Making sustainable fuels and feedstocks production scalable and efficient

Mid-level presentation

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Important notes to this slide deck

Please note, these slides are made in a “**Pick & Choose” Yourself Style**
Slides with this symbol need adjustments to the purpose of the customer meeting

It will be **continuously supplemented and updated**

Link to:

In this slide deck, this **symbol** indicates that there is **further information on the respective topic**. (e.g. Highspot, websites, ...)

Feel free to click on the symbol and follow the link to find more information.

We support you any time to prepare a project specific presentation for your customer. Please consider around two weeks time to get it done in a mutual discussion.

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The importance of sustainable fuels and feedstock production is increasing rapidly…

Decarbonization & Climate Goals

Global pressure to reduce emissions, government regulations and subsidies are key drivers for green sustainable fuels and feedstock investment.

CO_2 as sustainable feedstock

In industrial sectors such as chemicals, cement, refining, CO_2 in combination with green H_2 can be used as fuels and feedstocks to reduce carbon emissions in production.

CO_2, H_2 and Biomass as Basis for Fuels & Feedstocks

Captured CO_2 in combination with green H_2 or Biomass make it an attractive basis for sustainable fuels and industry feedstocks

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…still there are major challenges OEMs, EPCs and Operators face in sustainable fuels and feedstock technologies

Scalability & Technological Integration

- Technologies are still in development
- Scaling/Numbering up to an industrial-level production & integrating into different operational environments poses challenges in engineering, construction and operation
- Need for optimized, standardized and repeatable plant design

Decentralization & various stakeholders involved

- Distributed facilities
- Decentralized data and limited data access
- High complexity due to various disciplines & stakeholders involved
- Need for high interoperability, secure remote operations and efficient asset management

Volatility of energy prices

- Financial markets, governmental regulations weather and seasonality impact energy supply & demand
- Need for optimized and intelligent price forecasts taking into account various influencing factors

Missing qualifications & Skill shortage

- Specialized knowledge and expertise in various engineering disciplines required
- Limited manpower
- Need for efficient training
- Need for qualified maintenance workers at different locations

⚠ Cost and Profitability of sustainable fuels and feedstock plants

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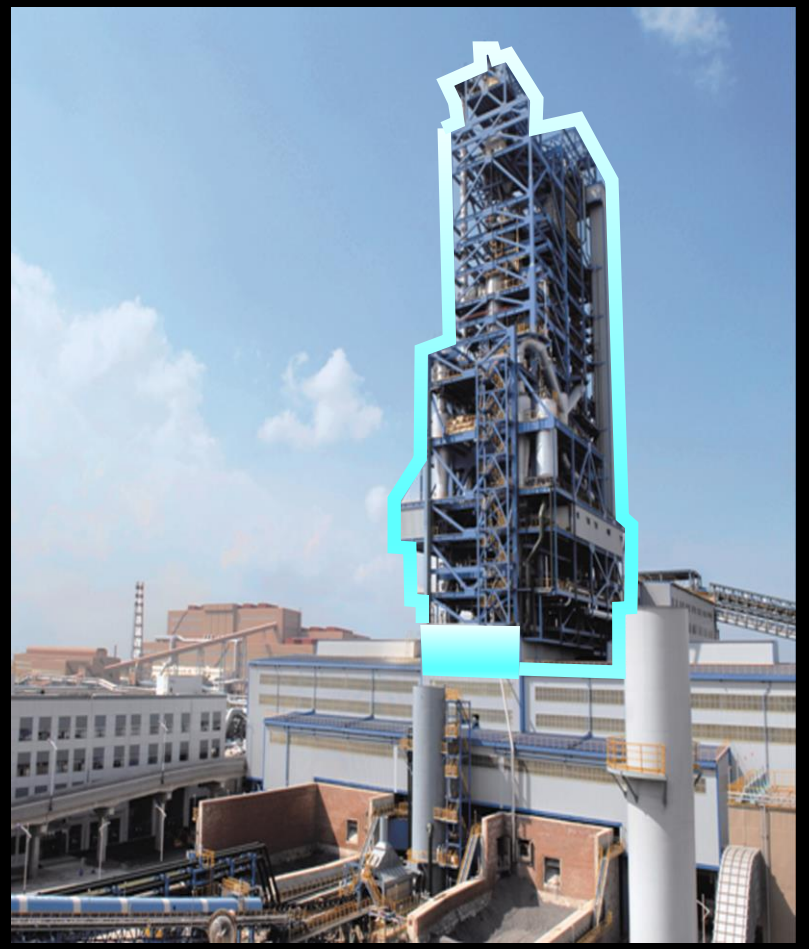
Driven by these mega trends, the demand of sustainable fuels and feedstocks is increasing rapidly.



However,

How do you manage to innovate, design and operate scalable and sustainably efficient plants in this new field with complex technologies, a lack of skilled workers and skills, and high-cost pressure?

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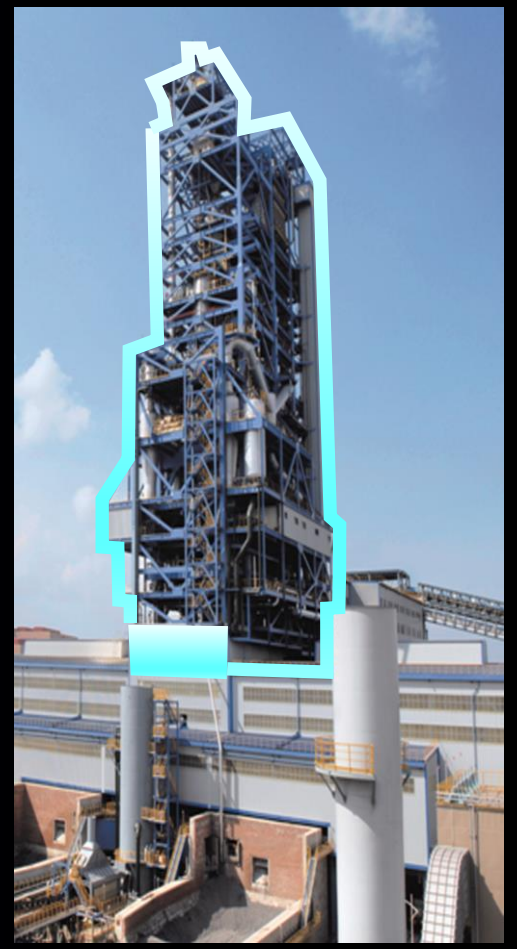
Imagine the following scenario

You have a new technology for sustainable fuels and feedstocks

The new technology must be developed to a commercial process incl. balance of plant

You need to optimize the technology to the requirements of the operational environment

The process must be efficient & scalable despite the complexity & high cost pressure



You have limited personnel knowledge in remote operational ecosystems for maintenance and innovation

You have to be faster than other technology developers

The competitors is announcing the implementation of a new blueprint for a comparable technology

Can you catch up so fast?

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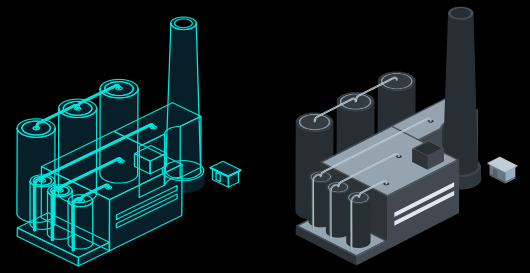
Siemens’ value proposition to address the challenges in the sustainable fuels and feedstock technologies

Challenges	Siemens Value Proposition
Scalability & Technological Integration Need for standardized plant design to scale-/ number up and reduce costs despite the novelty of the technologies.	**Repeatable, scalable and modular solutions for improved plant efficiency powered by the digital twin.**
Decentralization of operation in different ecosystem Need for secure centrally managed operations, high interoperability and efficient asset management.	**Centrally managed and efficient operation through data synchronization and digital asset monitoring enabled by the digital twin and cloud-based solutions.**
Volatility of energy prices Need for reliable price forecasts and efficient energy management despite the volatile market.	**Optimized energy management for production at lowest costs using scenario building for power plant resources.**
Missing qualifications & Skill shortage in remote operational areas • Need for for efficient training and qualified maintenance workers at different locations.	**Virtual operator training and empowerment of the staff in the field through digital workflows with the Digital Worker concept.**



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What our value propositions comprise for you in detail

Repeatable, scalable and modular solutions for improved plant efficiency

- Digital engineering tools to create a plant digital twin that can be easily modified and scaled
- Ready-to-use libraries to rightsize plants with the help of simulation and options for future plant expansions
- MTP concepts to integrate OEM solutions into plants

Centralized and efficient operation through data synchronization and digital asset monitoring

- Web-based centralized operation center for optimal plant operation and process optimization
- More efficient operator decisions based on the plant digital twin
- Avoid unexpected failures through smart asset condition monitoring with AI-based anomaly detection
- Secure data synchronization through umbrella management system and zero trust overlay network

Optimized energy management for ecosystem operation at lowest costs

- AI-powered energy price & availability forecasting to optimize the combination of power sources and utilization
- Connection between the plant, power market and off-taker load requirements
- Validation of plant decisions

Virtual operator training and empowerment of the staff in the field

- Open learning platform to train existing workers for plant start up, service maintenance, critical situations and changing processes
- Digital worker concept combining all relevant plant data and providing the maintenance staff with a user friendly interface on various smart devices
- Digital Workflows facilitating intuitive, efficient and paperless work execution also for unexperienced workers in the field

Digital Plant

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From design & engineering to operation and maintenance
Siemens can support you with multiple use cases along the entire journey

Design & Engineering — Operation & maintenance

repeatable modular solutions & design scale-up

Use Case 1: Standardized blueprint for sustainable processes	EPC OEM	›
Use Case 2: Digital process twin for plant design	EPC OEM	›
Use Case 3: Seamless modular integration in operational ecosystem	EPC	›

Centralized and efficient operation

Use Case 4: KPI monitoring & optimization services for package	OEM	›
Use Case 5: Zero trust overlay network	EPC OEM Operator	›
Use Case 6: Digital process twin for operation in ecosystem	OEM Operator	›
Use Case 7: Centralized operation centers for distributed plants	OEM Operator	›
Use Case 8: Smart asset condition monitoring	OEM Operator	›
Use Case 9: Predictive maintenance and performance improvement	OEM Operator	›

Optimized energy management

Use Case 10 : Intelligent Energy Management	Operator	›

Virtual operator training and empowerment of the staff in the field

Use Case 11: Common training platform for all the players	OEM Operator	›
Use Case 12: Digital Worker enabling: Inspection tours	OEM Operator	›
Use Case 13: Digital Worker enabling: Integrated Maintenance	OEM Operator	›

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Repeatable modular solutions

& design scale-up

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Repeatable modular solutions & design scale-up

CHALLENGE !

Need for a standardized plant design despite the novelty of the technologies to ensure optimized processes and plant construction so that later smaller plants can be scaled / numbered up efficiently

- Technologies/Processes are still in development
- Scaling up to an industrial-level, commercial production & integrating it in different operational ecosystems poses challenges in engineering, construction and operation
- Need for optimized, standardized plant design

Repeatable modular solutions & design scale-up

Use case 1: Standardized blueprint for sustainable processes

Use case 2: Digital process twin for plant design

Use case 3: Seamless modular integration in operational ecosystem

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Repeatable modular solutions & design scale-up

SOLUTION

Repeatable modular solutions and design scale-up for improved plant efficiency enabled by digital twin

- MTP concepts to integrate processes into operational cosystems
- Digital simulation tools to efficiently simulate the operational ecosystem
- Digital engineering tools to create a plant digital twin that can be easily modified and scaled
- Ready-to-use libraries to rightsize plants with the help of simulation and options for future plant innovations

Repeatable modular solutions & design scale-up

Use case 1: Standardized blueprint for hydrogen plants

Use case 2: Digital process twin for electrolyzer system design

Use case 3: Seamless modular component integration

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Standardized blueprint for sustainable processes

Blueprints as foundation for new sustainable fuels & feedstocks plants

The Layer-concept of SIMATIC PCS neo allows the re-use of Engineering templates & blocks independent from the plant configuration.

