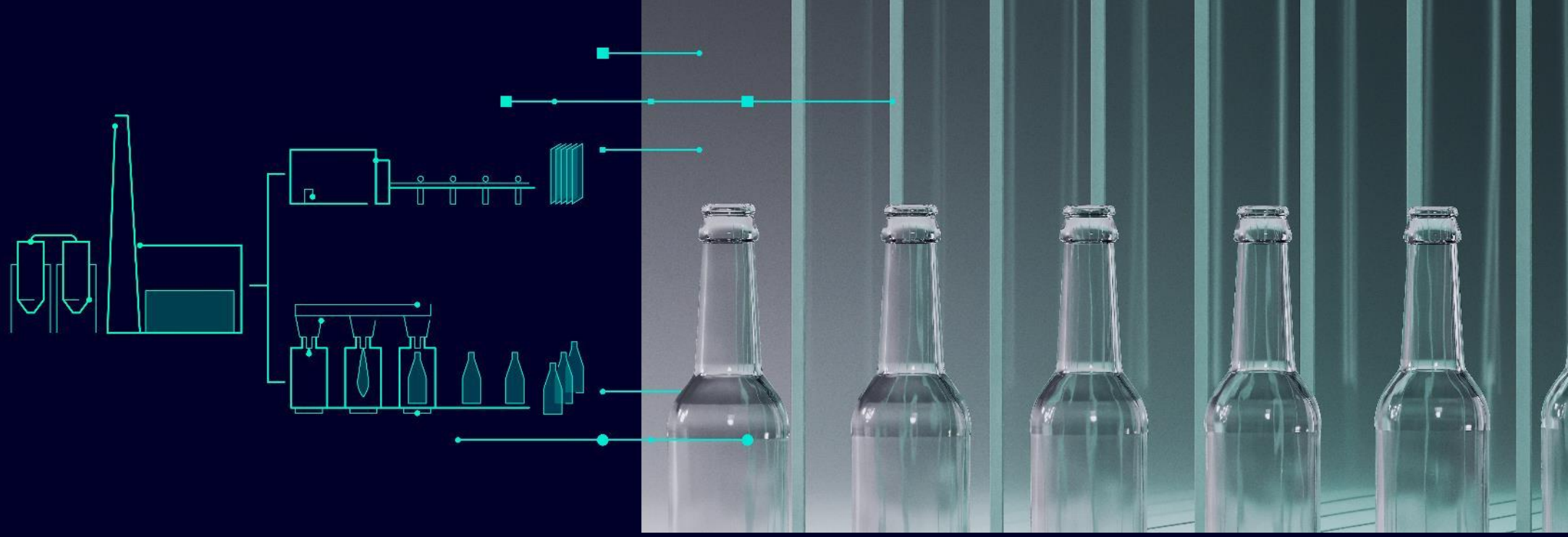


Reducing Glassmaking Emissions: a gateway to the digital future of process control technology

AI and Digitalization - the future for sustainable glassmaking (AIGMF, India)

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

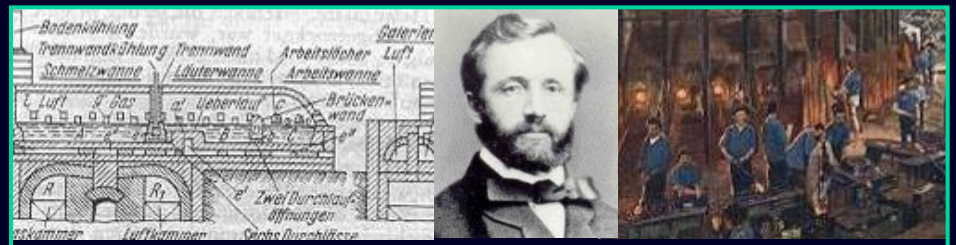
Our purpose

We create **technology** to transform the everyday, for **everyone.**

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Siemens footprint in the glass industry
We strive for customer proximity and reliable support



Friedrich Siemens invented and patented the regenerative furnace - beginning of the Industrial Revolution in the glass industry

1856

>30 years domain know-how

Establishment of a Siemens team for the glass industry with a focus on electrification and automation

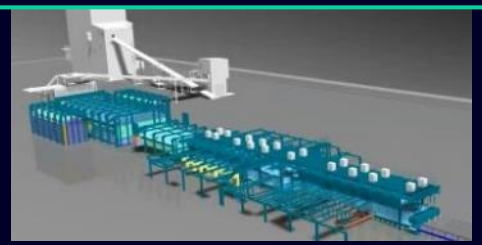
1862 – 1957

Siemens as hollow glass manufacturer with factories in Dresden, Wirges, and Berlin and a total of 7000 employees. During this period, Siemens was the leading European glass manufacturer

1987

Plant-wide automation concept was well received in the market and has since then served as an example of a comprehensive approach in the glass industry

2010



Development of digitalization use cases for the glass industry based on the principles of Industrie 4.0

2015

Environmental efficiency solutions based on our portfolio to save resources such as water, energy, reduce waste and lower CO_2 emissions

since 2020

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Various challenges in glass manufacturing

Digital enterprise

Are your plants and machines both flexible and highly available?

Security

Are all your security concepts up to date?

Energy transformation

How is your cost efficiency and your resource efficiency?

Sustainability

How close are you to achieving your sustainability goals?

» Digitalization

Looking at our giant monitor wall, you'll be amazed at how your glass production can be virtualized and improved in real terms across the entire value chain and throughout the lifecycle.

» Holistic Automation

We'll be happy to show you plant-wide, integrated automation solutions as well as the benefits of our comprehensive orchestration of all plant sections.

» Sustainability

In consultation with our colleagues, you'll learn how you can use smart software solutions to improve your energy efficiency while also reducing emissions.

» Convergence

See firsthand how we connect your worlds from the sensor to the cloud. Our many years of experience in IT/OT convergence can substantially boost your efficiency.

» Security

Protect what's important to you with our comprehensive approach. Let's talk about how we can also make your company secure on every level.

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

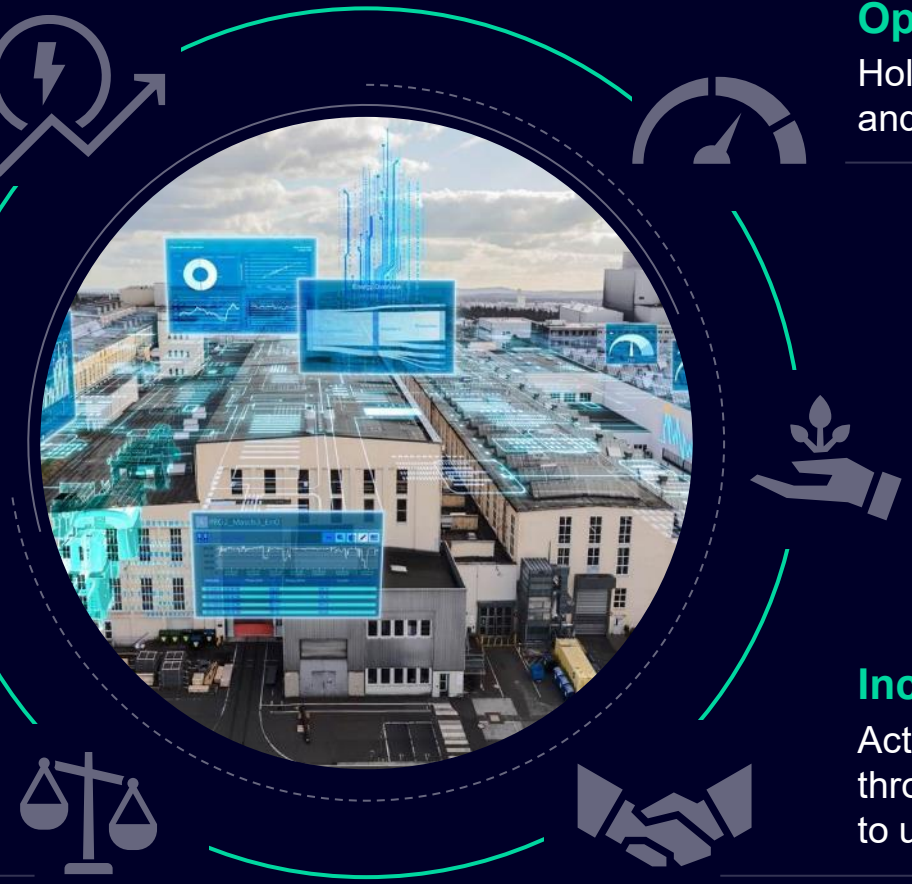
What is the market demanding?
Operational challenges for Glass Industry

