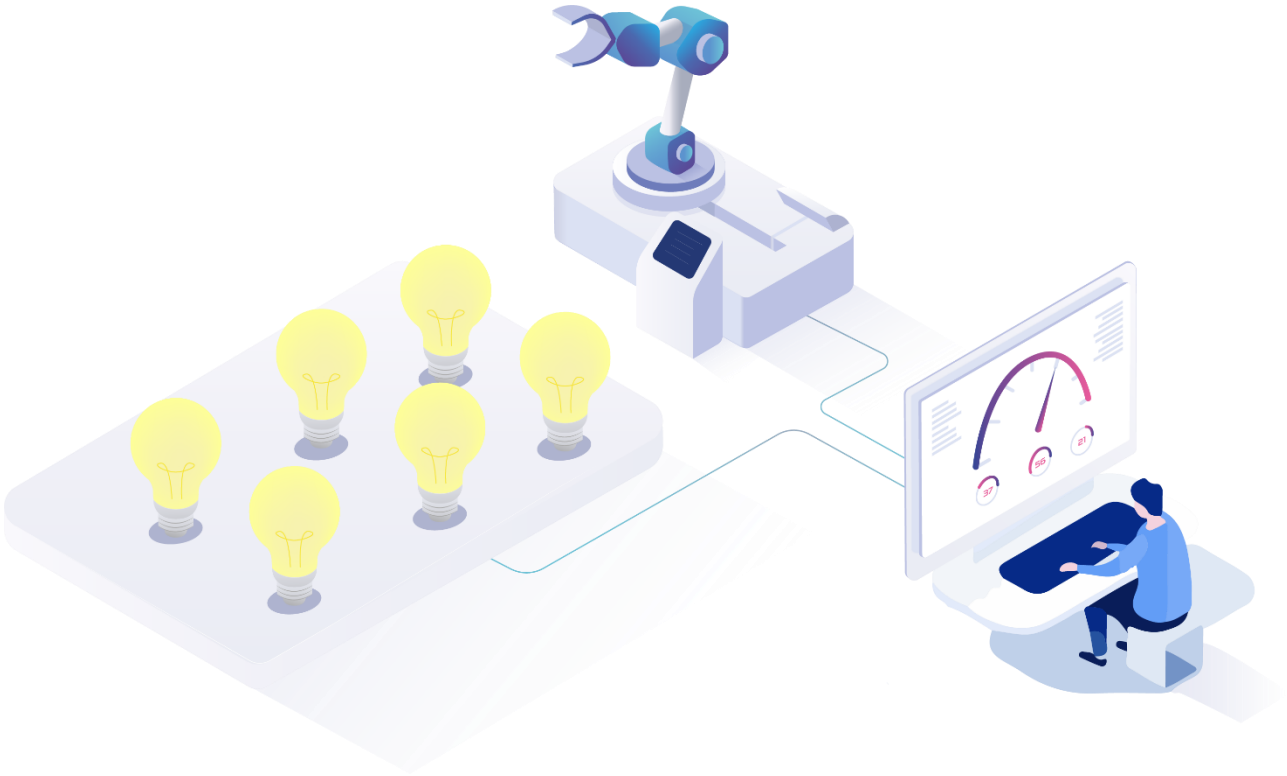
FORCAM FORCE



Sustainability

Version 5.11

Product Description

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Overview*

The initiative **Industry 4.0**, which has representatives from various well-known companies, is especially focused on linking ecological aspects more closely with economic opportunities.

In its **Impulse Paper of the Task Force "Sustainable Production"**, the Industry 4.0 Platform outlines three paths to sustainable production (see images below). The task force discusses how Industry 4.0 can contribute to a climate-friendly and resource-efficient future. An analysis of over 60 company examples shows that Industry 4.0 makes ecological sustainability possible in companies. Using resources more economically and with greater impact, we can reduce consumption and at the same time reduce negative effects - such as CO2 emissions.

