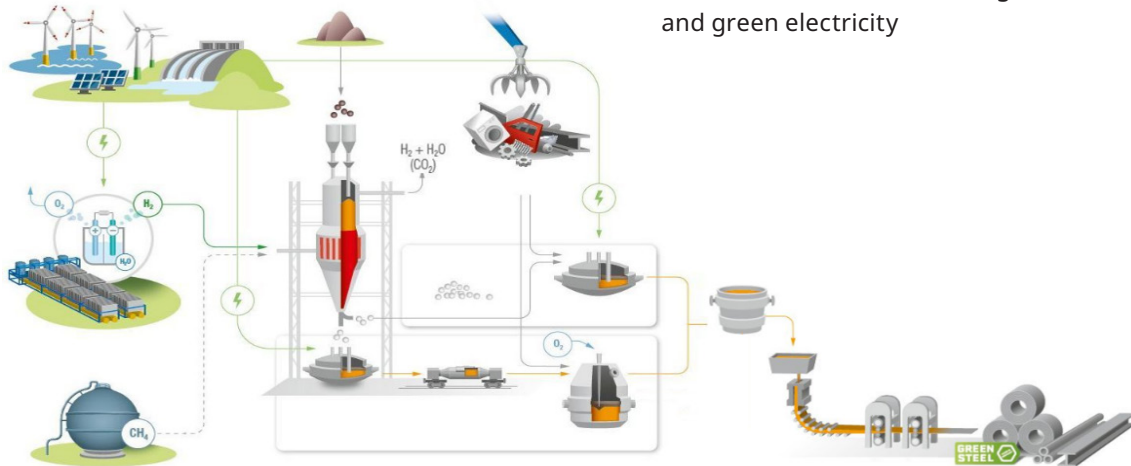
PSI 

Steel is a Heavy Emitter of CO

Radical Transformation Needed

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 (Direct Reduced Iron) based on regenerative energies and green electricity



Hydrogen-based DRI: the silver bullet to climate neutrality

DECARBONIZATION - FACTS & CHALLENGES OF TODAY & TOMORROW

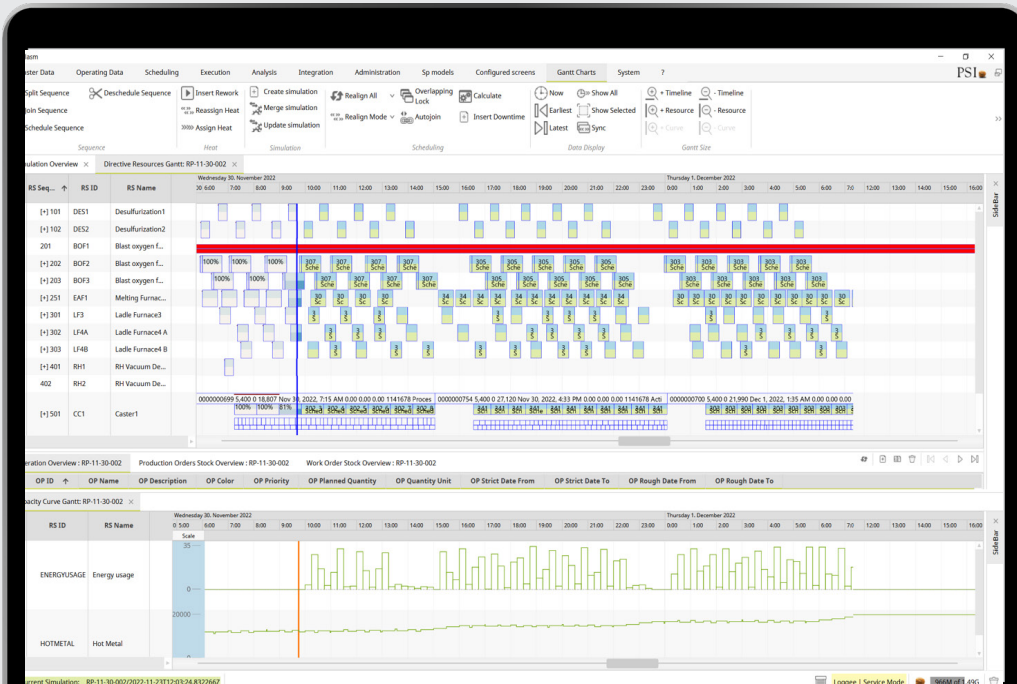
- ✓ "The future is electric" and we have to deal with high and fluctuating energy prices as well as availability of green energy
- ✓ More than ever, energy availability and price impacts on production have to be managed
- ✓ Customers and government regulations are increasingly demanding CO₂-reduced products
- ✓ Classical BF/BOF steelmaking will be replaced by processes using green hydrogen and DRI, smelters and Electric Arc Furnaces formation
- ✓ 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