		Target Group
A	Re-use Control Module Templates (CMTs) within an application (on the application layer)	Engineering responsible at Process Developer
B	Re-use CMT in different operational ecosystems	responsible EPC
C	Re-use of an engineering template/ a complete engineering solution (like a burner control)	OEM or System Integrator

Blueprints as foundation for new plants

Challenge

- Customers want to build plants based on previous knowledge & experience
- Customer should leverage from the advantages of constructing a digital plant's integrated engineering, even if he lacks expertise in all the required systems

Solution

- Establish a blueprint development process for new technologies.
- Offer virtual process/plant models as ready-to-use applications for customers in different operational ecosystems (provided as templates/blueprints).
- Provide continuous support for the implementation and customization of templates.
- Dedicated application support and engineering templates to empower OEMs to set up DCS systems

Value

For EPCs / ecosystem operators:

- Pre-implementation of the digital plant with low effort of individual adaptation-> more efficiency during the implementation
- Simplified implementation of the facility even with reduced expertise Provide reliable and tested solutions for optimal design, commissioning and operations
- Siemens as one point of contact to customers for holistic solutions

Products & Services

- Engineering templates for e.g. CO2, Methanol SAF or complete plants in COMOS, SIMATIC PCS 7, PCS Neo, SIMIT, etc.

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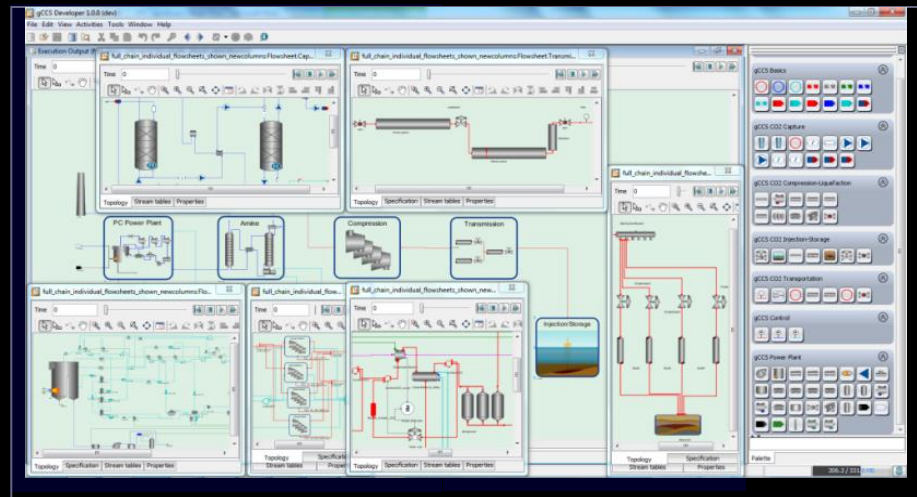
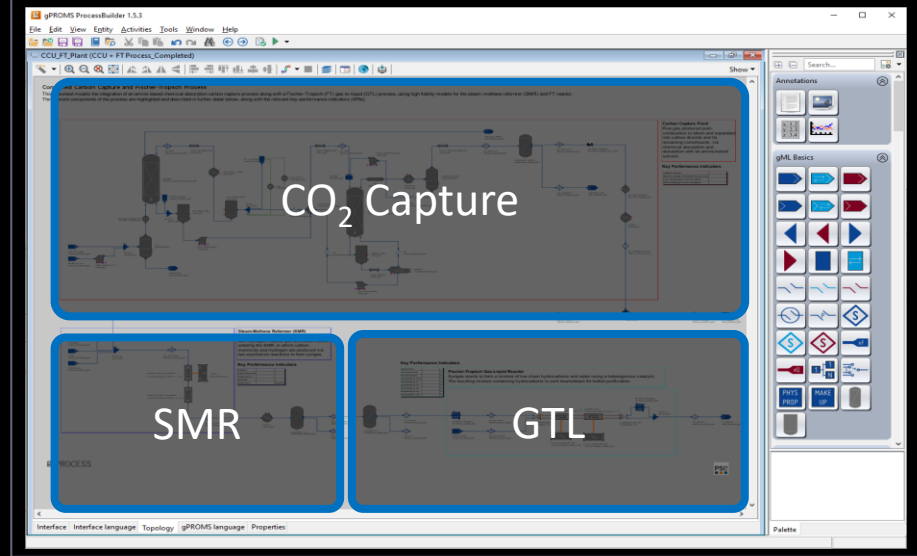
Digital process twin for OEM system design

Accelerate development, optimize design and manage risks



Whole-chain capture process model covering power generation, CO2 capture, compression, transportation and storage



Carbon capture and utilization process model covering CO2 capture, methane reforming and hydrocarbon (C5+) synthesis

Accelerate development, optimize design and manage risks

Challenge

- Integrate green hydrogen production with existing assets
- Test system robustness in uncertain environment
- Maximize hydrogen production at lowest cost

Solution

- Advanced Process Modelling platform with model-based design to efficiently and effectively explore decisions space
- The models are based on deep process knowledge and thus enable high prediction accuracy
- Reconcile real-world data with model predictions to provide reliable information for decision support
- Interface with other tools (e.g. engineering, operations)
- Siemens' world class expertise in optimization, uncertainty analysis & model validation

Value

For OEMs:

- Reduce Capital Expenditures
- Scale up from lab to industrial scale
- Increase competitiveness of designs & improve robustness in uncertain scenarios
- Provide more transparency to operators while protecting intellectual property

For EPCs:

- Reduce project cost by replicating designs
- Competitive end to end plant design (e.g., automation, instrumentation)

Products & Services

- gPROMS Process: Advanced Process Modelling platform
- Comprehensive model library for electrolyzer system design
- Training, support and consulting services

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Centrally managed and efficient operation

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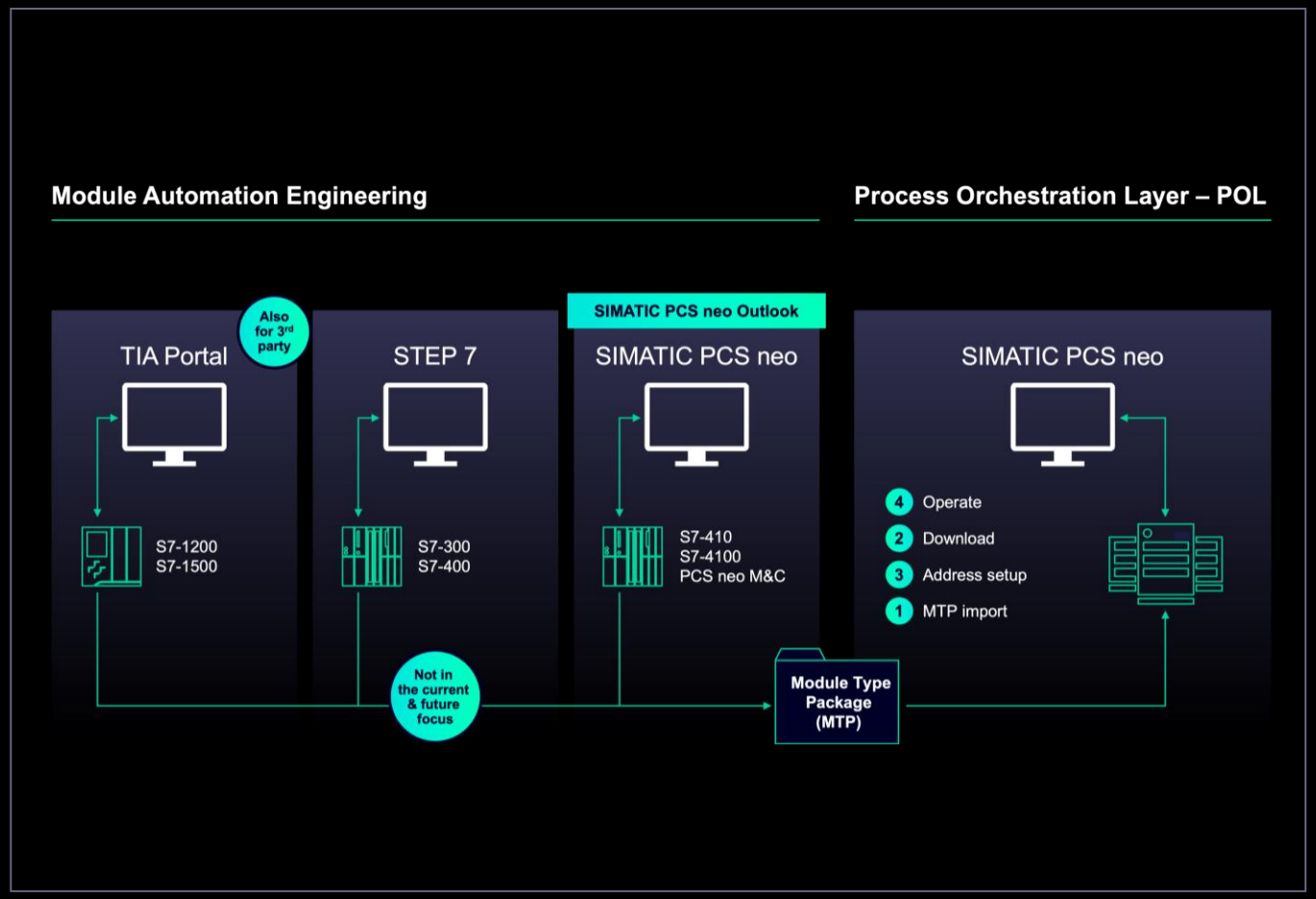
Seamless modular component integration

Easy integration of package units & third-party components



Easy integration of package units & third-party components

Challenge

- An EPC/owner operator faces the complexity of integrating package units supplied by various vendors, leading to potential issues regarding integration efforts and in the operation of the plant.

Solution

- Easy integration of package units into SIMATIC PCSneo, regarding modular hardware architecture
- Modular engineering via reusable, pre-tested and hardware-independent engineering templates for package units
- In case package units are equipped with own controllers: easy integration as e as SIMATIC S7-150 PLCs, perfectly fit into the process control systems PCS 7/PCS neo
- In case of integration of controllers from different suppliers: Siemens supports the MTP/OPAS standard at latest level of development

Value

For EPCs:

- Improved efficiency and reduced risks through streamlining the integration process of package units equipped with Siemens or via MTP/OPAS
- Easy scale up of individual plant constellations through digital twins/templates in COMOS

Products & Services

- SITRANS
- SIMATIC PFL, MTP (optional)
- SIMATIC PCS 7 / PCS neo
- S7-1500

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Centralized and efficient operation

CHALLENGE !

