



MARCH 2023

ABB Ability™ – OPTIMAX® Energy Management & Optimization

Optimization for Energy, Emissions and Processes

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Agenda

- 01.** Introduction to the OPTIMAX® platform
- 02.** Application: OPTIMAX® for Industrials and Commercials (EMS)
- 03.** Application: OPTIMAX® for Advanced Process Control (APC)
- 04.** Sample Cases
- 05.** Q&A

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Introduction to **OPTIMAX[®]**

ABB Ability™ – Sustainability Portfolio

1

We help industry to deliver energy efficiency improvements

2

We help industry achieve Net Zero

3

We help industry preserve their resources

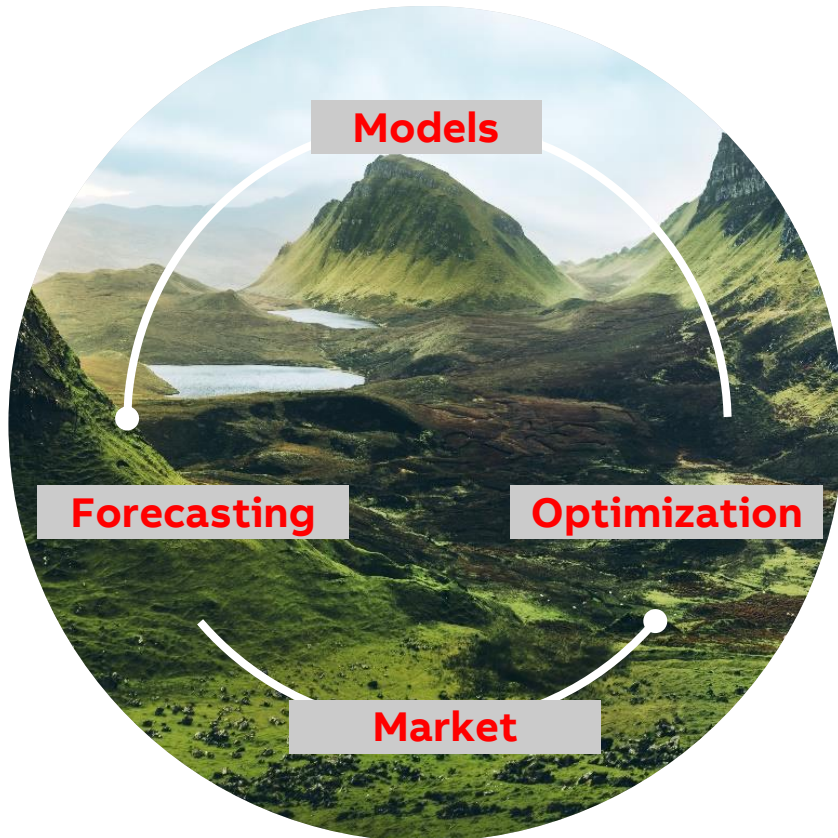
4

We help industry to become more profitable

Increase Energy Efficiency
and reduce carbon
footprint with Digital
solutions

Executive Summary

OPTIMAX[®] as the optimization environment for industrial applications



CO₂
↓ 100%

Cost
↓ 10%

Production
↑ 10%



Vertical Optimization Solutions

Where production, storage and consumption create and utilize flexibility

Sustainability Portfolio OPTIMAX - Energy Management & Optimization

Cross Industries



Cross Industry

OPX for Industrial Sites
Steam & Power Optimization
Carbon Capture
Wind + H2 + Solar (HPP) *
Hydrogen

Power, Water & Renewables



Power & Water

Waste Water Treatment
Desalination
Energy Eff for Smart Water
Virtual Power Plants/DERM
District Heating
District Cooling
Waste2Energy
Conventional Power Plants
Biomass

Chemical & Refineries



Chemicals & Refineries

Chemical Plants
Petrochem
Refineries

Oil & Gas



Oil & Gas

Offshore & Onshore
LNG
Offshore Wind

*) HPP ... Hybrid Power Plant

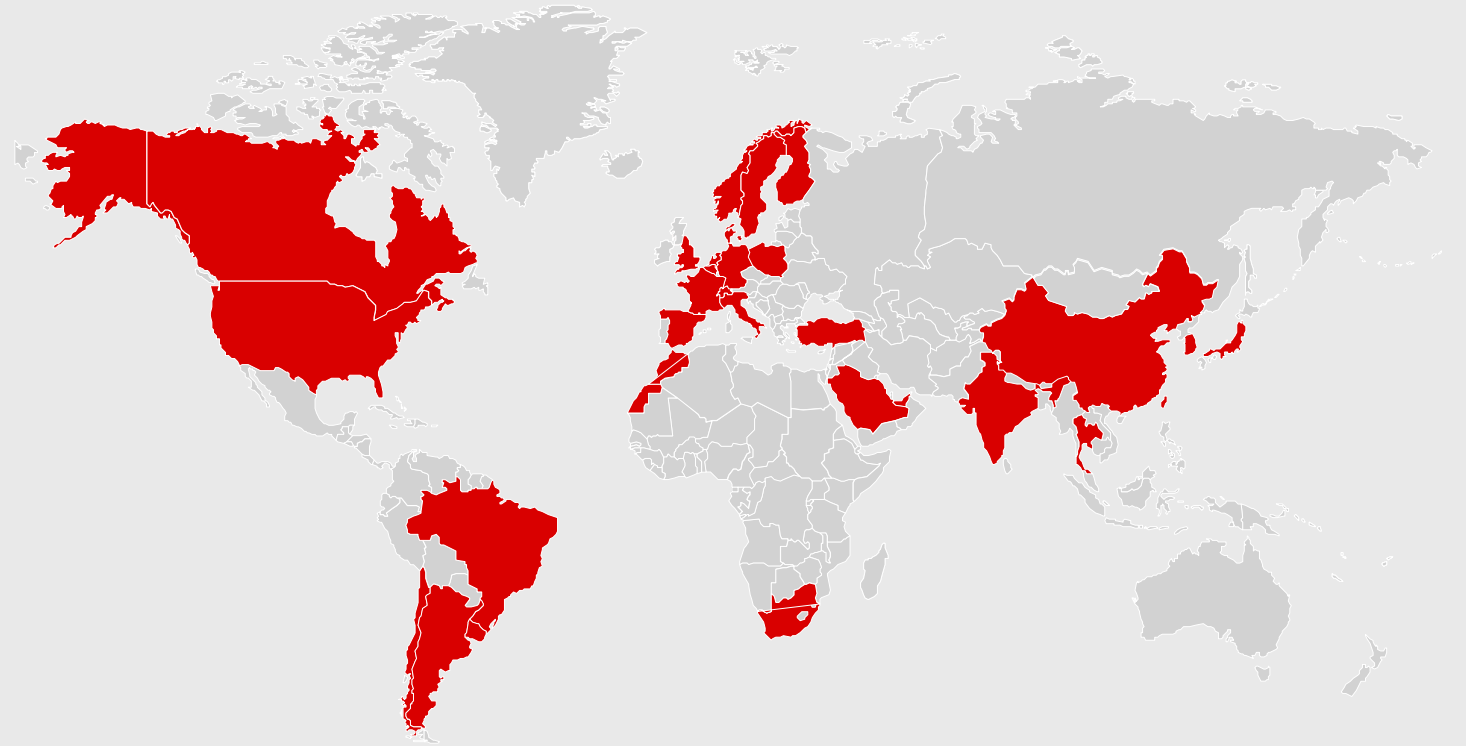
References around the globe

>200 installations

in

5 Continents

29 Countries



References

Scalable applications across all energy industries

From vision to mission

PTT-GC, Thailand

Scope of Supply:

- ABB Optimax EMS
- ABB Battery Energy Storage System PQplus (50kW / 120kWh)
- ABB Trio Solar Inverter (2x30kW), 3rd-party Solar Panel (60 kW)
- FAT, Installation, Commissioning, Training

OPTIMAX Energy Management and Optimization (SiteEMS) for the integration of Grid Connection, Solar, Battery, Consumption and Flexible Loads to save energy cost and avoid peaks (Peak Shaving) ABB BESS PQplus, ABB Trio Solar Inverter, Engineering from TH-IAEN

Success Points

- Starting from a great relation with customer, we realize of the customer's need to step in Renewable Energy and Digital Transformation, which are mega-trends of Thailand's energy sector, and Global disruption. The customer also rely on ABB's cutting-edge technology to fulfill the requirements.

Customer Benefits

- Reduced emissions and enabled 50% self consumption rate
- Avoiding peak loads by visualizing critical assets to the Central Control Building in the industrial complex
- Control and optimization of energy production, incl. solar, Battery storage, Diesel Generator

Customer: PTT-GC
Location: Rayong, TH Delivery: OPTIMAX®

50% Self



Application in the industry

Infraserv GmbH & Co Höchst KG

Customer need

- Control and optimization system for the flexibilization of the power plant park
- Generation units: 3 gas turbines, 2 electric boilers, 1 MVA, other external TEs (~ 255MW output)

ABB solution

- Optimization system for networking the TEs
- Real-time optimization of control power distribution
- Automated communication

Customer benefit

- Increase of the offered balancing power
- Power-2-Heat: Use of electric heat
- Flexible distribution of SRL/ MRL



Centralschweizerische Kraftwerke AG

Customer need

- Bundling of power plants and loads
- Scalability: 10 to more than 1,000 units
- Participation in the balancing energy market

ABB solution

- Scada-System
- Optimization of assets and pools
- Automated communication
- Str...



100%



360-degree service concept

Holzmanufaktur

Customer need

- Realization of CO2 savings
- Maximization of the local own consumption
- Optimization of energy influences
- Automation of the solar system

ABB solution

- Scalable and flexible energy management systems with OPTIMAX
- Energy and Efficiency as a Service from MWV
- Communication of energy flows in production by traffic light system

Customer benefit

- Transparent energy consumption
- High degree of network self-sufficiency
- Energy use is monitored in real time
- New plant generation can be integrated into a virtual power plant
- 360-degree service package for a sustainable, decentralized and efficient energy supply

Customer: Holzmanufaktur Liebich
Location: Zwiessell Delivery: OPTIMAX®

74% Network Independence



Large scale industrial sites

Multi-site operation

Virtual Power Plants

Customer need

- Central platform for optimizing energy consumption and generators
- Visualization of the individual retail locations
- Using the flexibility of the energy market
- Individual site optimization
- Load balancing of different assets

ABB solution

- Real time control / Intra-day and day-ahead optimization
- Peak Shaving
- Create schedule, avoid imbalances
- Warehouse management (batteries, cold storage)
- Control of consumers, storage and producers
- Monitoring function for validation
- Loading management as parking solution

Customer benefit

- Reduced energy costs
- Flexible switching on and off of consumption units
- Increased transparency and internal consumption
- CO2 saving
- Network autarky



14.09.2021 Slide 9

Customer need

- High scalability for a rapidly growing business (>8.000 units with >7,1 GW)
- Independent extensibility
- Marketing of available capacity on energy market

ABB solution

- Central control system for one virtual power plant:
- Biogas, Biomass, CHP/MicroCHP, Water/Hydro, Solar, Wind, Industrial Sites, Power-2-Heat, Standby-Sets,...

Customer benefit

- Balancing power & direct marketing
- Optimal distribution of balancing power calls
- Virtual server architecture with 11 servers in geographically redundant datacenters

Customer: Nekt Kraftwerke Location: Cologne
Delivery: OPTIMAX® for Virtual Power Plants

One of the biggest VPP

ABI

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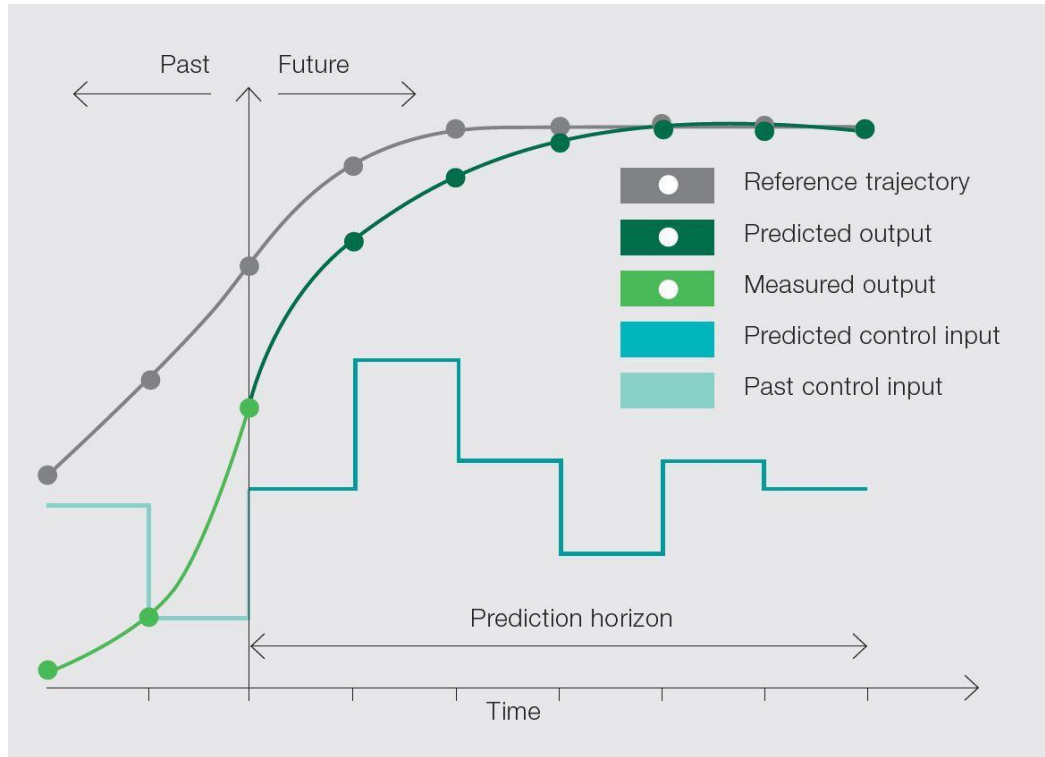
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Technology introduction

