Performance Insight for Industrial Edge

Update V1.3, October 2021

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Introducing

Industrial Edge

An open software platform that
makes shop-floor IT simple,
scalable and manageable

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Edge Computing introduces IT-mechanisms to the shop-floor to provide local data processing and analytics capabilities in the <u>most easiest</u> way

Provides decentralized and **local** data
- acquisition,
- storage,
- analytics and
- transfer
capabilities

Increases a **flexibility** by allowing to deploy **any** software fast and **reliably** on to the shop-floor

Reduces complexity and IT-costs by providing Edge device and application lifecycle management functionalities

Reduces infrastructure costs for data storage and transfer and allows **secure data** handling **within production**

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Low-Code platform

Build apps faster for cloud,
on-premise or hybrid infrastructure

IIoT as a service

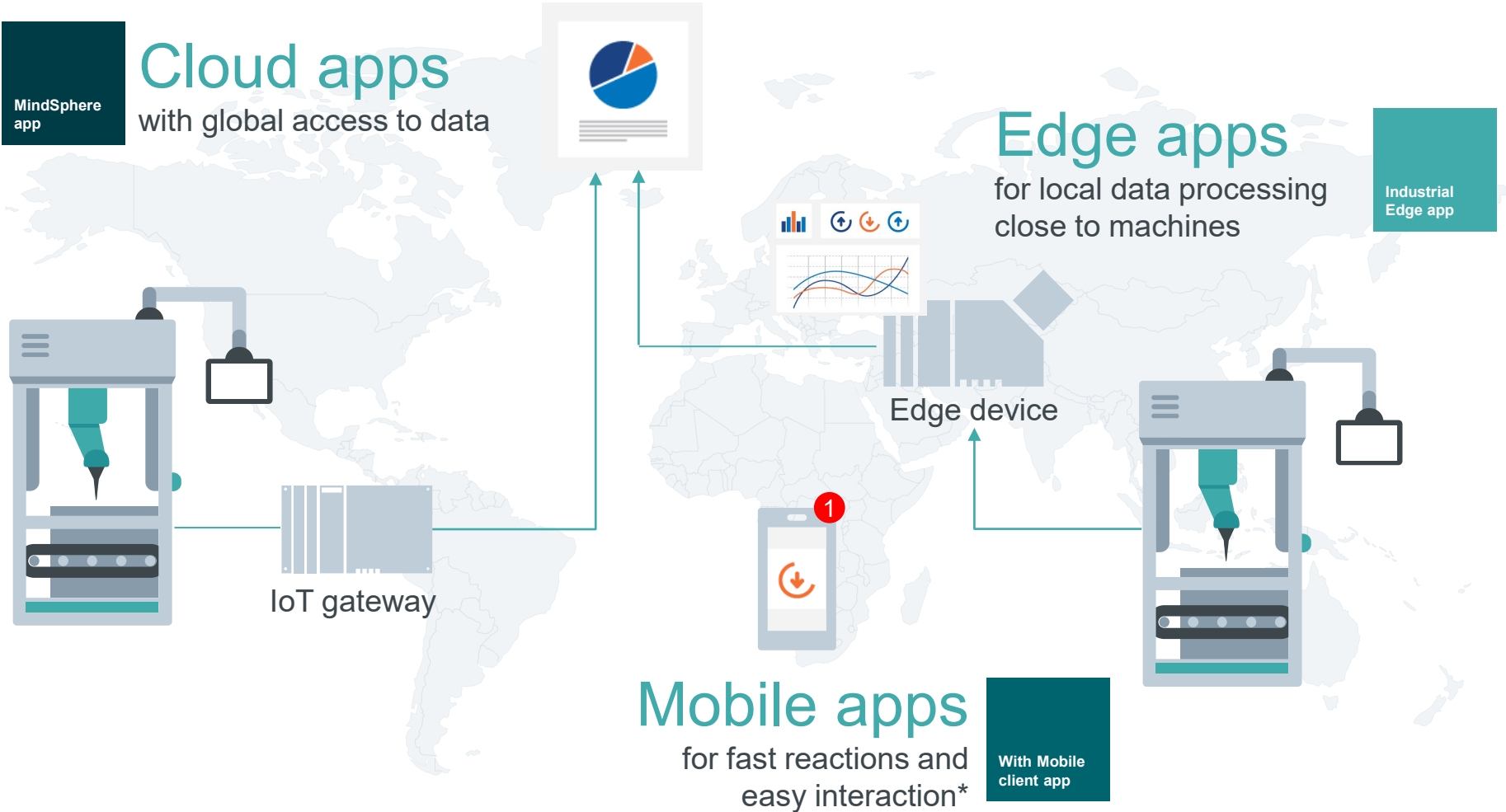Centralized compute & storage,
with solutions, apps & services

Edge Computing

Decentral compute & storage with
device runtime, apps & management

**Field/Control**

Automation runtime & engineering
connectivity

Industrial IoT apps add value to our open IoT ecosystem around MindSphere and Siemens Industrial Edge

Cloud apps
with global access to data

MindSphere app

Edge apps
for local data processing close to machines

Industrial Edge app

Edge device

IoT gateway

Mobile apps
for fast reactions and easy interaction*

With Mobile client app

* Mobile Client apps in addition to Cloud or Edge apps

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Performance Insight
Easy transparency about machinery
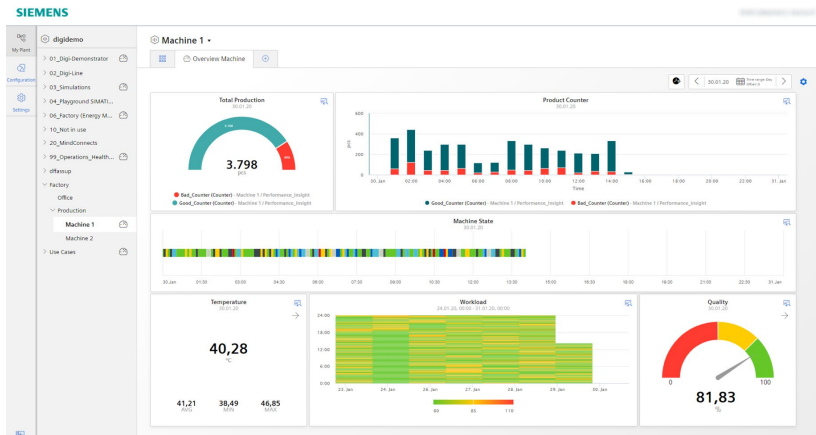
Performance Insight is the tool to increase productivity for any machine, line or plant. Calculate and visualize key performance indicators to detect optimization potentials worldwide.

Benefits:

► Calculate KPIs based on individual formulas to determine machine and plant performance.

► Access machine and plant performance worldwide.

► Get the most valuable information for precise decision-making to optimize machine availability and performance.

Features:

► Performance overview of machines, lines and the whole plant.

► Flexible dashboard configuration with detail views.

► Support of different widgets (charts, gauge, bar, Gantt) to visualize machine states and performance indicators over time.

► Choose time period to detect unused performance potential in retro perspective.

Industry focus:

Cross industry based on flexible dashboard and KPI calculation.

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Product Overview

Performance Insight

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Easy transparency about machinery with Performance Insight
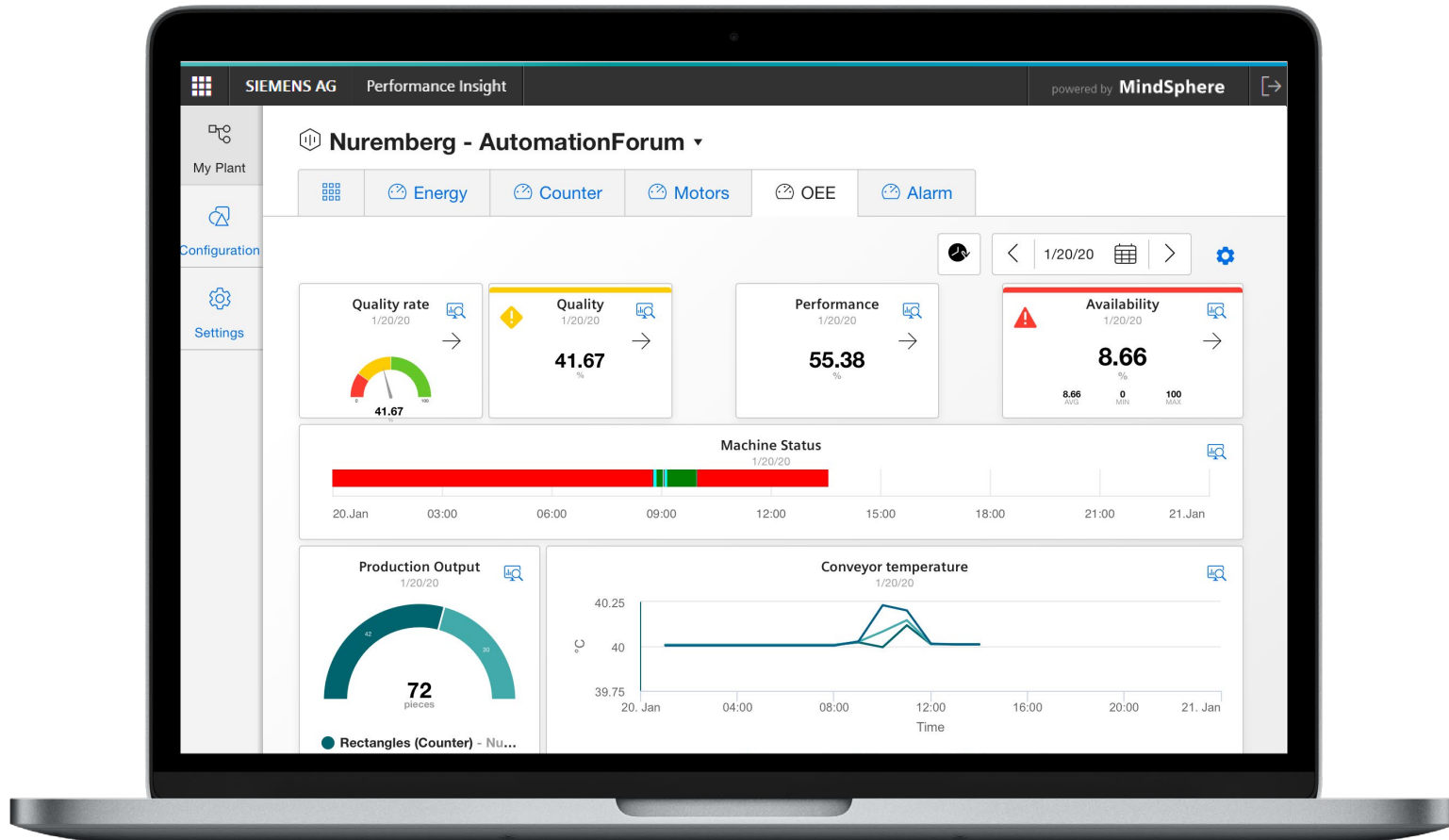
Increase productivity for machines, line or plant:

- Flexible tool for calculating and visualizing the machine condition to get additional machine transparency.