Decentralization & various stakeholders involved

- Distributed facilities
- Decentralized data and limited data access
- High complexity due to various disciplines & stakeholders involved
- Need for high interoperability, secure centralized operations and efficient asset management

Centralized and efficient operation

Use case 4: KPI monitoring & optimization services for package

Use case 5: Zero trust overlay network

Use case 6: Digital process twin for process system operation

Use case 7: Centralized operation centers for distributed plants

Use case 8: Smart asset condition monitoring

Use case 9: Predictive maintenance and performance improvement

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Centralized and efficient operation

SOLUTION

Data synchronization and digital asset monitoring for improved efficiency

- Web-based centralized operation center for optimal plant operation and process optimization
- More efficient operator decisions based on the plant digital twin
- Avoid unexpected failures through smart asset condition monitoring with AI-based anomaly detection
- Secure data synchronization through umbrella management system and zero trust overlay network

Centralized and efficient operation

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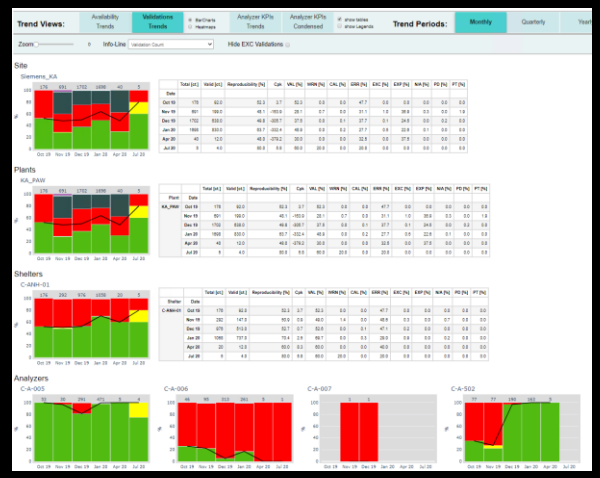
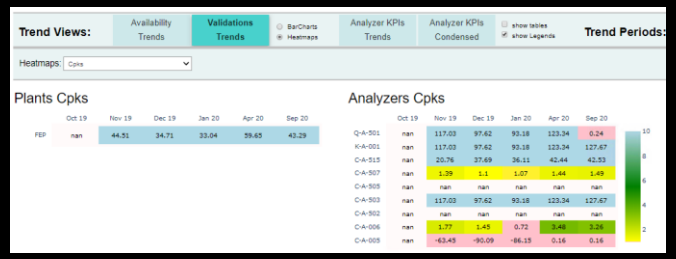
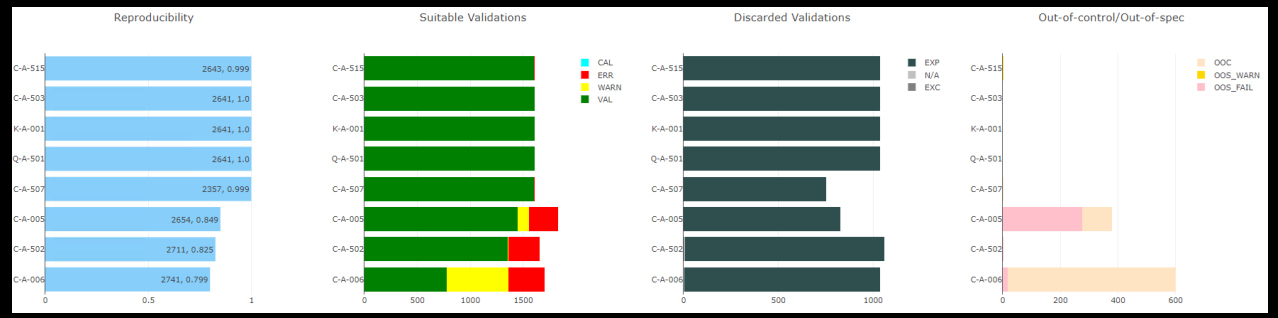
KPI monitoring & optimization services for package units

Empowerment of OEMs to increase growth







Empowerment of OEMs to increase growth

Challenge

- The customer as package unit provider receives specific complaints (e.g. with the membranes)
- He has no or only limited access to the process data, this complicates the problem diagnosis and the optimization of the unit

Solution

- Monitoring and optimizing the KPIs throughout the entire operation lifecycle of a package unit without being the operator of the plant
- Automated inspections by software and failure prediction
- Minimizing unexpected issues

Value

For OEM:

- Empower OEMs to identify areas for improvement & optimize operation
- Enable OEMs to introduce new business models covering the entire lifecycle of package units (e.g., fleet management, warranty management, (predictive) maintenance)

Products & Services

- Namur Open architecture
- Plant connectivity
- Simulation models
- ASM IQ - AID IQ

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Zero trust overlay network

Data synchronization through umbrella management system

Data synchronization through umbrella management system

Challenge

- One remote operation center handles several plants
- The "hardware drivers" need to be provided in a secure way automatically through dynamic tunnels
- Currently the communication rules are set up in a static way manually

Solution

- Secure, encrypted and dynamic overlay network for providing "drivers" for package units over the cloud
- An umbrella management system that synchronizes the information of the systems attached

Value

For EPCs:

- Simplify integration of package units via the secure and dynamic cloud

For OEM:

- Save staff to configure the package units
- Unlock new business potential with remote services (e.g. new business models)

For Operator:

- Remote cloud-based operation, maintenance and analysis in a secure and dynamic way

Products & Services

- Umbrella management system
- COMOS + PCS neo + SIMIT + Field devices
- A dynamic Zero Trust overlay network

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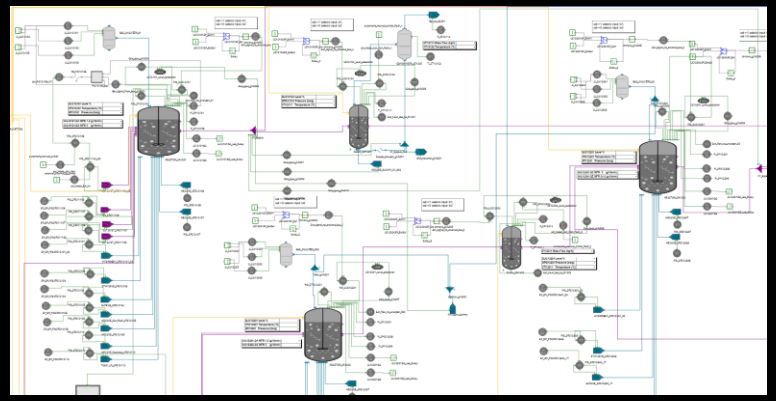
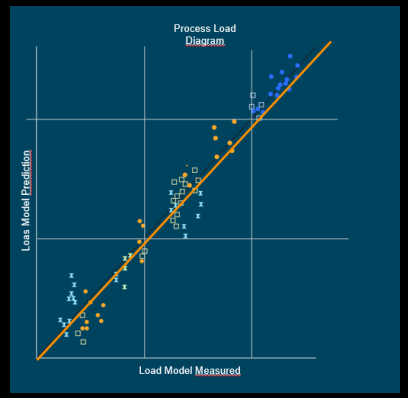
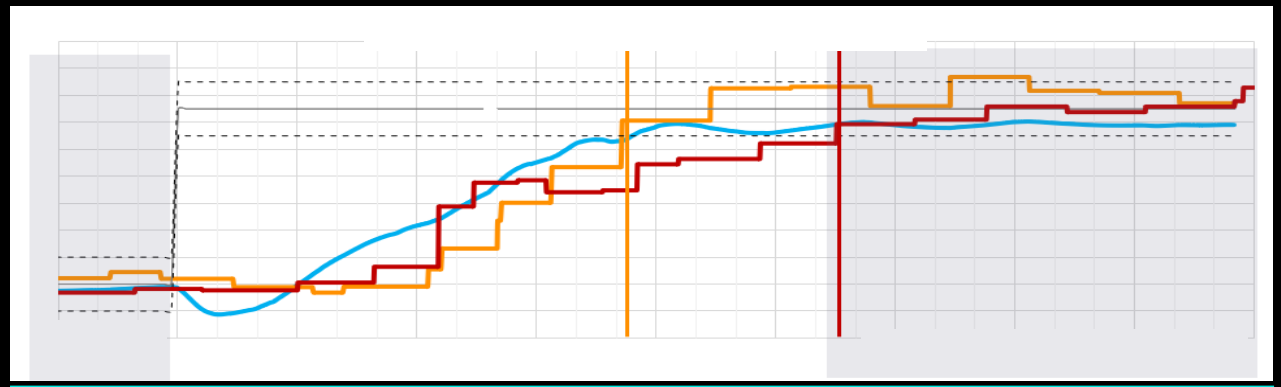
Digital process twin for electrolyzer system operation

Monitor, soft-sense and optimize real-time operation





View detailed model results based on model reconciled with plant measurements



Optimisation of load profile to meet demand

Monitor, soft-sense and optimize real-time operation

Challenge

- Produce fuels and feedstocks at the lowest cost
- Make optimum use of existing plants for the production
- Extend the life of plants
- Provide real-time insights to process operators

Solution

- Digital Process Twin to support operator decisions and explore what-if scenarios
- High-fidelity models validated on experimental data, connected to short-term forecasts for power supply and process conditions
- Connect to real-time plant systems

Value

For Operator:

- Monitor internal properties of the process
- Extend equipment life time
- Reduce cost of production by making optimal use of available assets
- Operator decision support: advise on optimal operation and explore what-if scenarios

For **OEMs**:

- Software for operator decision support adds value to hardware offering

Products, Services and Solutions

- gPROMS Real-Time Optimization,
- gPROMS Soft Sensing
- Configuration and implementation services
- Solution configuration for specific assets

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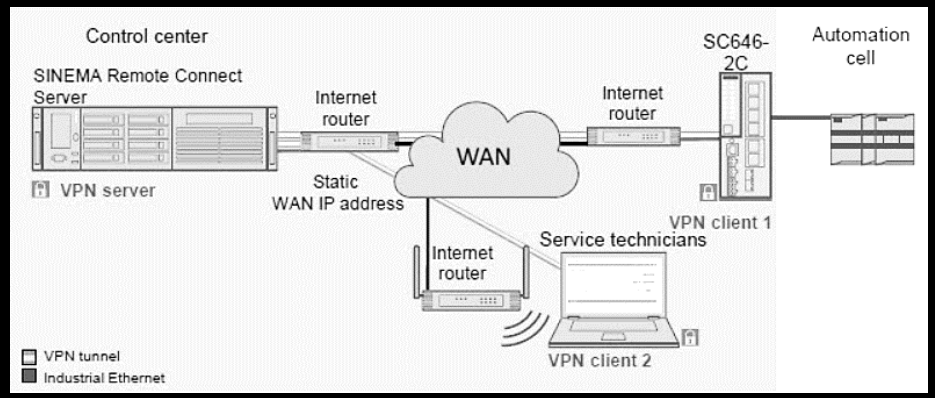
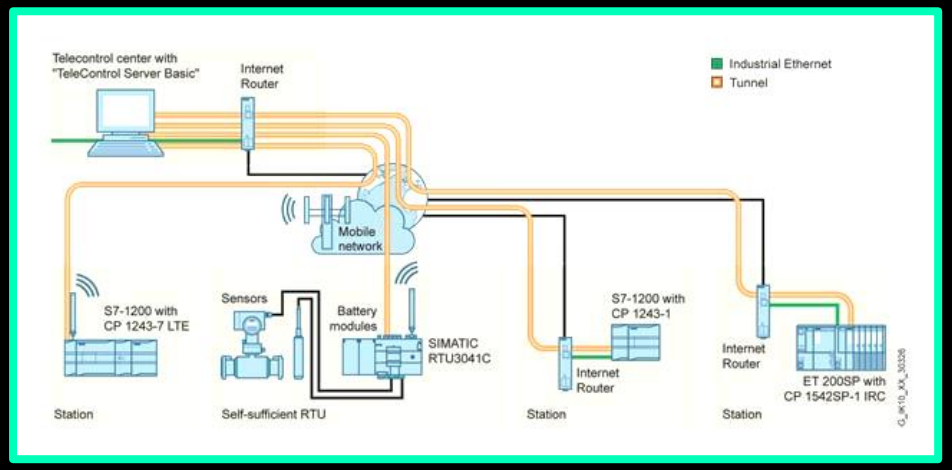
Centralized operation center for distributed plants