Increase energy efficiency

Energy data transparency
Production KPI indication and analysis

Optimum use of renewable energy

Holistic concept for generation, storage and utilization/sourcing & supply



Reduce energy cost

- Energy peak management
- Optimize energy procurement
- Optimum use of waste heat/energy

Reduce CO_2 footprint & fulfill sustainability targets

- Emission monitoring and control
- CO_2 recycling

Compliance and legal regulations

ISO 50001, legal requirements, tax refunds, carbon footprint certificates

Increase employee awareness

Active consideration of energy costs through the value chain, from plant floor to utility facilities

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

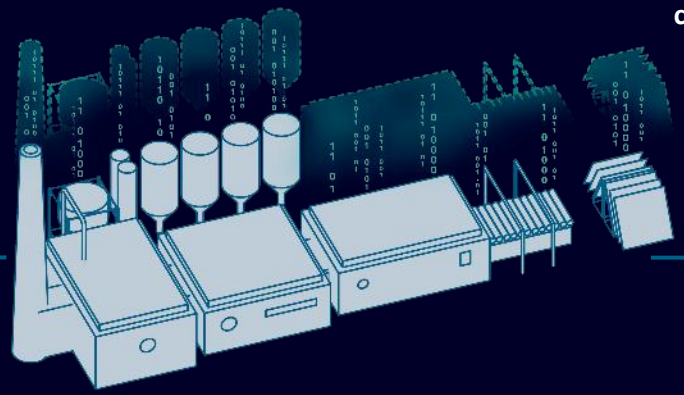
A clear view into the futures
How can Siemens assist you

Optimize production through
Digitalization

Integrate a holistic **digital twin**
to achieve closed-loop optimization

Enhance **cyber security** and drive
the convergence of OT and IT with the help of
cloud and edge computing

Innovation in products, production
and machines



An individual and customer-specific digitalization
roadmap with **digitalization consultant**

Flexibility with plant-wide
automation for individual production
needs and scale up

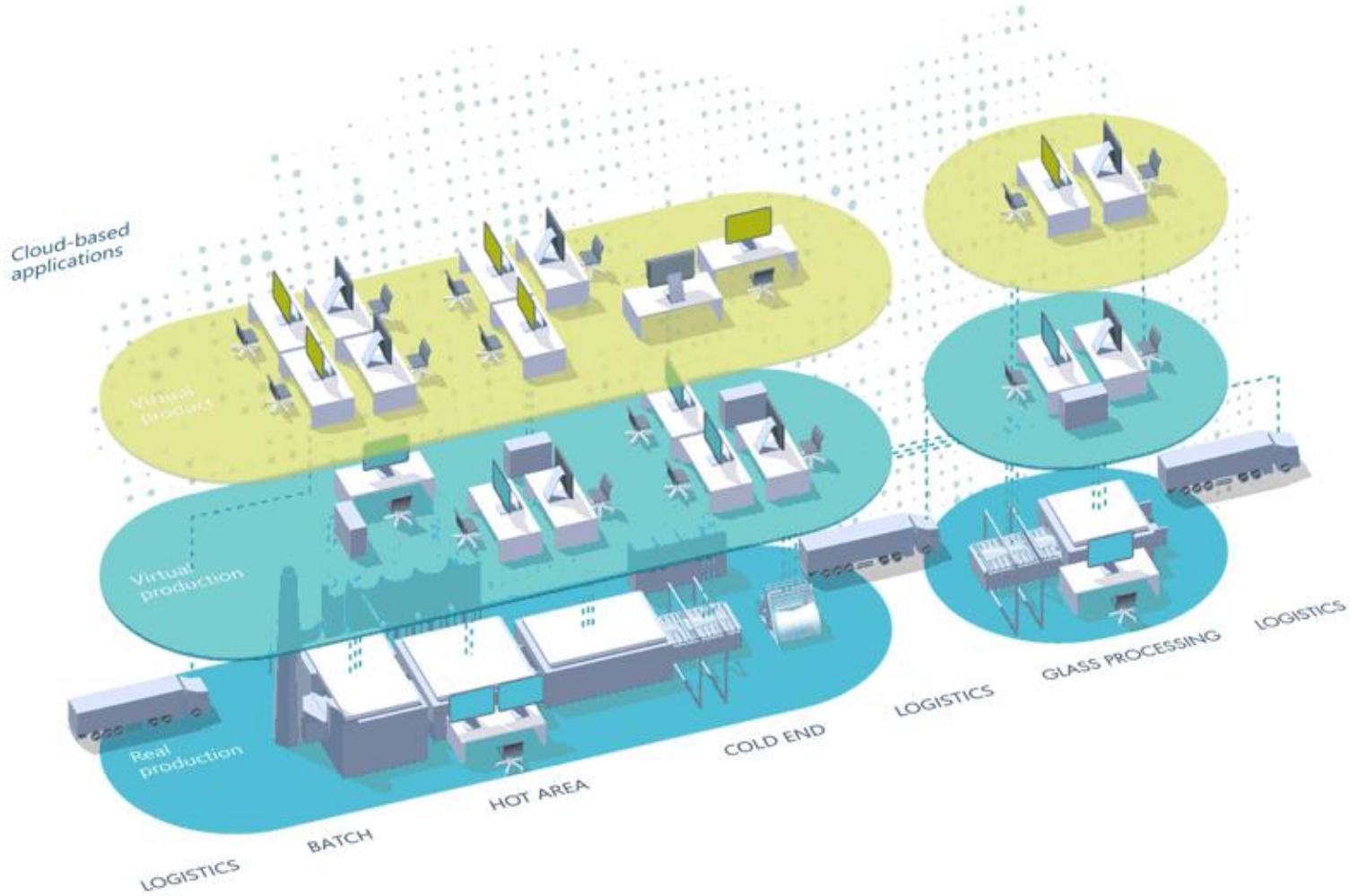
Various application and use-cases for
Energy Efficiency and
Decarbonization

Make best use of data and AI-
supported analytics improving
maintenance and operating
autonomous plants

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

End-to-end digitalization: Automation, software and services through the value chain for the digital enterprise in glass industry



Virtual Product

Virtual Production

Real Production

SIEMENS

Innovative use-cases and concepts along the entire supply chain for the Glass industry

Siemens Xcelerator

Value add

Digitalization

Digitalization as enabler to optimize production

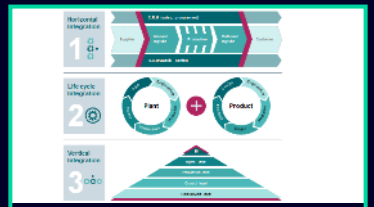
Ecosystem

Together with our partners we support our customers' efforts becoming future-proof