- Optimize assets by gaining transparency about OEE, quality and further KPIs.

- Generic visualization enables an integration of all kind of machines.

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Transfer data to information with Performance Insight

Production output over time

Visual representation of machine states

Live machine parameters

Using custom dashboard with different widgets to transfer data to information:

- Gauge Widget provides an overview about the Quality of your machine.

- In the heat map the value is represented as color. → see when the Workload was on point.

- Additional Widget types like Pie Chart, Value, Diagram, Gantt are used to display KPIs in a way that measures can derived immediately.

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Out of the box analysis with Performance Insight

Production over time

Integrated statistics

Trend analysis with regression curve
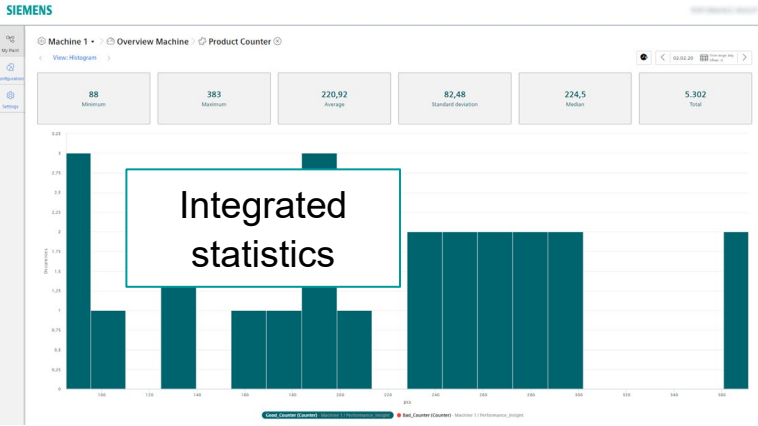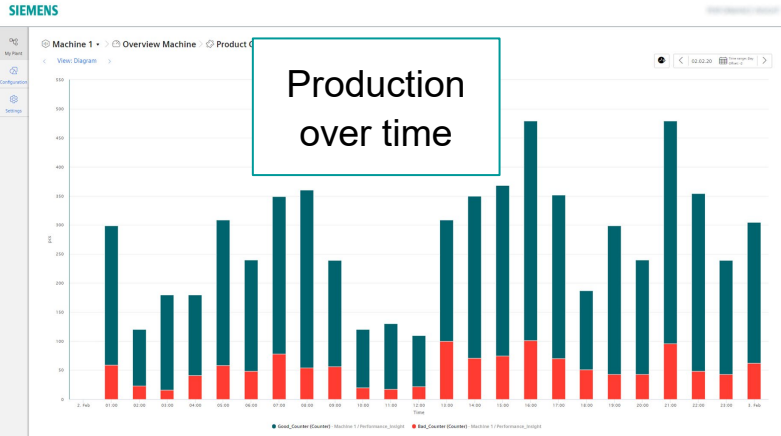
Detailed information for each widget in the dashboard:

- Statistic view provides a histogram for each parameter including the statistic. (min, max, average, median, standard deviation and sum).

- Regression view provides the possibility to display the data in a x-y chart including a trend representing the plant characteristic.

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Out of the box OEE monitoring with Performance Insight
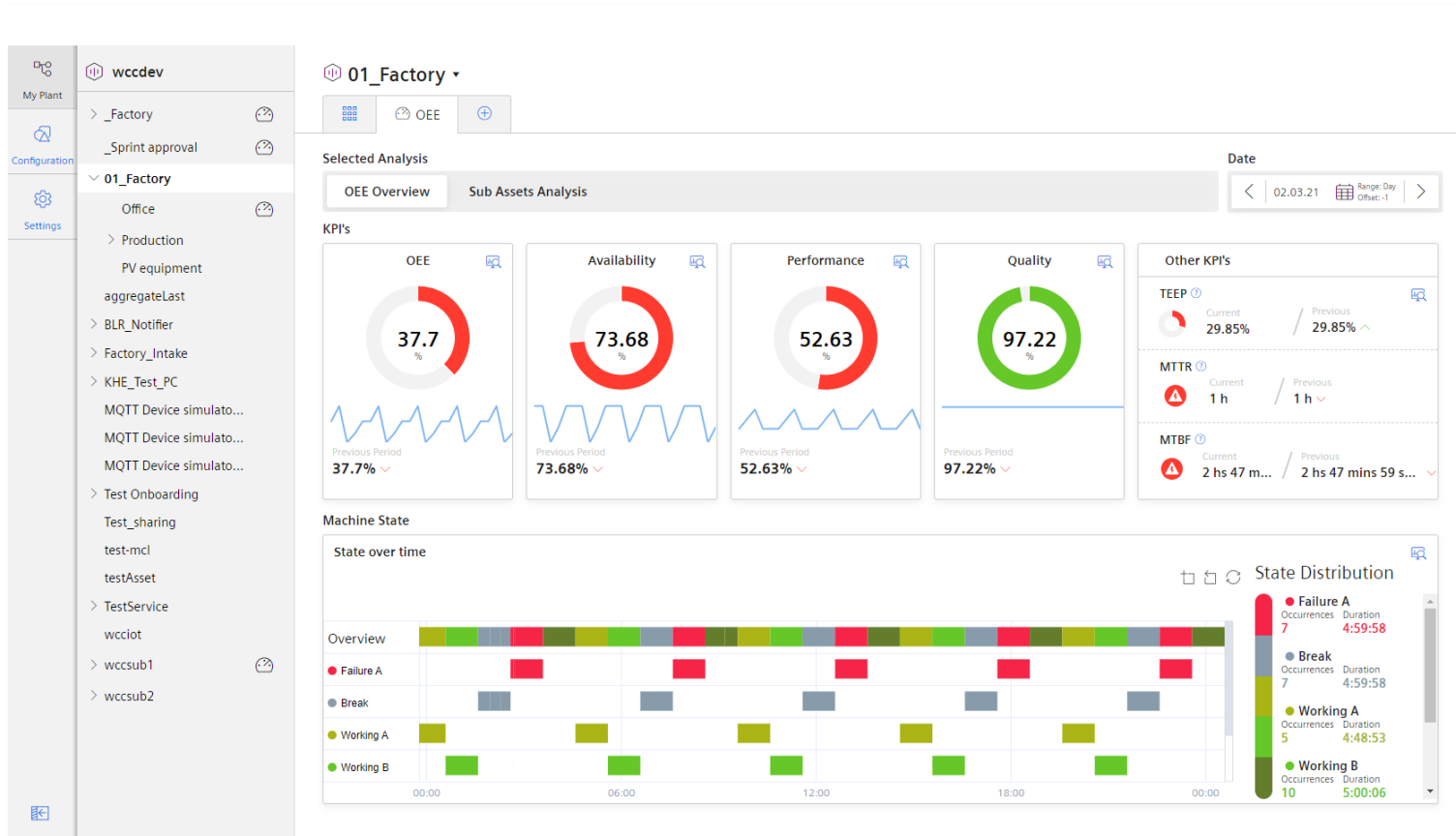
With just a view clicks to a holistic view about the machine or the line performance:

- Analysis capabilities with charts, statistics or time comparison.

- Transparency about machine states for route cause analysis.

- Time model analysis to visualize the Performance.