Manage the Complexity of Hybrid Steel Plants

A hybrid steel plant allows gradual transition to green steel. However, by combining the BF and BOF with DRI, Smelters and 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.

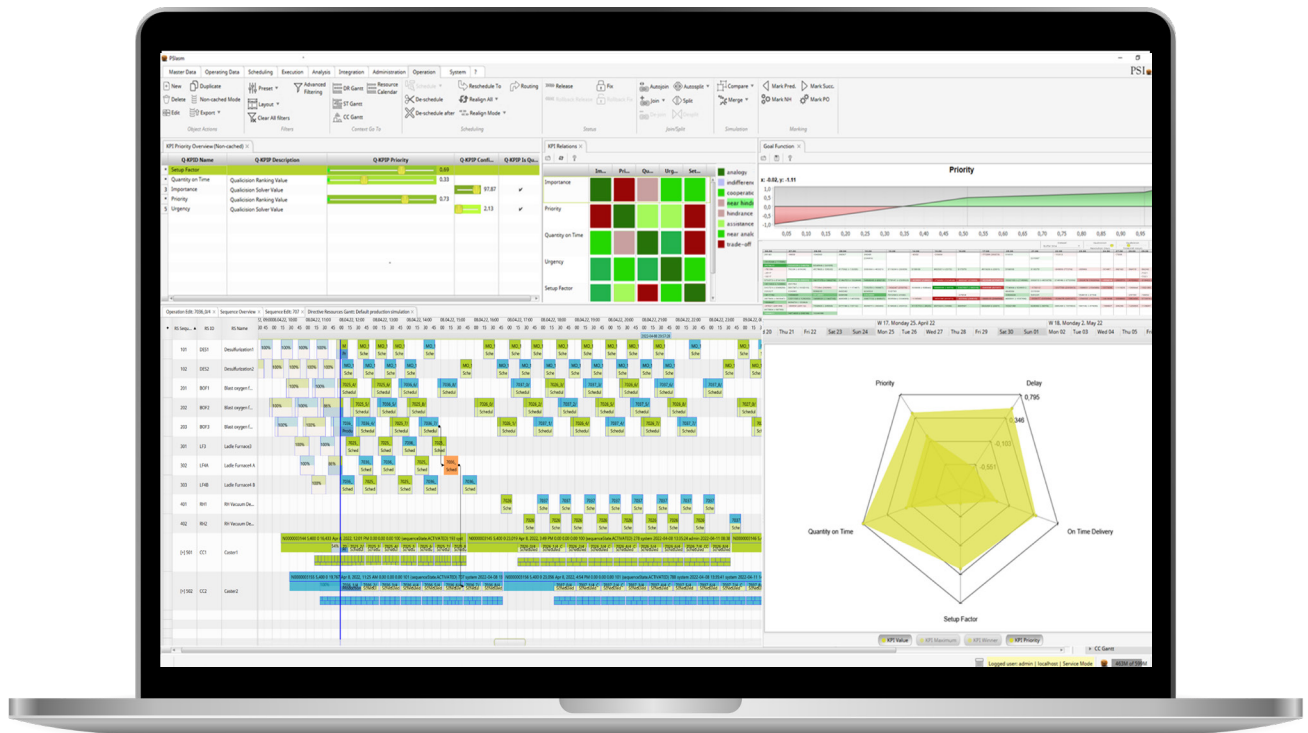
KEY FACTS & BENEFITS OF PSIMETALS ONLINE HEAT SCHEDULER

- + 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 scenario to analyze and compare schedules with different KPI settings