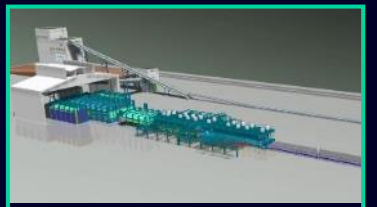
Flexibility, Efficiency, Quality

Concepts and technology to achieve the next level of productivity

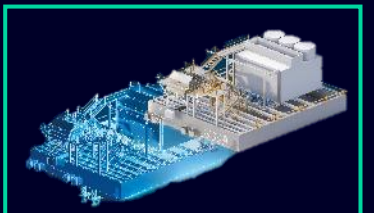
Use-cases and concepts in focus areas



Digitalization consulting



Production simulation



Digital twin for machines

IT/OT convergence

Operator Training, digital worker, Lifecycle Services

Security

Plant-wide automation

Engineering standards
Advances Process Control

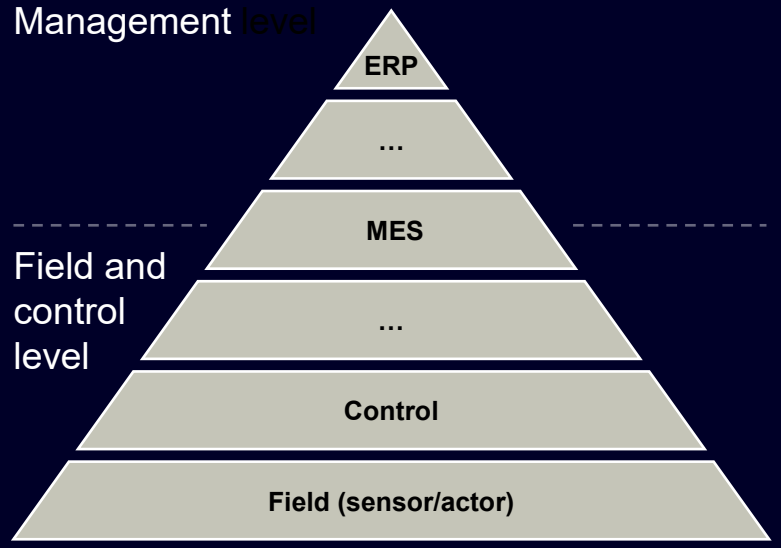
Energy Efficiency and Decarbonization

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

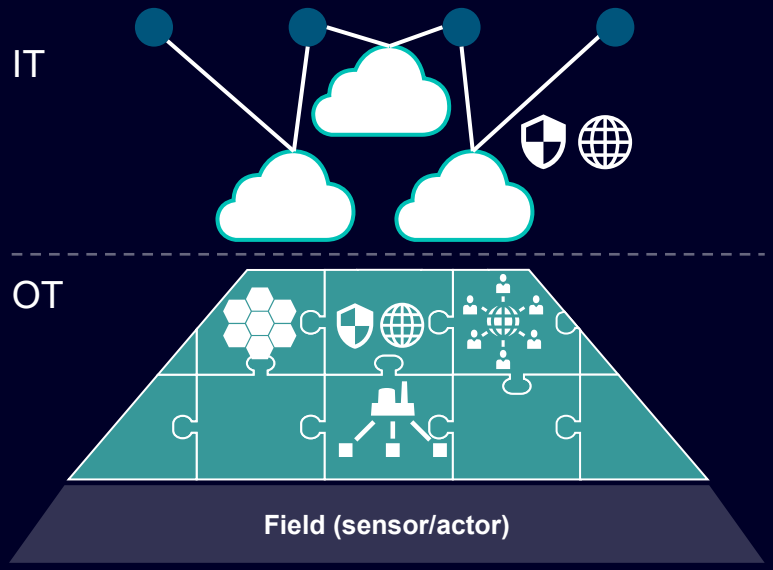
SIEMENS

Software-defined Automation is the way the industry will evolve from classic automation pyramid to a user-oriented, flexible architecture

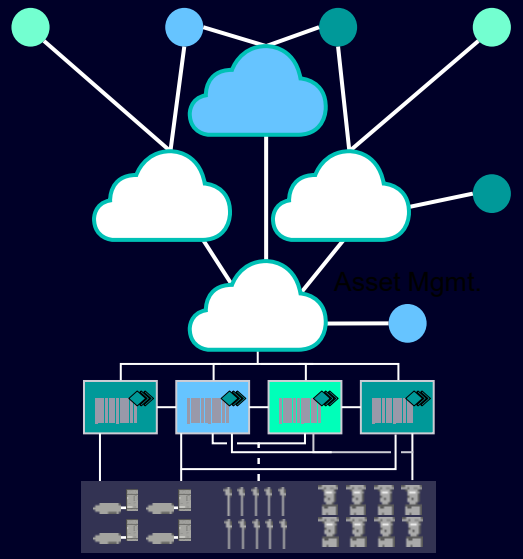
Yesterday



Today



Tomorrow *exemplary*



IT – OT convergence
with SIMATIC PCS neo

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

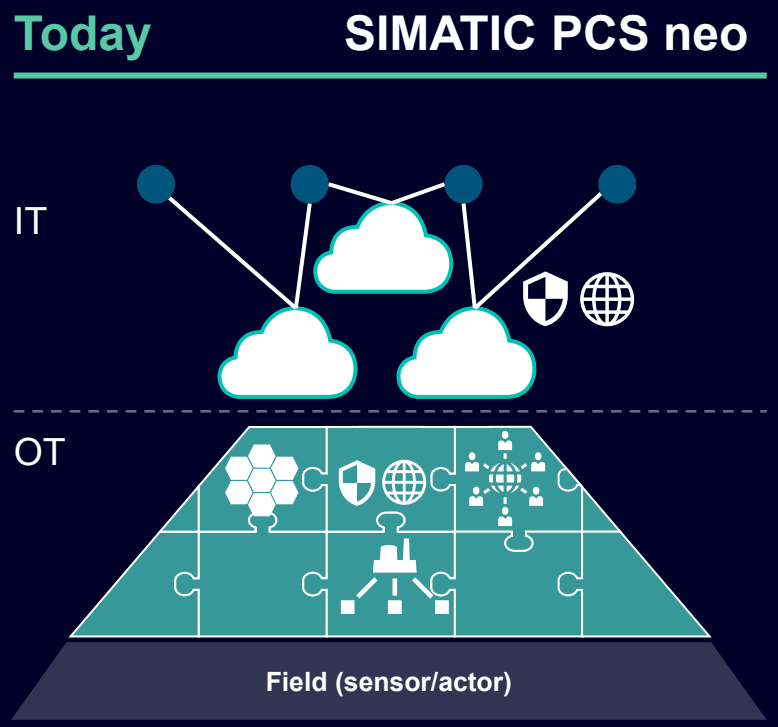
Software-defined Automation with SIMATIC PCS neo paves the way from classic automation pyramid to a user-oriented, flexible architecture

Built-in security
Security by design and defense in depth based on IEC 62443 and IT encryption

Object-oriented Data Management
Always up-to-date & consistent information

Flexibility and Openness with MTP*
Modularization for flexible plant design in SIMATIC PCS neo

* **M**odule **T**ype **P**ackage (**MTP**)



Scalability and Deployment
Flexible deployment, SaaS, efficient engineering and operation from smallest applications to world-scale plants

Collaboration
Multi-user engineering and operation for global collaboration on a highly efficient level just within a browser – anywhere, anytime and device independent

SIEMENS

Glass Futures
A groundbreaking collaboration with Siemens

CUSTOMER PROFILE

Glass Futures is a global not-for-profit research and technology organization dedicated to advancing the glass industry. To lead the glass industry towards a sustainable future by bridging the gap between research and commercial viability. Glass Futures focuses on developing innovative technologies and processes that reduce carbon emissions and enhance the overall sustainability of glass production.

CHALLENGES

- Utilize state-of-the art technologies
- Share new technologies, tools, and training opportunities
- Expertise in digitalization, automation, drives and security

SOLUTION

- Founding member and technology partner:
  - Consulting expertise and network support
  - Technologies for digitalization, automation, drives, communication, security and power distribution
- Technological contributions:
  - Plant-wide automation for integrated sub-plants and systems
  - SIMATIC PCS neo process control system
  - SCALANCE network components
  - SIWAREX and SITRANS weighing and level devices
  - SINAMICS variable frequency drives
  - Continuous Emission Monitoring system)

BENEFITS

- Sustainability: Supports global sustainability goals and carbon neutrality for glass manufactures, suppliers and end user
- Efficiency: Increased energy efficiency and optimized processes based on integrated systems and data for planning and services
- Collaboration: Open platform for industry-wide collaboration and innovation

“The collaboration of Siemens has allowed us to see a route through doing things differently and actually taking the leap.”