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Install and start the Apps on the Unified Comfort Panel
Overview

Performance Insight

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Install the App on the Unified Comfort Panel
Install Offline

1 Click the "Install Offline" Button

2 Browse the *.app file
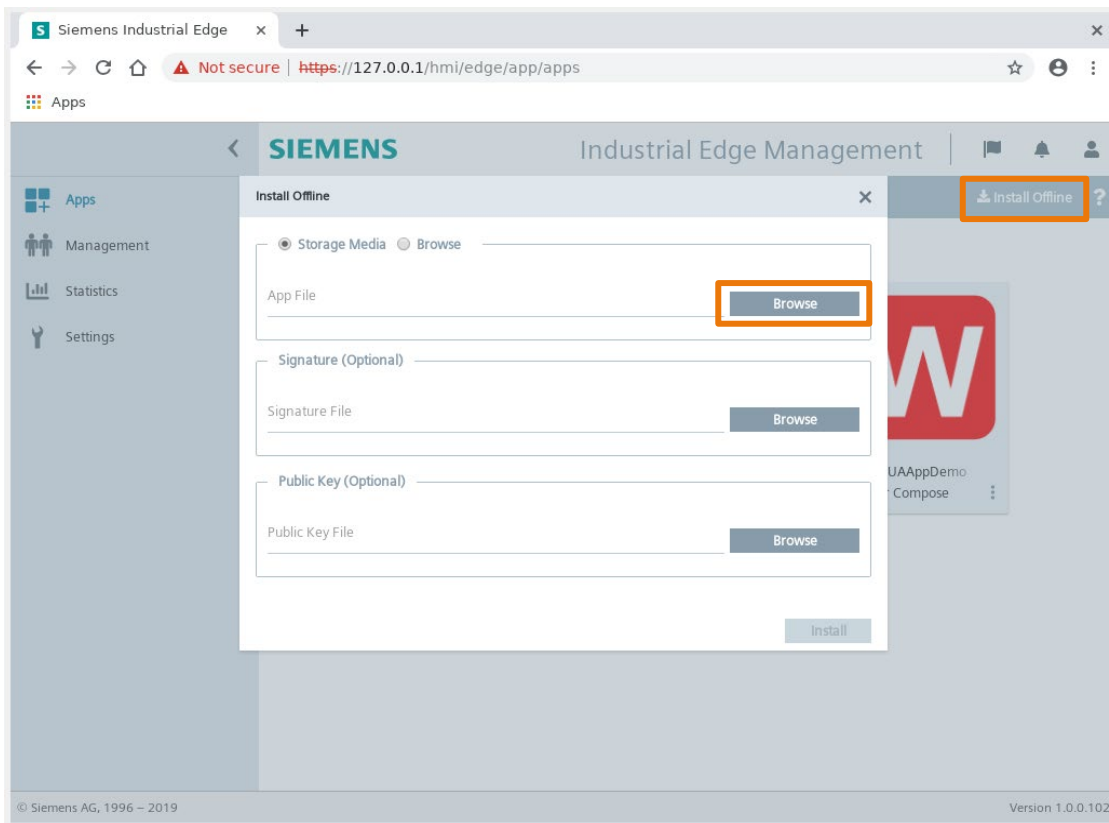
To install the App on the Unified Comfort Panel you need to save the *.app file on the USB Stick and plug it into the slot.

- Click on "install Offline"
- Browse the *.app File

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Install the App on the Unified Comfort Panel
Install Offline

3   Select the *.app file

4   Open the *.app file
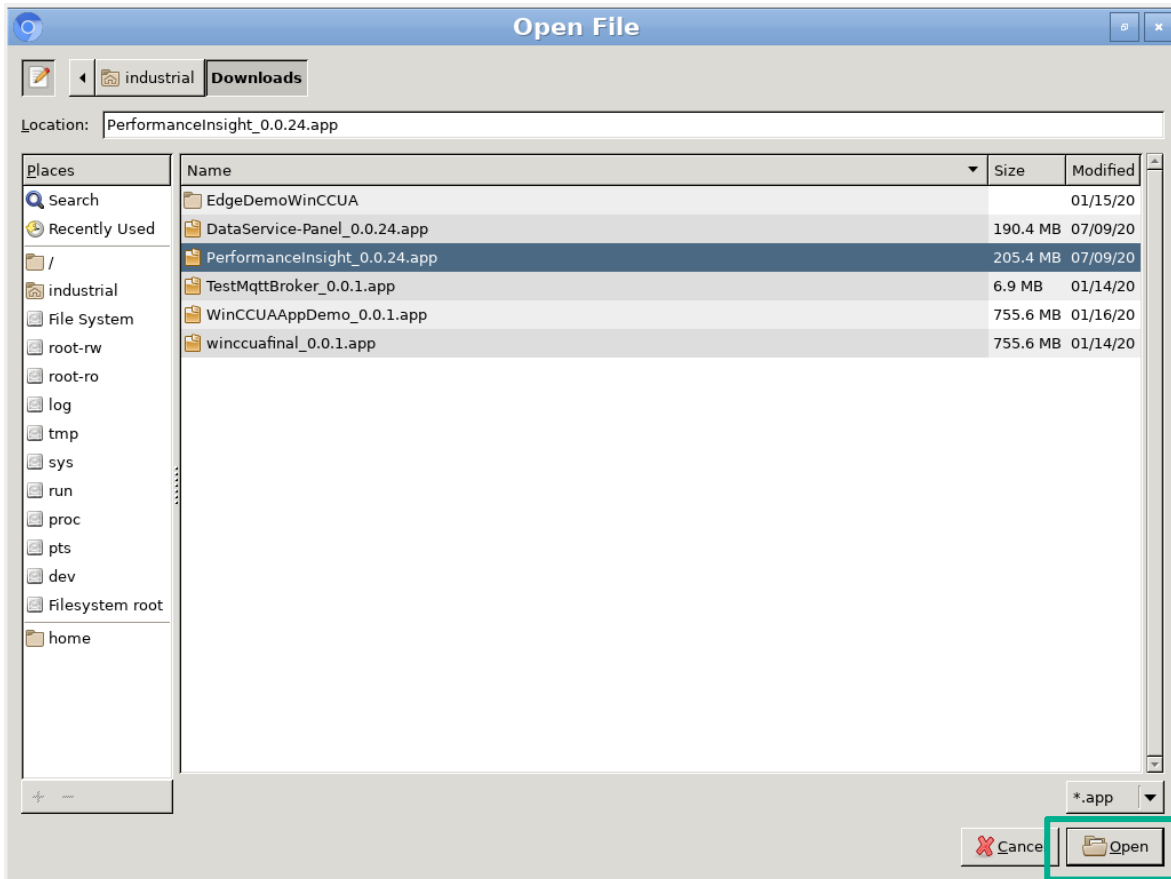
To install the App on the Unified Comfort Panel you need to select and open the *.app file.

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Install the App on the Unified Comfort Panel
Install Offline

5 Install the *.app file
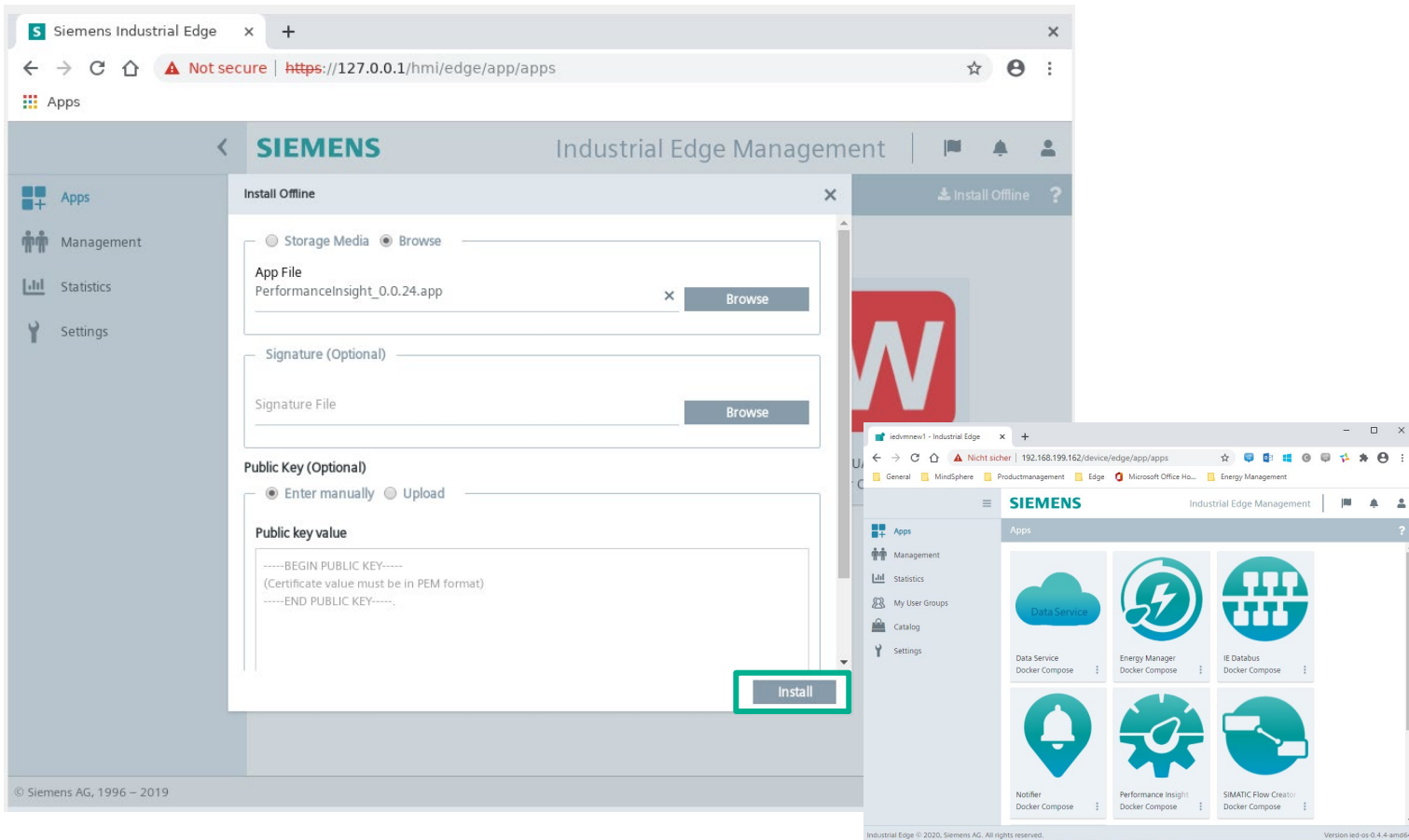
To install the App on the Unified Comfort Panel you need to install the App on the UCP.

After the successful installation, the App Home screen appears.

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Start the App on the Unified Comfort Panel
Start the App

6 Start the App

To start the App, go to the "Management" view and start the App.

