WiriTec
Wireless Resource Information Technology

Energy and resource management

WiriTec® C

WiriTec GmbH | Berliner Ring 103 | 64625 Bensheim
Phone: +49 62 51 / 5835 - 0 | Fax: +49 62 51 / 5835 - 299

Internet: www.wiritec.com
E-Mail: information@wiritec.com

www.wiritec.com

CERTIFICATE

Certificate-ID: C-11-2015-21231037

Certificate for: Audited energy data management system

Certificate holder: WiriTec GmbH
Berliner Ring 103
64625 Bensheim
Germany

Test report: B-11-2015-21231037

Energy Data Management System
Regular Surveillance
www.tuv.com
ID 0000043580

Product: WiriTec C

Basis of certification: Audited energy data management system in accordance with the catalogue of requirements Version 2.2 (as of 02/2014)

Scope of certification: Document and system review of functionalities for use with energy management systems in accordance with ISO 50001 and energy audits in accordance with EN 16247-1

It is herewith confirmed that the functionalities and characteristics of the energy data management system WiriTec C described in the results report B-11-2015-21231037 as well as in the appendix to the certificate, have been verified within the framework of a document and system review. The energy data management system WiriTec C verifiably supports compliance with the requirements of the chapters of the standards ISO 50001 and EN 16247-1 as listed in the appendix to the certificate.

This certificate is valid until 30 November 2017.

Dated in Cologne, 13 November 2015

Norbert Heidelmann
TÜV Rheinland Group
Energy Services

Florian Grießl
TÜV Rheinland Group
Energy Services

www.tuv.com

TÜVRheinland®
Precisely Right.

PREAMBLE

Efficient energy data management is the basis for all energy management systems as well as all involved processes based on energy data. Only reliable, timely and automatically collected data from energy meters, control systems and sensors provide the necessary calculation basis for saving strategies and investment decisions.

We, the WiriTec GmbH, have specialized in the development of holistic, integrated energy data management solutions since 2009. We support the entire process from the collection of meter data on the field level to the visualisation of real-time energy consumption up to business processes such as accounting, measure management, consumption and demand forecasts as well as significant energy allocation and performance figures for real estate and machinery.

The C platform is a web based software platform and was created in cooperation with our affiliate, the speedikon Facility Management AG. This completely new development uses state-of-the-art IT methods. On the one hand, it is based on our extensive experience. On the other hand, wishes and demands from the application practice of many well-known companies are taken into consideration.

Facility management, data centre and energy processes are integrated by using a common software basis. Interfaces between applications and processes for exchanging data are therefore no longer necessary.
Effects of maintenance measures can be checked by means of resource consumption data or the current and target cooling capacity of data centres can be compared and monitored.

We can handle all field devices that are installed in inhomogeneous customer environments since we are a hardware and measurement technology independent software company.

Our strength lies in the integration of already existing measurement technologies. Therefore, additional and often substantial costs are prevented.
Since we combine approved and existing measurement technologies with the IT-world, we can rely on hard- and software standards that allow for reasonable costs.

This approach ensures that all existing data can easily be transferred from pre-processing systems or data suppliers and additional data sources can be connected with the most modern interface technologies.

These technical possibilities are paired with the know-how of our specialist engineers in order to offer you customised IT solutions by using update proof standard methods. The WiriTec software provides a seminal IT tool in order to operate all processes regarding the energy and resource consumptions of your organisation.

In addition, the central C platform provides a basis for digitisation of technical processes. All production processes and associated support processes can be displayed transparently and evaluated with individual performance indicators by merging all information, not only resource consumption but also production (plan) numbers, machine and installation conditions as well as other production relevant parameters. The use of specialized data loggers and databases which can be designed both redundantly and distributed enable a high-performance data handling even with the largest data volumes.

This brochure is divided into two sections. The first part describes the features and performance of our energy management solution WiriTec® C. The last chapters of the brochure deal with commercial, technical and digitisation processes that are closely connected to energy management. These include lifecycle management or maintenance for example.

We have made every effort not only to describe features but to illustrate individual application cases of the software of hundreds of our customers. Particularly in the last chapter, a clear emphasis is on the use of energy and resource management in larger contexts as well as related processes.

OVERALL CONCEPT

Our energy and resource management supports all processes that are necessary to import measuring data from the field level where they arise to the IT platform where they are permanently available for any evaluations. The assignment of each individual value of the consumer or producer remains. This ensures that the interpretation of values is always connected to the correct process and can be evaluated professionally. This professional evaluation is the basis for energy and resource efficiency.

In general, our system is designed to be easily integrated into existing environments. Functioning components do not need to be replaced neither on the hardware side nor on the software side. We integrate these as smoothly as possible in order to save you high investment costs. Our goal is to close gaps and to provide a continuous digitisation.

We developed a flexible modular system in order to guarantee a full integration into existing environments,
The energy data server is always the centre of the solution since all measuring and sensor data are stored together with all other process and frame parameters. The energy data server is an implementation on a SQL database (Oracle and MS SQL Server) as long as data intervals of 1 minute or more are supposed to be managed. Data frequencies up to 10.000 Hz require time series databases and configurations which can be integrated smoothly into the rest of the system.
Normally, the energy data server is integrated in the IT environment of the customer; this means that the server is located in the data centre of the customer and is managed by the customer-specific IT or IT service provider. The energy data server can be implemented as externally hosted cloud solution in an external data centre upon request. Since it is a flexible browser- application, we can completely adapt to individual IT needs of our customers.
The so-called data connector is upstreamed of the energy data server. This is a specialized software process that accepts the values from the field or pre-systems, checks them for plausibility and stores original values as well as compressed or corrected values on the energy data server.

This simple and proven configuration can be easily adapted to security and performance requirements. It is very reliable and flexible. Installation and administration do not require any high demands. Within a very short time such a system can be set up on site and administrated and configured remotely.