Aston Fuller,
General Manager, Glass Futures

LINK for reference

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

How to adopt industrial AI solutions in the glass industry improving the Energy efficiency

Process Optimization
(real and digital worlds)
to empower glass manufacturer
to improve their operations
and drive innovation

A digital and IoT enabled
portfolio with offerings from
Siemens and partners

Our **AI framework**
provides hardware,
software, and services
enabling to create, operate
and scale AI solutions

AI Energy Optimizer

Advance Process Control

Industrial Edge

Senseye

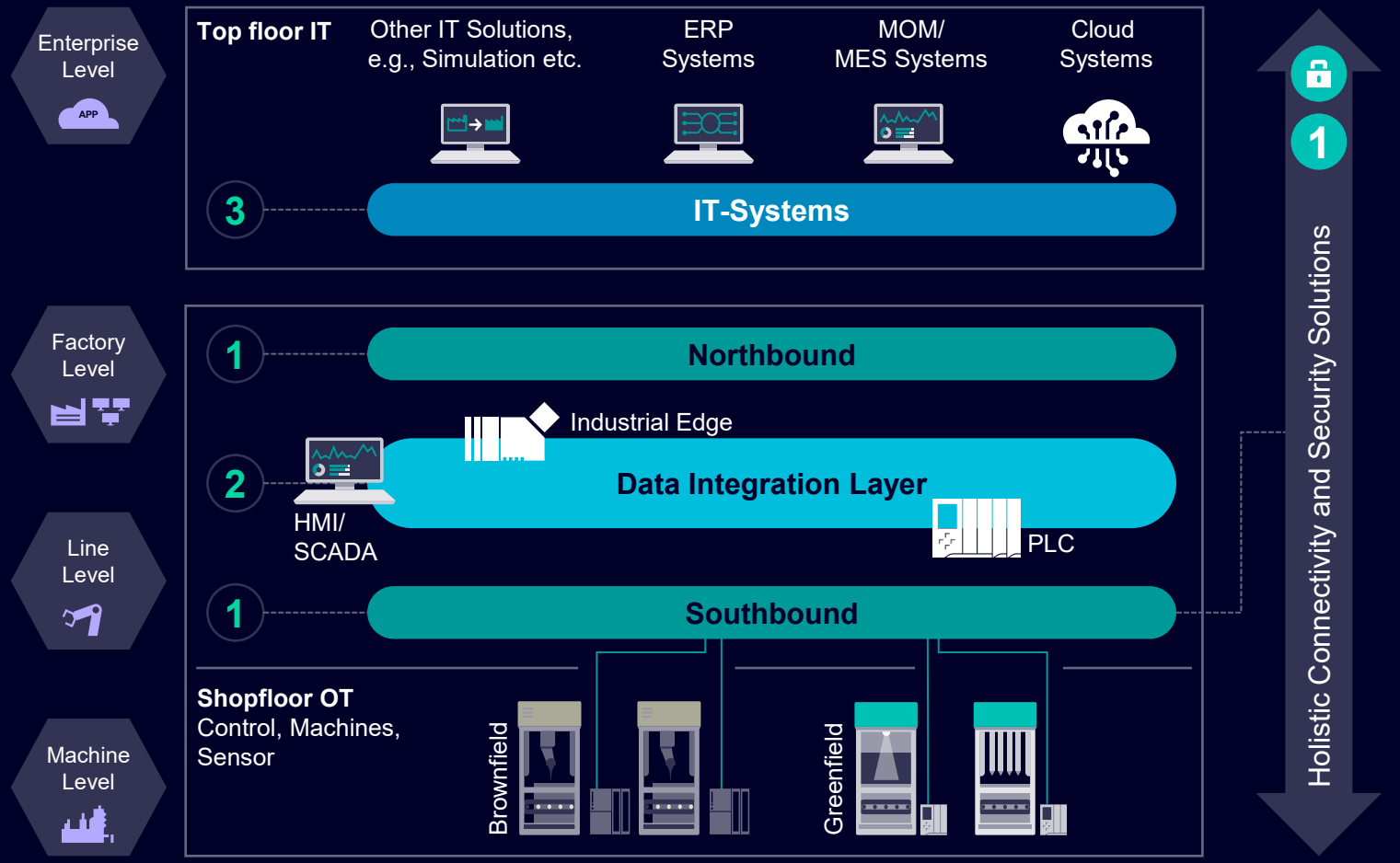
AI framework

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Siemens delivers holistic solutions integrating relevant data to scalable use cases

Back to solution overview



Exemplary Architecture with connectivity options and technical possibilities

Think Big, start smart

Integrated Solutions,
e.g., Order Execution, Tracking and Tracing

1. Integrated of existing equipment for a uniform data model and protect the factory from cyberattacks
   - Industrial edge
2. Manage standardized data to enable scalable digital workflows to increase productivity
   - Industrial edge
   - Mendix low-code platform
   - Scada System, DCS / PLC
3. Increase transparency for better manage processes and optimize the production
   - Opcenter Advanced Process Scheduling
   - Mendix low-code platform
   - Flow simulation

Part of Industrial Operations X

SIEMENS

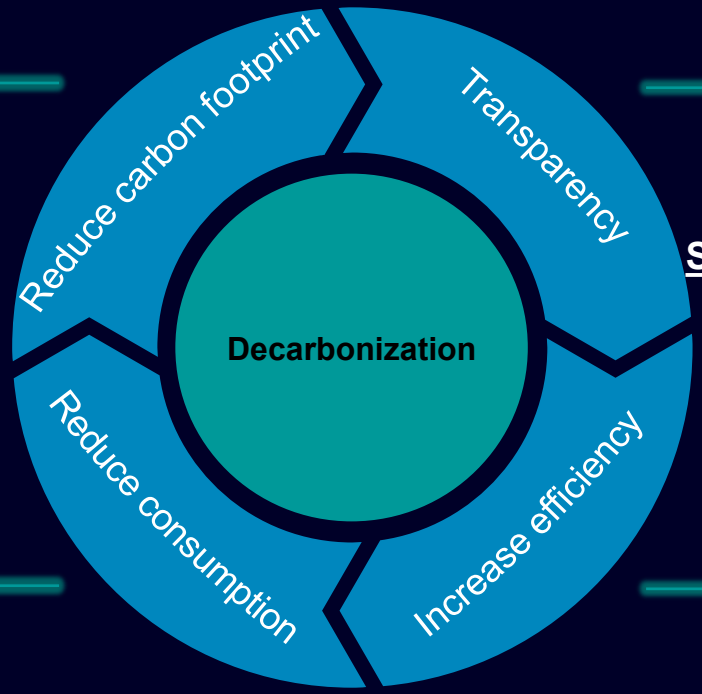
Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

Siemens decarbonization solution overview

Emission Monitoring System

Carbon Capture and Utilization System

Cullet Recycling



SIMATIC Energy Manager

SiGREEN Product Cabon Footprint managent tool

Green Consulting

Decarbonization Roadmap

AI based process optimizer SiePA

Smart Power Management

Logistic optimization with digital rate card

Building optimization with Desigo

AI based energy optimizer system

Furnace simulation and Model predictive control

Increase OEE with Industrial Edge

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Our industrial Energy- and Carbon Emission Management portfolio

SiGREEN

Product Carbon Footprint

SIMATIC Energy Management

Plant and company-wide energy management

SIMATIC PCS 7, PCS Neo

Efficiency in production

- Process monitoring and control
- Automatically generated instead of programmed
- Real-time measurement directly in the field