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Out of the box OEE monitoring

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Performance Insight offers an out of the box OEE dashboard
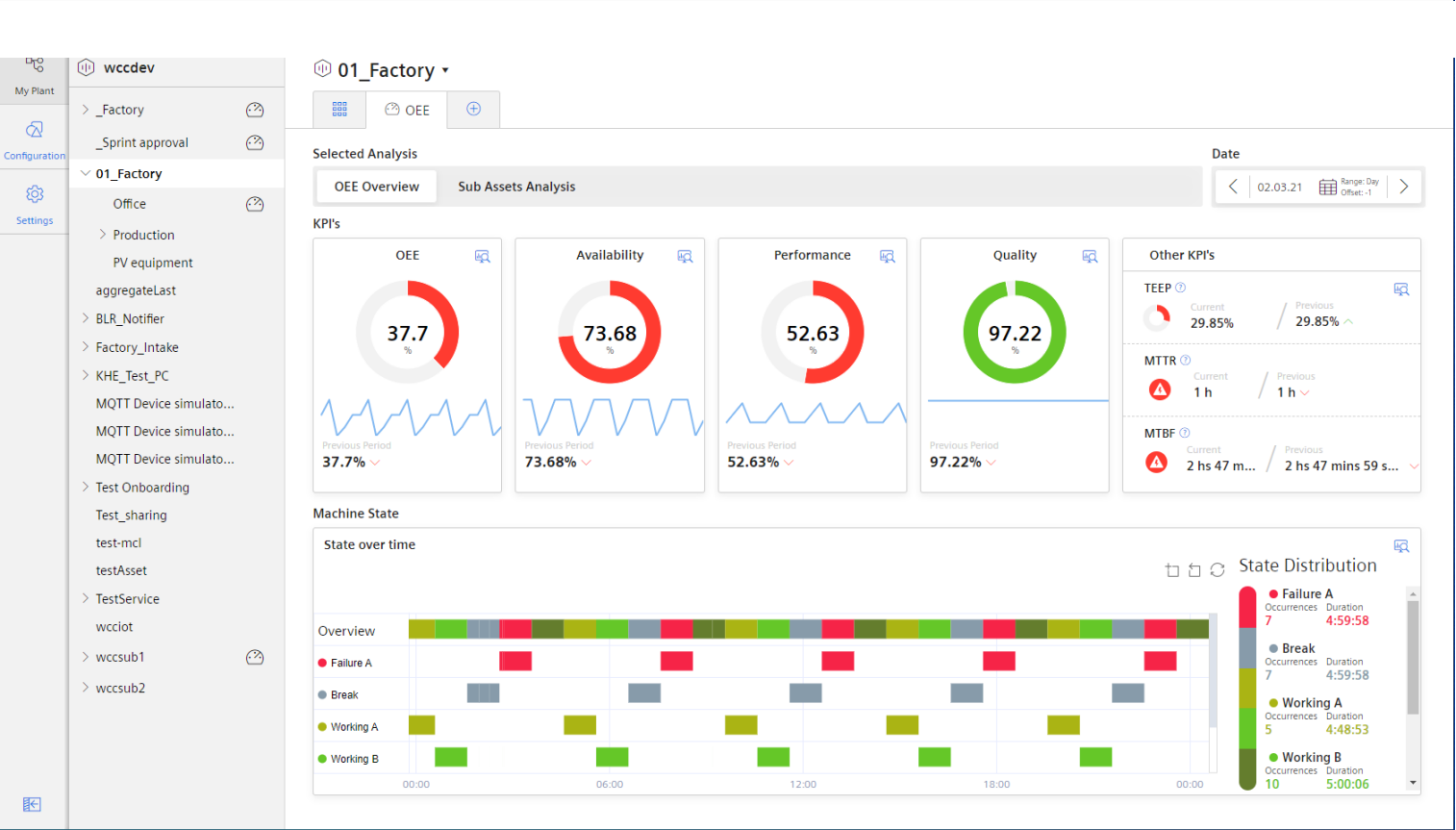
- As soon as the OEE settings are defined for the asset, the dashboard will be displayed.
- The main KPIs are displayed including the value of the previous period and the detailed data in the preview area.
- The limits are pre-defined but can be adjusted for each KPI .
- The Gantt Chart provides an overview about the individual machine states including a summary.
- As soon as if an OEE Configuration is available for a sub asset, the button "Sub Asset Analysis" is active.

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Detail view for Performance KPIs

Chart analysis

KPI comparison per day, week or month

Statistic information (e.g. min, max, average)
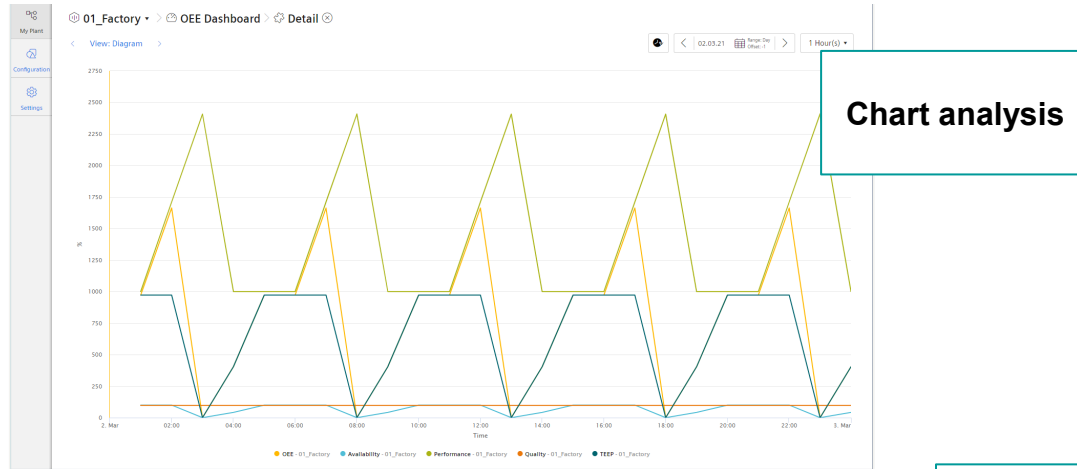
- Detail view of each KPI Widget provides all relevant KPIs in a line chart (TEEP, OEE, Performance, Availability and Quality).
- Change the analysis period or the resolution using the time picker.
- Histogram view is available providing statistic information.
- In the Time Comparison view, Performance KPIs are compared for the previous day, the previous week and the previous month, to detect deviations.

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Detail view for the Performance Gantt chart

Detailed Gantt Chart

Time model analysis
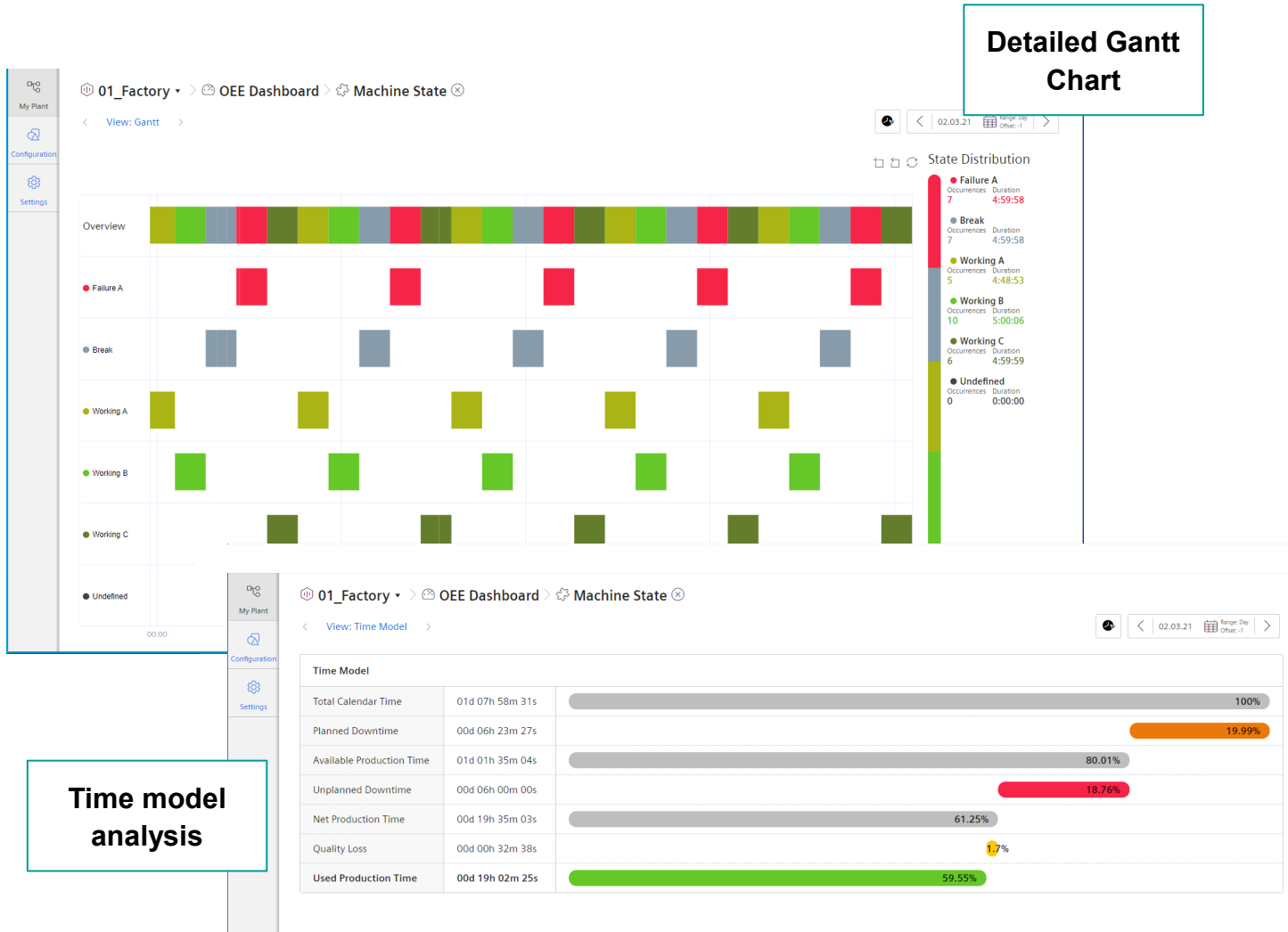
The Time Model analysis provides the overview about the total calendar time and the portion of Planned Downtime, the Unplanned Downtime and further the Net Production Time.