Online Heat Scheduling – Forecasts in PSImetals Virtual Factory

Applying KPI-driven Optimization in Online Heat Scheduling



PSImetals OHS – KPI driven optimization and display of results to the user Scheduling

SCHEDULING PRINCIPLES IN PSImetals ONLINE HEAT SCHEDULER

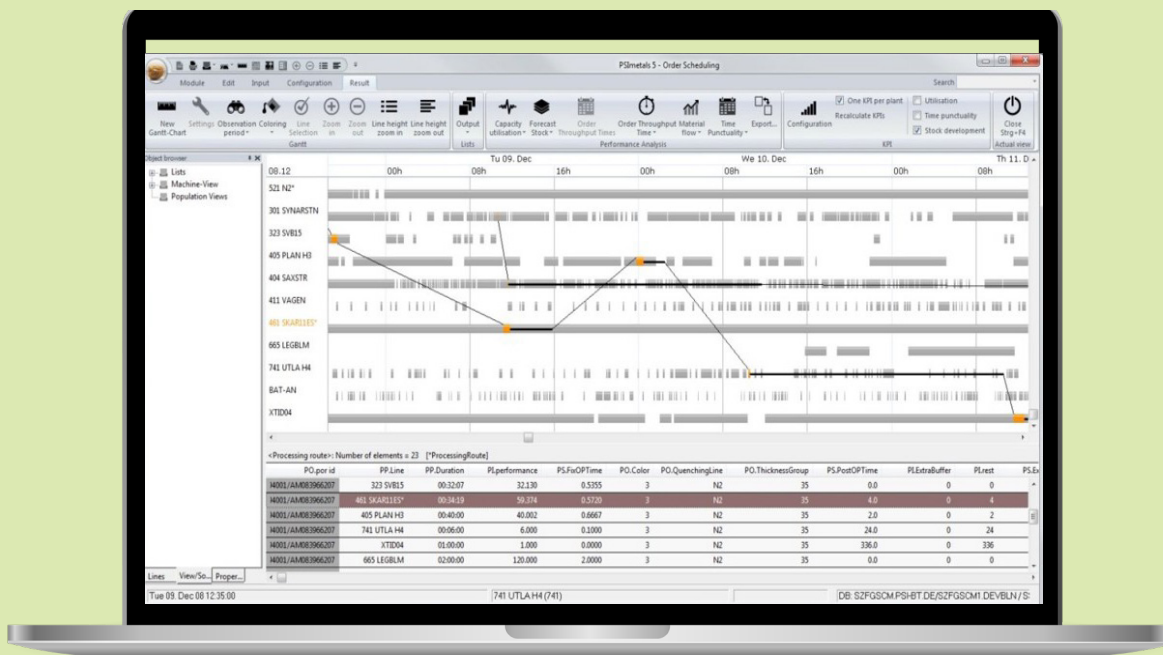
- ✓ The operator can influence the optimization result, giving priorities to KPIs
- ✓ They will also get an overview of KPI achievements of the proposed solution
- ✓ In simulation mode, the user can still overwrite the optimizer results by manual interaction
- ✓ The energy demand forecasts are available for the energy procurement and/or can be sent 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 & campaigns.