Web-based platform to centralize operation centers





Web-based platform to centralize operation centers

Challenge

- Manage and coordinate the operations of distributed facilities in multiple locations around the world while eliminating inefficiencies and the need for local staff at each site

Solution

- Telecontrol center for the centralized process control operation for up to 5000 distributed plants / outstations
- Flexible protocols and network integration via OPC UA communication
- Teleservice with user authentication, time stamp, management protocol

Value

For Operator:

- Central overview to ensure optimal plant operation and process optimization
- High plant availability and efficiency through status monitoring
- Simple data management in an integrated system solution
- Reduce operation costs & trained local operators
- Faster maintenance with remote Teleservice with diagnostic, condition monitoring, error detection
- Highest security with encrypted wireless communication or via Internet

Products & Services

- Telecontrol / Teleservice / SINEMA Remote Connect
- PCS 7 / PCS neo / WIN CC / TIA /S7-1500/1200/ ET200SP HA/CN4100
- SCALANCE M / S , RTU3000C
- Cybersecurity service

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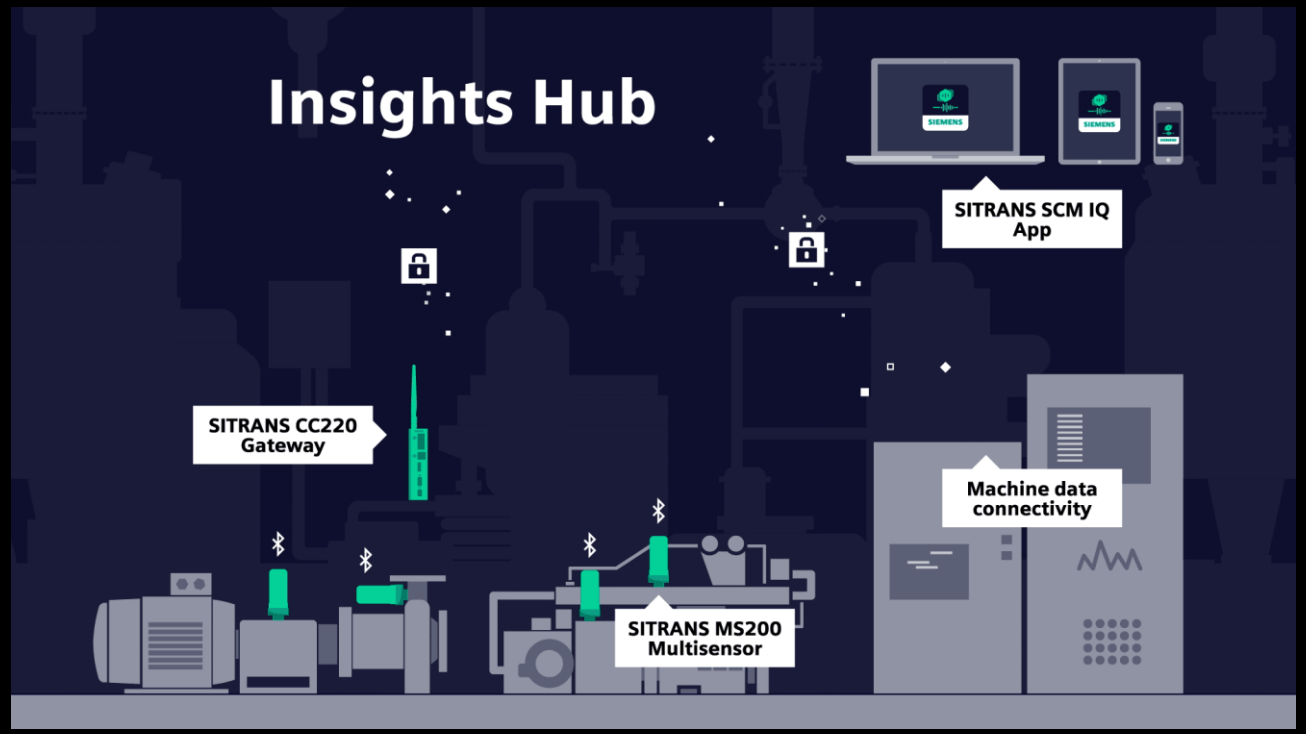
Smart asset condition monitoring

Avoid unexpected failures with AI-based anomaly detection



Avoid unexpected failures with AI-based anomaly detection

Challenge

- Unexpected failures of mechanical assets, e.g. pumps and gearboxes can lead to expensive plant downtimes
- Time-based maintenance management leads to high operating costs

Solution

- The SITRANS SCM IQ system is a cloud-based out-of-the-box solution for smart condition monitoring of vibrating or rotating plant equipment
- For data collection wireless SITRANS MS200 multisensors can be used or the existing machinery data can directly be connected to the machine learning algorithms in SITRANS SCM IQ
- AI-based anomaly detection and early event-related warnings before asset failures occur

Value

For Operator:

- Event-driven maintenance management & avoidance of unexpected failures
- Secure, open ecosystem - quickly adaptable to new business challenges
- Non-expert system with easy installation and fast commissioning
- Low investment and operating costs
- System scalability from small installations to extensive plant monitoring

Products & Services

- SITRANS CC220 Gateway
- SITRANS MS200 Multisensor
- SITRANS SCM IQ App

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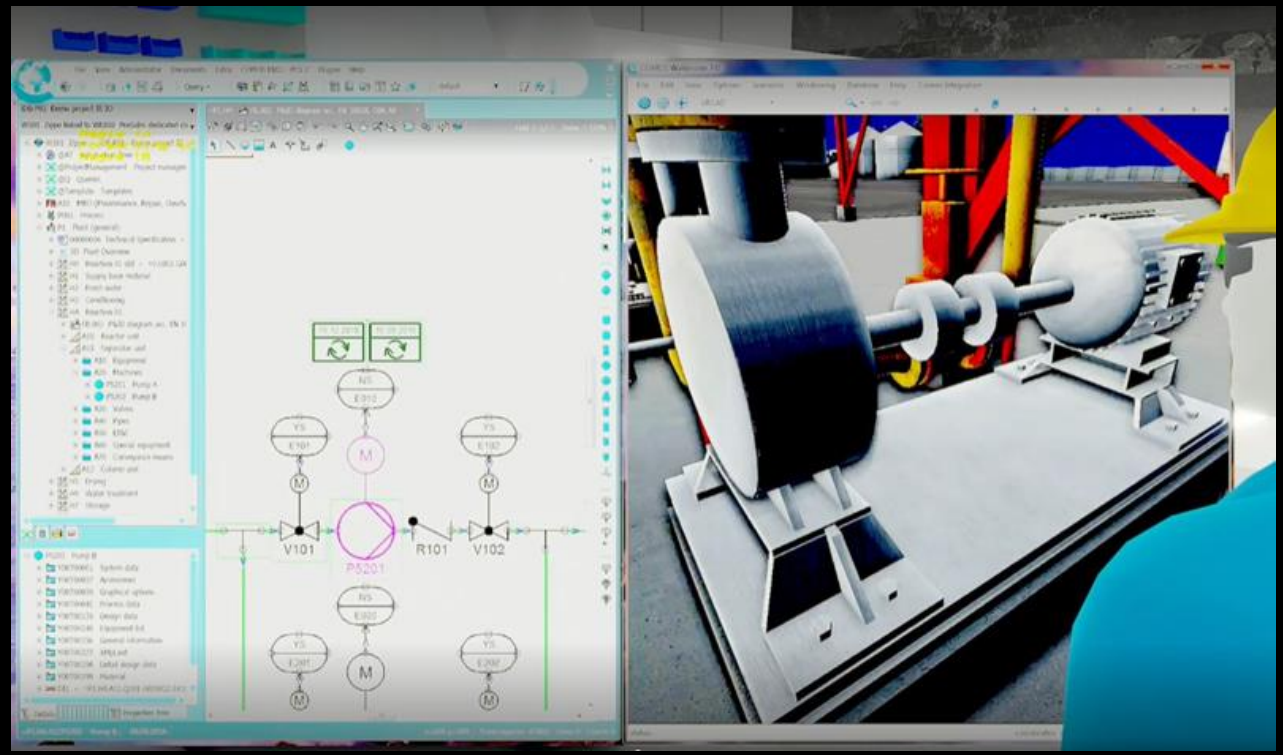
Predictive maintenance and performance improvement

Always one step ahead for reliable plant availability



Always one step ahead for reliable plant availability

Challenge

- Need for condition check of mechanical components such as pumps and valves to keep the plant up-and-running and prevent unplanned downtimes
- But since the components do not have their own sensors for monitoring the condition check becomes quite difficult

Solution

- Thanks to digitalization and the “PumpMon” module within SIMATIC PCS 7 the operator will be alert before a cavitation enabling him to take countermeasures
- He can transfer the information from the DCS to COMOS before generating a maintenance request
- In COMOS he can plan the maintenance work packages and check relevant information (e.g. cabling, data sheet, pump and documentation).
- With COMOS Walkinside it is also possible to execute the maintenance tour upfront in 3D Virtual Reality for route planning, localization, etc.

Value

For Operator:

- Improve/Optimize plant availability
- Optimal usage of equipment lifetime
- Faster and more efficient maintenance planning and execution
- No data losses or manual entry

Products & Services

- SIMATIC PCS 7 “PumpMon”
- Walkinside
- COMOS MRO

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Optimized energy management

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Optimized energy management

CHALLENGE !

Need for reliable price forecasts and efficient energy management despite the volatile market.

- Financial markets, governmental regulations weather and seasonality impact energy supply & demand
- Need for optimized and intelligent price forecasts taking into account various influencing factors

Optimized energy management

Use case 8: Intelligent Energy Management

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Optimized energy management

SOLUTION

Optimized energy management for production at lowest costs

- AI-powered energy price & availability forecasting to optimize the combination of power sources and utilization
- Connection between the plant, power market and off-taker load requirements
- Validation of plant decisions