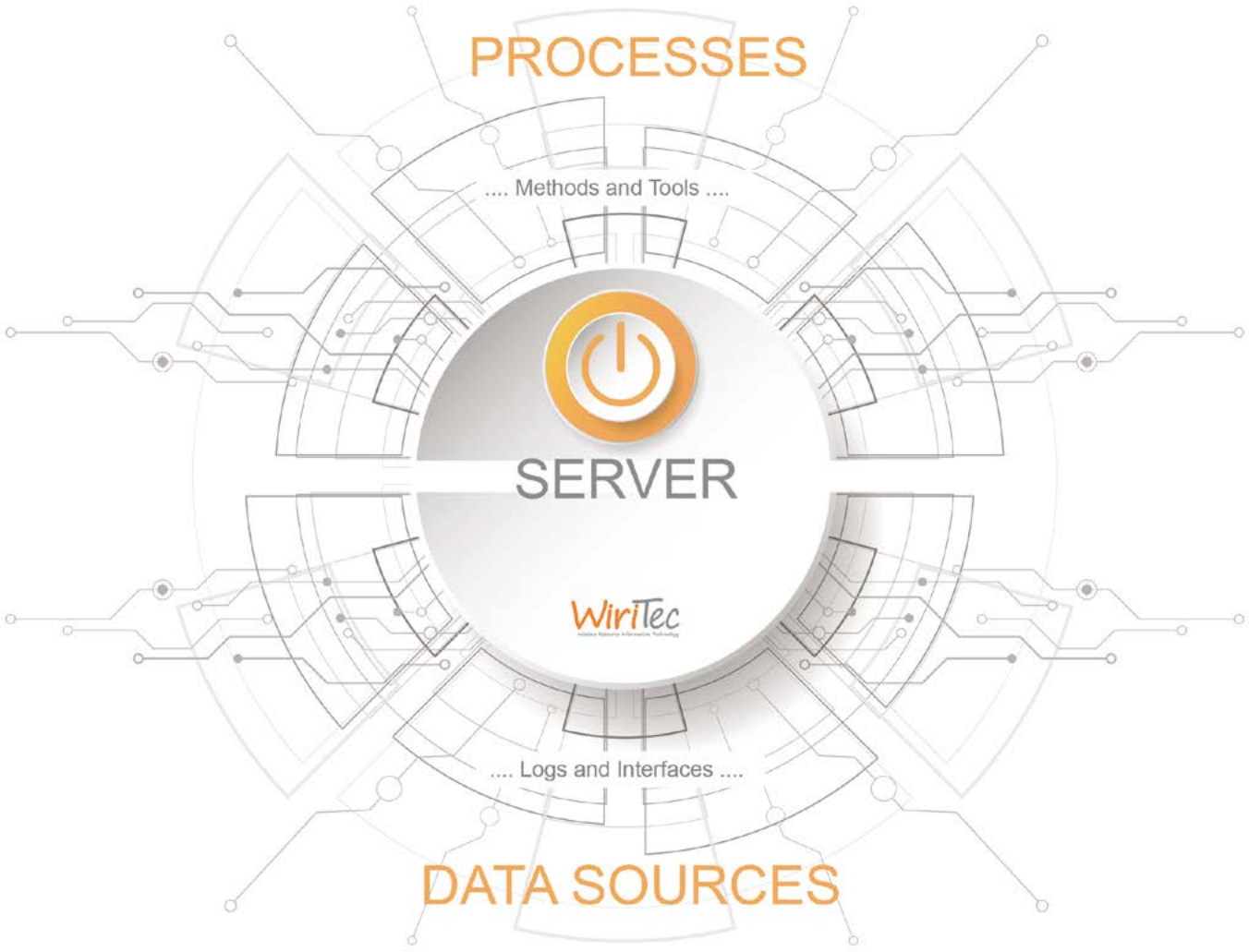
Our approach for the entire field level is characterized by the fact that we are hardware-independent, highly flexible and manufacturer neutral. It is highly important for us not to change the collection infrastructure that we find. With the help of IT methods or field interfaces, we integrate existing control systems such as building automation, process control systems or other machine data collection into our system and import necessary data. Data loggers from third-party companies, existing collection systems or field devices with IT interfaces such as OPC UA or ModBus TCP are also connected via these paths. Meters, sensors or other devices that do not yet have an IT interface can be made intelligent with the WiriBox®. The WiriBox®, a Linux-based industrial PC, supports a variety of common field interfaces such as M-Bus, ModBus RTU and IEC 62056-21. In addition, sensors or other signal transmitters can also be connected directly to the WiriBox®.

The values collected with the help of the data connector from the field level and stored in the energy data server form the basis for all analyses and follow-up processes. The evaluation and further processing of data on the energy data server is made with the proven features of the C software platform. All analysis and evaluation processes as well as administrative features regarding the data server are implemented in the browser application. Therefore, no additional software has to be installed on the clients.
On the C platform the individual mapping of the customer processes with all workflows, evaluations or calculations is in the foreground. We use a modular set of flexible standard methods which has proven itself in hundreds of customer projects in order to realize individual customer processes.

These standard methods ensure that the system remains updateable in the future despite the high level of individualisation. These tools and methods include the powerful formula editor, the extensive chart engine but also descriptive attributes and elements as well as dashboards and reports for displaying performance indicators or states.

Typical customer processes which are implemented with these methods include accounting and cost allocations, forecasts, performance indicator calculations, measure management or maintenance processes.

The use of state-of-the-art IT technologies make it possible that processes or applications are not only limited to be used in an energy and resource management environment. We ensured that the methods we have implemented already represent processes from the world of digitisation and industry 4.0. The necessary collection and evaluation of high-frequency data from production installations via WiriBox HF and InfluxDB, the analysis and simulation of installation states on the basis of consumption data, fault messages and maintenance information as well as the tracking of production batches with the help of digital twins: these and many others processes are possible with our methods.



Index

Energy data server
Central database for all energy and process-relevant data.

Messpunktstrukturen, Objekte und Merkmale
Mass data are only useful if they are significantly structured and characterised.

Meter devices
Management methods for meter devices and the associated exchange processes.

Virtual data series
Basis for all calculations performed on different data sets.

Internationalisation of systems
WiriTec solutions are prepared for worldwide use.

SECTION 1

CENTRAL DATABASE

The energy management solutions of the WiriTec are integrated into the speedikon® C browser-based IT platform of our affiliate, the speedikon FM AG. The platform is based on our extensive experience and on the wishes and requirements of the application practice of many well-known companies. This IT platform is a powerful and future-oriented software tool to meet the challenges of upcoming years.

THE ENERGY DATA SERVER

The energy data server is the central database for all measuring points and collected measured values, sensor data or other operating parameters. This is where all measured data come together, regardless of the original source or with which measuring method they were identified.

The goal is to process data in order to make them accessible and online evaluable for many users. Individual users, user groups and data areas are separated from each other by freely configurable access rights or different clients. Therefore, different divisions of company groups can be clearly separated from each other or service providers of several customers can be operated with a single system without interferences.

Energy management covers a very wide area in many companies. This means many different departments and users must have an insight into the system. Therefore, in WiriTec® C the access to data and the operation of all features is done exclusively via web browser. An installation of additional components on the clients is not required.

On the energy data server reliable data without gaps and outliers are mandatory since the collected data are the basis for all further data evaluations. In order to achieve that specific algorithms are implemented which close data gaps, fix faults as far as logically possible and ensure the data quality. The appropriate method is selected depending on the data types.

The original values are generally saved unchanged and the quality of each individual measured value is noted. This procedure ensures audit proof and prevents drawing wrong conclusions for subsequent evaluations. We are using a specialised time-series database for the storage of original values with InfluxDB in order to ensure the performance of the system. This is the only way to ensure that all data are being held available while the system continues with high performance.

The energy data server is designed for large amounts of data and short response times, even with many simultaneous users. Basis is an Oracle or SQL server database that gives you the security of a professional system. For data backup and system tuning we use proven tools of database producers.

We are adding a time-series database to the SQL energy data server since the processes of digitisation and „Industry 4.0 „often need data in frequencies up to milliseconds.

We have made the best experience in terms of performance and stability with the used InfluxDB.
This means that it is possible to build up easily distributed systems which are finding high-frequency measured data on the energy data server only if needed. This „edge computing“ approach reduces the use load very strongly and leaves the data on separate computers near the data sources. Therefore, it is ideally suited for a setup of redundant systems.