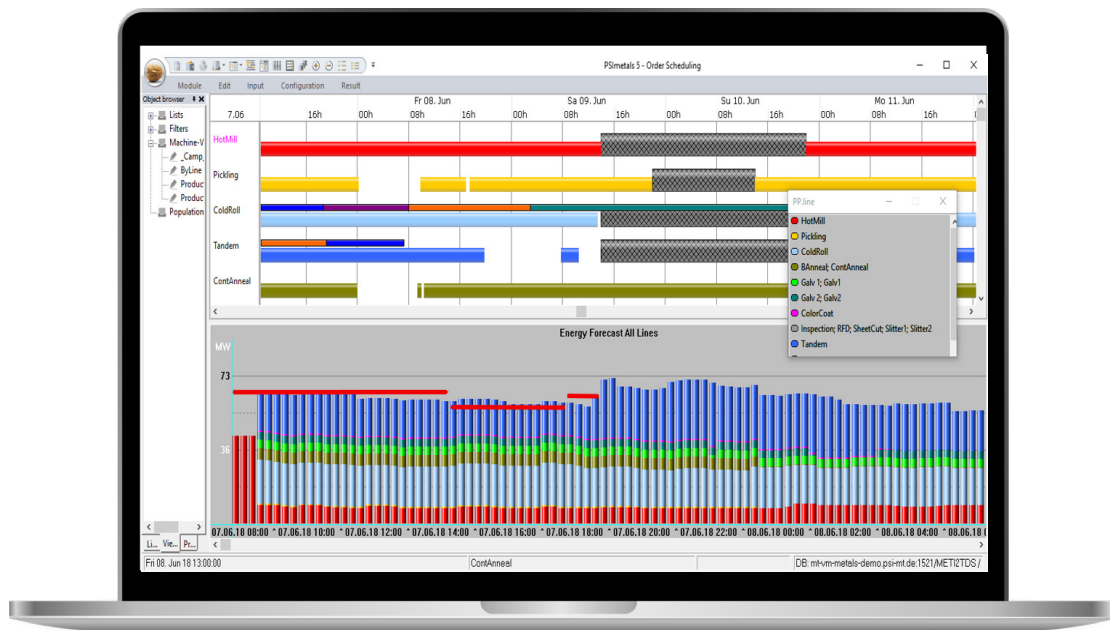
KEY FACTS & BENEFITS OF PSIMETALS ORDER SCHEDULER

- + 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 OS



Forecast of overall electrical energy demand color-coded by contribution of the individual production lines (schedule not aligned to energy availability)

ENERGY MANAGEMENT BENEFITS WITH PSImetals ORDER SCHEDULER

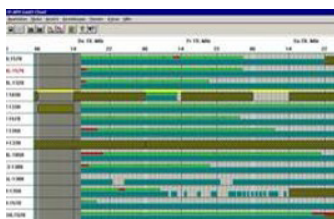
- ✓ Predict overall energy demand based on specific energy demand by product, production step and resource
- ✓ Apply statistical methods to derive a more accurate energy forecasting for planned schedules
- ✓ Compare projected energy demand to energy availability, costs and possible limits to adjust the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

With Green KPI to Optimize Planning & Scheduling Cycle

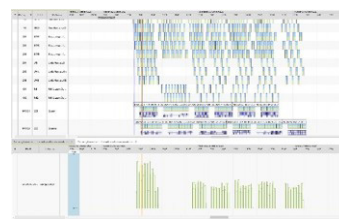
To optimize production, maintain quality standards, balance cost-effectiveness and environmental considerations, all facilities on the different routes must be synchronized in such a way that both already established KPIs and the green KPIs can be set and managed in the PSImetals Online Heat Scheduler.