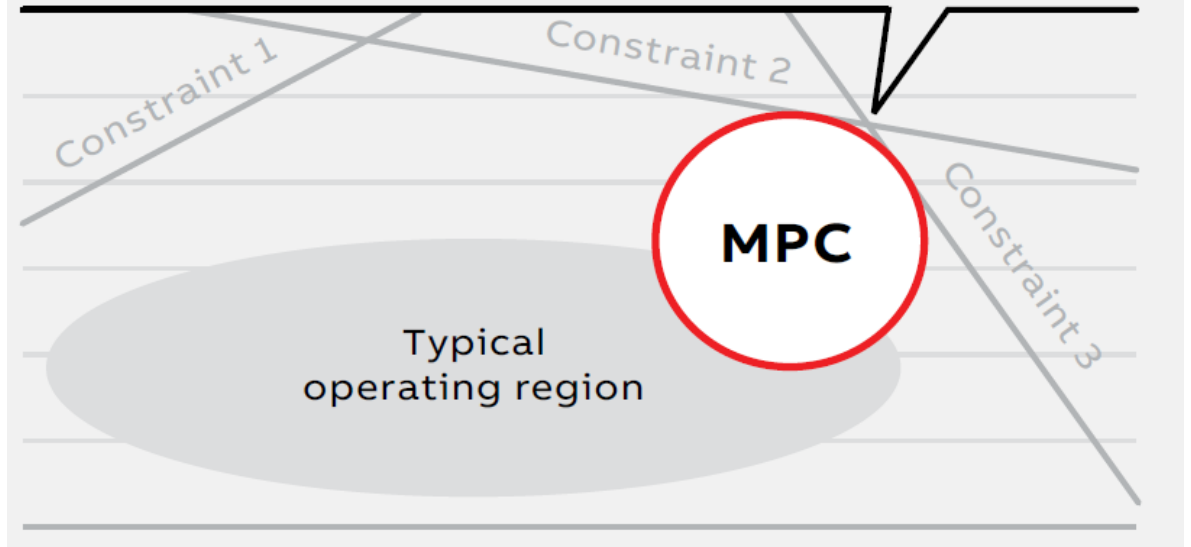
Optimization calculations over predicted time horizons

Model Predictive Control (MPC)

Graphical introduction



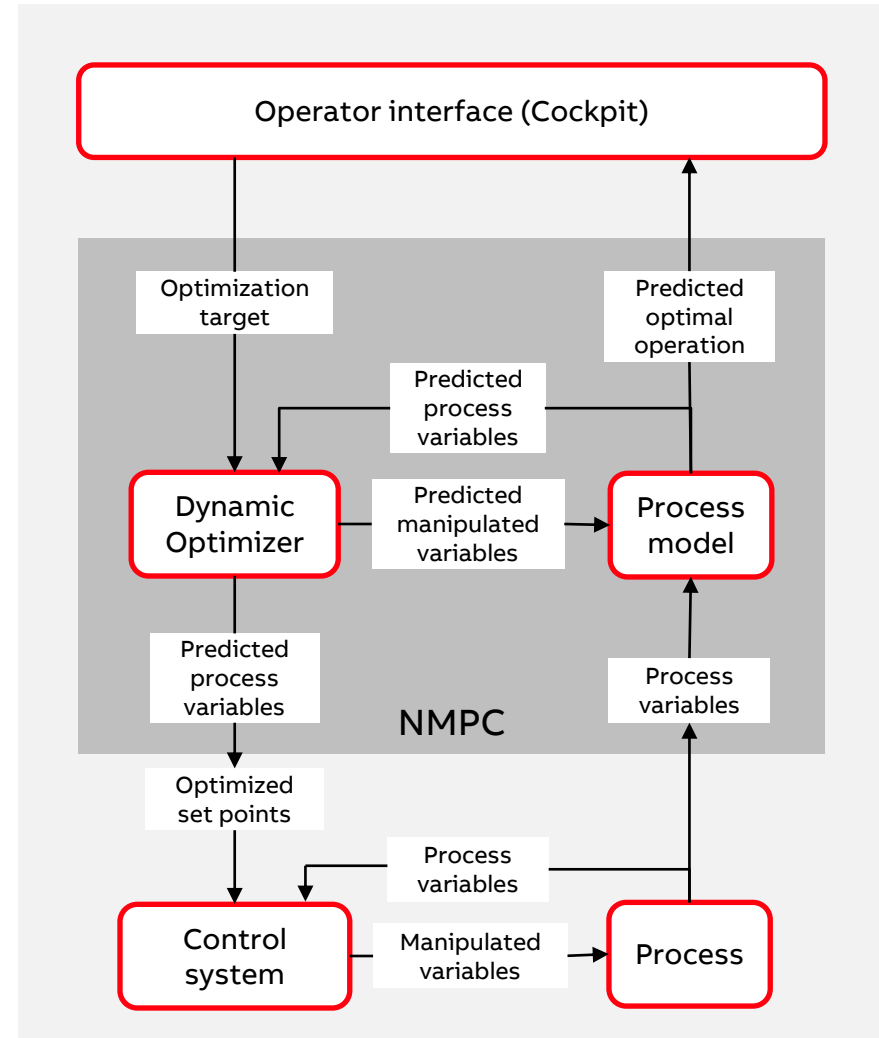
Operate close to multiple constraints limits and economic optimum



Iterating Optimization Process

Operation, optimization, monitoring and control go hand-in-hand

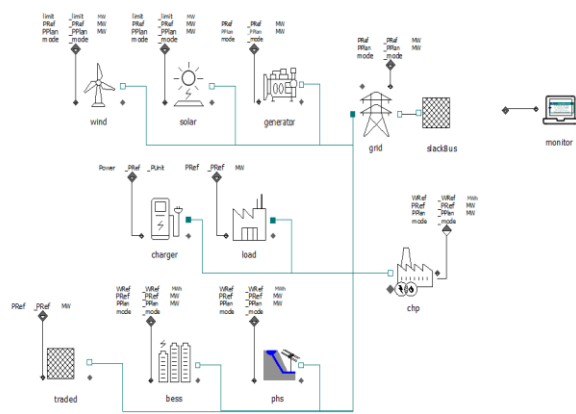
- **Modelica:**
 - Modelling language to build process models
 - Standard FMU export for runtime execution
- **Dynamic Optimizer (DO):**
 - optimizes target values according to objective function
 - Executes the FMU process model based on Modelica
 - Sends and receives real time values
- **Control System:**
 - adjusts process accordingly & regulates overall process according to setpoints
- **Process:**
 - Physical process, such as solar plant, CHP etc
- **Operator Interface:**
 - Monitor and modify the optimization processes