The Quality losses are also considered but this is a calculated value based on the quality rate.

Example: If the net production time is 60% and the quality rate is 90%, the Quality losses are 60(1-0.9) = 5,4%*

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Sub asset OEE analysis

Note: The aggregation from machine performance to line performance (several machines) has to be implemented in Visual Flow Creator, the PLC, or in a similar tool.
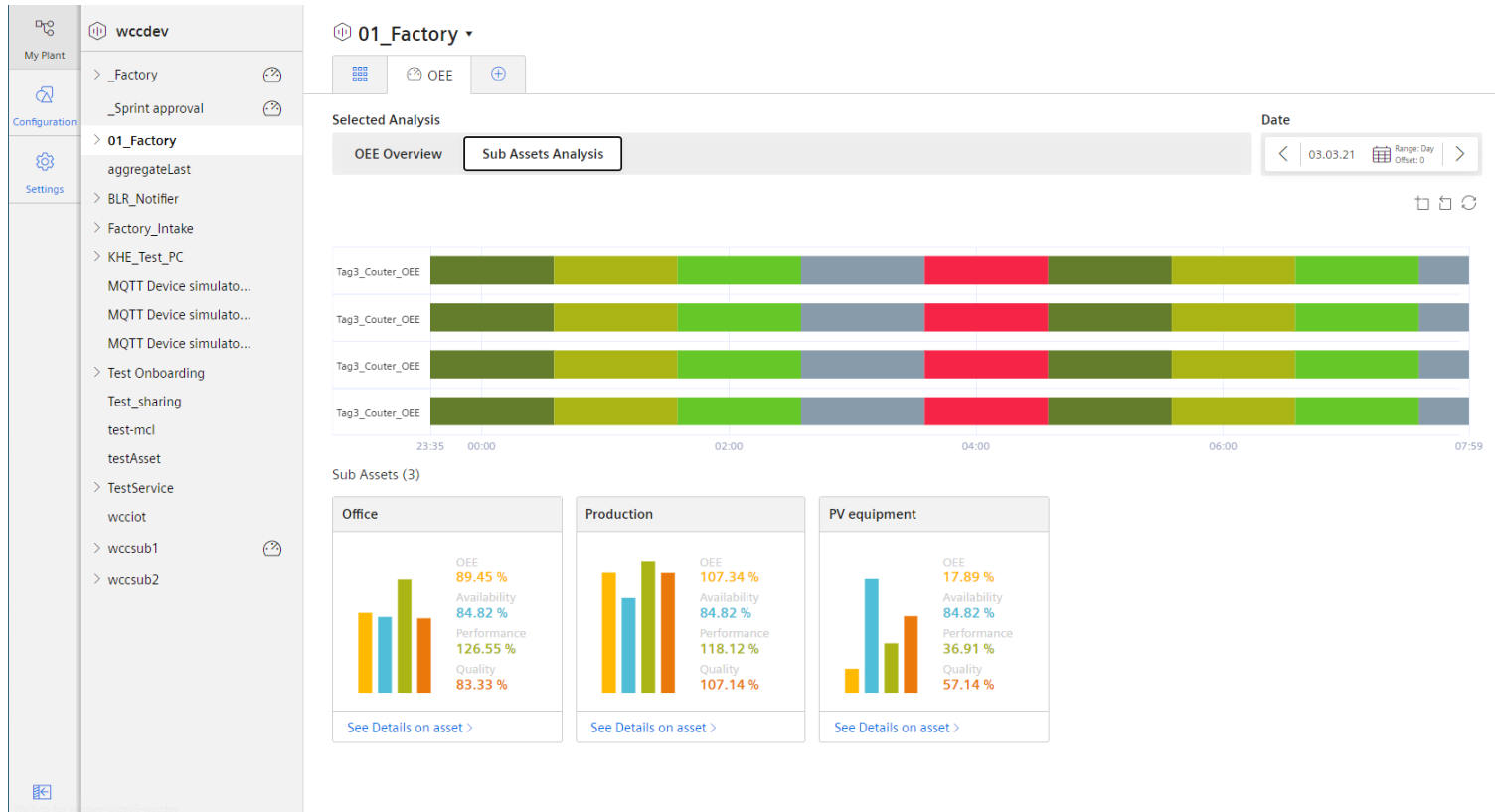
As soon as if one of the sub assets has an OEE configuration, the sub asset analysis is available.

The Gantt chart provides an overview about the complete line as well as the overview for each sub asset.

For each sub asset the main KPIs (OEE, Performance, Availability and Quality) are displayed for a fast comparison.

The OEE configuration for the line is similar to the configuration of a dedicated asset. The produced pieces can be used from e.g. the bottleneck machine.

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Easy and fast OEE configuration

In the Asset Configuration the user can define parameters used for several KPI Instances.

The user can select the status mapping where also the machine states are mapped to the time categories.

The user can select the variable representing the machine state.

The user can assign the variable for GoodCount, TotalCount and the TheoreticalSpeed in pce/sec.

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Dashboards and widgets

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Dashboard Overview
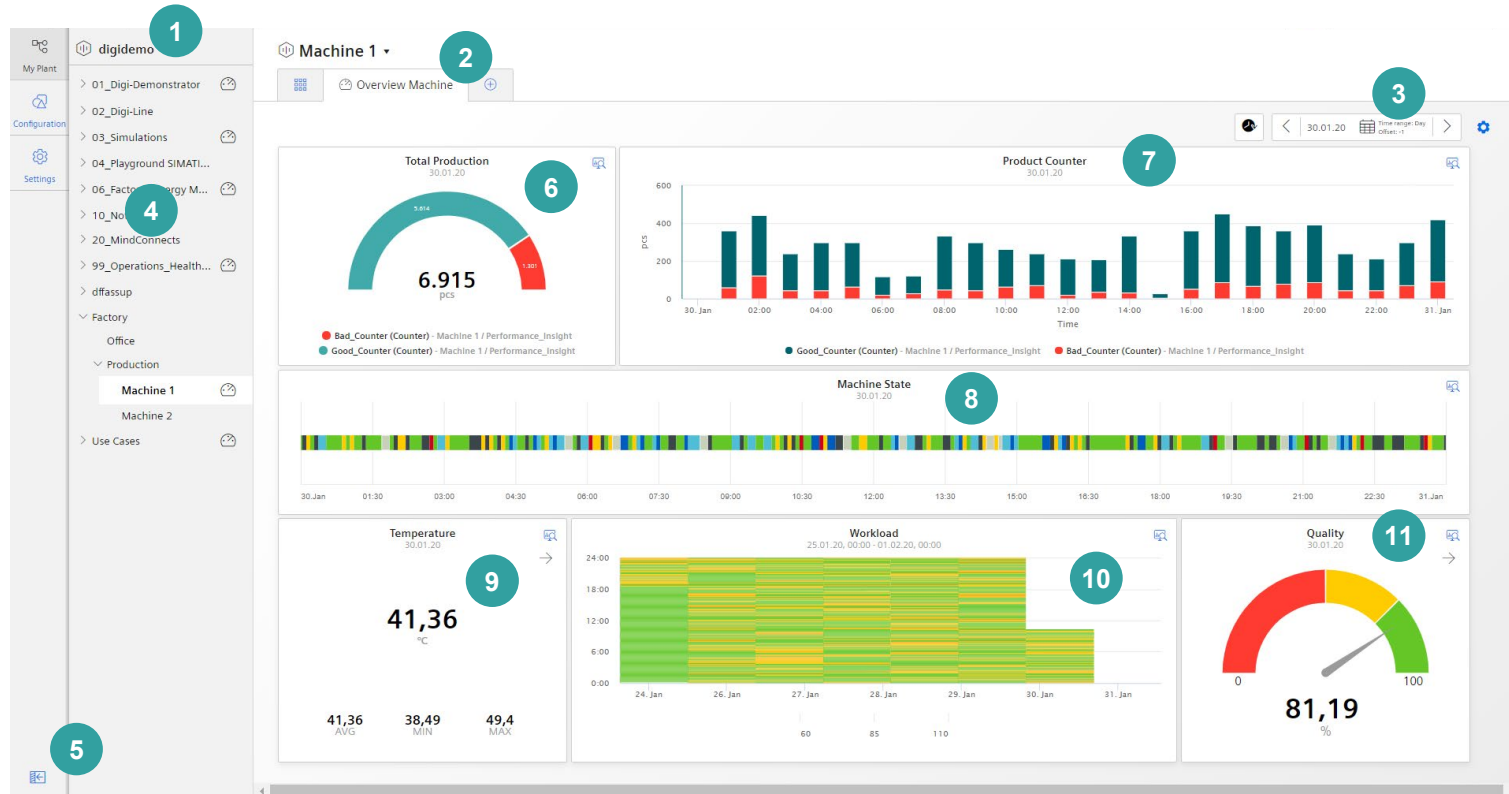
01: Asset model root
02: Dashboard name
03: Time Picker
04: Asset Structure
05: Show/Hide Asset Structure
06: Pie Widget
07: Chart Widget
08: Gantt Widget
09: Value Widget
10: Heatmap Widget
11: Gauge Widget

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Adding a new dashboard in Performance Insight

Plant structure

The plant structure is defined by the MindSphere asset model. For each asset you can define up to 5 dashboards

Creating a dashboard:

- Click the button "Create first dashboard" or click the + in the tab.
- Define the name of the dashboard.
- Define the default time range for widgets with the time picker.
- With the Offset you can move the time range to the past.