Optimized energy management

Use case 8: Intelligent Energy Management

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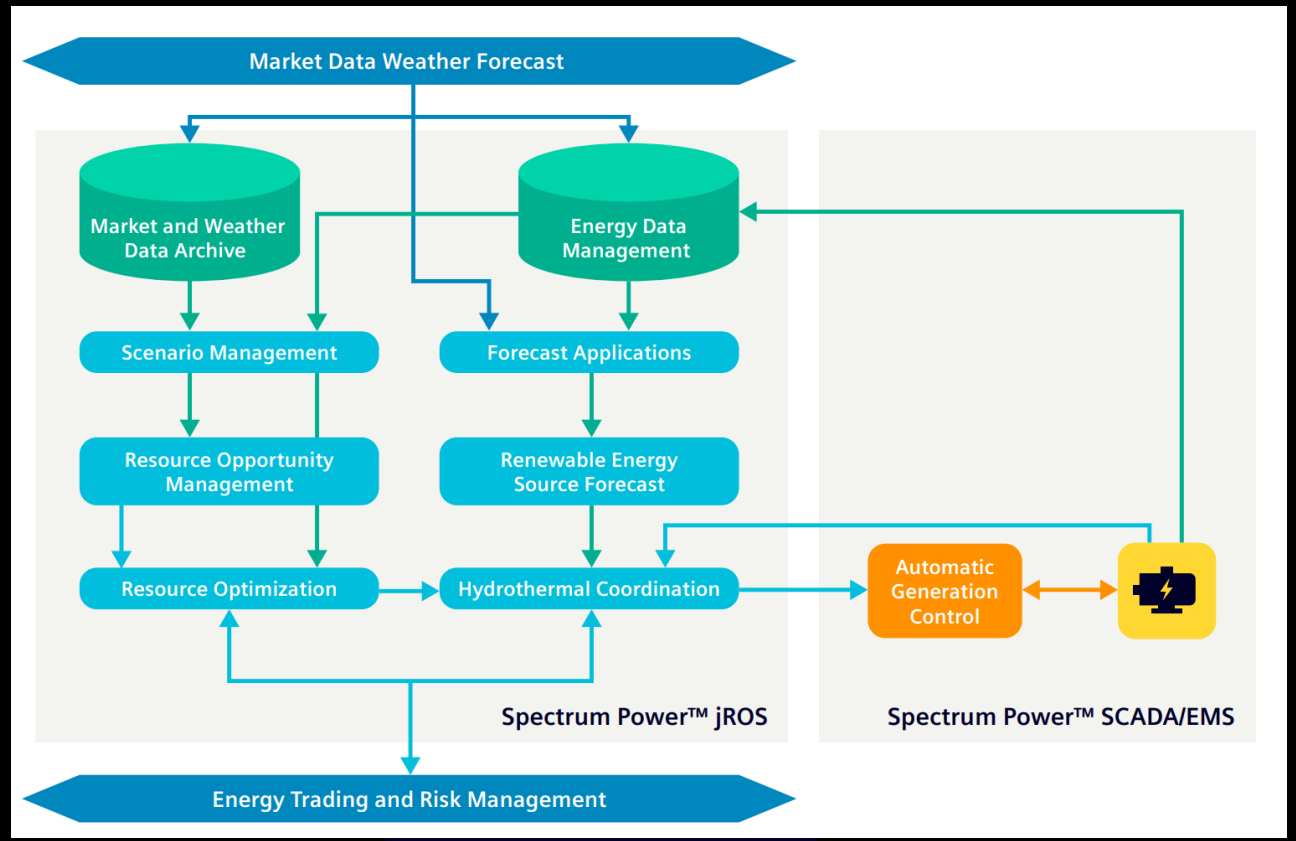
Intelligent Energy Management
Unlocking Sustainability and Risk Mitigation



Unlocking Sustainability and Risk Mitigation

Challenge

- Ensuring reliable energy forecasts and maintaining stable production
- Regulatory hurdles that require strict compliance with a wide range of energy and environmental policies
- Economic hurdles requiring skillful navigation through volatile energy markets and the complexity of different market dynamics

Solution

- Energy Management System with advanced forecasting models to precisely predict and optimize wind and solar power generation
- Ensuring strategic short-term scheduling for future, day-ahead and intraday energy market decisions

Value

- **For Operator:**
- Mitigates energy procurement risks
- Enables intelligent trading decisions
- Promotes sustainability by optimizing the utilization of renewable resources

Products & Services

- Spectrum Power jROS
- gPROMS
- XHQ

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Virtual operator training and empowerment of the staff in the field

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Virtual operator training and empowerment of the staff in the field

CHALLENGE !

Missing qualifications & Skill shortage

- Specialized knowledge and expertise in various engineering disciplines required
- Limited manpower
- Need for qualified maintenance workers at different locations
- Need for efficient training

Virtual operator training and empowerment of the staff in the field

Use case 11: Common training platform for all the players

Use case 12: Digital Worker enabling: Inspection tours

Use case 13: Digital Worker enabling: Integrated Maintenance

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Virtual operator training and empowerment of the staff in the field

SOLUTION

Common training platform and intuitive maintenance support in the field through digital workflows

- Open learning platform to train existing workers for plant start up, service maintenance, critical situations and changing processes
- Digital worker concept combining all relevant plant data and providing the maintenance staff with a user friendly interface on various smart devices
- Digital Workflows facilitating intuitive, efficient and paperless work execution also for unexperienced workers in the field

Virtual operator training and empowerment of the staff in the field

Use case 11: Common training platform for all the players

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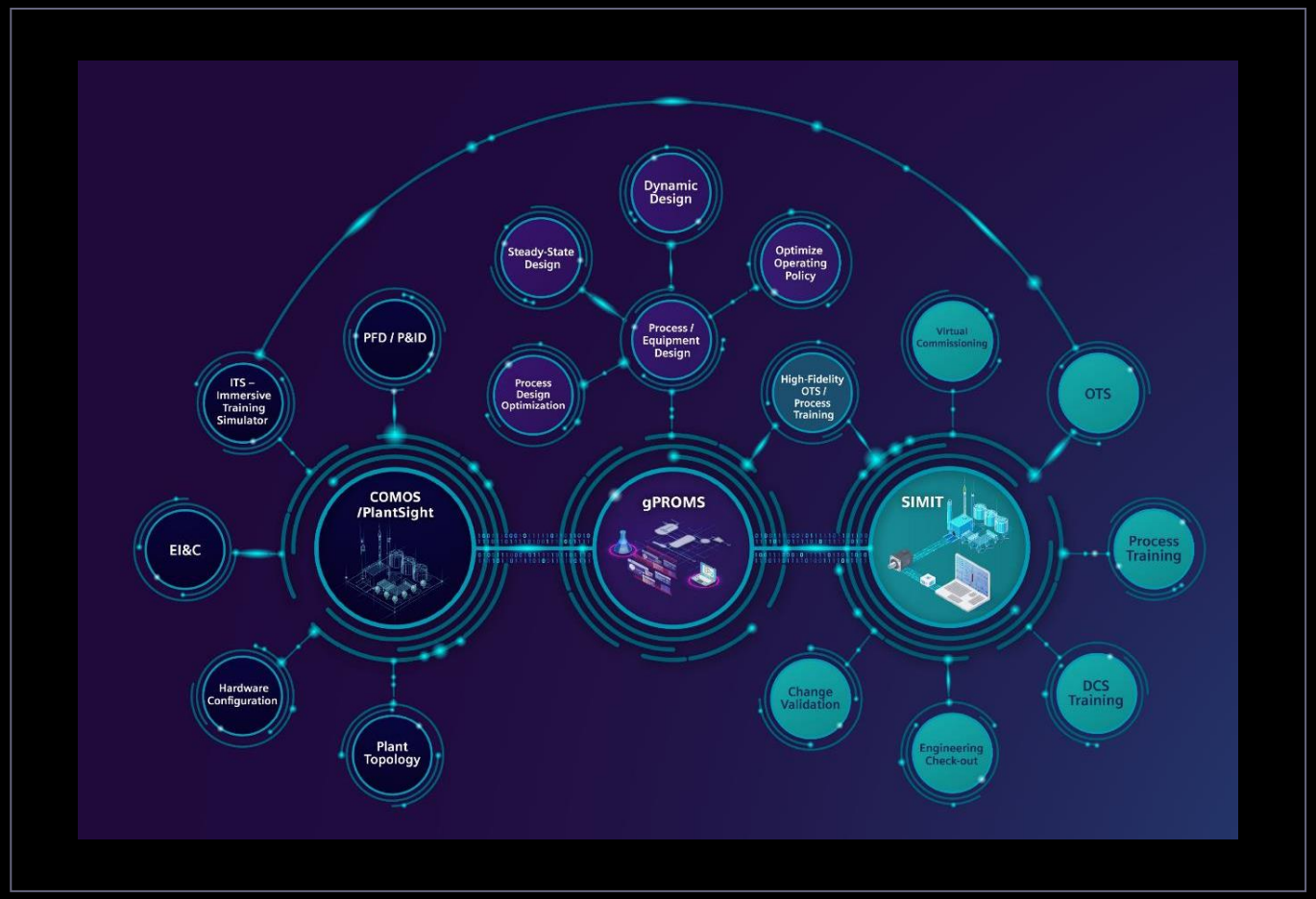
Common training platform for all the players

Virtual platform for optimized operator training



Virtual platform for optimized operator training

Challenge

- OEM has to deliver a complex plant unit / package unit to customer
- Customer has to learn the control and maintenance of the plant unit (high complexity)

Solution

- Offer virtual trainings even before the plant is built
- Virtual commissioning of the plant
- Frequent training especially for exceptional situations

Value

For Operator:

- Training for service maintenance of all devices
- Faster start up of the plant
- Training for critical situations, e.g. incidents
- Support contacts from Siemens to react faster
- Higher reliability
- Process optimization

Products & Services

- Virtual training for operators
- SIMIT
- COMOS Plantsight

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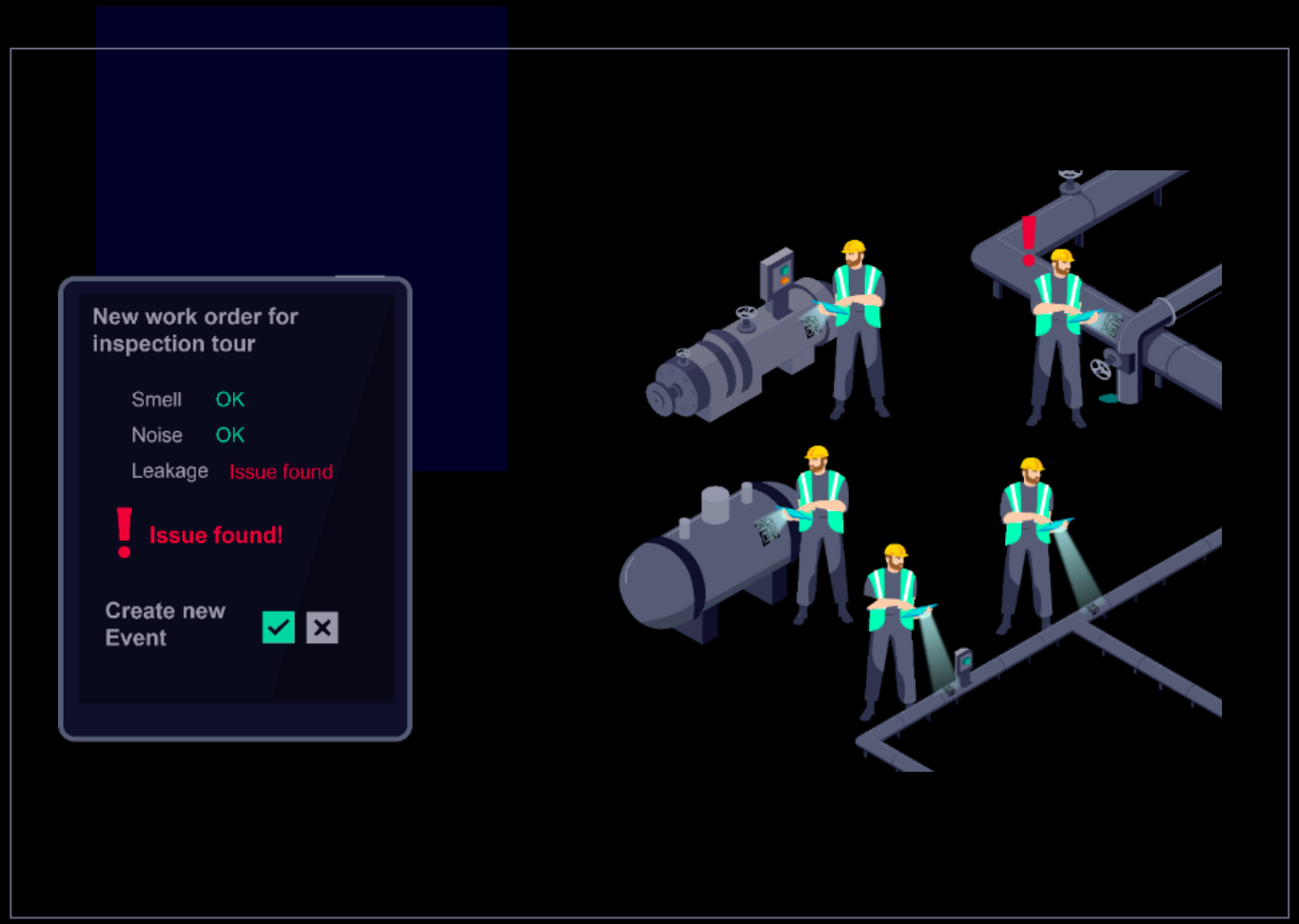
Digital Worker enabling: Inspection tours