Path 1: Reduce consumption, increase impact: Towards resource-efficient and CO2-neutral, digitized production

Path 2: From mass market product to transparent service offering: How a changed value proposition influences digital business models

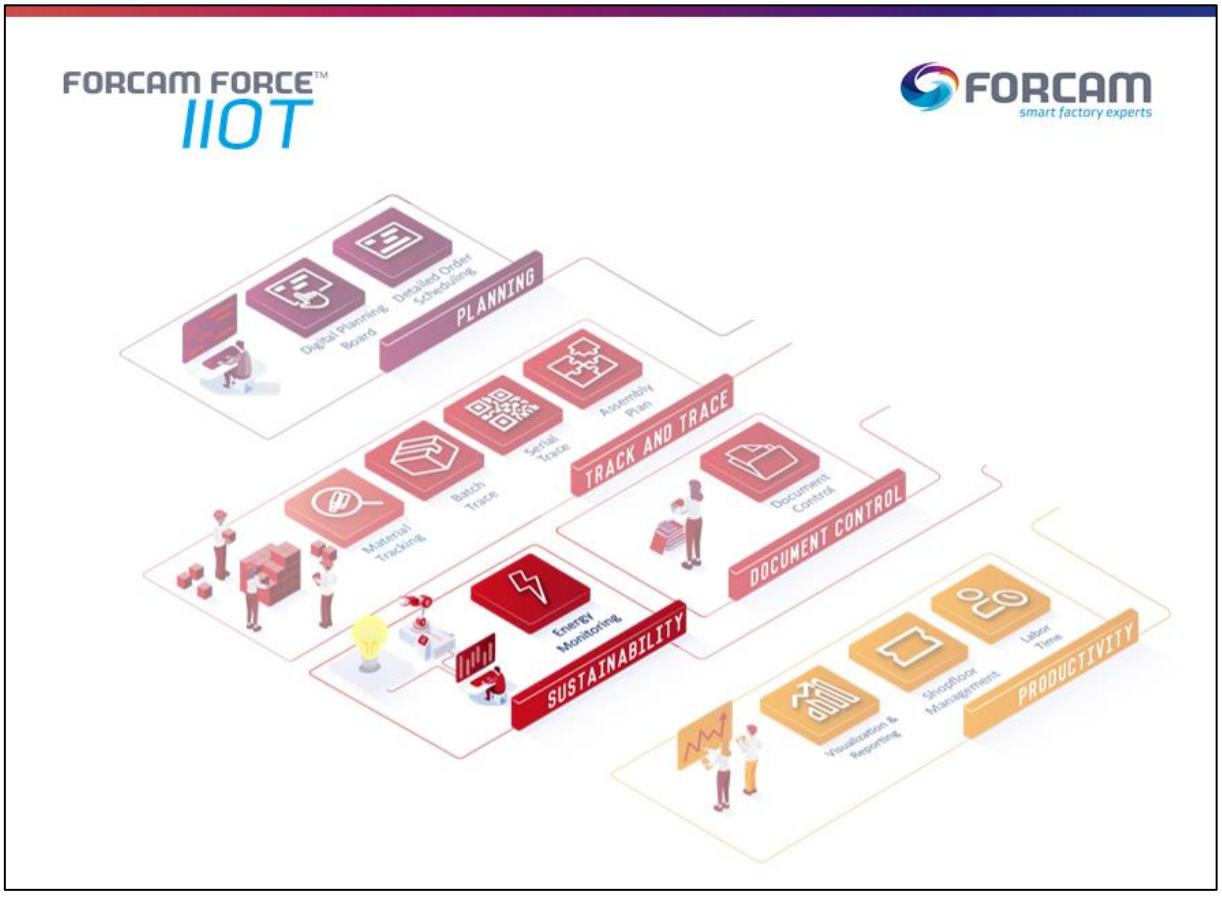
Path 3: Sharing and networking: Sustainable digital business means cooperating and engaging in circular economic systems

Industries have an important role to play in this. Key figures for sustainability will become an integral part of financial accounting in the future. Similar to the tax ledger and other secondary ledgers, every company has a sustainability ledger, the so-called "Sustainability Ledger" which provides information, for example, on the CO2 consumption and emissions of products and services as well as on their recyclability. In addition, companies record resource consumption and emissions during production and for upstream products in their Sustainability Ledger. Based on this, it is then possible to financially evaluate and compare different options in terms of their sustainability. This enables a future-oriented, prospective calculation which, for example, takes into consideration future price increases of CO2 certificates.