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Show data in individual time intervals with time picker

Time picker for showing the dashboard in the desired time range.

The initial time picker configuration can be defined in the dashboard configuration

Supported time ranges:

- User-defined: the begin & end date incl. time can be defined.
- Day: 00:00 – 00:00.
- Week: Monday – Sunday.
- Month: 1st – last day of month.
- Year: January – December.
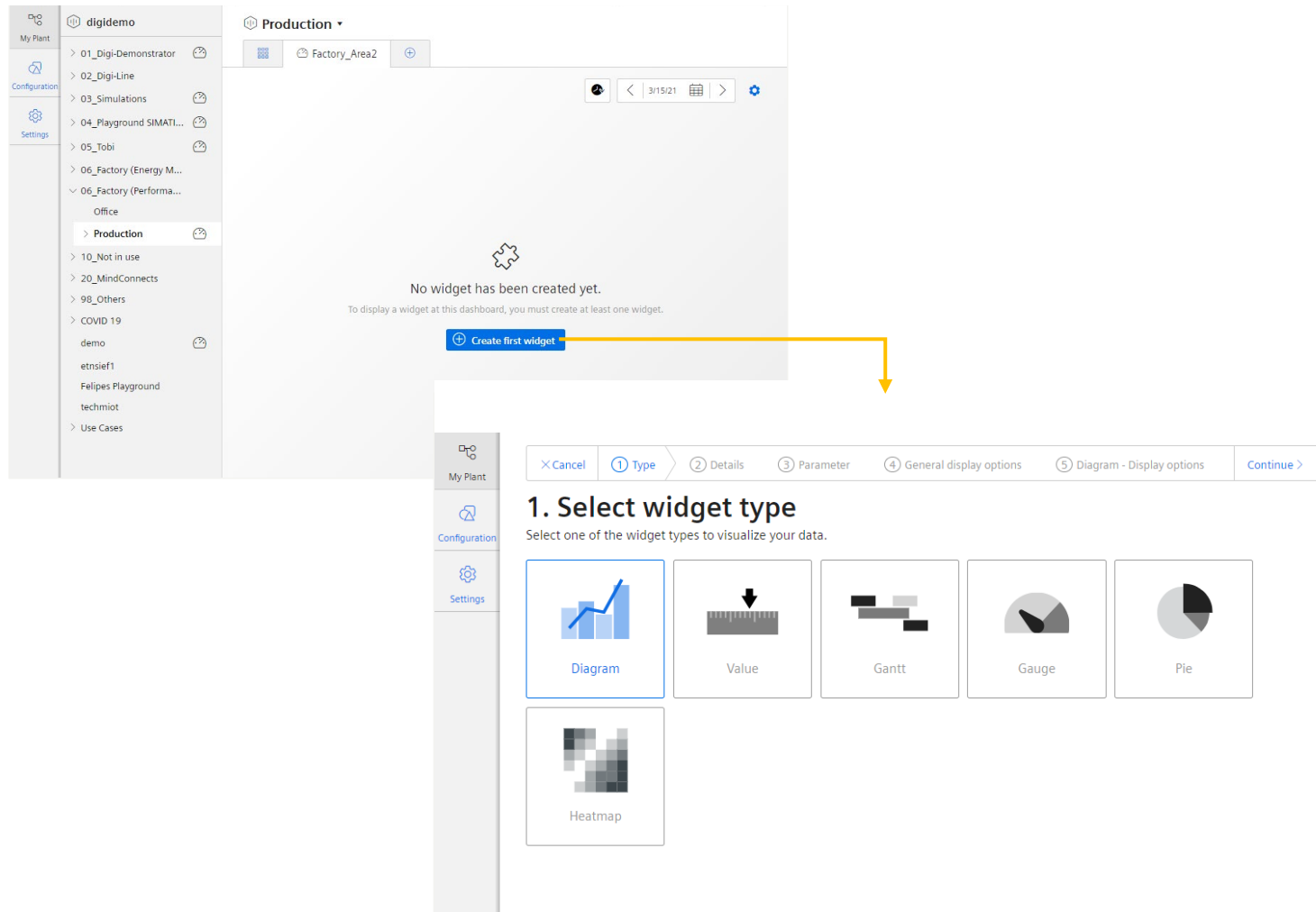- The last 3 hours, last 7 days, last 14 days, last 30 days.

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Widgets have a detail view that includes historical data
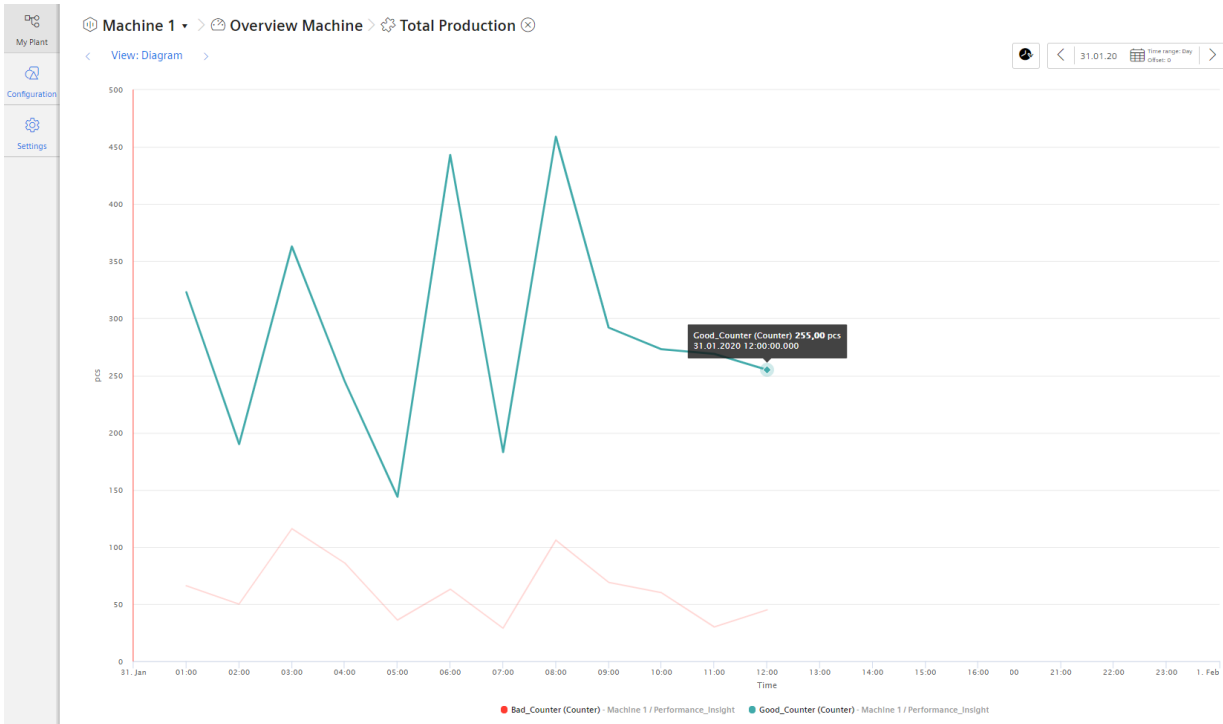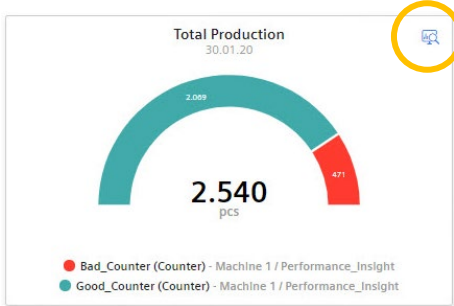
Detail view opens data in full screen with for detailed analysis capabilities and historical data.

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Add Widgets to the dashboard
1. Select Widget Type

Create the widget:

1. Select the widget Type.

2. Define the details like name and time picker behavior.

3. Select the parameter which should be displayed.

4. Define the parameter specific settings like limits, color, decimal places or an alternative name.

5. Define the widget specific settings like line type, visibility or if the lines shall be stacked.

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Add Widgets to the dashboard
2. Define time settings

Step 2: Define time settings

Enter a unique name for the widget

Define the date/time settings:

- Use the date settings from the dashboard.
- Dedicated date & time definition by selecting the time range and optionally an Offset.

The interval for the time range is used for the KPI calculation or the Variable aggregation.

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Add Widgets to the dashboard
3. Select the parameter

Step 3: Select parameter

The user can select one or several variables or KPI instances based on the widget type.

Variable:

- Available MindSphere variables can be selected.
- For the variable the user can select the aggregation algorithm. NONE means displaying the raw data which is only applicable in the chart.

KPI Instances:

- If there is no matching KPI Instance a new KPI Instance can be created.

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Add Widgets to the dashboard
4. Define the display options

Step 4:

The User can define general settings for each parameter in the Widget:

- Set an alternative label which is used in e.g. the legend.
- Set the number of decimal places.
- Set the color of the graphs.
- Set the lower and higher limits.

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Add Widgets to the dashboard
5. Define display options

Step 5:

The User can set the display option for each parameter in the Widget:

- Line Type (Line, Spline, Area, Bar, Scatter).
- Visibility.
- Stacked.

The user can define up to 5 y-axis and can configure the scaling option:

- Autoscaling (two blank fields).
- 0 Point scaling (Lower Limit = 0).
- Fix Range (e.g lower limit, 10 upper limit 100).