OPTIMAX for Virtual and Hybrid Power Plants

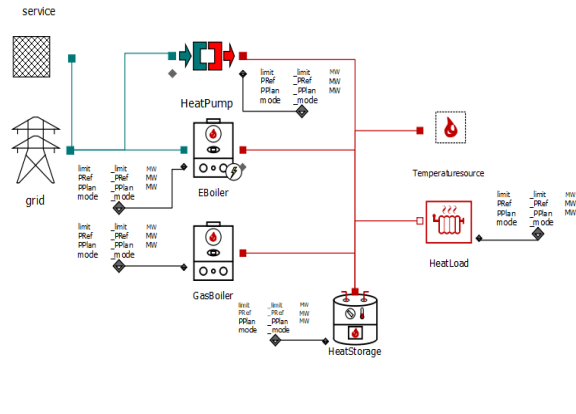
Sector coupling with multiple domains

Electrical



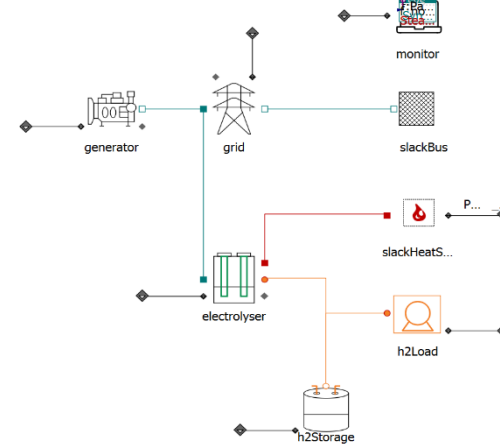
- Renewable power
- Grid connection
- Compensation

Thermal



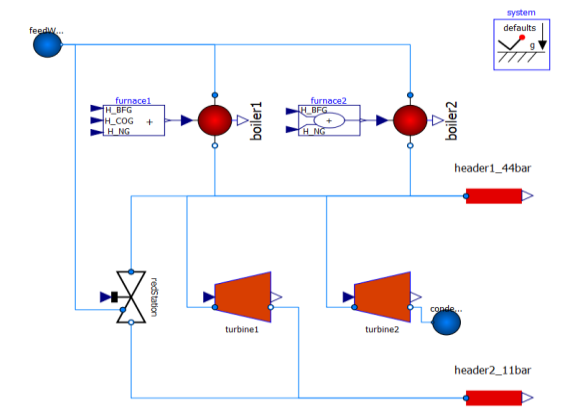
- Exploitation of waste heat
- Heat pumps

Hydrogen



- Enable circular systems

Steam/Water



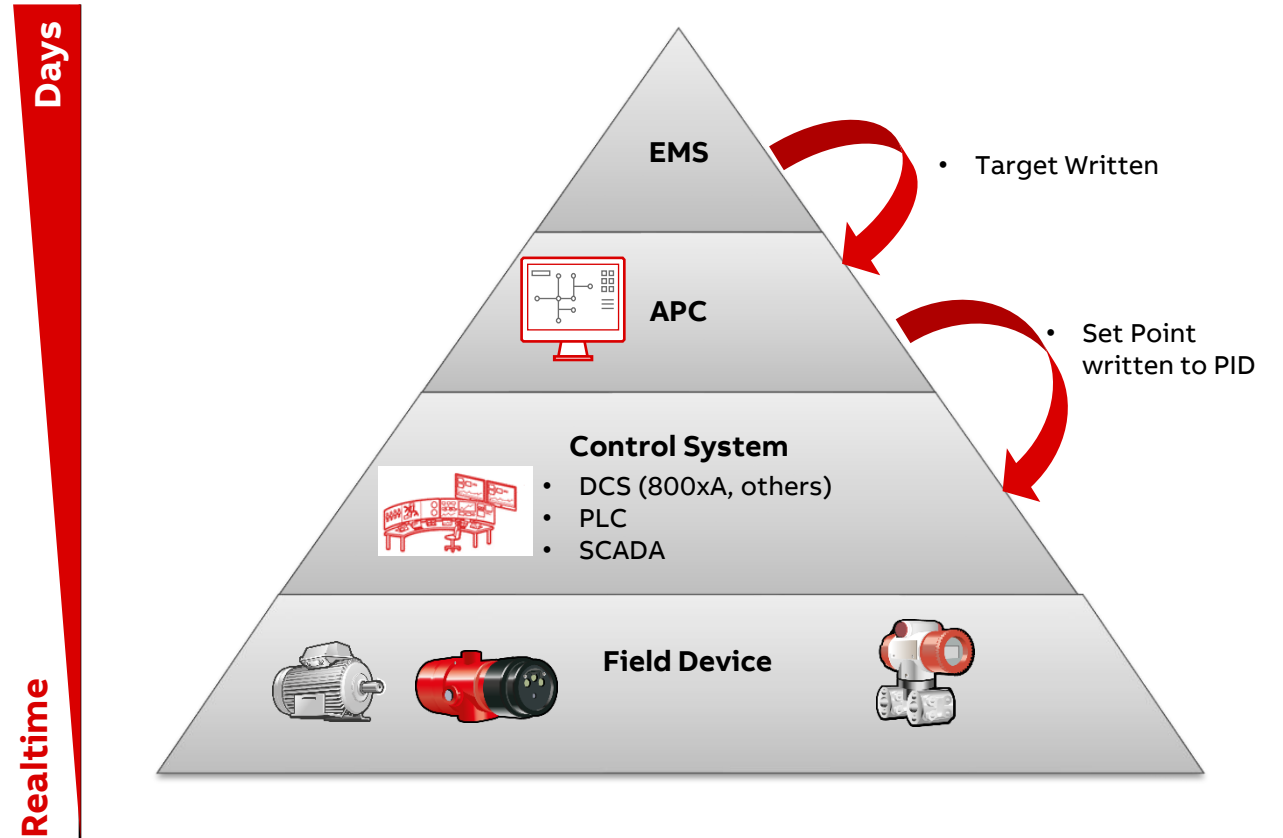
- Process steam
- WWTP

Integrated Energy Systems

Advanced Process Control and Energy Management System

Hierarchical approach

- Coordinated control of plant production using a standard software solution
- Energy Management System (EMS) computes the optimal operating point considering non-linear, first principle models
- Advanced Process Control (APC) drive the plant to optimum operating conditions.
- Allows more flexible strategies – multi objective with explicit priorities



OPTIMAX[®] for Industrials and Commercials (EMS)

Optimization for Energy, Emissions and Processes

Monitoring & Reporting + Control & Optimization = Energy Management

OPTIMAX Energy Management

Energy Efficiency for Industrial Sites

Monitoring & Reporting

Save time on reporting

Comply to ISO 50001

Identify areas of improvement

Control & Optimization

Reduce cost and emissions

Avoid peak loads

Allow optimal sector coupling

Achieving energy savings by increasing the efficiency of operations. Key to helping enterprises reach their sustainability goals, reduce emission and cost.



ABB Ability™ – OPTIMAX Energy Management provides customers with insights to take better decisions and run smarter operations while reducing risk, emissions and cost.