* For better readability, we generally use the generic masculine in the text. These formulations, however, are equally inclusive of all genders and address all equally.

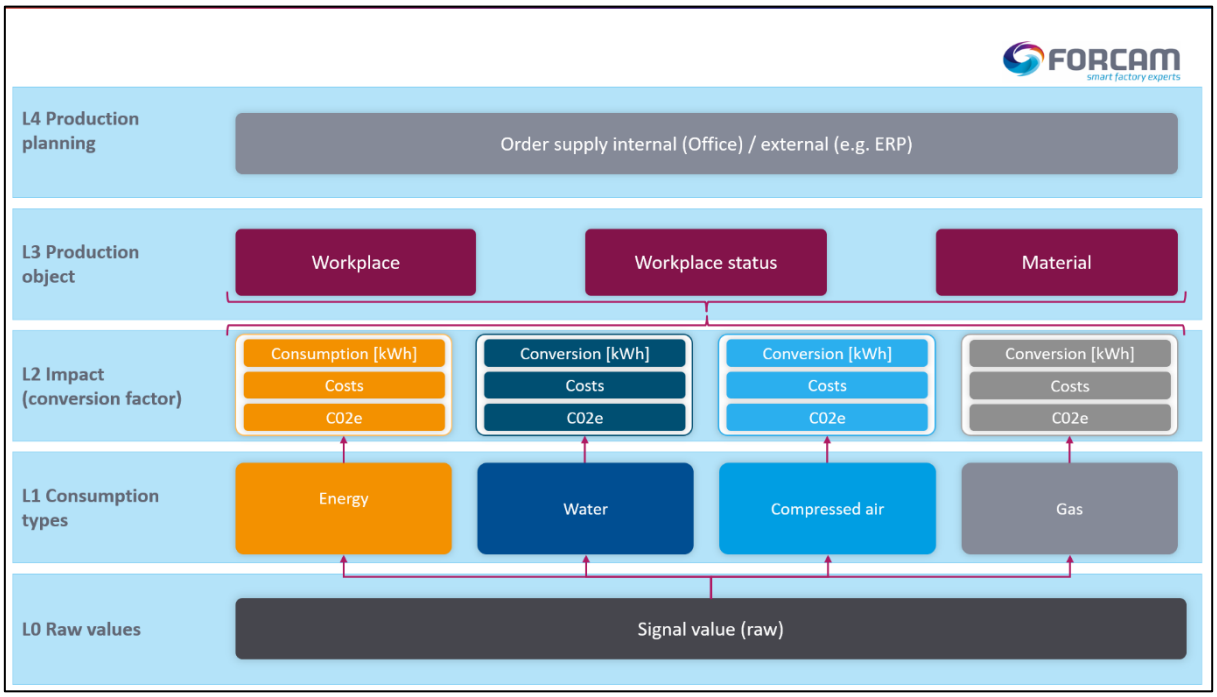
Resource/energy monitoring

With the Sustainability app, you purchase **resource/energy monitoring**. FORCAM thus provides you with a solution that helps you make your production more sustainable. The process data recorded by the machine connection is converted into energy data and enables you to evaluate the resource/energy consumption per workplace/machine or per material. Energy consumption is converted into kWh value via fixed conversion factors.
This app lets you detect energy waste and identify improvement potential. The operating costs of energy-efficient machines can be compared.
Finally, the app creates transparency that can be used to reduce overall energy costs.