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Copy a widget or export data
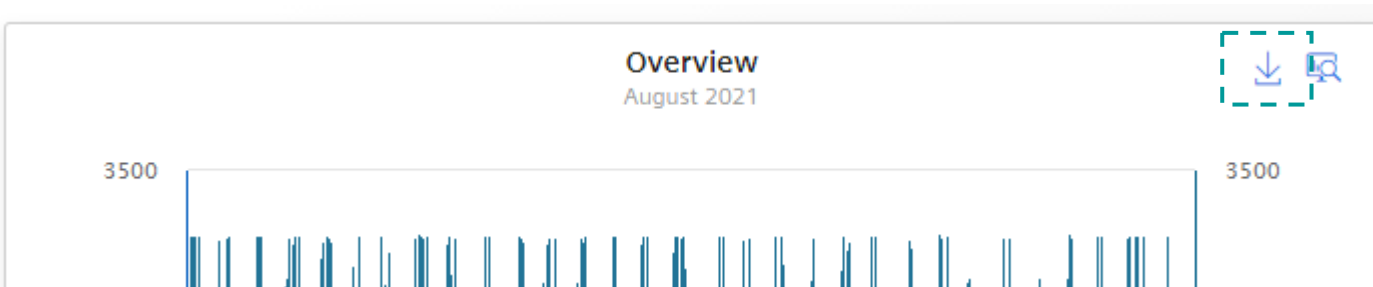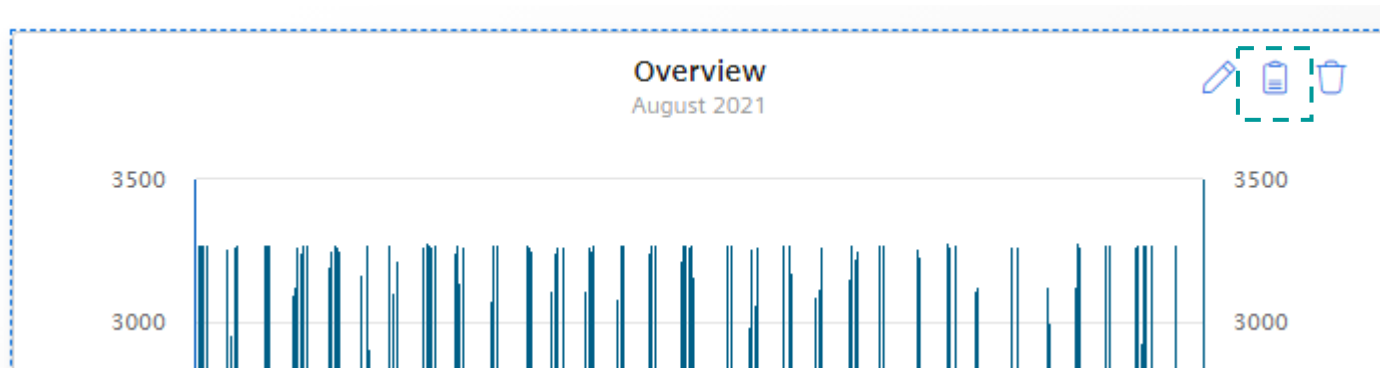
Copy a widget:

- In the Dashboard edit mode, the user can copy a widget and past it. After pasting the user can define a new name or change the analysis period.

Export data to a csv file:

- The user can export the widget data to a csv file.

- In the csv file, the value with both time stamps (local time and UTC) are available.

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Widget types

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Widget types
Diagram - Chart widget
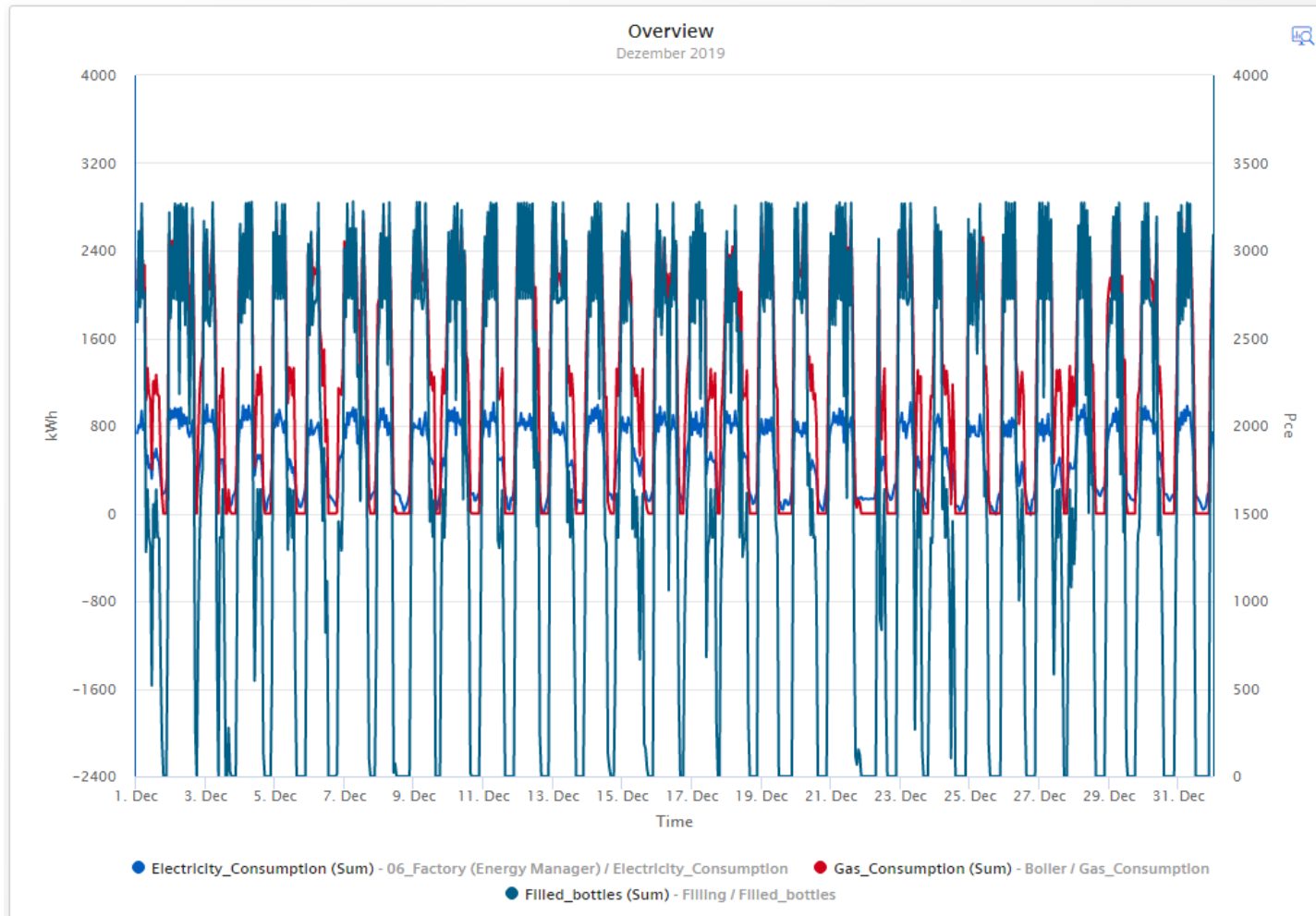
User can perform data analysis by using the functions as follows:

- Changing time range, Using the zoom functionality.
- Hide or unhide a graph; show the limits for an individual parameter.
- Use the tooltip for the exact value.
- Using up to 10 variables and up to 5 Y-Axis.
- The following detailed views are available:
  - Chart displaying detailed data.
  - Histogram including statistic values.
  - Regression analysis.

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Widget types
Value widget

User overview about the KPI or aggregated variable:

- Display the statistic (Note: The statistic is based on the KPI or variable aggregation based on the interval for the time range).
- The arrow represent the trend of the displayed value compared to the previous period.

The following detailed views are available:

- Chart displaying detailed data.
- Histogram including statistic values.

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Widget types
Gauge widget
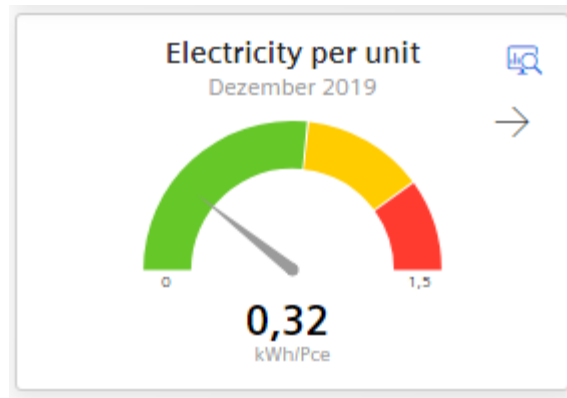
With the Gauge Widget the user gets an overview about higher and upper limits of values:

- The user can define the limits for the sections whereby the limits for the parameter are used.
- The arrow represent the trend of the displayed value compared to the previous period.

The following detailed views are available:

- Chart displaying detailed data.
- Histogram including statistic values.