Empowering maintenance staff in the field with digital workflows



Empowering maintenance staff in the field with digital workflows

Challenge

- Inspection tours within a facility to check for strange odors, noises, leaks, etc. are often documented in paper form makes documentation more time-consuming and carries the risk of errors and loss of documents
- Time-consuming manual conversion of detected issues into maintenance requests

Solution

- COMOS Mobile Worker facilitates digital Workflows including paperless work execution as well as all relevant information at the right time in one view
- Use case-oriented user interface on various smart devices to document the results of the inspection tour
- Works also offline in case there is no network connection in the field side, as soon as a network connection is available, the data will be synchronized

Value

For Operator:

- Reduction of necessary work effort
- Electronic documentation on the fly
- Reduction of errors and enhanced quality/safety

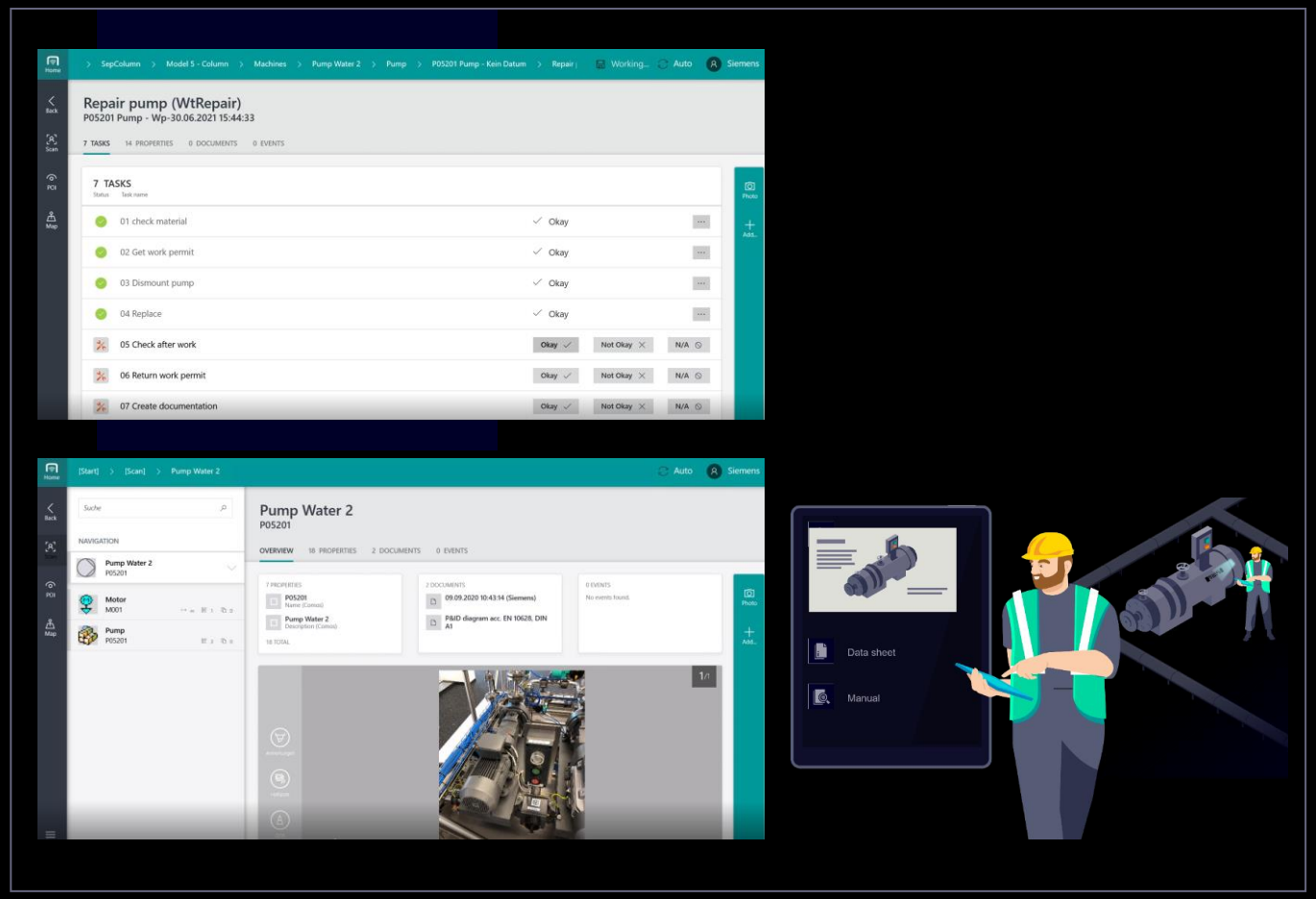
Products & Services

- COMOS Mobile Worker
- COMOS MRO

SIEMENS

Digital Worker enabling: Integrated Maintenance

Empowering maintenance staff in the field with all information at a glance



Empowering maintenance staff in the field with all information at a glance

Challenge

- Maintenance often takes a lot of time, resulting in costs and effort because of:
  - Outdated information and the use of multiple data systems increases the risk of incompatibility
  - Finding field devices and detecting errors within a large system can be time intense
  - Maintenance documentation in paper form makes documentation more time-consuming and carries the risk of errors and loss of documents

Solution

- COMOS Mobile Worker combines the data from various systems, summarizes all relevant plant information and provides the maintenance staff with a use case-oriented user interface on various smart devices
- Includes system photos, 3D models of pumps & videos of maintenance steps
- The AR and navigation function makes it easier to find field devices
- After maintenance, the current status is digitally documented, which keeps the data in the higher-level systems up to date

Value

For Operator:

- Better utilization of skilled-staff across plants
- Reduce downtimes because staff can conduct more tasks than usually
- Higher maintenance efficiency (faster completion, reduction of errors)

Products & Services

- COMOS Mobile Worker
- COMOS MRO

SIEMENS

Siemens helps you overcoming major challenges to make your sustainable fuels and feedstocks production scalable and efficient

The Challenges

Our Solution

Your Value

The Challenges	Our Solution	Your Value
Scalability & Technological Integration	• Standardized blueprint for hydrogen plants • Plant & Process digital twin • Modular component integration with and without MTP / OPAS	**Repeatable, scalable and modular solutions for improved plant and process efficiency**
Decentralization & various stakeholders involved	• Web-based centralized operation center for distributed plants • Data synchronization through umbrella management system • Operation digital twin • Asset condition monitoring with AI-based anomaly detection	**Centralized and efficient operation, minimized downtimes and consistent system availability**
Volatility of energy prices	• Energy Management System leveraging AI-powered energy price & availability forecasting	**Optimization of the process and production at lowest energy cost**
Missing qualifications & Skill shortage	• Virtual training platform • Digital worker concept making all relevant plant data accessible via various smart devices for workers in the field • Digital Workflows facilitating intuitive, efficient and paperless work execution	**Location-independent training** **Reduction of maintenance costs and empowerment of maintenance workers without additional qualification**

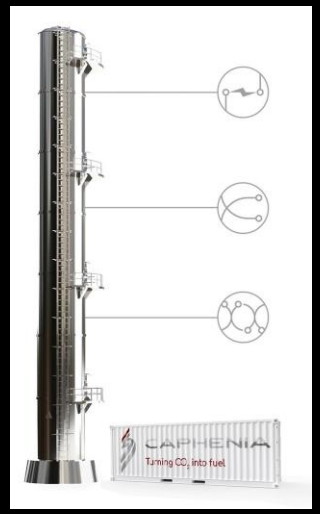
SIEMENS

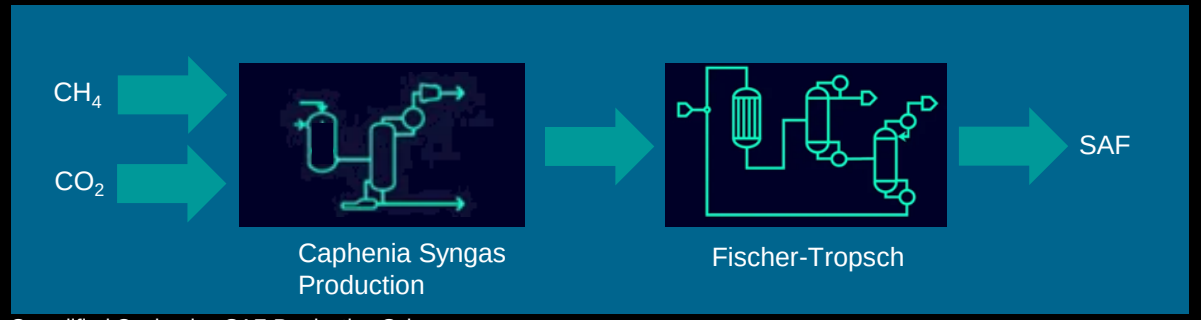
SAF – Sustainable Aviation Fuel
gPROMS Process Modelling and Simulation

CAPHENIA

Customer: Caphenia
Period: 2024

Highlights:
SAF pilot plant with new process technology:
Plasma-Boudouard-Reactor

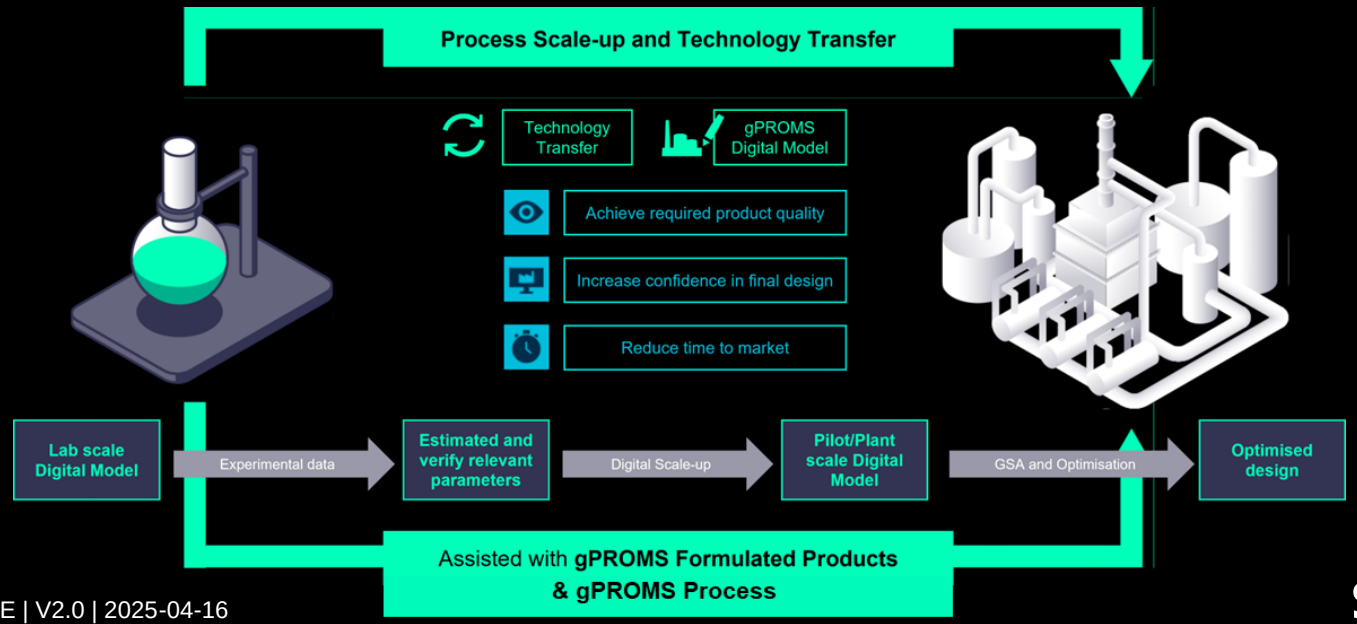




Symplified Caphenias SAF-Production Schema

Challenges

Modelling and simulating a productive system from an experimental setup with the available data. This model is to be used as the basis for a later up-scaling in order to subsequently simulate the model created in-house together with a Fischer-Tropsch model in its entirety and to optimize the processes. The aim is a stable process, high efficiency and a high-quality finished product.