ABB Ability™ Energy Management for Sites - OPTIMAX for Industrials and Commercial

Powerful, user-friendly, state-of-the-art energy management and optimization system for all applications

Our core solution



Monitoring & Reporting

- Enhanced user experience and visibility of your energy usage on-site
- PDF reports
- Excel export

Real Time Operation

- Real-time control and optimization
- Coordinated control at site level

Intra-Day- / Day-Ahead-Opt

- Intra-Day and Day-Ahead Optimization
- Optimal schedules based on forecasts, loads and prices + updated during day

Option



Forecasting & Simulation

- ML Forecasting
- AI Enhanced Forecasting
- Digital Twin
- Steam and power

Option



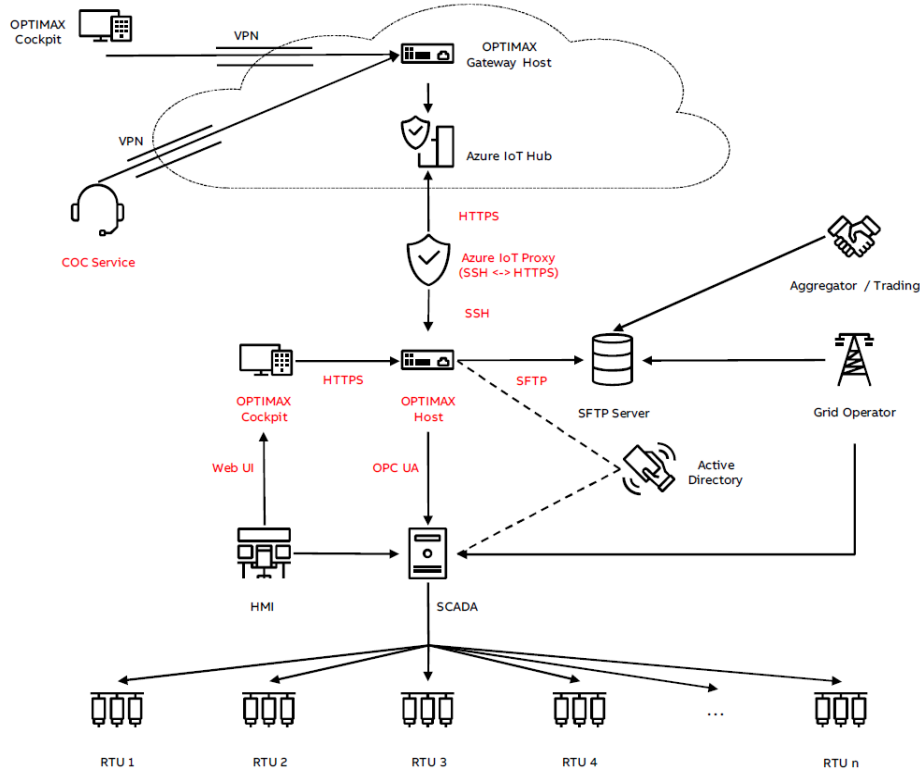
Multi-Site Operation

- Benchmarking sites
- Enterprise wide energy optimization

ABB Ability™ Energy Management - OPTIMAX® for Industrials and Commercials

System Architecture: edge or cloud deployment

Edge Deployment – on premise (with SCADA)



Cloud Deployment

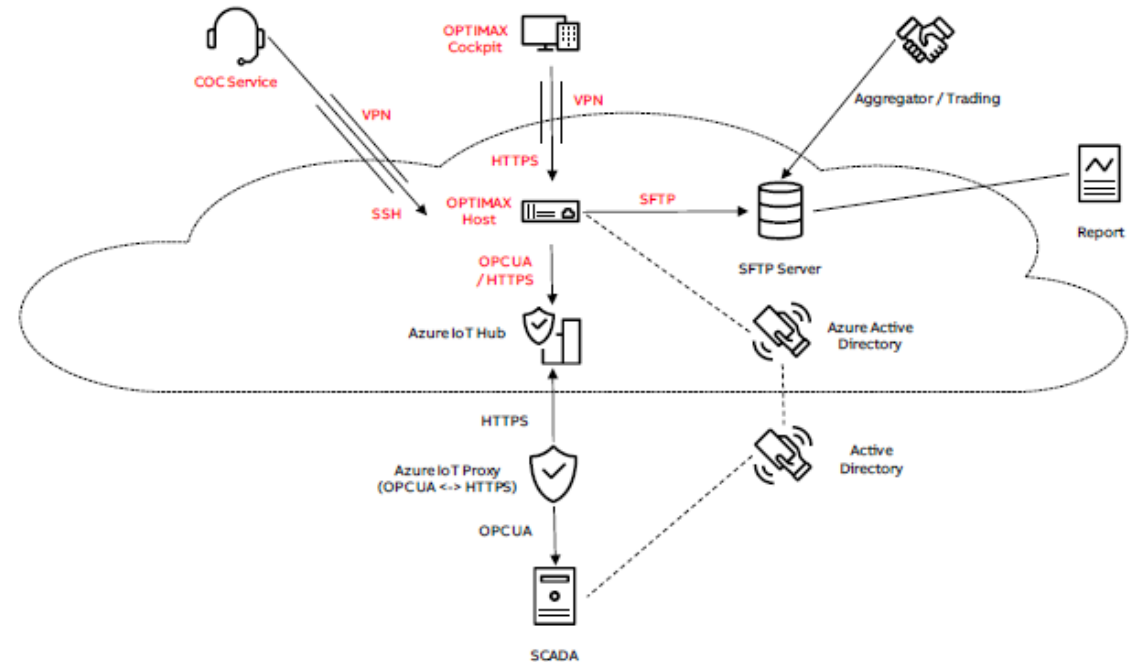


ABB Ability™ Energy Management for Sites

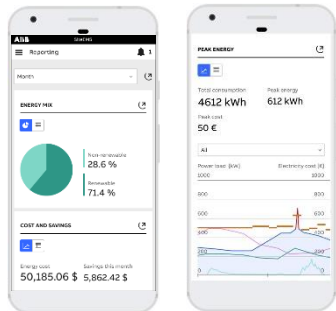
Take Away – Unique Selling Points

Stepwise Approach

1. Create Visibility
2. Automate Control
3. Optimize Operation

Single site

Multiple site for enterprise wide optimization



Why ABB – Unique Selling Points

Not only energy management for control and monitoring

- 1. Optimal operation**
by planning and scheduling ahead without impacting production processes
- 2. System Integration**
Easily add new on-site generation, EV-chargers, batteries
Energy Management for Sites is your control system to integrate all assets
- 3. Enterprise wide energy optimization**
Benchmarking sites against each other
Central Participation at energy markets