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Widget types
Pie widget
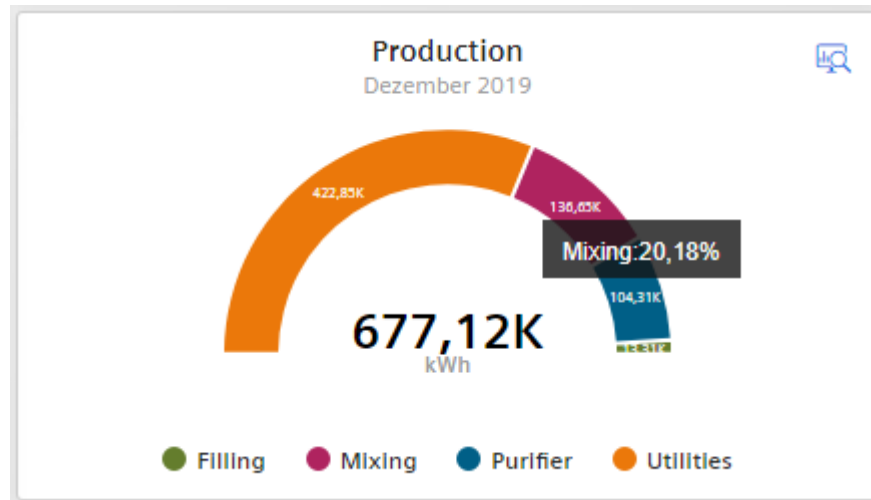
With the Pie Widget the user gets an overview about the distribution of quantities:

- With a click on the section the section is highlighted and user gets the corresponding value.

The following detailed views are available:

- Chart displaying detailed data.
- Histogram including statistic values.
- Regression analysis.

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Widget types
Heatmap

Heatmap
November 2019
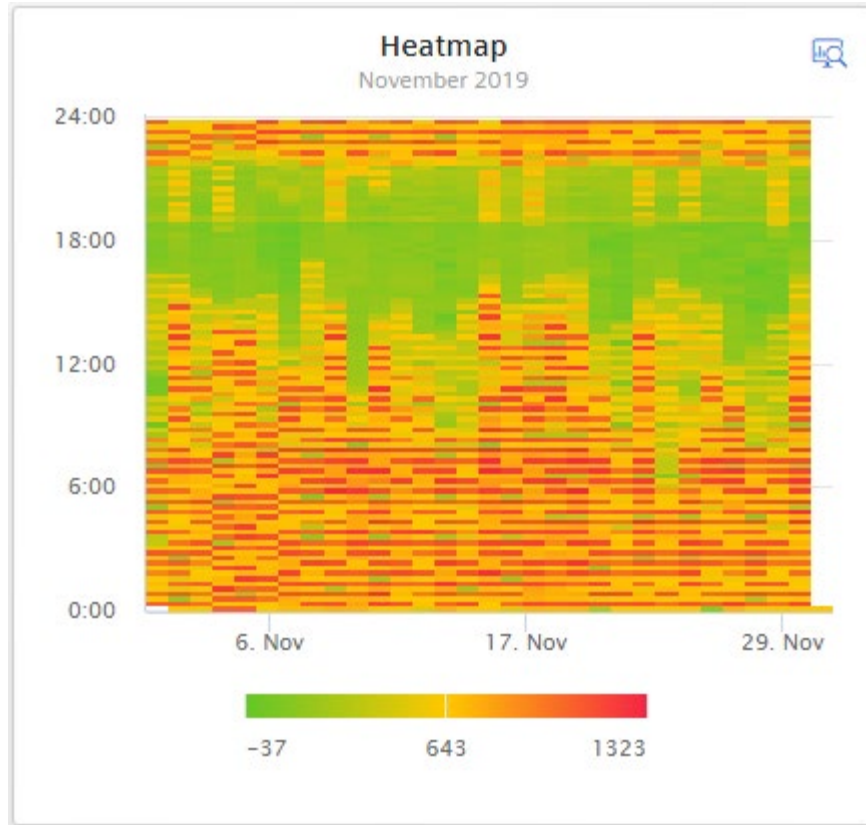
With the Heatmap Widget the user gets an overview about when (time of the day) the peaks appear. The value is represented by a color:

- Zoom in to get details.
- A tooltip provides the exact value.

The following detailed view is available:

- Heatmap.
- Chart displaying detailed data.
- Histogram including statistic values.

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Widget types
Gantt chart

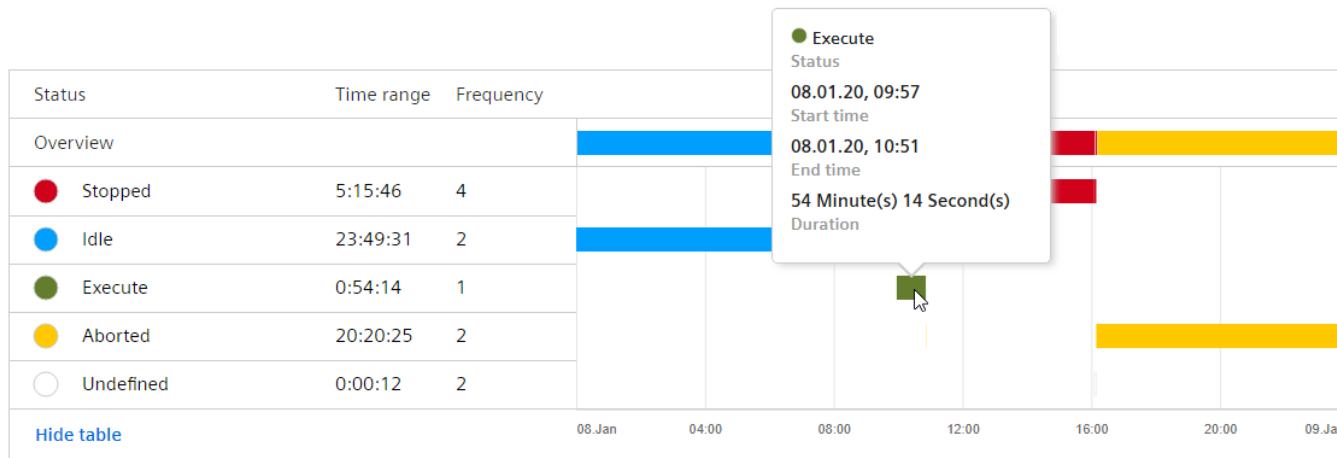With the Gantt Chart Widget, the user gets an overview about the machine state:

- User can change the time range.

- Use the tooltip for the exact values.

- Use the Advanced Gantt View to see in detail, how often and how long the machine was in the different defined machine states.

- Use "Show table" to show the time range and frequency.

Note: For the first and the last state period, the actual start and end time is used. Also in cases if this is out of the observation period.

This is the reason why the sum of all time ranges can be greater than the observation period.

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Configuration

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Status mapping helps to assign different machine states for later use in e.g. Gantt Chart

Configuration

	Status mappings A list of all existing status mappings
	KPI types A list of all existing KPI types
	Periods A list of all existing peri...

My Plant
Configuration
Settings

‹ Configuration

Status mappings

Search   ⊕ New status mapping

Name	Description		
AE_StatusMapping		✎	🗑
Bool Mapping	Map FALSE to red and TRUE to green	✎	🗑
BraumatRecipe		✎	🗑
DigiDemo Mapping		✎	🗑
F&B - Material		✎	🗑
OMAC_DigiLine		✎	🗑
Opening Houres		✎	🗑
Simulation		✎	🗑
testMapping		✎	🗑
Webianr_Mapping		✎	🗑

Go to Configuration/Status Mappings

- App admins can add, modify or delete a status mapping table which is used in Gantt chart widgets.

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Machine states are configured in the mapping table

Add or modify a status mapping table:

- App admins can add a status with a color, a value, a label and optionally a description.

- Each status can be assigned to a time category which is used to calculate how long the machine is in a dedicated time category or how often one of the assigned machine state were in a dedicated time category.

- If no match between the received value and the definition in the status mapping table is given, a state "undefined" with color white is used.

- User can change the order in the status list to define the order in the Gantt chart detailed view.

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Calculate individual KPIs based on machine parameters

Only app admins can add, modify or delete KPIs.

Note:

A KPI Type can only be deleted if there is no linked KPI Instance available.

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KPIs are configured in an excel-like formula editor

A KPI Type is defined by its Name, its unit of measure and its formula

Within the formula the user can add operands, constants, time categories and calculation operations.

The name of the operands can be changed as well. An operand can be copied to be used several times in the same formula.

Operands are placeholders for the real variable assigned in the KPI Instance.

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Pre defined KPI Types for OEE Performance monitoring

$$OEE\ [\%] = \frac{Availability\ *\ Performance\ *\ Quality}{10\ 000}$$

$$Availability\ [\%] = \frac{Net\ Production\ Time.\,Duration}{Available\ Production\ Time.\,Duration} * 100$$

$$Performance\ [\%] = \frac{TotalCount\ [pcs]}{TheoreticalSpeed\ \left[\frac{pcs}{s}\right] * Available\ Production\ Time.\,Duration[s]} * 100$$

$$Quality\ [\%] = \frac{GoodCount}{TotalCount} * 100$$

$$TEEP\ [\%] = \frac{Available\ Production\ Time.\,Duration}{Total\ Calendar\ Time.\,Duration} * OEE$$

$$MTTR\ [s] = \frac{Unplanned\ Downtime.\,Duration}{Unplanned\ Downtime.\,Occurence}$$

$$MTBF\ [s] = \frac{Net\ Production\ Time.\,Duration}{Unplanned\ Downtime.\,Occurence}$$

- Pre-defined OEE KPI-Types are available from scratch.

- The formula editor is extended by a "Time Category" option.

- For the time category the function "Duration [s]" and Occurrence are available.

Overall Equipment Effectiveness (OEE)

Total effective equipment performance (TEEP):

Mean time to repair (MTTR)

Mean time between failure (MTBF)

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Ordering

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Machine Insight
Order information

01		**Industrial Edge Hub Access** Get Initial Access to IE Hub	6ES7823-0EE00-4AX0	SDEX
02		**Industrial Edge Devices**	Device specific	Device specific
03		**Industrial Edge Management Device Licence** Per device per year	6ES7823-0EE00-4AY0	SDEX
04		**Performance Insight** base subscription incl. 3 assets	6AV2170-0JA10-0AA0	SDEX
05		**Performance Insight** 1 additional asset	6AV2170-0JA11-0AA0	SDEX

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Thank you for your attention!

For further information and support, please contact:

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