Integrated energy measurements

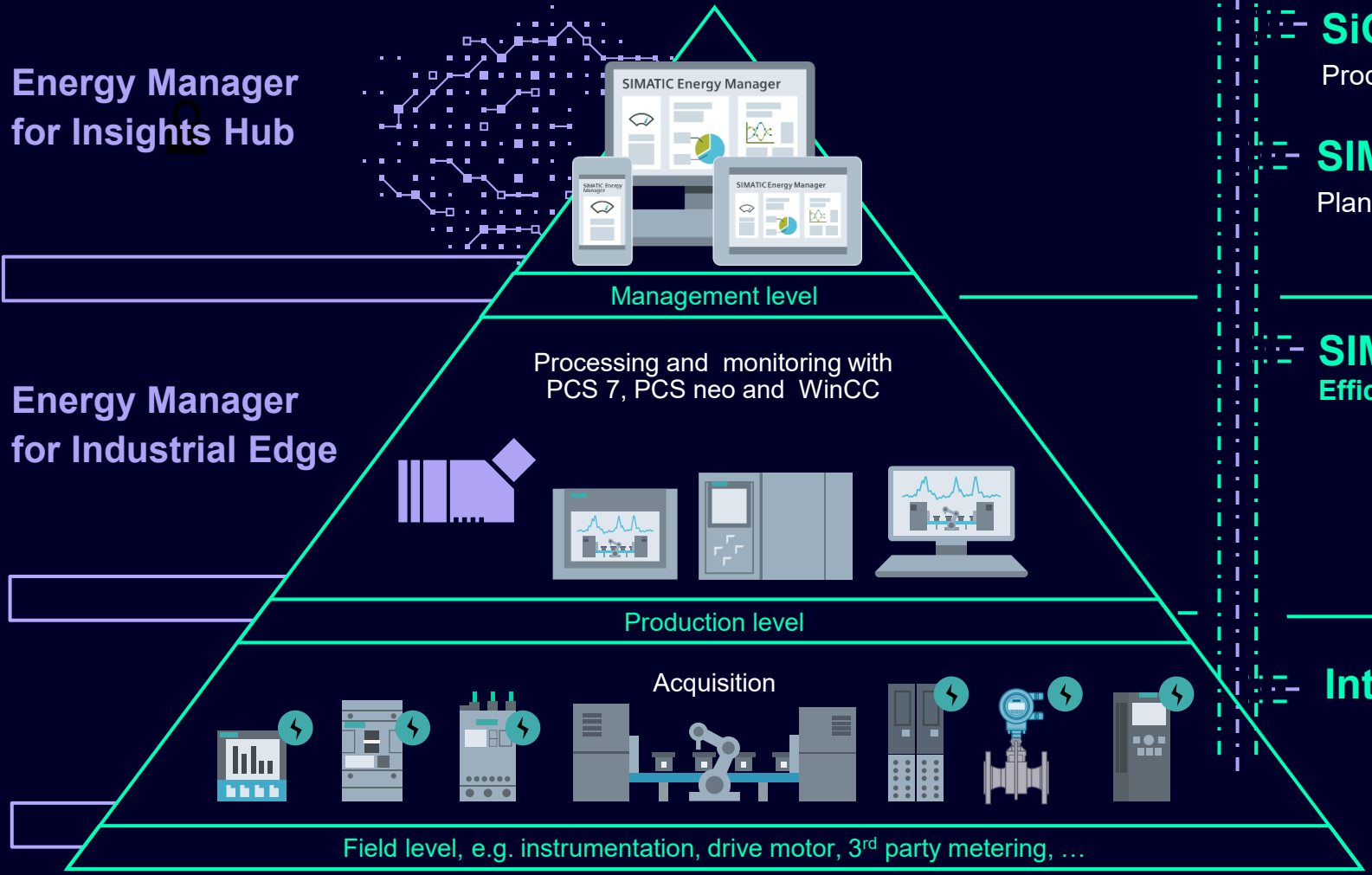
Directly in the field: For example with SITRANS metering devices

SIMATIC Energy Meter (ET 200SP)

SENTRON PACs, …

Energy Manager for Insights Hub

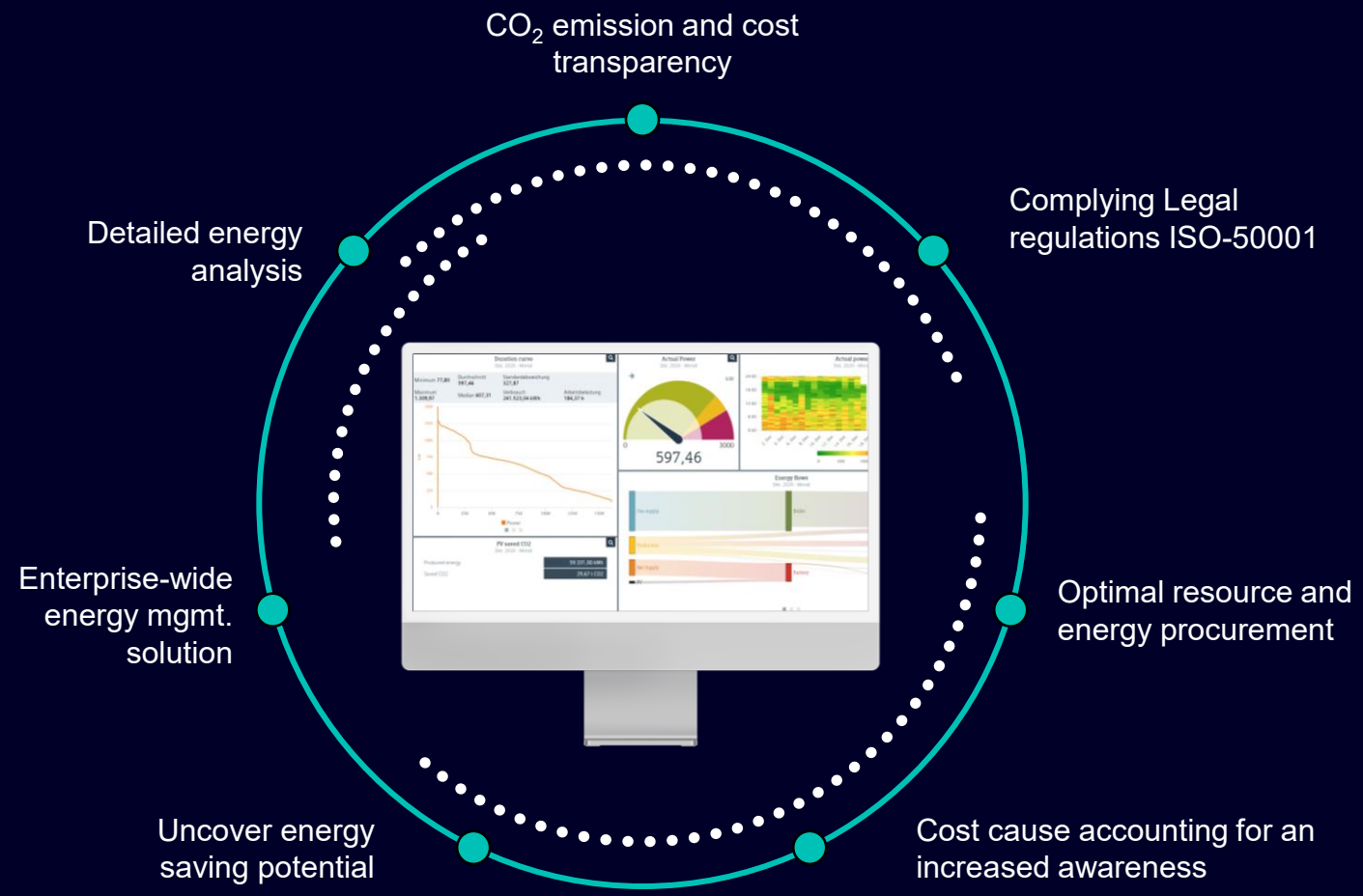
Energy Manager for Industrial Edge



Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Obtain the greatest value from transparency with our Energy Manager



Further information: Energy Manager (www.siemens.com/energymanager)

Reference link

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

Legal regu-lations

Carbon Footprint

Optimized use of resources

Situation

- Insufficient data and analytics
- Inability to conduct detailed energy analysis