MEASURING POINT STRUCTURES, OBJECTS AND ATTRIBUTES

The collected mass data are only of profound significance for an organization if they are hierarchically or logically organised and meaningfully described.

Therefore, the measuring point structures form the backbone of the energy and resource management. They are the connection between meters, sensors and measuring devices, technical devices, buildings and installations as well as business organisation with departments and installations. The measuring data supplied by meters and sensors are directly connected to the measuring points and can be evaluated in various ways.

The flexibility of the software is the basic prerequisite for a cost-effective solution since each company is organizationally different and therefore has deviating processes. We placed great importance to this flexibility during the development in order to easily display the individual characteristics of the application without any programming effort.

WiriTec® C ensures this necessary flexibility by using user-defined object types as well as freely configurable attributes to describe these objects. Each customer can create his own object types and describe them with arbitrary attributes.

Each of these attributes can have its own time axis. Therefore, it is possible not only to document changes but also to retrace them.

All configurations within the software are stored in a specially designed database area which are not touched during updates. Therefore, the update security of all configurations is ensured.

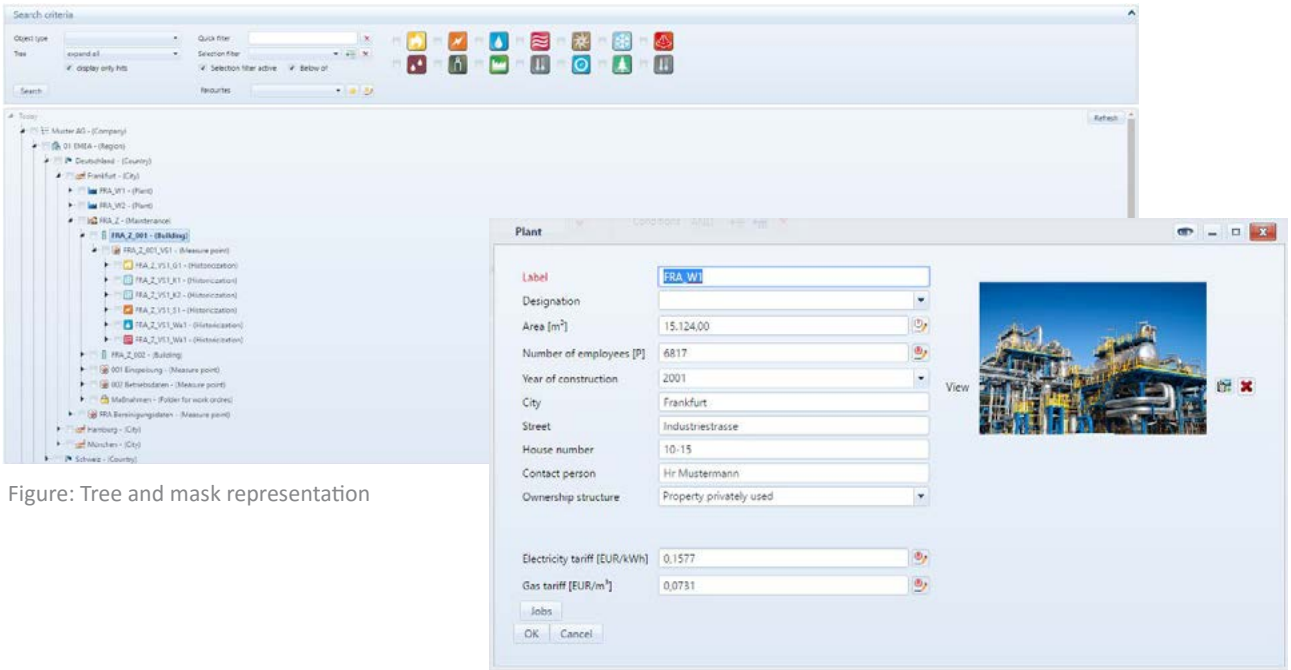


Figure: Tree and mask representation

METER DEVICES

Meter and measuring device management

The management of the meter devices is divided into 4 points:

1. Create and collect meters
2. Installation of meters
3. Removal or take out of service of meters
4. Change of meters

In a meter stock, existing meters and the ones ready for installation with their attributes and specifications are saved. Each readable measuring channel is documented as medium, format, performance values, converter factors, etc. besides attributes which describe the meter.

The meter is normally assigned to an object in order to measure its consumption. The measuring channels are connected to data series in which measured data are integrated. Therefore, all necessary logical contexts are defined.

The feature meter installation takes either one meter from the stock or generates on the basis of a template a new meter which exists as a unique device in the system from that point in time. This feature regulates automatically all necessary connections.

The installation and change features are designed in such a way that they can be integrated in different processes like meter procurement, storage, calibration and take out of service.

Special features are provided by the meter change. The removal meter reading and the installation meter reading need to be added subsequently. The reason for this is that the physical meter change executed by the installer cannot be synchronized simultaneously with the logical change in the energy management system. The transition from the old to the new meter is evened out by the automatic insertion of discontinuities in the data series. Therefore, there are no jumps in the displayed charts.
Due to the speedikon® C basic system, automatic historicisation can be tracked at any time in order to see when, which and where a meter was installed.

VIRTUAL DATA SERIES

An elementary part of the WiriTec system are calculated measuring points, the so-called virtual data series. These are characterised by values originating from calculations and not from measurements.

The calculation for virtual data series takes measured data series and any variables, factors and constants or other logical contexts (for example „if ... then“) into consideration. Another special feature is that virtual data series in the system are treated the same as all other – measured- data series. They can be displayed in charts, used for reports or analyses and are the basis for further calculations as well. The formula editor used for offsets is as powerful as a programming language (C #). It is possible to handle it for trained users by using corresponding dialogues without programming knowledge.

Not only simple standard calculations like residual value meters or summation meters but highly complex calculation results can be displayed because of this powerful formula editor. The methods of the formula editor will be used in order to calculate consumption forecasts, the moving average or other mathematical dependencies between values. Furthermore, the calculation with regard to energy allocations, characteristic values or unit conversions is configured.

Both measured and virtual data series can be described with the same characterising features. The only distinction exists in the data source of the data series; for measured data series this is a meter or measuring device and for virtual data series it is a formula.

The underlying formula has its own time axis since calculation rules or mathematical dependencies can change over time. A formula is always valid for a particular time period. Once a new formula is introduced, the old one is completed and the new formula is activated. Of course the old formula is still retained and serves as a calculation basis for her validity period. This ensures that even with changing formulas it always will be calculated with the respective valid formula at any point in time. The user does not have to worry about data integrity because this validity check takes place automatically.

This continuous formula time axis allows the user to decide freely if a virtual data series is pre-calculated and saved or only calculated while accessing it ad-hoc. This makes it possible to reduce the required storage space for data series- especially if a lot of data series are available in the system.

The calculation of energy or operating parameters is one of the main applications of virtual data series besides different conversions or offsets of data, units or costs.