INTEGRATED PLANNING AND SCHEDULING SCENARIO

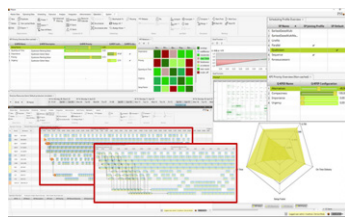
- + Close and reactive integration of planning and scheduling is inevitable
- + Production needs to be replanned/re-scheduled to react to short-term impacts
- + Customer demands and due dates for green products depend on planning/scheduling green energy prices
- + Planning and scheduling need to be synchronized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



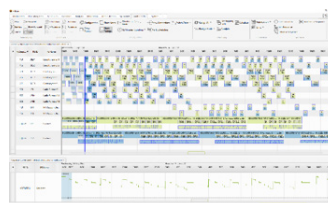
GIVEN PLANNING SOLUTIONS



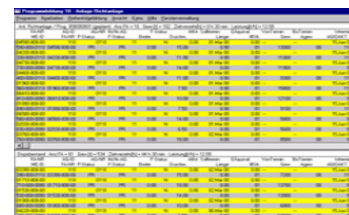
OPTIMIZED SCHEDULES



SCENARIO ANALYSIS



SCHEDULE AND FORECAST



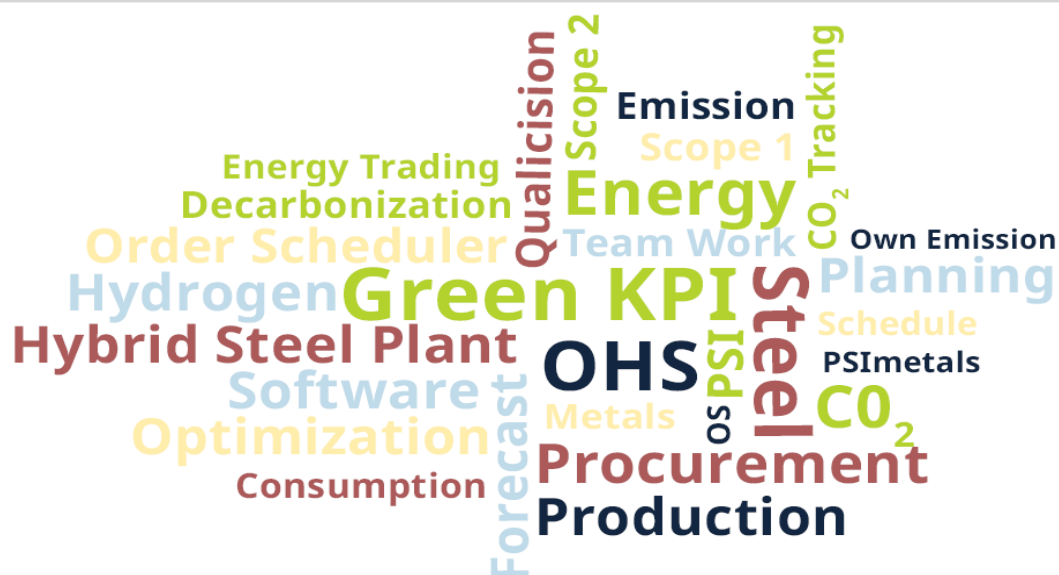
REPLANNING AND OPTIMIZING

WHAT IF YOU COULD:

- ✓ Forecast energy and resource demand
- ✓ Get a clear overview of energy availability and restrictions
- ✓ Align and optimize schedules accordingly

BENEFITS OF GREEN KPI 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



Industrial Consumers Procure Energy Based On a Mix



Energy Procurement & PSI Smart Day Trader



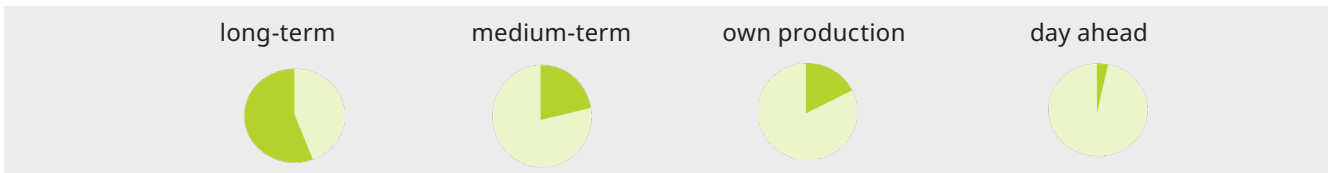
Meeting the Net Zero Target Requires 24/7 Team Work