Requirements

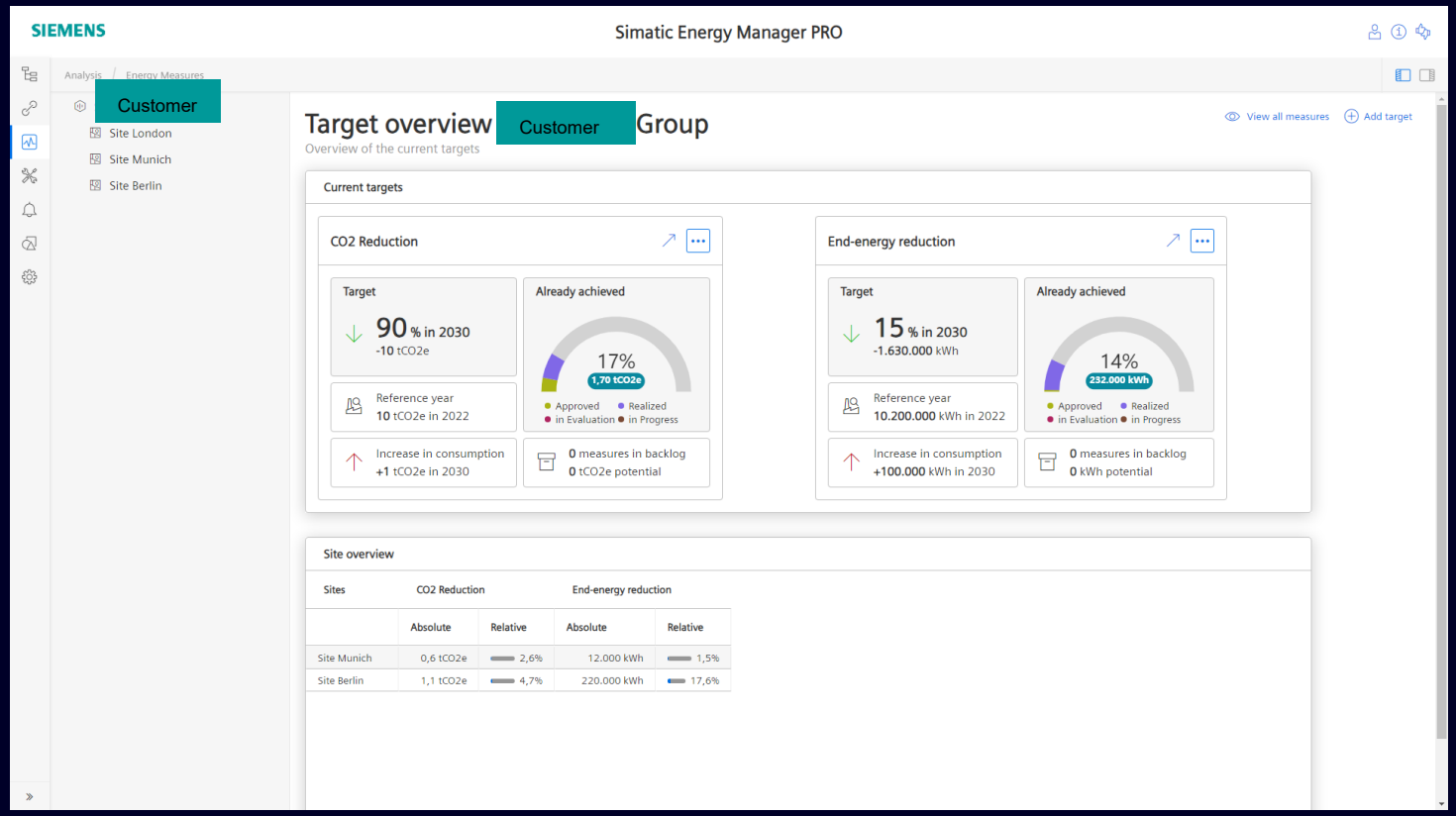
- Enterprise-wide energy management solution
- Complying legal regulations ISO-50001

Benefits

- Providing a holistic view about the energy and resource consumption
- Comprehensive analysis functions to investigate and improve of energy efficiency
- Transparency of energy costs and CO_2 emission from different plants worldwide

SIEMENS

SIMATIC Energy Manager
Target Cockpit



Target achievement

- The Target Cockpit provides an overview about defined targets and the target achievement with detailed information
- User can see the base year, the consumption and the expected increase of energy consumption without considering measures
- User get an overview about the target achievement of each individual Site
- The user can define further site-specific targets.

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Reducing carbon emissions and energy use in glass manufacturing

↓ 50% Potential reduction in municipal water use

↓ 20% Potential reduction in natural gas use

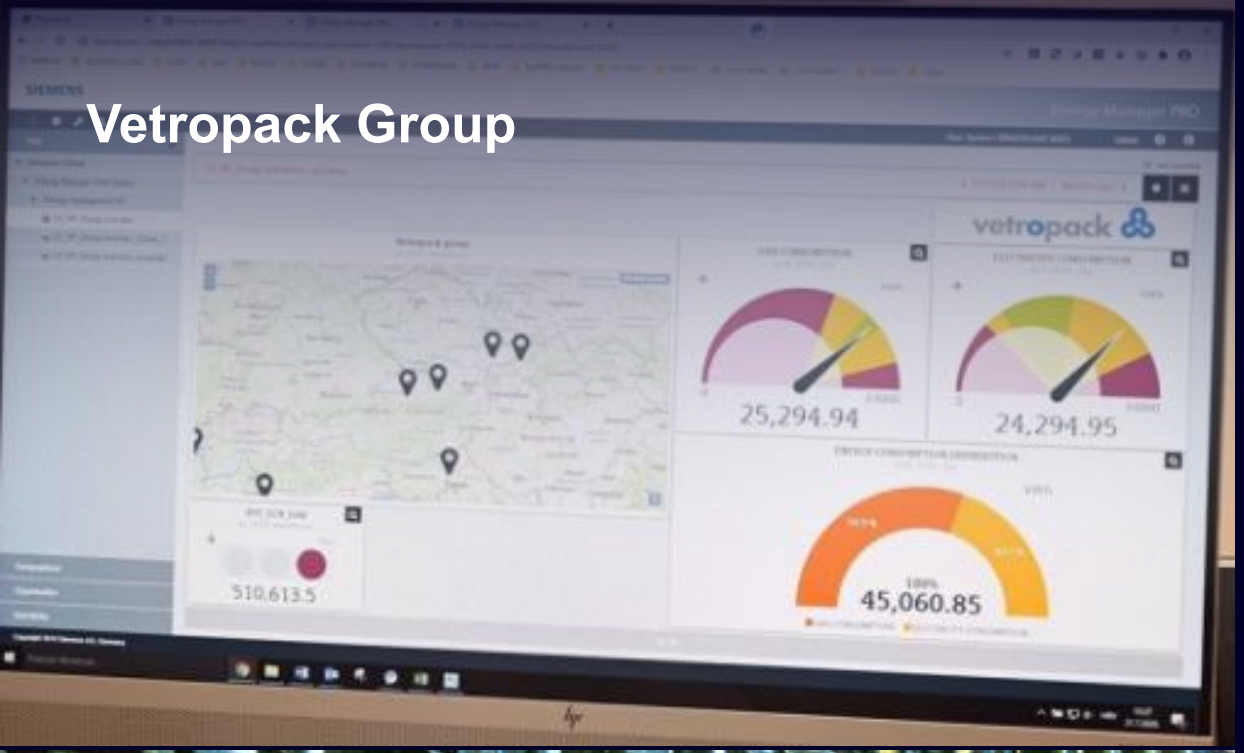
STOELZE GLASS GROUP

Partner with Siemens to implement an energy management system providing full transparency of energy use, define CO2 KPIs and exchange emission data along the value chain to obtain a product's true carbon footprint

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Vetropack Group



“What you do not measure, you can’t manage.”

Head of corporate procurement - Vetropack

vetropack

“Sustainability ensures our business success”

Customer profile

International container glass manufacturer HQ in Switzerland, with several production plants in Europe, serves food & beverage industry

Challenges

- Standardization of the energy measuring points and KPIs
- Planning and strategic procurement to invoice verification
- Define the standards for local factories, harmonize group company-wide energy efficiency activities

Solution

- Implement the EDMS Simatic Energy Manager Pro in 8 factories in Europe
- Consultancy, commissioning, training, services, customization in individual plant
- Realize energy purchasing application
- complete transparency across all relevant energy and media consumption including CO2