Implementation in FORCAM FORCE IIOT

The FORCAM resource/energy monitoring consists of the following core levels:



L0 – Raw values

Collection of process data from the machine connection: FORCAM connects machines via standardized plugins and evaluates signals from the machine control.

L1 – Consumption types

Enhancing process data with the unit context (physical units): Process data is always being generated in production. FORCAM records these directly from the machine connection and enhances them to put them in the context of physical units.

L2 – Impact (conversion factor)

Energy data compression: FORCAM converts process data into base units and target units.

⚠ By default, conversion factors are configured statically. In the course of an implementation project, the customer must make these available.

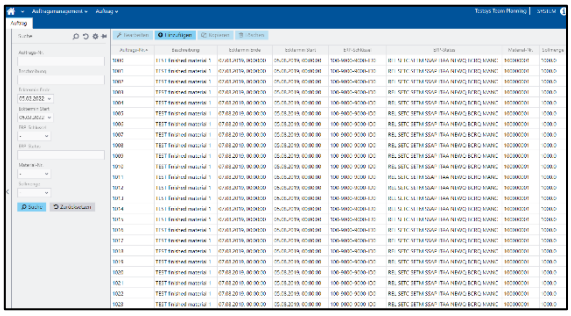
L3 – Production object

Production objects (business objects) serve as data collectors for context information of the data derived from the machine connection. They are visualized at the reporting level.

L4 – Production scheduling

Order supply: Internal order supply via FORCAM order management. External supply via standardized interfaces (e.g. SAP, INFOR, Generic XML).

Order management



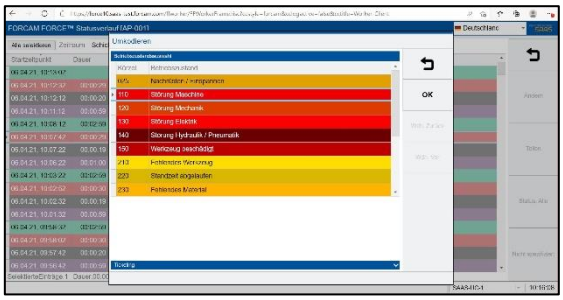
Supplying production orders enables the evaluation of energy data with reference to orders or materials. The FORCAM order management user interface is available for internal order management.
For external order supply, standardized interfaces can be used to access the desired ERP system (e.g. SAP or INFOR). The generic XML interface also offers the option of providing orders in this form.

Recording of machine signals

```
10 oncepersecond
11 begin
12 if( oldValue != @|PLC|@:DONE) then
13 begin
14 oldValue := @|PLC|@:DONE;
15 if @|PLC|@:DONE then
16 begin
17 sendState("Production", "qty1", GETPARAMETER("OrderNumber"));
18 end
19 else
20 begin
21 sendState ("Stoppage", "qty1", GETPARAMETER("OrderNumber"));
22 end;
23 end;
24
25 debugOut("@|WPL|@ - @|PLC|@ => DONE=" + toString(@|PLC|@:DONE));
26 end;
27
```

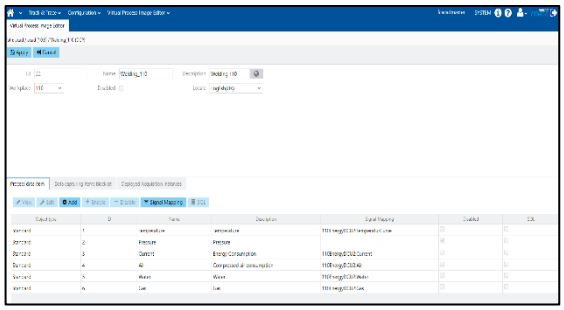
Machine signals consist of the machine status and information on media consumption (process data). The process data is captured continuously and is therefore not dependent on the machine status or the production order.
This enables a complete representation of the actual consumptions. The production context (machine status) is only captured by the worker.