Proven Benefits

Reduce cost and site emissions

Manage peak consumption

Up to 10 %

Increase ratio of self-generated energy & reduce energy purchase

Save time

20 – 100 h/m

Create operational visibility

Automate manual engineering processes

Generating accurate and easy-to understand reports and visualizations

Increase revenues

2 – 5 %

Participate at energy markets

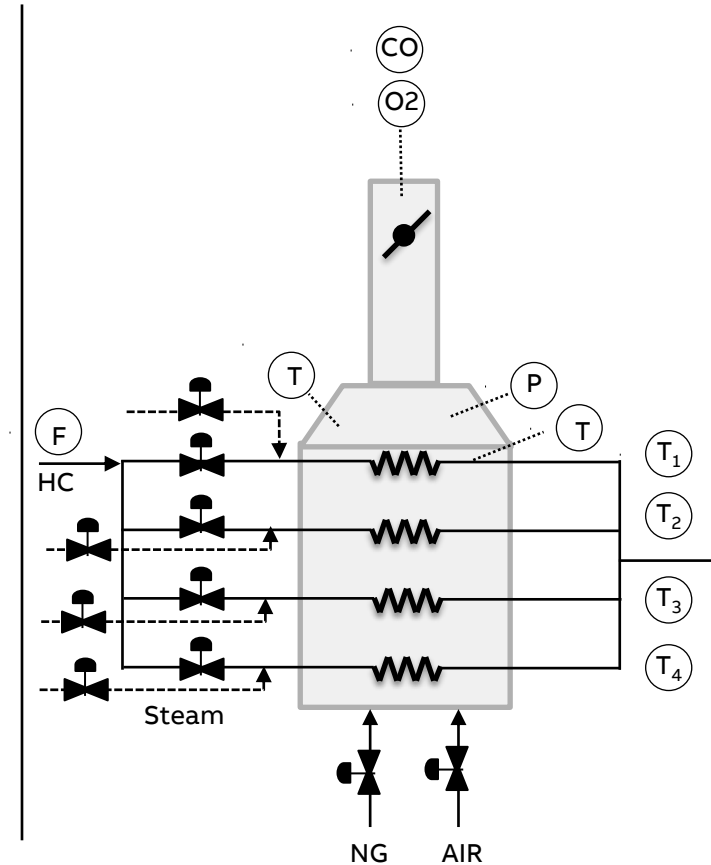
Use dynamic pricing schemes from your EaaS provider

OPTIMAX[®] for Advanced Process Control (APC)

Can automation help improve Energy Efficiency?

Process units are complex

- Simple, decoupled single control loops based on P&ID do not necessarily provide optimal performance in many cases
- Each control loop pursues a local optimization with the same priority, missing a global optimization based on priorities
- Example: let us consider a Steam Cracking Furnace
 - Many actuators
 - Many objectives
 - Priorities e.g. CO more important than O2
 - How do I handle this with uncoordinated simple control loops?
- Even if I use a complex DCS strategy, how can I handle priorities and interactions?



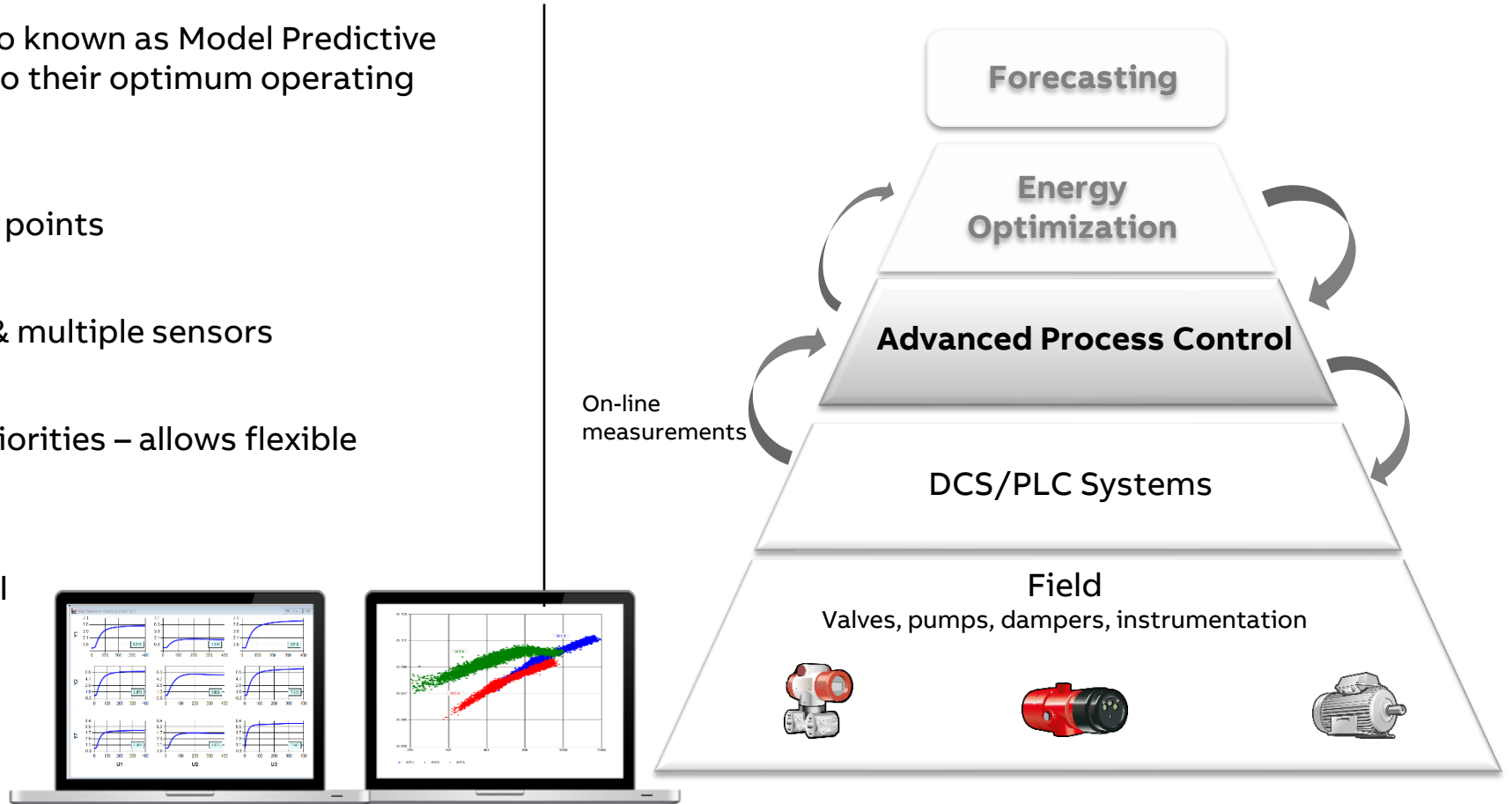
- Keep COTs at target - conversion
- Keep skin temps below max
- Keep furnace temps below limit
- Maximize Flow
- Keep CO below limit
- **+** Minimize O2
- **-** Preserve stoich. Ratio
- Keep HC/Steam ratio at target based on conversion

Moving one step further: Advanced Process Control technology

OPTIMAX - Predict & Control Basics

Weather, Energy Prices, Power Plan

- Advanced Process Control, also known as Model Predictive Control, helps drive the plant to their optimum operating conditions
- Automatically changes the set points
- Considers multiple actuators & multiple sensors
- Multi objective with explicit priorities – allows flexible strategies
- Uses an explicit process model



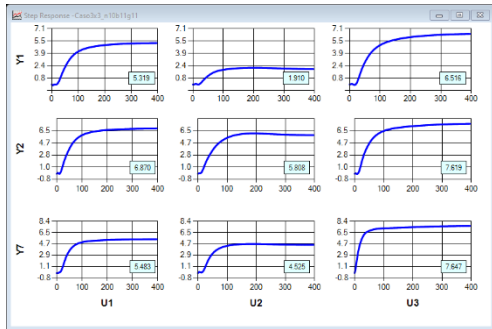
Advanced Process Control Technology

Some key Advantages

Interactions

Handle interactions between variables using an explicit process model.