INTERNATIONALISATION OF SYSTEMS

Since WiriTec® C is a browser application it can be easily made available on international locations and for local users. In order to ensure this endeavour, we already have been made various arrangements in the development of the software. These relate in particular to dealing with different time zones as well as units and currencies.

All collected measurement data in the database are stored always in world time (UTC), independent of their own time zone. In the later analysis of the data they are prepared and provided with the appropriate time offset to the world time according to the system time of the user or the time zone of the collection. This flexibility allows the user to compare worldwide data to each other in the appropriate time zone.

The WiriTec standard system is delivered in both languages German and English. Language tables facilitate the easy implementation of any other language. The user can change the language manually with one click or the software follows the language of the operating system automatically.

Customised objects, attributes or catalogues can be localised by the customer using simple tools. For this purpose, the corresponding names are completed in the necessary national languages in the fields.

The conversion of measuring units and currencies is easily possible in WiriTec® C. First it needs to be distinguished between constant and variable conversions.

The constant conversions are fixed conversion factors that cannot be changed. The most common application is the conversion of decimal multiples such as tonnes to kilogram or kWh to MWh. A further conversion is the one of metric units such as m² or tonnes in non-metric systems such as sq ft or lbs. These constant conversion factors which are necessary for this purpose are stored in the system and the user can change the units via mouse click.

In addition there are variable conversions like currencies. For variable conversions the conversion factor is stored in the system and used automatically for the conversion similar to the weather adjustment. By using time-dependent attributes changes of factors are documented and taken into account in the calculations. Therefore, it is ensured that always values are calculated with the valid correction factor for the point in time.

Data collection
Reliable collection of measured data is a mandatory prerequisite for energy management.

Connection of existing measuring systems and data sources
We have a variety of methods to connect existing measuring systems and data sources to the WiriTec system.

WiriBox®
Make your meters and sensors intelligent.

DataConnector / Watchdog
Ensure that all data are collected and the quality is monitored.

Mobile applications
Optimise manual meter collection via specialized smartphone and tablet apps.

SECTION 2

COLLECTION OF DATA

The values generated and collected in the field level are the backbone of all processes regarding energy data management. Since the inhomogeneous field structures can only be adapted with great effort, we are pursuing the goal of being able to communicate with all existing field devices. Therefore, we have developed methods, procedures and interfaces with which the data can be transferred safely, in a timely manner and reliably from the field level, centrally stored in the database and displayed in the browser application.

DATA COLLECTION

The reliable collection of measurement, sensor and condition data as well as flanking values such as process data is the essential prerequisite for energy management.
As a hardware-independent software house it is one of our key attributes that we can handle all field devices and field interfaces and can use their data. This means that all installations installed in the field, control systems, meters, sensors, other devices which are connected to the WiriTec software and collected data can be centrally collected and evaluated.

While very new systems and devices often already have modern interfaces such as OPC UA or ModBus TCP, the situation appears to be different regarding existing installations. In this case individual solutions are necessary depending on available technologies of the installation. Sometimes it needs to be worked with replacement measurements, approximations or even calculations in order to obtain corresponding data.
The collection of data does not stop with the pure digitisation of data. It has been proven in the field that the actual transfer of data from the field environment into the central IT network will be a challenge.

The safety requirements of the customer IT while transferring data from net to net are very high especially against the background of Stuxnet and other threads. Our know-how as a software company is highly valuable and a great advantage. We have developed many different methods in the last years in order to meet individual safety requirements of the customer IT.

If the quality of the collected data is insufficient, all evaluations, analyses and processes based on those are automatically doomed to failure. Therefore, it is essential to check and monitor all data while importing for completeness – Do all sources supply your data?-as well as to content-related plausibility - Do the values fit to the process and boundary conditions?. We developed a specialized software process with the watchdog which automatically monitors all data both formally as well as content-related and initiates measures if necessary. In case of non-plausible values, individual substitute values can be initiated according to customer requirements. In case of missing values or source failures the responsible persons can be notified via helpdesk notifications and emails.

CONNECTION OF EXISTING MEASURING SYSTEMS AND DATA SOURCES

In many companies the installations and the associated supply structures were growing for years or even decades especially in the manufacturing industry. This means new installations were steadily purchased, old installations were reconstructed or replaced; therefore, the supply structures have been rebuilt and adapted to the new requirements. This means that already installed measuring devices are measuring whole areas or several different installations. A simple assignment of the consumption is therefore not possible. In addition, measurements just became increasingly important in the last years, so that the existing measuring infrastructure often can be described as very „holey“.

This situation in most companies is not easy to eliminate. On the one hand, large investments in meter devices and sensors are not economical and on the other hand a production area cannot be switched off easily in order to install additional hardware.

This means for the collection of energy and sensor data that data need to be recorded and collected in an immensely inhomogeneous environment. Since these inhomogeneous meter structure is common, we developed many methods to ensure an easy and economical connection of measuring devices and sensors
Basically there are three different types of measuring systems or data sources; Field devices such as meters or sensors, inspection and control technology such as BMS, PLS or MES and „real“ IT systems with databases or IT interfaces like web services.

Since these pre-processing systems differ considerably from each other, we have developed a variety of different methods for each of these systems in order to import the necessary data.

LOGS

OPC UA
SNMP
M-Bus (EN 13757)
BACnet
Modbus
LON
IEC 62056-21
KNX
OneWire

EVU Formats
.csv, Excel
.txt (z.B. MSCONS)
FTP
SQL-Import

BMS / PLC

ABB
JCI
Kieback & Peter
Siemens SIMATIC S 7
Neuberger
OSIsoft PI
Sauter cumulus
Zenon
Saia
WAGO
...

METERS/SENSORS

ABB
Hydrometer
Elster
Landis & Gyr
Görlitz
NZR
Janitza
Finder

...

Pulse
Analogue
Standard logs

FIELD DEVICES, METERS AND SENSORS

The frequently used field protocols such as MBus, ModBus TCP, ModBus RTU or even KNX are mainly standardised. Therefore, they can be connected by default. The difficulty is that the precise parameterization of the measuring devices is unknown. This means there is no documentation of which value is in which register of the meter or which conversion factors are to be applied. We considered this fact in our software. If factors were set incorrectly, they could be adjusted afterwards and the values could be corrected automatically.

In addition to these standards, we connected meters, field devices or data loggers directly in the past. How these connections are technically realized depends on interface options of the external device. These range from the takeover of meter impulses via IT methods for data exchange of data loggers up to completely individual developments in order to support the manufacturer-specific logs. Sometimes we even work with replacement measurements, approximations or even calculations in order to receive appropriate data in cases where no measuring devices are installed. Here our technology of virtual data series comes into effect.

BUILDING MANAGEMENT SYSTEMS

Many of our customers have been using various field systems such as manufacturing execution systems (MES), building management systems or process control systems for many years. These often highly specialised inventory systems collect data which are required sometimes for energy management or other energy-related processes.

As a software house, we can import data from these pre-processing systems and make them available for users via our central energy data server. It depends on the possibilities of the pre-processing system on how the interface of the respective pre-processing system is procured. In the simplest case, the system has its own host computer or a corresponding value database which can be connected using standard IT methods.