Context information



Context information enhances the pure consumption measurement with information on machine status and orders or workplace phases, thus forming the basis for subsequent reporting. The context information is added by the worker directly in the Shopfloor Terminal (SFT). It includes qualification of workplace status, setting of phases in setup or production, confirmation of order quantities, and specification of malfunction messages.

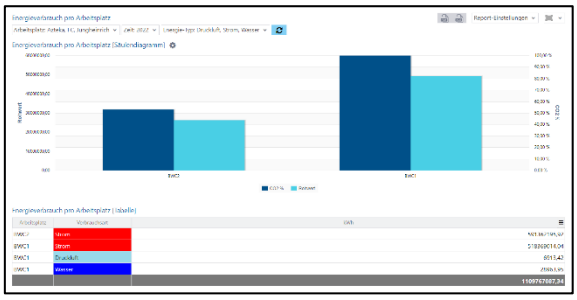
Conversion of energy data



Process data (raw values) are recorded from the machine connection. These are given a designation and are mapped to a physical unit (in accordance with customer requirements). This is followed by conversion with energy capture factors according to customer-specific conversion specifications.

Reporting

Energy consumption per workplace



The report **Energy consumption per workplace** evaluates the recorded energy consumption per workplace individually and as a cumulative value. The cumulated value is particularly interesting for line functions.

ⓘ This evaluation is purely related to the workplace. The production order is not referenced.

Energy consumption per material

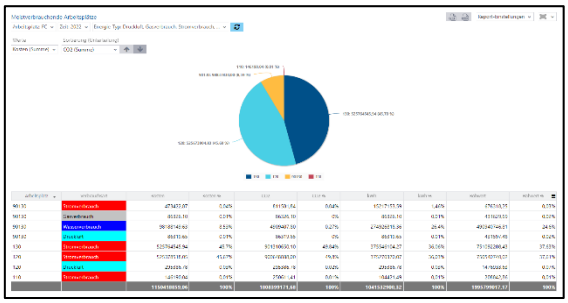
The report **Energy consumption per material** displays the recorded energy consumption for each material individually and as a cumulative value. Several materials can be compared directly with each other and used for CIP measures.

Energy consumption per operating state

Evaluating the **energy consumption per operating state** provides information on how much energy and other resources were consumed during and outside of production. It indicates the exact amount of consumption for each operating state.

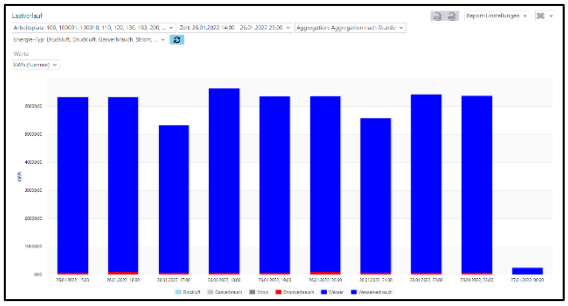
ⓘ This evaluation is purely related to the workplace. The production order is not referenced.

Workplaces with the highest consumption



The report **Highest consuming workplaces** lets you compare the consumptions of workplaces in a pie chart. It immediately shows you which workplace has the highest consumption among the configured consumption types or incurs the highest costs in this context.

Load curve



Load curve is a report that shows the time-specific history of resources and consumptions over customer-specific time periods. This gives insight into how the consumptions develop at certain times.

ⓘ This evaluation is purely related to the workplace. The production order is not referenced.

Scope of functions

- Evaluation of energy data with reference to orders and materials with and without the supply of production orders
- Mapping of all actual consumptions by reading out machine signals
- Conversion of process data and mapping to physical units according to customer requirements
- Recording context information on the Shopfloor Terminal
- Reporting with predefined and configurable displays of the evaluated data:
    - Energy consumption per workplace as bar chart and table
    - Energy consumption per material as bar chart and table
    - Energy consumption per operating state as bar chart and hit list
    - Highest consuming workplaces as pie chart and table
    - Load curve as column diagram