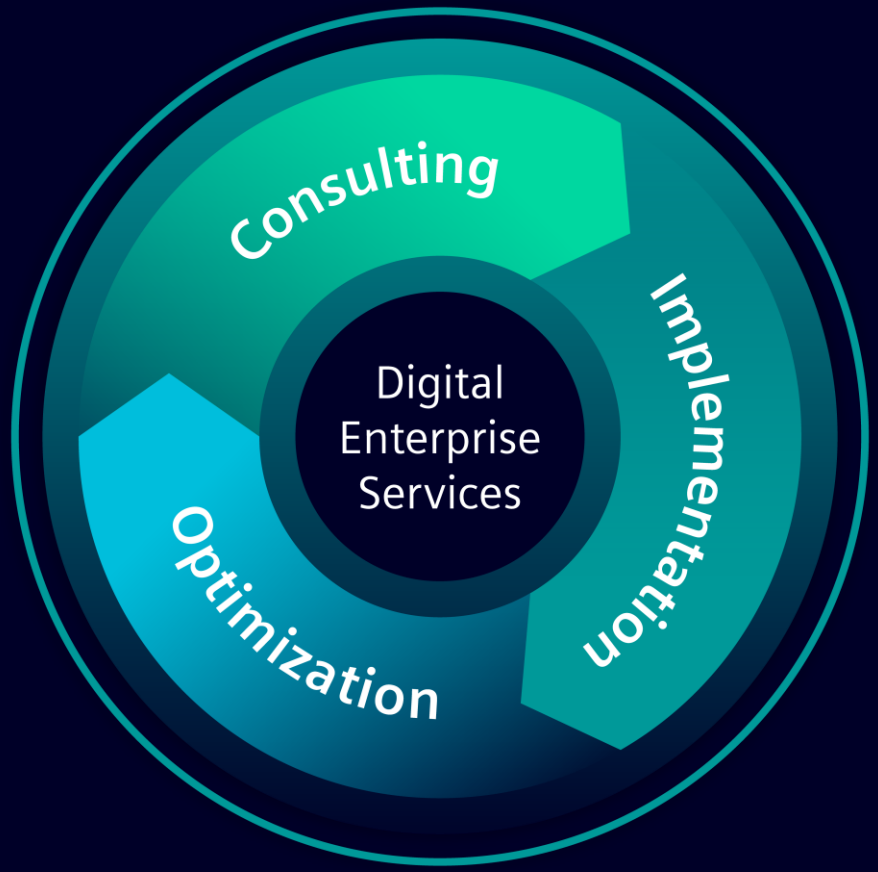
Comprehensive approach to link operating and energy data

Reference link (glass-energy-management-vetropack)

SIEMENS

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

How to start?
Our Services for industrial Energy and Carbon Management Systems



01 | Consulting

Concept-Workshop

- Definition of Energy Performance Indicators (EnPIs and KPIs e.g. CCF, PCF)
- Creation of a measurement concept
- Assessment of data collection and connectivity requirements

02 | Implementation

- Installation of required hard- and software
- Data modelling and pre-processing of input data
- Creation of dashboard and reports
- Basic and expert trainings for user and administrators

03 | After sales support and service

- Analysis of the energy performance
- Tailor-made recommendations for action and optimization potentials
- Hard- and software maintenance services (SUS)

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

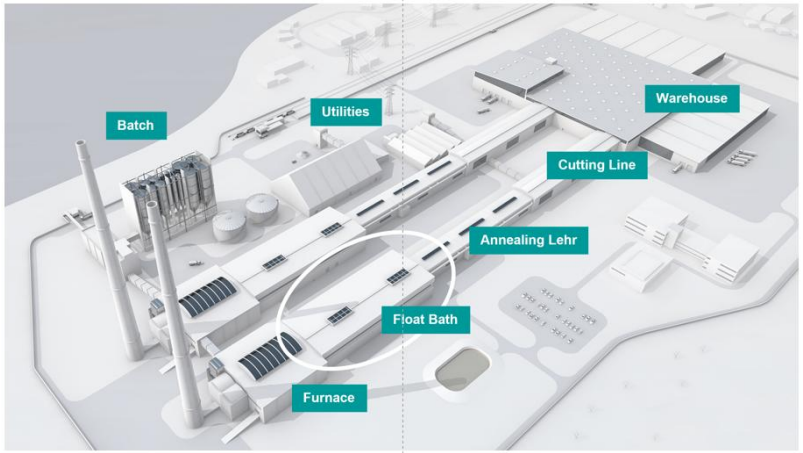
SIEMENS

AI Energy Optimizer

Energy optimization through artificial intelligence enhanced analytics

Initial situation

The complexity of industrial process applications



Challenges

- complexity of industrial process applications
- Float glass industry need tools that enhance process and production transparency to identify potential and starting points for optimizing process parameters

Value Proposition

- Machine Learning model
- collects data from Energy Pro or any other data source
- results are then visually shown
- Siemens cloud-based operating system

Enabled by Siemens offerings

Energy optimization for the glass industry

Rule-based alerts
AI Energy Optimizer reads pre-defined tags in real-time and runs the machine learning algorithm to assign anomaly scores which, if exceed certain thresholds, trigger alarms for operators.

Predication Energy
Prepare standard adapters for data collection (remove dependence on Energy Manager) and platform agnostic (on-premise, cloud-based).

Energy saving and Carbon reduction
Proper operation and the optimization of tin bath electric roof heating results in energy saving opportunities for the glass industry.

Cost saving
Provides early alarms of improper operation allowing users to take rectification actions to mitigate material and other losses in contrast to the late detection of anomalies.

Intuitive interface
Intuitive user interface enables users to use the tool without extensive training.

Open, cloud-based IoT operating system
AI Energy Optimizer is part of our Asset and Process Performance Suite for industrial applications and advanced analytics.

Advantages

- recognizes complicated consumption patterns
- maintains assets at their optimum performance levels
- identifies energy-saving opportunities
- assists energy consumption planning
- enables data transparency
- offers alarm capabilities

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

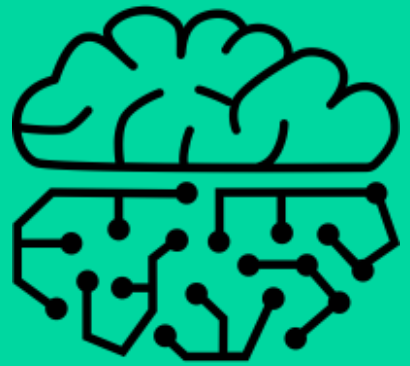
AI Energy Optimizer, Improve efficiency with power of data

Our solution uses AI/ ML to predict the ‚good' power consumption

1. Glass pull
2. Lehr speed
3. Glass width
4. Tin bath outlet temperature
5. Tin bath inlet temperature
6. Tin bath center temperature
7. Glass thickness
8. Glass quality

…

ML/ AI Model



Tin bath roof electric heating

The deviation between measured power vs. predicted power defines the opportunity of energy saving

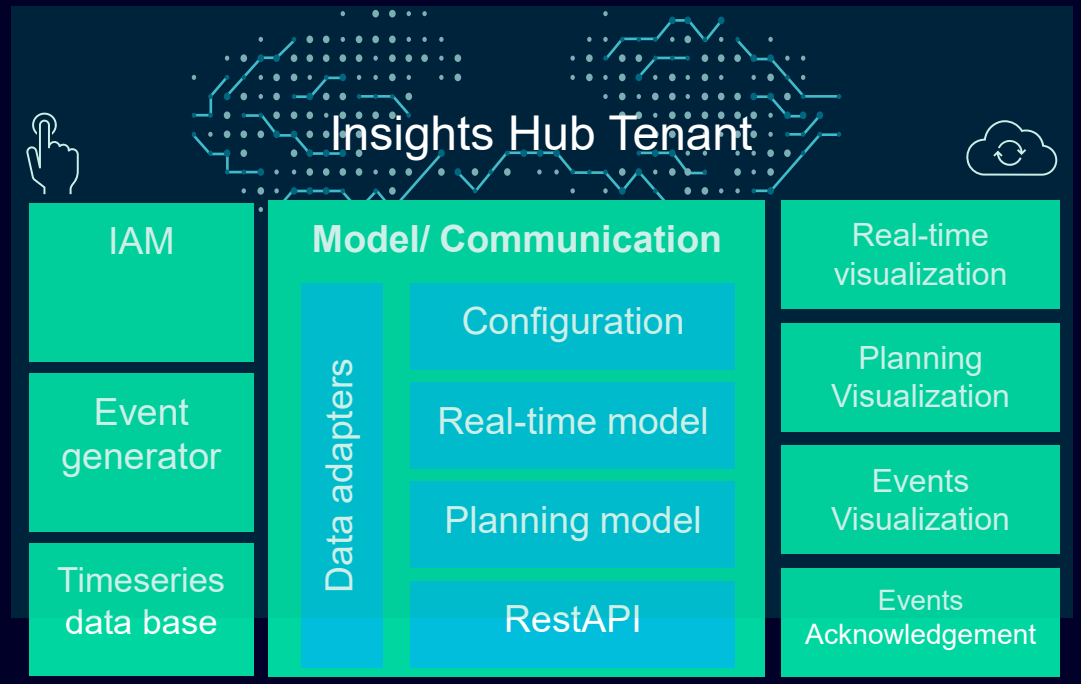
Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