If the pre-processing system does not allow a direct database connection, the use of Excel or .csv imports provides an alternative. The pre-processing system exports all necessary data as an Excel or .csv file in regular intervals in a file system or to a corresponding server. The WiriTec import mechanisms retrieve these files and import them the contained data.

If none of these methods are supported by the pre-processing system, there are other hardware and manufacturer - specific possibilities to import data from the pre-processing system. These range from directly reading out corresponding data registers via programming interfaces via „latching“ in existing bus systems with so-called „sniffers“ which read the entire data traffic up to solutions that are customised to the specific situation.

IT-SYSTEMS

Modern IT interface technologies provide the most elegant way to import data from pre-processing systems for us as a software house. The pre-processing system provides the technology to be used since we are very flexible with different techniques. All these IT methods have in common that they are suitable for high-frequency collection and import of data due to their performance. Therefore, we use these technologies in the industry 4.0 environment as well when it comes to high-frequency collection of data, states or reports.

Modern installations or machines are normally connected to our system via latest OPC specifications, OPC UA. Since OPC UA is designed for machine communication, it is very performant and has now - in contrast to older versions – its own security implementations which increase data security. The use of IT technologies like web services is possible with the new specification. Currently just very few installations and machines support this modern log.

We connect existing IT systems or IT-related control systems such as ERP systems, the PI system of OsiSoft or other process control systems or control systems via web services.

This IT technology has the advantage of being used standardised, independent of platforms, programming languages and logs. Our software is dedicated to handling any processes involving large amounts and /or complex data.

A third possibility of data import is provided by the SNMP log which we support completely in all three versions. This network protocol was developed for monitoring network components. It is used to connect IT devices such as PDUs or server. The unbeatable advantage of SNMP is besides the complete standardisation in the IT environment, the possibility of the so-called management Information base (MIB) in order to import all import configurations automatically. Therefore, SNMP provides especially in the data centre management environment a plug and play feature - as soon as a PDU is installed and registered in the system, the data can be imported automatically.

These diverse methods allow us to connect all field devices, control systems or pre-processing systems used by our customers, to our portal and to import all necessary data.

WiriBox®

The WiriBox® is an intelligent computer for collecting energy data and sensor values. It is equipped with various interfaces (RS-485, RS-232, M-Bus, Modbus, USB, LAN, etc.) and supports all important protocols for collecting meter and sensor data.
The WiriBox® is designed for collecting, pro-cessing, controlling and transferring energy data, even within inhomogeneous sensor and meter structures.
The basis is a powerful out-of-the-box Intel© board running a Linux operating system. All features are implemented within the software, so they can be extended, altered and updated remotely.

The number of meters and sensors connected is only limited by the performance of the CPU and not the number of interfaces or ports.

TECHNICAL DATA

The WiriBox® Industry has been designed especially for rugged industrial surroundings, especially for the installation in electrical cabinets. For those needs, it cannot only be mounted on cap rails but is also equipped with an according power supply from 12 to 36 volts.
The numerous on-board interfaces the industry box is equipped with, do not only allow for direct communication with the field level, but also linking different IT-networks with each other.

The WiriBox® is available in different versions in order to meet various requirements in terms of scope of application, performance and storage space.

FACTS AND FIGURES

- Complete remote administration for updates and new features
- Automatic booting, connection establishment and login
- No moving parts and very low heat output
- Mirrored and protected database, protected operating system
- Usable in any environment via according cases
- Communication options UMTS, GPRS, LAN, Bluetooth®, W-LAN
- Intelligent pre-processing of data, profile checks, efficiency calculations and logical interpretation of different measurement series
- Automatic notification feature for freely configurable results
- Privacy and security via encryption
- Self-monitoring for power failure, meter and sensor failure, operating temperature etc.
- Drivers for meters and new features via remote maintenance can be retrofitted
- Transparent crack down on connected devices with appropriate tests and operating software

Figure: WiriBox®

WiriBox® Industry Standard

Form factor	DIN Rail
CPU	Intel® Atom™ E3825mit 1.33GHz
Memory	SO-DIMM DDR3L mit 2GB
Memory	Industry SSD 16GB
Storage Space	2* RS232/422/485 2* 10/100/1000 RJ45 2* USB 2.0 1* USB 3.0 4* DI, 4* DO
Power Supply	+12V ~ 36V DC in
Dimensions (LxBxH)	52 x 130 x 127 mm
Operable Temperature	-40° ~ 70°

DATACONNECTOR / WATCHDOG

THE DATEN CONNECTOR is an innovative software solution which receives meter-, consumption-, sensor- and process-data from various sources and in different formats in such a way so that it can be stored in the Energy-Data-Server. The data supplied at different times is monitored concerning their integrity and plausibility, and are then transformed into structures suitable for future processing. The data are then transferred to the Energy-Data-Server for long-term storage.

All incoming original values are permanently saved in a raw state in the Influx database which is part of the DataConnector to ensure audit proof and traceability of data. Since all import logs of the DataConnector are programmed by us, we are able to read any meter structures and integrate all existing data sources. The state-of-the-art protocols like ModBUS TCP, SNMP (version 1, 2 and 3) as well as OPC UA are implemented already in order to be prepared for the future.

THE WATCHDOG is a software process which monitors all data sources and checks if data are received in the desired time interval and required quality. The tool is using flexible rules and scripts to define exactly when and which data set must exist. Since many data sources cannot deliver in the same time grid for different reasons, it will be taken into account by the watchdog via corresponding settings.
The watchdog cannot prevent failure during data import but he informs the user or circle of users immediately of the failure or missing data delivery.

However, the watchdog is not only there to alert while data are missing but for the content-related data validation as well. The bandwidth is determined within which a measured value or state needs to move with the help of corresponding profile curves, min / max rules or other calculations. The watchdog now checks the incoming values to ensure compliance and triggers notifications in case of deviations.
The reporting process which is triggered by the watchdog is individually customised to requirements of the customer. An existing helpdesk or ticket system can be connected for the notification dispatch or an independent helpdesk can be defined and configured alternatively.

MOBILE APPLICATION FOR DATA COLLECTION

Companies are expecting with the increasing use of efficient smartphones and tablet pcs that these devices are usable for consumption and performance charts as well as for reading and control processes.

We have taken this into account and developed solutions in order to make data from the energy management available and editable in a mobile form.

The consistent browser-orientation of the software already ensures the operability of all applications on mobile devices. Just masks need to be adjusted to size and resolution of devices for better usability. It does not make any difference anymore if the browser is running on a tablet, a smartphone or a desktop.

A special form in the area of mobile applications is the meter data collection. In contrast to other mobile processes, an online connection of the device cannot be assumed regarding the mobile meter readings collection. On the one hand this is due to the typical installation locations of meter devices in basements, supply shafts or other places without reception. On the other hand, customers are often using service providers or other third-party users without access to the company network in order to collect data.

We are using special apps which do not require an online connection. These apps are fed with necessary data such as meter numbers, units or pre-values before the process execution - in this case the meter reading.