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

Industrial Energy Procurement

1 PSI Metals 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 shortterm energy needs on the energy market.

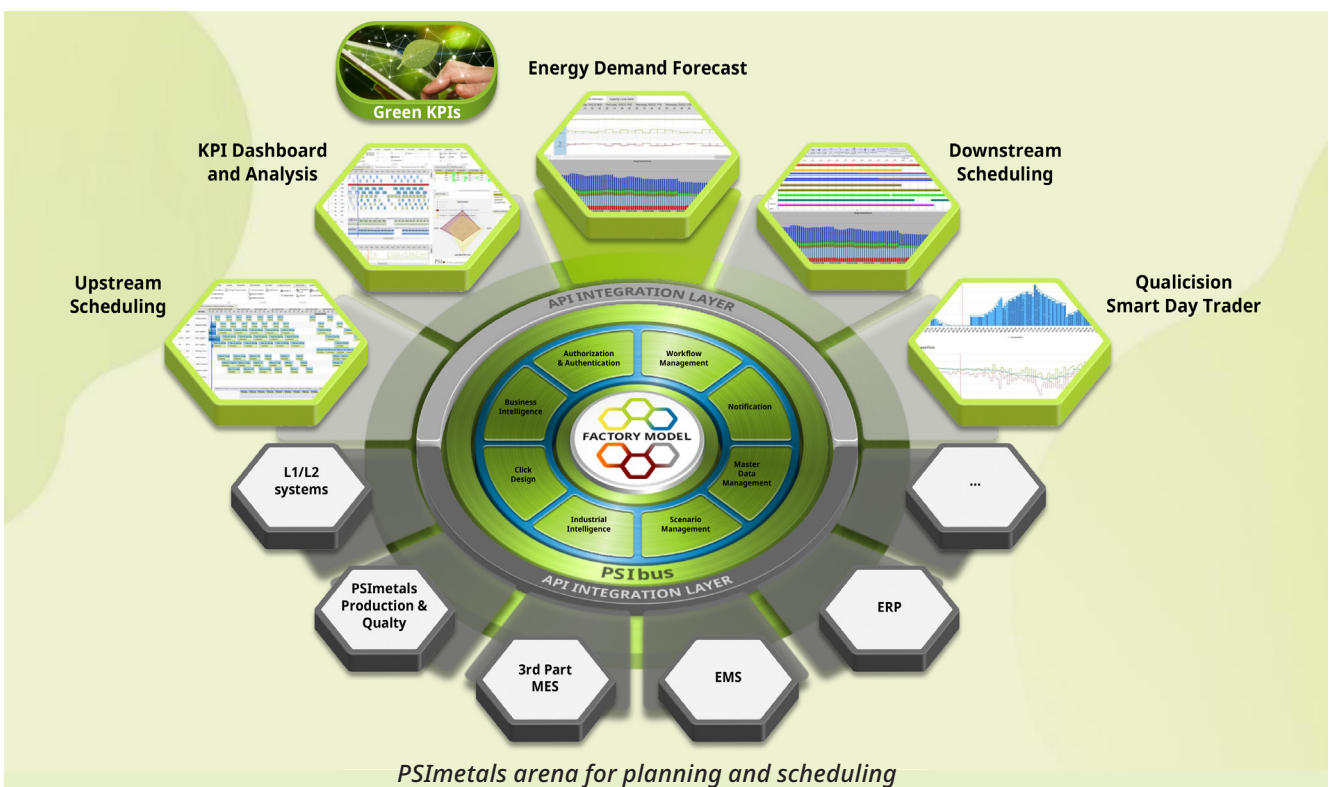


PLANNING & SCHEDULING

- + Long-term planning (S&OP)
- + Mid-term planning (Order & Material Planning)
- + Short-term planning (Line Scheduling)
- + Schedule execution (online)