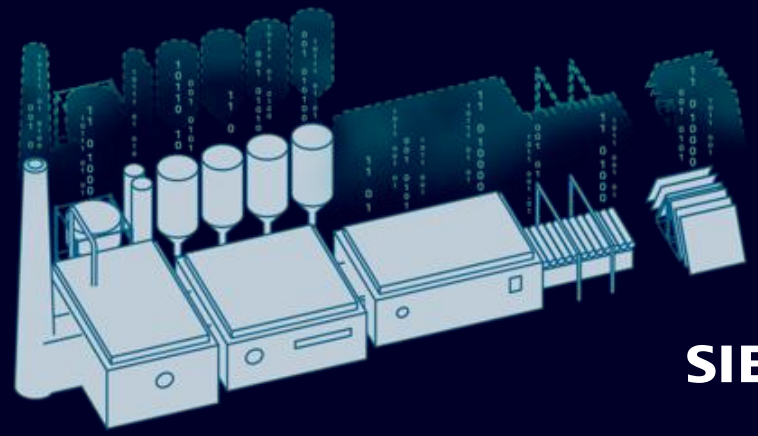
SIEMENS

AI Energy Optimizer
From Engineering to Deployment…

Back to solution overview

- ❑ Data collection, cleansing, labeling
- ❑ AI model inputs (tags) identification
- ❑ AI model training, validation & testing
- ❑ Setting the inputs ids' (tags) needed for real time operation
- ❑ Setting graphs alias names
- ❑ Deployment

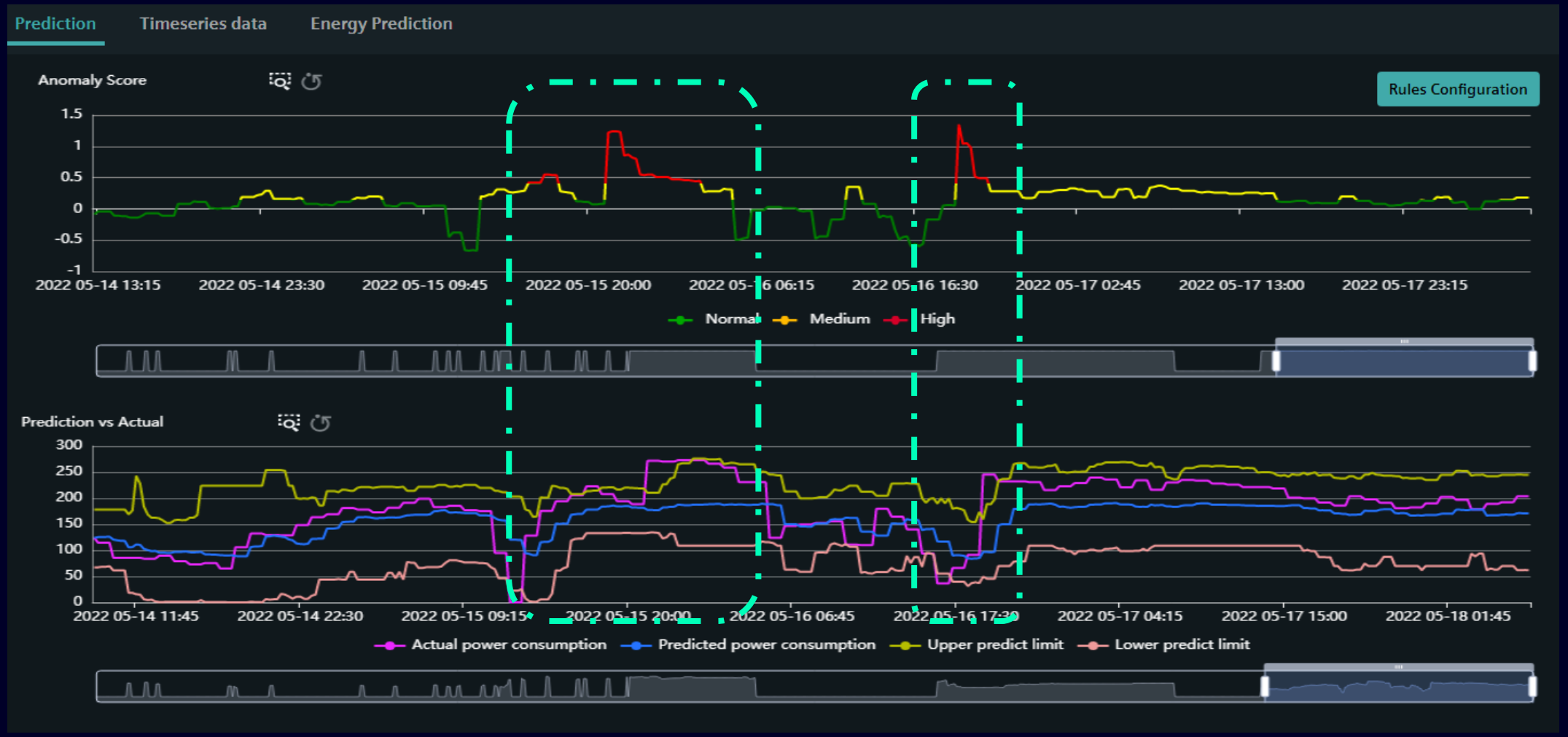




Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

AI Energy Optimizer:
Energy saving opportunities for the customer

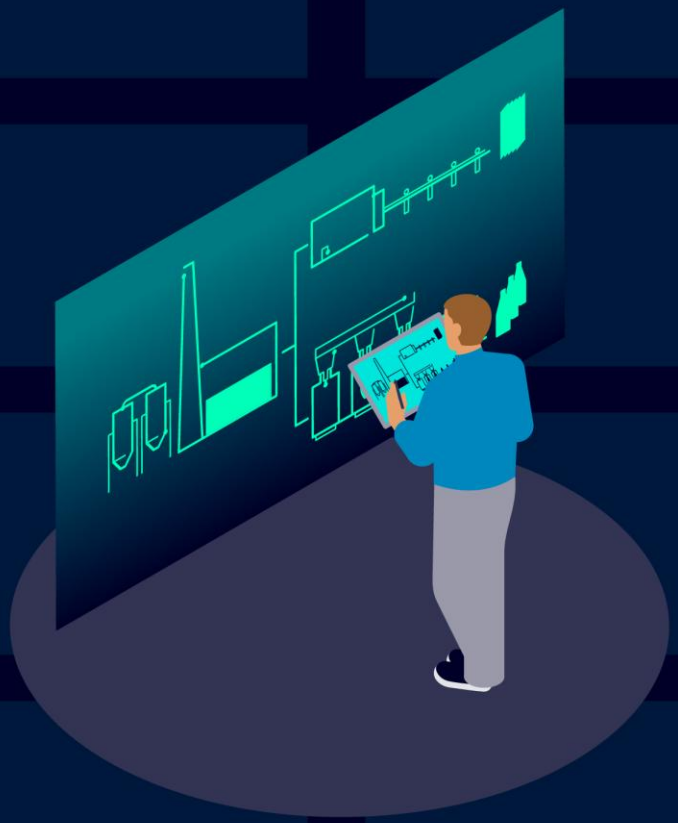


Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Summary:

- Green and clean energy use
- Increase energy efficiency
- Process optimization
- Equipment and facility efficiency
- End-to-end digital transformation
- Waste heat recovery
- Carbon capture, utilization, and storage (CCUS)
- Cullet recycling



Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Contact

Published by Siemens AG

Magdi El-Awdan

Senior Manager

VM Glass & Solar

Siemensallee 84
76187 Karlsruhe
Germany

E-mail: magdi.el-awdan@siemens.com

Web: siemens.com/glass

Unrestricted © Siemens 2025 | Vertical Management Glass & Solar

SIEMENS

Disclaimer

© Siemens 2025

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

All product designations may be trademarks or other rights of Siemens AG, its affiliated companies or other companies whose use by third parties for their own purposes could violate the rights of the respective owner.