Subsequently, the reader can proceed his collection tour and collecting data completely self-sufficient and offline. The identification of meters to be detected is always a source of error of such an application: Therefore it needs to be ensured that the user records the correct value for the correct meter. In order to support this it either can be worked with meter numbers or meter descriptions. Alternatively, it is possible to use modern identification methods such as NFC, QR codes or RFID. To prevent typing errors or transposed numbers while entering the values, the mobile device checks the value directly after collection for plausibility and thus prevents errors to be detected lately and a new tour for correction.

After completion of the collection, the collected data are transferred to the central server. The transfer is made as soon as the terminal is logged in the company network. The data transfer can be done via email if for safety reasons the direct connection to the server is not possible. These apps are not only available for common mobile operating systems but are customised for individual process or needs.

Basics of evaluations
These tools and features form the basis of all evaluations in WiriTec C.

Live Charts
In addition to standard tools for load analysis, the chart engine has a variety of special evaluations with which very detailed evaluations of the database are possible.

Dashboards
Dashboards and cockpits are indispensable for the clear presentation of many and complex data.

Data analytics and formula editor
Only if data can be properly processed and analysed, valid conclusions can be drawn.

Graphical simulations
Our graphical simulations provide an overview of your supply situation and help to dimension installations correctly.

Alphanumeric evaluation
In addition to the charts, the alphanumeric evaluation methods form an elementary component of WiriTec.

Reports
The report features meet all requirements for a modern, flexible reporting.

SECTION 3

DATA EVALUATION

An energy data management system must be able to collect many million or even billions of data sets and make them available for evaluations at short notice. WiriTec meets the challenge to clearly visualise this data, relating it chronologically and logically and offer an easy navigation possibility. In addition to evaluations and analytics, we have developed effective tools for data monitoring as no one can manually monitor the large number of incoming data.

BASIS OF EVALUATION

In the WiriTec system nothing is pre-calculated but data are prepared and displayed at the time of evaluation according to selected time periods and intervals on-the-fly. We have optimised the underlying database, the energy data server exactly for this application in order to display even large amounts of data without disturbing waiting times. These technical details form the basis for a series of tools and features which facilitate unique evaluation flexibility for the user.

The time slider and time selection are two powerful tools for the user in order to navigate on the timeline. The user can select via corresponding buttons if data are displayed in an absolute (a date or time period) or relative (last 3 days, last month, etc.) period of time. A separate timeline can be chosen for each selected data set besides the full-time selection for the complete chart evaluation by the same means. In this case, several time axes are illustrated in the chart.

For annual evaluations the beginning of the year can be adjusted to the individual business year with a few mouse clicks, if necessary. For considerations beyond the date line, you can move the start of the day to the forefront or backwards. Analogously while doing a comparison over a period of several months, weekdays can be superimposed and the comparison of the correct weekdays can be ensured with the help of a day offset. The time slider allows selected periods of time to be enlarged and minimised via Drag&Drop. It is possible to shift an entire interval on the time axis as well.

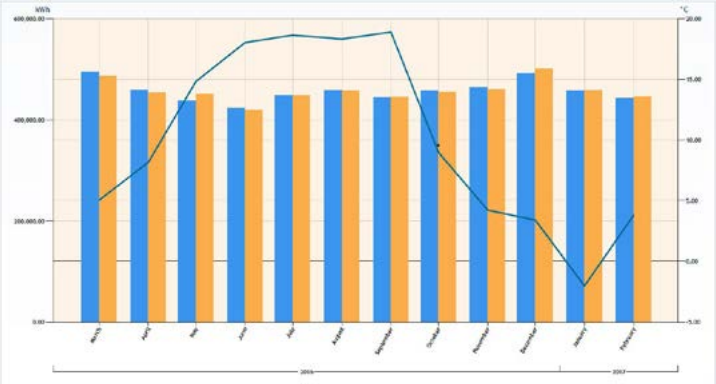
The master data, factors and other parameters existing in the system are connected to the time axis as well and can be shown in the chart. Changes to these data are considered and prepared according to the time horizon within evaluations and calculations. This procedure ensures that valid master data and factors of the database for the selected period of time are taken. Therefore, even factor-dependent comparisons such as characteristic values or cost calculations over long time periods are displayed.

For the distributed data storage in the course of edge computing there are proper mechanisms available within evaluation methods in order to prevent the user from worrying about data storage. Each data series has information, which data granularity is to be found and where it can be found in the distributed systems. Intervals over a minute are typically saved on the energy data server, smaller intervals in the InfluxDB or sometimes on distributed field computers as well. The chart engine evaluates this information and automatically refers to the appropriate storage location depending on the selected evaluation interval.

Another important feature is the creation of views. Each chart representation can be saved as a view. The next time it is requested, it picks up the current data and displays it as previously specified. The charts automatically adjust to the current date via relative time reference (e.g., the last month). This means views can be used with current data about a random period of time.

LIVE CHARTS

The user can perform various graphical data evaluations with the help of the integrated chart component. All data to be evaluated are imported live from the database which ensures a high flexibility. Once configured charts can be saved as views and can be retrieved with current data at any time.

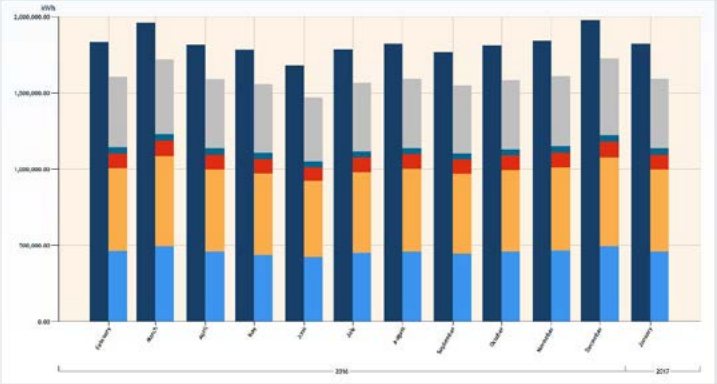


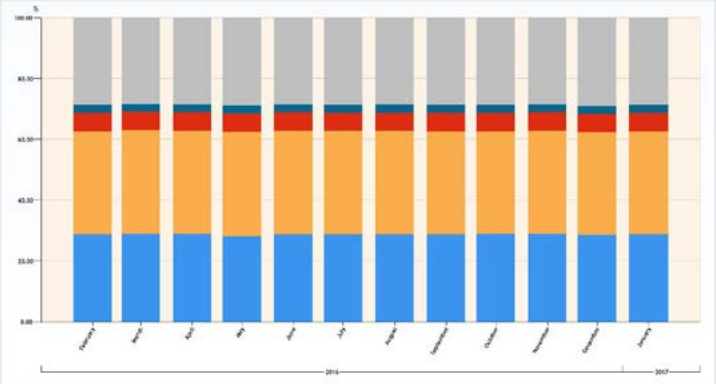
BARS AND LINES

The bar and line representations are the most common form of data processing.