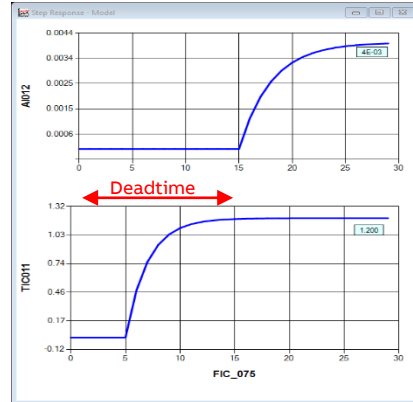
The APC controller takes into account the interactions when performing calculations



Long Delays/Settling Times

Handle long dynamics that PID controllers fail to control with adequate performance.

The APC controller takes into account the long dynamics when performing calculations



Priorities

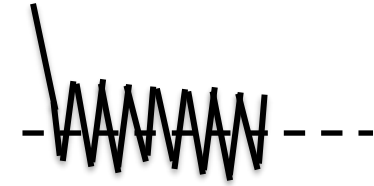
Handles an explicit list of priorities.

The APC controller will consider the priorities in case of conflict in the objectives

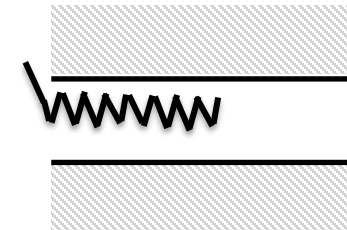
Hierarchy:

1. Safety
2. Process Constraints
3. Specifications
4. Economics

Range Control



Pure Setpoint. Actuator always working to bring process variable to setpoint



Range control. Actuator working only when predictions show process variable will go outside the limit

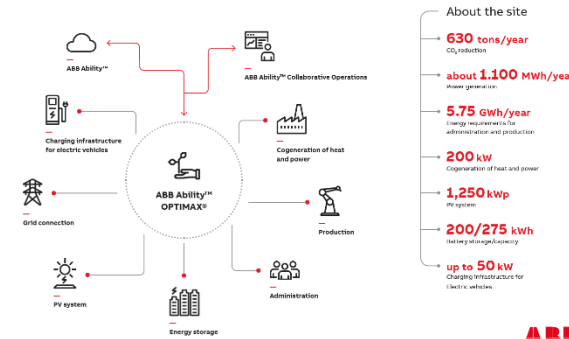
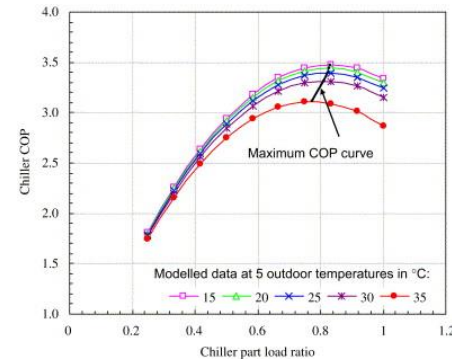
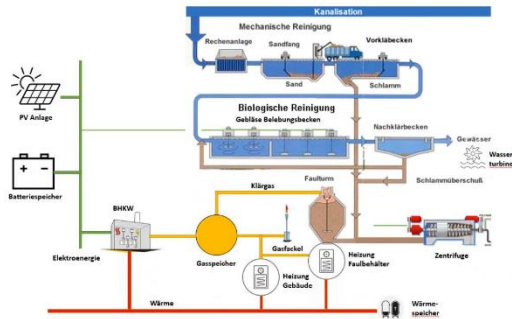
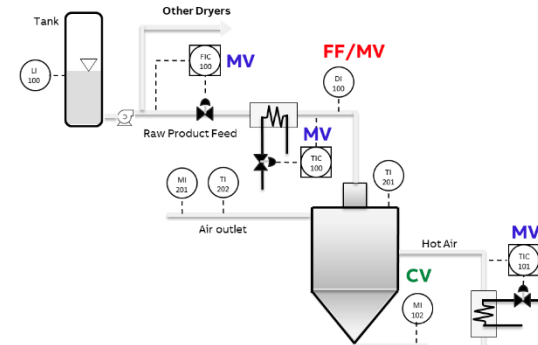
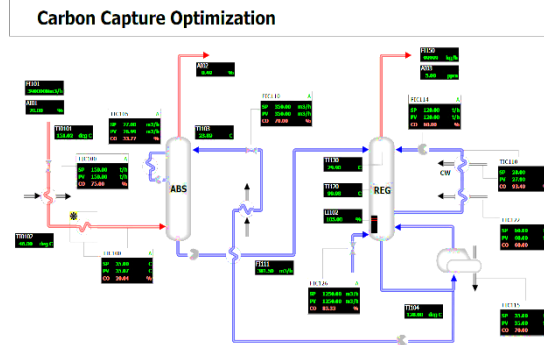
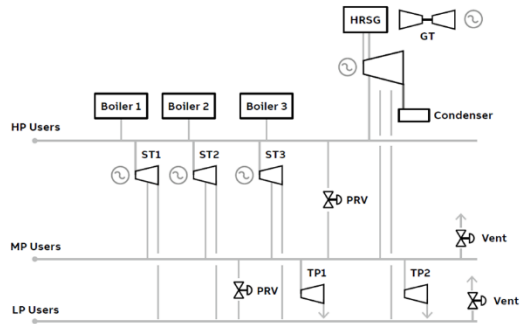
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OPTIMAX®

Sample cases

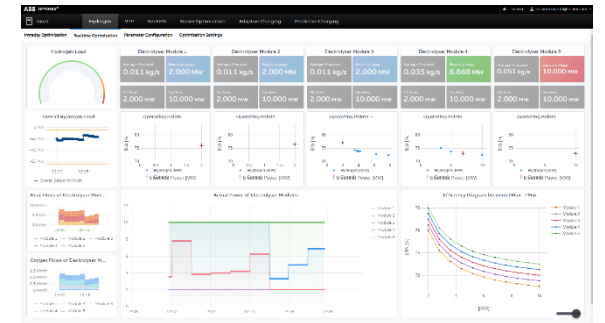
Sample cases of OPTIMAX®

Advanced Process Control and Energy Management System



About the site

- 630 tons/year CO₂ reduction
- about 1.100 MWh/year energy generation
- 5.75 gwh/year Cogeneration of heat and power
- 200 kw Cogeneration of heat and power
- 1,250 kwp PV system
- 200/275 kwh battery storage/energy storage
- up to 50 kw Charging infrastructure for electric vehicles