ENERGY PROCUREMENT

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



Tracking & Reporting of Steel Plant's CO₂ Emissions

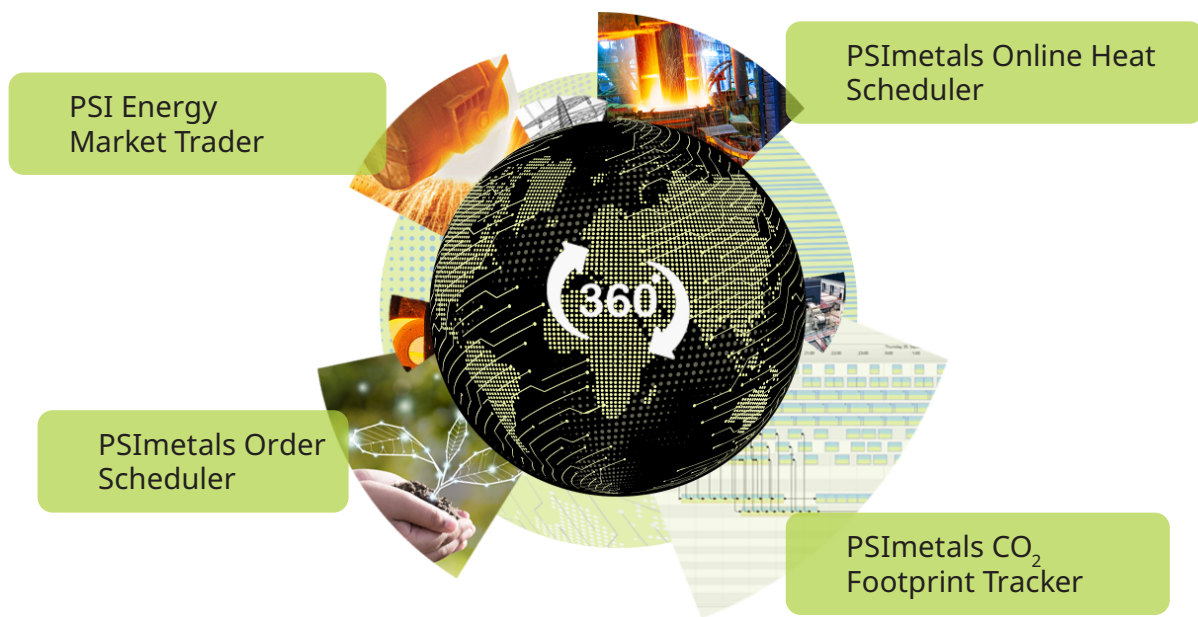
CO₂ FOOTPRINT TRACKING - DID YOU KNOW?

- ✓ Tracking leads to transparency and accountability, which are important for decarbonization?
- ✓ Today, no single piece-related emission is known or tracked for any product?
- ✓ Customers are asking for detailed CO₂ footprint of individual products?
- ✓ PSI Metals is the first to begin CO₂ footprint tracking in the steel sector?
- ✓ PSI metals PMS transparently tracks Scope 1 & 2 emissions on piece and product level?
- ✓ In the future, steel products with reduced CO₂ footprint will drive the core aspects of business?



360° View on Green Production Management

PSI Supports Digital Transformation to Green 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 often 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

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**Software Excellence
for Steel and Aluminium Producers**

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PSI Metals GmbH

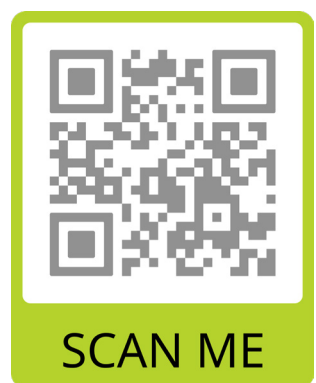
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Let's get in touch!