STACKED BARS

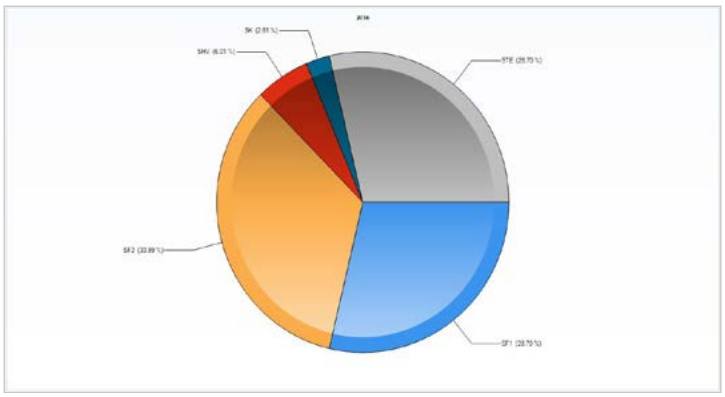
Values which are available in the same unit in the chart can be displayed with one click as stacked bars. This means as the sum of individual values.





STANDARDISED BARS

For standardised bars, the sum of several data series is defined as 100%. The bar components are the percentages of the individual data series of the total quantity.

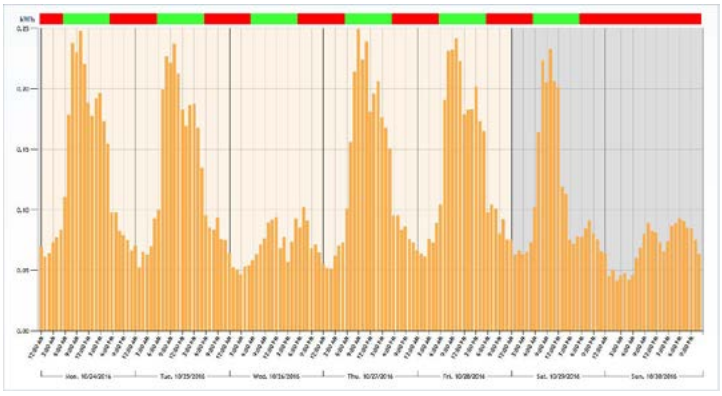


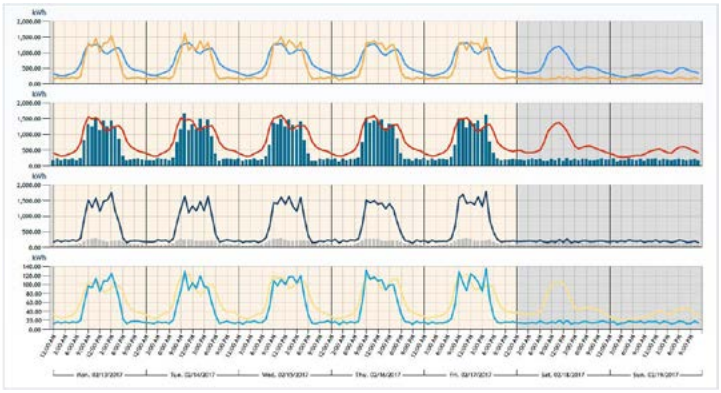
PIE CHART

Displays values relative to each other for the selected time period.

STATUS BARS

Load curves or consumption series are displayed in connection with reference series (e.g., installation conditions, sensor values, operating times or other rows) for better plausibility. For these reference series (horizontal bars) barriers can be set and values within the barriers can be indicated in colour.



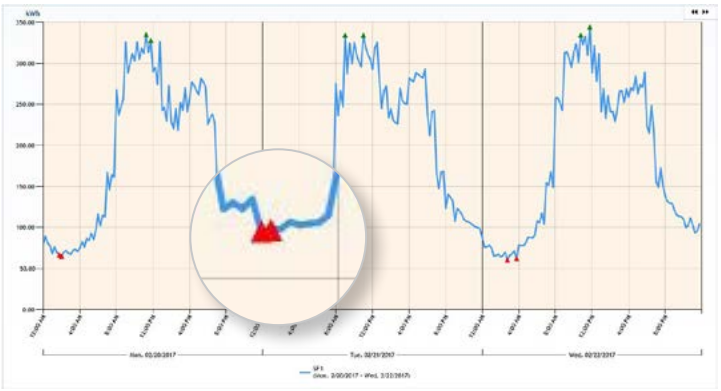


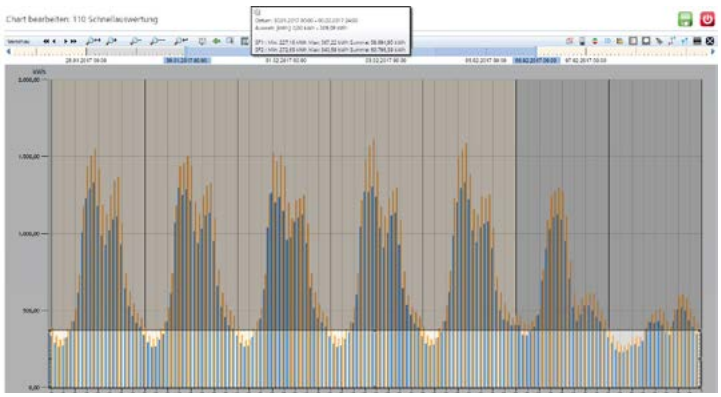
MULTIPLE-CHART

The multiple charts offer the possibility to display many data on a common time axis but in different chart areas. By assigning data sets to different groups, the user controls in which chart area and which data set is displayed.

SHOW MIN-MAX

This chart feature shows for the selected time period the minimum or maximum values of any data set. The user himself controls through corresponding entries how many values are supposed to be displayed and which data interval is supposed to be considered.



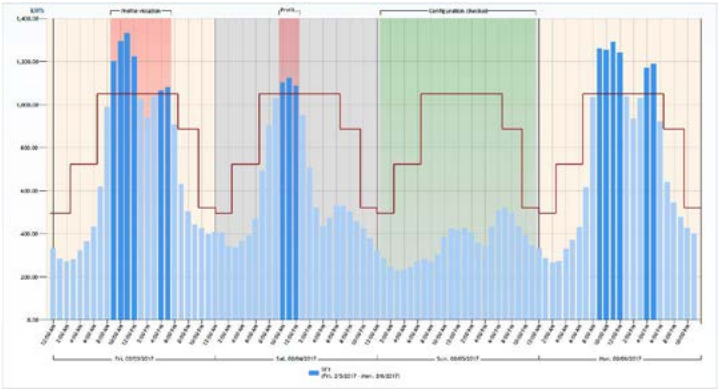


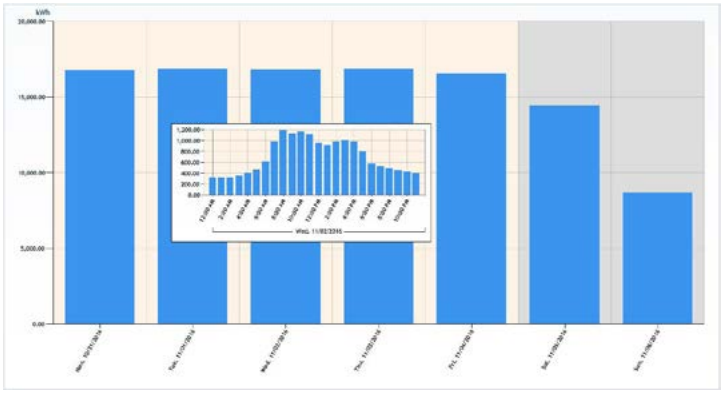
QUICK EVALUATION

The consumption of an area can be calculated with the help of the quick evaluation. The areas are defined by graphical input with the mouse in the chart and calculated ad-hoc.