SIEMENS

Carbon2Chem
CO2 emissions as raw material for the chemical industry

Customer challenge

- Reduce the release of carbon-rich gases into the atmosphere and substitute fossil raw materials as carbon source

Siemens solution

- Digitalized plant, a system that calculates temperature profiles and provides values for evaluation in the control system, forming the basis for implementation and optimization of the processes control as well as for management of the installed assets
- SIMATIC PCS 7 for visualization and process control
- Sitrans TO500 to determine the temperature profiles in a reactor

Customer value

- Recycling of harmful CO2 emission
- Reliably working with new feedstock
- Scalable and adjustable solution to adapt to application need
- Meet the goals of the EU Commission’s Green without jeopardizing competitiveness

SIEMENS

Membrane Electrodialysis

Mission Zero Technologies

Customer challenge

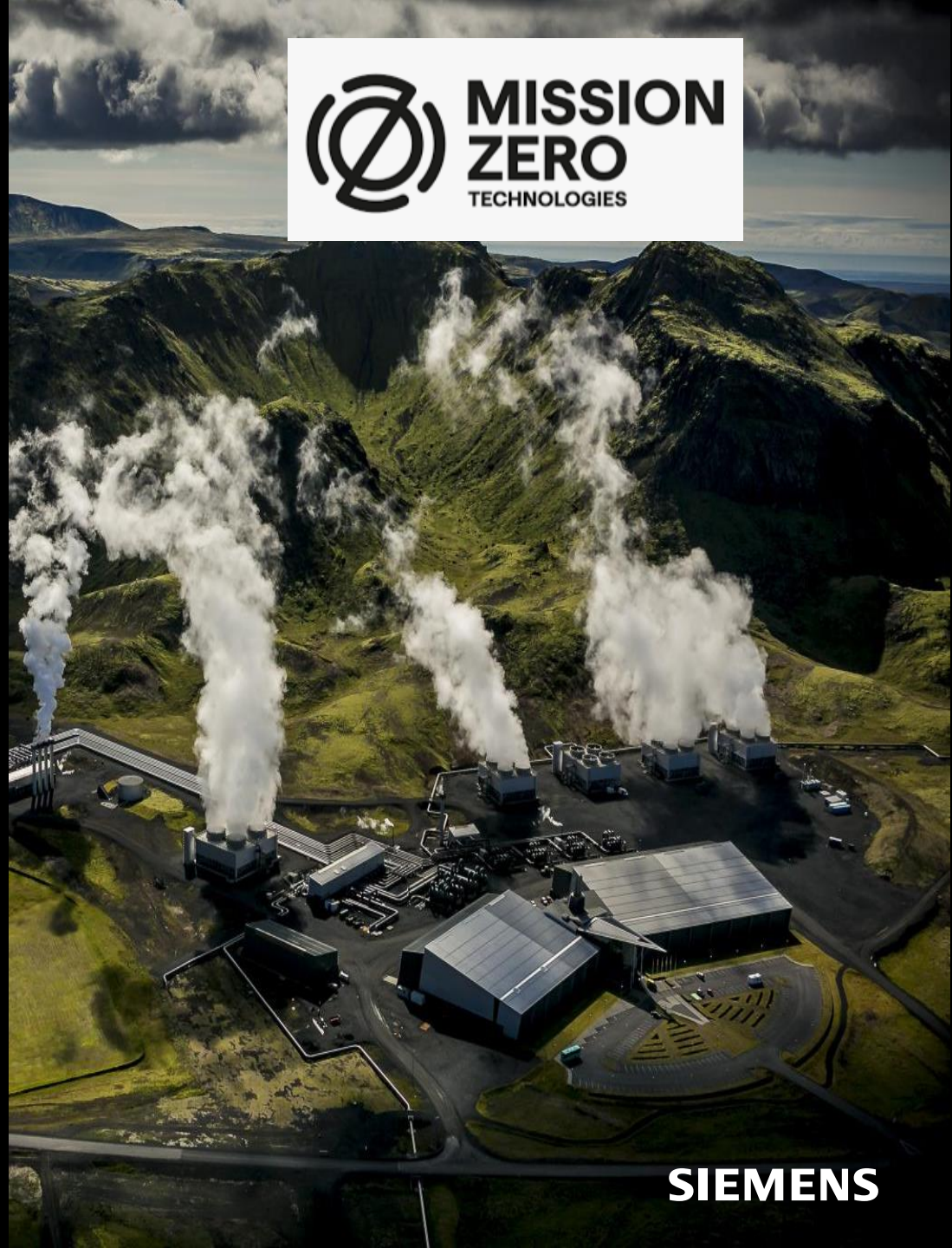
- Mission Zero Technologies developed a DAC technology which reduces energy consumption
- The technology uses
  - **Amine-based capture**
  - **Regeneration** of the solvent using electrical power
  - **Selectively pass captured CO_2** in the form of bicarbonate ions through a membrane

Solution: plant design and optimisation with gPROMS

- Mission Zero are developing models of their carbon capture process for use in R&D and process engineering

Benefits

- **Improved** R&D efficiency
- **Identified** optimal design
- **Scaled-up** with confidence



SIEMENS

The Shell Peterhead CCS Project

Shell plc

Customer challenge

- **First plans** for full-scale CCS project on a gas-fired power station
- **CO_2** was captured at Peterhead Power Station and stored in depleted Goldeneye gas reservoir (100 km off shore)

Solution: Simulation of system startup and shut-down

- Developed full chain model from FEED deliverables
- High level verification of the overall CCS plant control philosophy
- Simulated dynamic operation scenarios including start-up, shut-down and various failure models
- Analysed the simulation results to identify improvements of existing operating procedures, which need to be followed up in detailed engineering studies

Impact

- 10 to 15 million tonnes of CO_2 over a 10 to 15-year period (90% CO_2 capture from one turbine)

National Corn-to-Ethanol Research Center, USA
Industry R&D Investment

Project description

A longstanding partnership has elevated renewable fuel production with state-of-the-art technology for process control, simulation and monitoring, including SIMATIC PCS 7 BATCH, SIMIT Simulation Platform and a range of SITRANS instrumentation.

Customer situation

NCERC provides clients with access to facilities equipped with leading-edge process automation, instrumentation, electrical and analytics solutions from Siemens for the purposes of process control, simulation and monitoring.

Siemens solution

- PCS 7 automates, visualizes and optimizes the core process equipment for every client, giving NCERC the flexibility to offer continuous or batch runs for multiple feedstocks.
- SIMIT Simulation Platform to create a virtual model of a plant's original SIMATIC PCS 7 control screens, making it possible to train operators on a variety of procedures and critical scenarios without disrupting production or endangering worker safety.

Customer value

- Modular approach to PCS 7 configuration enables NCERC to change campaigns quickly and with minimal effort, making it possible to support a large number of clients with diverse needs.
- SIMIT has proven very cost-effective in training students and new employees
- Tight integration between PCS 7 APL and SIMIT is paying dividends for NCERC since they can easily test potential changes to the physical plant with SIMIT before putting anything into production – resulting in "right the first time" campaigns that save time and money.
- The SIMATIC PDM (Process Device Manager) application integrated into PCS 7 collects valuable data from all PA- and HART-enabled field devices in the plant to support NCERC operators in minimizing plant downtime.

SIEMENS

CATHAY Industrial Biotech Ltd., Wusu Xinjiang, China
Bio-manufacturing polymers with a digital factory

Customer situation

- Mostly managing and maintaining the equipment is not an easy job, requiring the input of information from thousands of machines
- Bio-manufacturing processes are complex and mutable
- Process can produce special chemical materials with excellent characteristics that could not be synthesized through chemical methods, but at the same time may generate different kinds of metabolites
- It is difficult for people to fully master all of the complex and subtle details of the conversion from maize to polyamide. But with sufficient data accumulated from experiments, screening, and trial, people can identify the relationship between different strains, reaction conditions and the final yield of the target products

Siemens solution

- Siemens provides Cathay Wusu manufacturing site with complete digital solutions covering the whole lifecycle of the process
- COMOS and PCS 7 will help Wusu manufacturing site to manage the integration of engineering, operation and maintenance.
- Siemens' manufacturing execution system Simatic IT will help ensure stable and efficient productions at Cathay Wusu manufacturing site.
- Application of SIPAT could help the researchers to directly identify the relations between some important parameters and the final yield through digital analytics, reducing the number of processes required

Customer value

- Simatic IT MES helps reduce operation cost and error rate
- Ensuring uninterrupted reaction
- Stable and efficient production
- Siemens software and hardware help Cathay improve bio-manufacturing efficiency

SIEMENS

KIT, Karlsruhe, Germany
Pilot plant for the bioliq® process (biomass and waste to synthetic fuels and chemicals)

Project description

- The bioliq® pilot plant covers the process chain required for producing customized fuels from residual biomass. Being mainly synthesized from dry straw or wood, the BTL fuels offer environmental and climatic benefits through clean combustion. The integrative process chain, moreover, enables production of synthesis gas and chemicals. bioliq® intends to mainly convert large local quantities of residual biomass by densifying energy. To save carbon dioxide and reduce the transportation expenditure to refineries, the Karlsruhe BTL concept combines decentralized production of energyrich biosyncrude by means of fast pyrolysis and central processing with final industrial-scale refinement. Since the energy density of biosyncrude is higher than that of the dry straw volume by more, it is evident that the method's efficiency is enhanced by decentralized energy densification and that such densification ensures that biomass can be fully exploited and put to use in substance and in energy.