Various applications across all industries



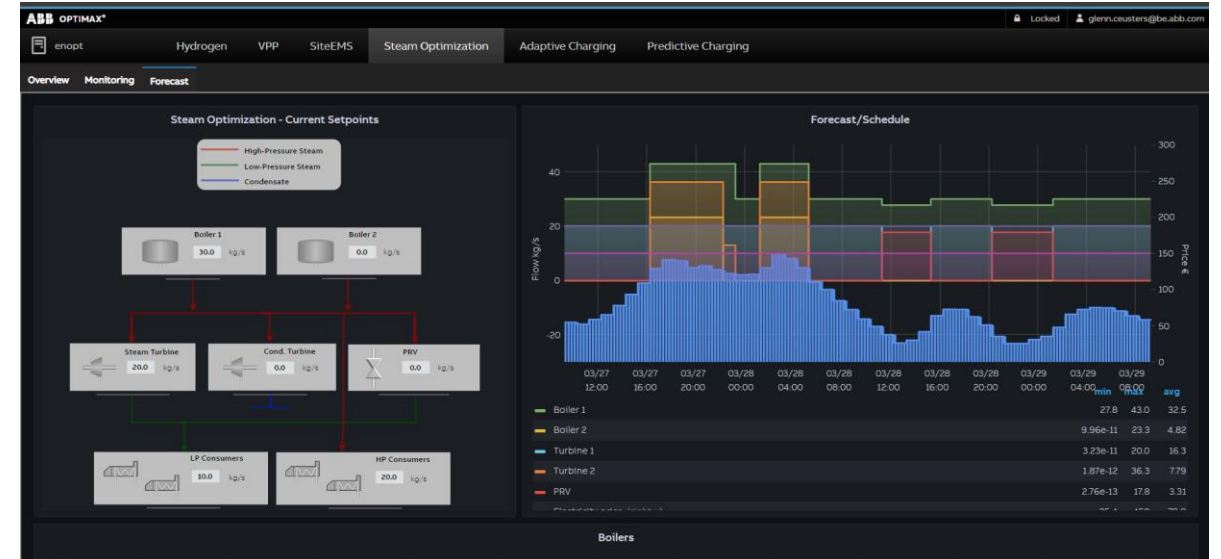
Sample cases of OPTIMAX®

Some screenshots

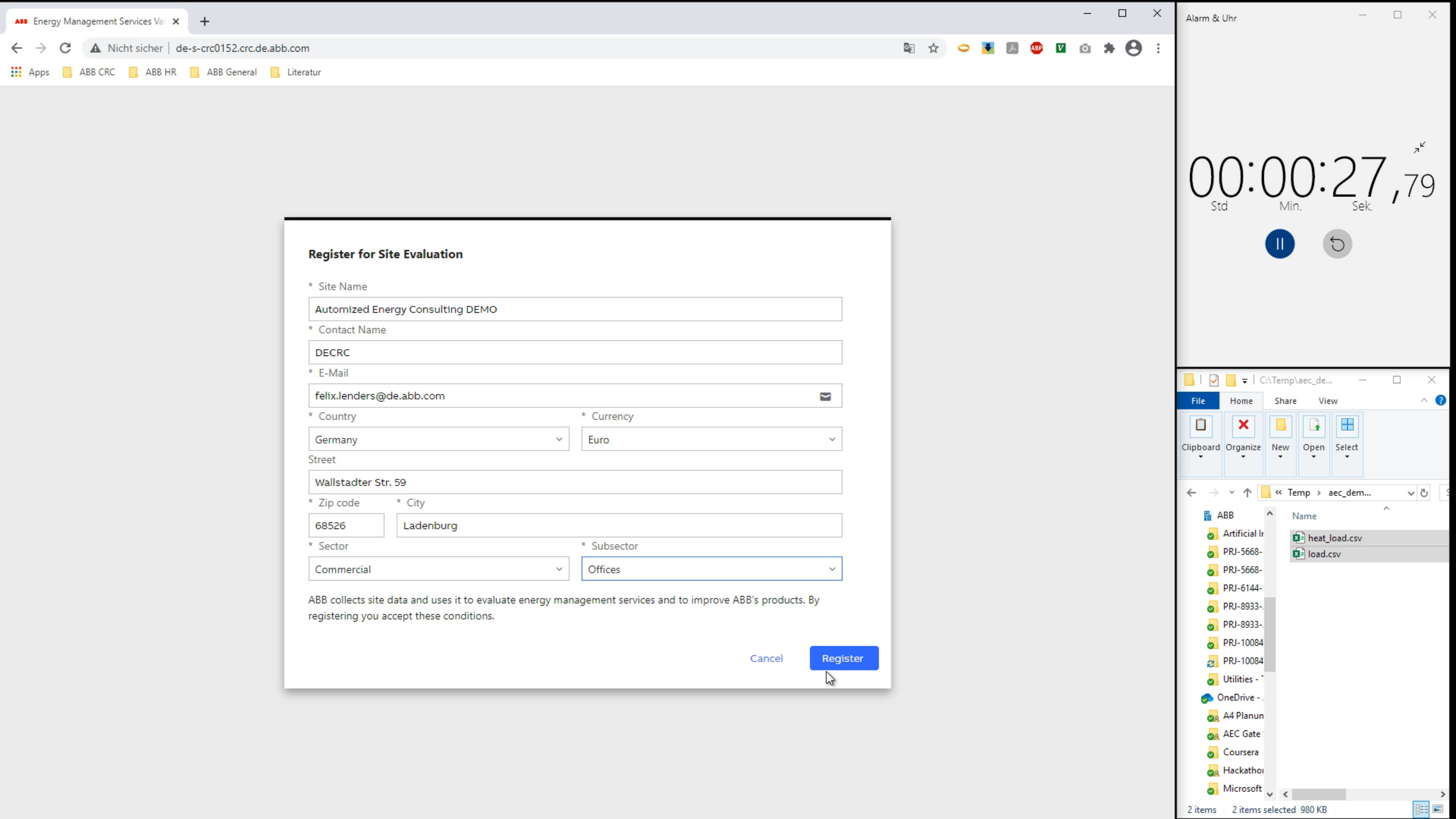
EMS example



APC example



Various applications across all industries



Register for Site Evaluation

* Site Name
Automized Energy Consulting DEMO

* Contact Name
DECRC

* E-Mail
felix.lenders@de.abb.com

* Country
Germany

* Currency
Euro

Street
Wallstadter Str. 59

* Zip code
68526

* City
Ladenburg

* Sector
Commercial

* Subsector
Offices

ABB collects site data and uses it to evaluate energy management services and to improve ABB's products. By registering you accept these conditions.

Cancel

Register

Alarm & Uhr

00:00:27,79
Std Min. Sek.



C:\Temp\aec_de...



<< Temp > aec_dem...

- ABB
 - Artificial In...
 - PRJ-5668-
 - PRJ-5668-
 - PRJ-6144-
 - PRJ-8933-
 - PRJ-8933-
 - PRJ-10084
 - PRJ-10084
 - Utilities -
 - OneDrive -
 - A4 Planun
 - AEC Gate
 - Coursera
 - Hackathoi
 - Microsoft
- | Name |
|---------------|
| heat_load.csv |
| load.csv |

2 items | 2 items selected 980 KB

Key Takeaways

1. Optimax® – Solid offering from Energy Monitoring to APC, Energy Management to Energy Markets interaction
2. Energy Monitoring – start with a KISS
3. Build on with APC and Energy Optimization
4. Coordinated management of assets delivers tangible benefits
5. Optimization benefits can pay for the project but also, automation upgrades



Q&A

CONTACT DETAILS

Let's get in touch!



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