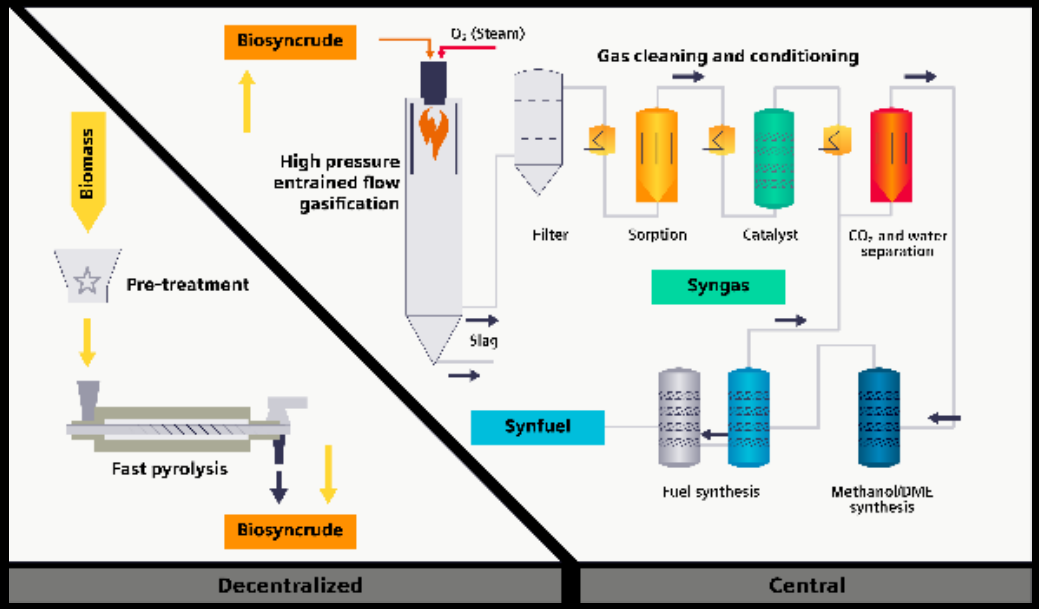
Customer situation

-

Siemens solution

- Process Control System, Analytics, Drives

Customer value



SIEMENS

INBICON A/S, Denmark
Demo plant: Lignocellulose Bioethanol

Project description

In its refinery in Kalundborg, Denmark, designed as a demonstration plant, Inbicon turns straw into bioethanol. Siemens was the most important technology partner during the planning, construction and commissioning of the plant. In August 2010, the plant reached the scheduled production quantities of ethanol, C5 molasses and lignin pellets for the first time.

Customer situation

For efficient operation of the plant – and efficiency is the main variable, especially in this environment – Inbicon requires precise information about the processes. Only then, it can be ensured that raw materials are used sparingly, that power is used optimally and that a high-quality, reproducible end product is created. This process requires continuous measurement of temperatures, flow rates, fill levels, pressure or pH and ethanol content.

Siemens solution

- Installation of transformers, the main switchgear and local switchgear units with the appropriate fire protection
- In toal 697 measuring instruments and anytical devices, coordinated with PROFIBUS, helped to save time during installation and commissioning of the devices
- SIMATIC PCS 7 for process automation

Customer value

- Measurement instruments and analytical devices guarantee availability of precise information for greater process safety and product quality; in addition it helps to save valuable time during installation and commissioning of the devices
- SIMATIC PCS 7 process control system provides the necessary overview and makes for efficient plant operation

SIEMENS

UPM BIOCHEMICALS, Leuna
Biorefinery to produce bio-based mono-ethylene glycol, mono-propylene glycol, and renewable functional fillers

Project description

- UPM Biochemicals, Leuna, Germany, Leuna, Germany
- Electrification, Automation and Digitalization of the new Biorefinery of UPM in Leuna, Germany
- More Info: https://www.upmbiochemicals.com/about-upm-biochemicals/biorefinery-leuna/

Customer situation

UPM is a company based in Finland. The segment UPMBiochemicals produces renewable biochemicals based on wood.UPM Biochemicals offers innovative, sustainable andcompetitive wood-based biochemicals for replacing fossil-based raw materialsand improving the environmental performance in various applications. It will apply novel process innovations to sustainably convert100 percent wood into bio-based mono-ethylene glycol (MEG), mono-propyleneglycol (MPG) as well as renewable functional fillers (RFF). Both MEG, MPG aswell as functional fillers have traditionally been produced using fossil-basedraw materials. Lignin-based renewable functionalfillers offer a sustainable alternative to carbon black and precipitated silicain a broad range of rubber and plastic.UPM will provide alternatives to considerably reduce the CO2footprint of end-products such as PET bottles, packaging materials, textiles usedin various applications. From wood: Bio-Mono-ethylene Glycol (Bio-MEG), Bio-Mono-propylene Glycol (Bio-MPG), Renewable functional fillers (RFF)

Siemens solution

- The biorefinery is built into the chemical complex in Leuna/Germany.
- Project is actually in implementation phase by Siemens Energy, go-live is scheduled for 2024. Biorefinery plant, Siemens Energy supplies the electrification, automation
- and digitalization Solution. Electrification: Mill-wide medium- and low-voltage power distribution system and drive system (motor control center, variable speed drives, motors) Digitalization: Complete digital twin for the entire plant, covering the entire life cycle covers from integrated engineering to integrated operation Automation: Siemens Energy also supplies SIMATIC PCS 7 process control system for different process areas and remote I/O control cabinets (for a total of 9.000 process objects). Including process safety and ATEX.
- Integration of third-party small installation (ABB, Allen Bradley, etc…), Connection from WinCC to ERP via scripts, SIMIT to simulate the equipment (Digital Twin), for virtual commissioning and to provide an Operator trainings station, COMOS used for bulk engineering, Dynamic high-fidelity process simulation and optimization (UPM uses 3rd party software ASPEN)

Customer value

- Siemens Energy's scope of supply for the project includes electrification, automation and digitalization of the new plant.
- The Leuna Biorefinery will be a big step for UPM to expand its business into wood-based biomolecular products and solutions. It will be the first industrial-scale facility of its type ever built. The annual production capacity of the UPM plant in Leuna will be a total of 220,000 tons.

LINK to reference database

Customer Quote
"We are confident that the bio-based mono-ethylene glycol, mono-propylene glycol, and renewable functional fillers made in Leuna will meet the strong demand of customers and end-users looking to change towards a truly sustainable portfolio. By implementing Siemens Energy's digitalization solutions and digital twin, we can help ensure safe and efficient operations."
Juuso Konttinen, Vice President UPM Biochemicals

SIEMENS

Chempolis, Oulu refinery, India
A clean future with renewable raw materials

Project description

Oulu biorefinery, Chempolis Technology

The purpose was to increase the level of automation at the biorefinery by developing process control. The Siemens sequencing tool and standardized libraries, which have proven to be handy, have supported this goal. Standard libraries make it easy to implement process changes and carry out system maintenance. Founded in 1995, the company is currently busy with various customer projects, customer test runs and an investment project at the **Oulu biorefinery**. Chempolis has a cooperation agreement with Fortum to provide test runs and engineering services for commercial biorefinery projects.
“Together with Fortum and the Indian state-owned oil company NRL, we’re currently building the first biorefinery based on Chempolis' technology in India.

- Production of bioethanol, biochemicals and energy from bamboo.
- Biorefinery in Assam, in northeastern India

LINK to Siemens web page

Customer situation

Chempolis’ technologies enable bioethanol, dissolving pulp, cellulosic sugars, biochemicals and sulfur free lignin to be produced from all lignocellulosic raw materials: hardwood and softwood, non-wood and non-food biomasses such as straw, bagasse, corn stover, grasses, Empty Fruit Bunch and bamboo. **Chempolis’ business model** is to license biorefining technologies and to provide related services. They biorefinery in India is the first biorefinery in the world producing cellulosic ethanol and bio based chemicals from bamboo. *“Lignocellulose is a plant biomass consisting of cellulose, hemicellulose and lignin. Chempolis’ technology can be used to produce biofuels, various fiber products and numerous biochemicals from lignocellulosic raw materials,”* says General Manager Keijo Hytönen from Chempolis.

Siemens solution

- Siemens Solution Partner PCS Engineering
- SIMATIC PCS 7

Customer value

- The project included the replacement of the old ABB automation system with a Simatic PCS 7 process control system.
- “Simatic PCS 7 is a commonly used system in industry, which means that its use in customer projects is also a viable option, PCS-Engineering’s experience of the PCS 7 and engine control systems was essential for the success of the project,” Keijo Hytönen (chempolis) explains.

SIEMENS

KawARTHA eTHANOL, Canada partners with Siemens to achieve their goal of expanding their production facility and to equip it with the latest technology.

Project description

Kawartha Ethanol Inc. is an Ontario-based firm that operates an ethanol production facility that primarily produces ethanol and high-quality alcohols from corn. The production facility is capable of producing 80 million litres of fuel-grade ethanol per year.

Customer situation

Kawartha's objective is to expand their production facility and to equip it with the latest technology.

Siemens solution

- Upgrade the Simatic PCS 7 V8.0 to the latest version of Simatic PCS 7
- transform the existing DeltaT Library to Standard APL Library.
- Expansion of the plant includes Siemens Process Instrumentation (Pressure, Level, Flow, Temperature) and the supply of Motor Control Centers
- Project implemented by BCS Automation, Siemens PCS 7 Solution Partner

Customer value

- *“Our process includes hundreds of Siemens instruments, measuring flow, level, pressure, and temperature. All feeding back to a centralized DCS system via a Profibus network. We rely on the accuracy and dependability of this system to ensure we operate efficiently and safely.”*
- Bill Harris, Electrical Supervisor, Kawartha Ethanol

LINK to Siemens web page

SIEMENS

Marquis energy, USA
total DCS replacement in very short time

Project description

Marquis Energy completed its expansion in 2015, making it the largest dry-mill ethanol facility in the United States at that time with a production capacity of about 4,5 million liters per day (one million gallons) of fuel grade ethanol per day.

- Contract with **SIEMENS SIMATIC PCS 7 Solution Partner Trident Automation**
- Replace of APACS+ system with PCS 7, implement smart fieldbus technology, leverage the PCS 7 APL configuration library, all while utilizing a SiVaaS virtualized system architecture.
- “weekend work” full system migration including lessons learned and best practices.

Customer situation

- Positioned in Hennepin, IL on the Illinois River for global distribution via the inland waterway system and Class 1 rail access.
- Producer of ethanol, distillers grains, and crude corn oil.
- Production capacity > 1, 3 million cubic meters / year (>300 million gallons)
- Total DCS replacement in very short time (under 60 hours)

Siemens solution

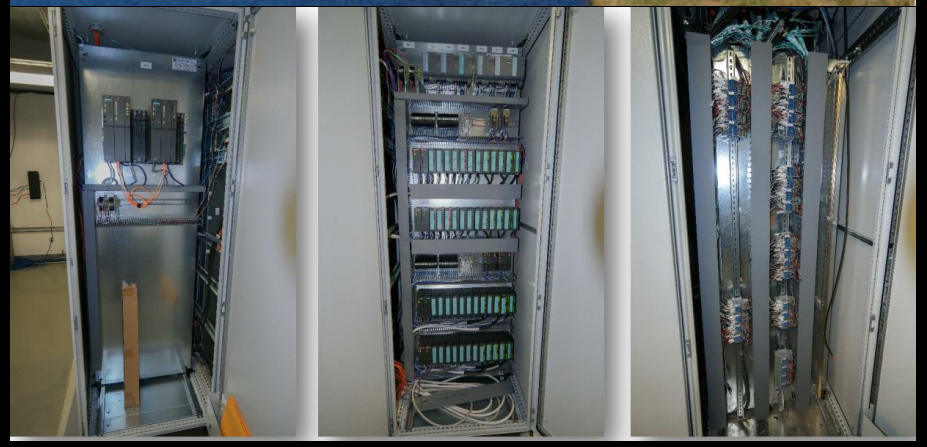
- SIMATIC PCS 7 and SiVaaS VM solution
- MCCs for Water treatment, Process, Fermentation and Energy

Customer value

- Value add since the 2015 migration including: Five PCS 7 4x4x1 MPC blocks and continued improvements around alarm management.
- The future plans include Advanced Process Graphics (spider diagram) and the Logic Matrix for advanced interlock visualization.

- More Information:

Trident Automation | advanced system
Trident Automation (youtube.com)



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