COMMENTS

All existing comments for the data set can be shown in the chart. Comments can be added to the chart engine.



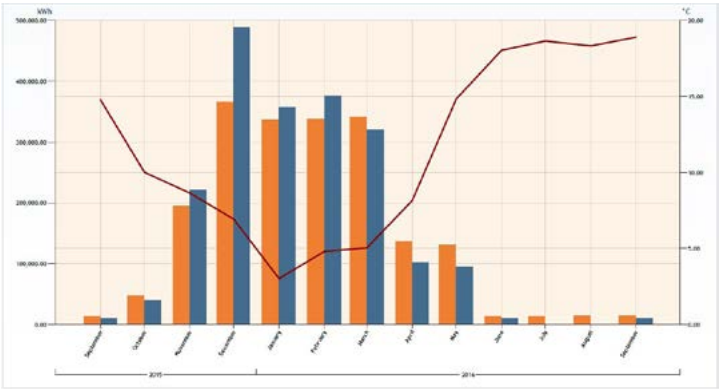


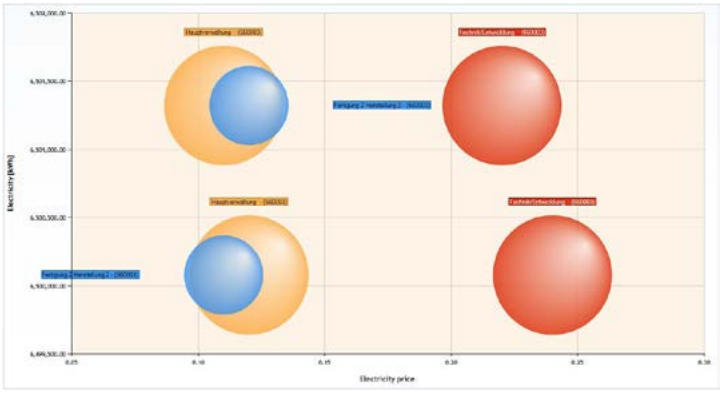
MAGNIFIER

If the feature is active the window of a chart of the next smaller interval is displayed as soon as the mouse is above a bar in the chart. Therefore, it can be checked ad-hoc if outliers are present within the selected interval.

CORRECTIONS

Corresponding methods are available in the system for data cleansing such as adjustments for climatic conditions or CO2 equivalents. The user can adjust climatic conditions of a data series or display the CO2 equivalent or the gas consumption in kWh via button in the chart.



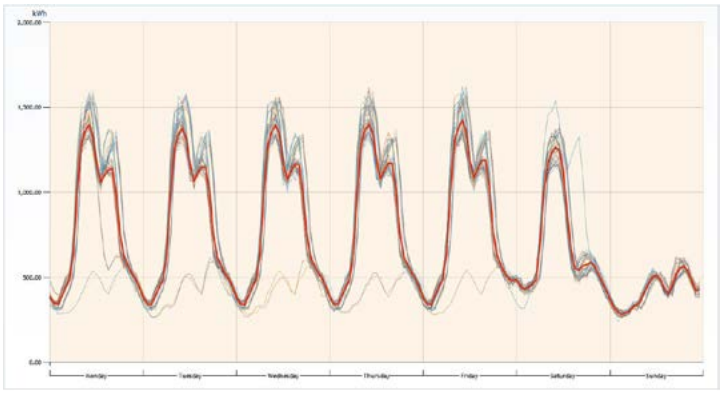


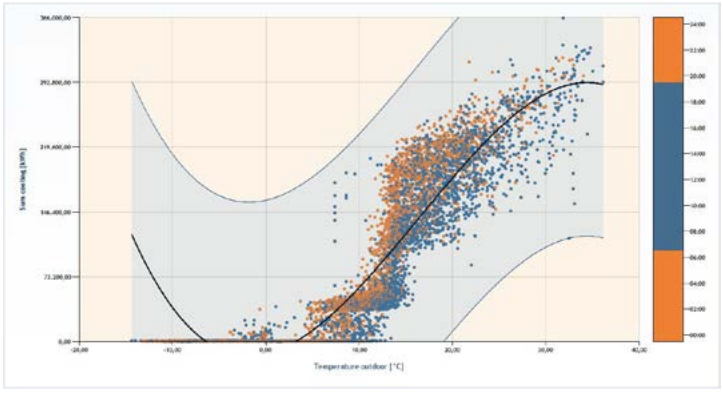
BUBBLE CHART

Our Bubble Charts are capable of mapping up to 5 dimensions. The 3 usual dimensions are the position of the bubbles on the x axis and y axis as well as the size. In addition, the fourth dimension (colour) and the fifth dimension (shape) may vary depending on the value. The sixth dimension (time) can be added for annual or monthly comparisons. In these cases, the bubble will not change but additional bubbles are created which represent value sets at different points in time. Therefore, a total of 5 value sets can be simply compared over several years.

RÉSUMÉ

The résumé superimposes these consumptions in one chart in order to identify deviations of period consumptions over a longer period of time. In this example, the ¼ hours consumptions of each week for a whole year are superimposed. The red curve shows the mean value; occasional outliers are identified up and down which should be studied more closely.



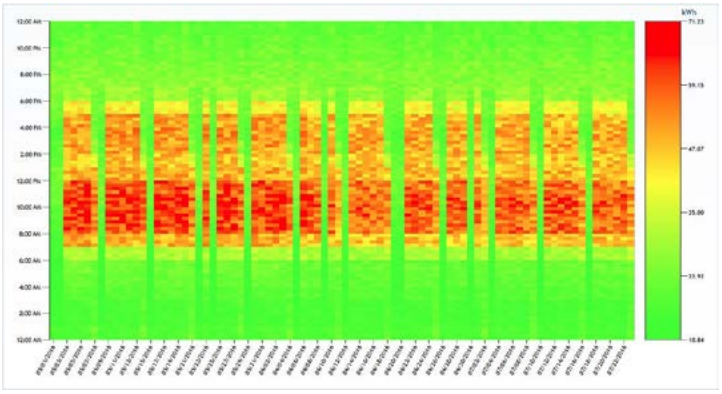


SCATTER PLOT / SCATTER DIAGRAM

A scatter plot, also called a scatter diagram, shows the connection of two measured values. In this example, the dependency of the energy consumption of a refrigeration plant with regard to the outside temperature is shown. The time of day in which the pairs of variates were collected, are highlighted graphically with the help of the colour scale. These pairs of variates are represented at the same time by default. They can also be shown with delay times in order to check the inertia of a system. For in-depth analyses, regression curves can be displayed within the scatter diagram.

SAVING DIAGRAM

The saving diagram processes consumption savings compared with a previous period and generates an easily interpreted graphic image. The baseline or saving target-settings are represented by the upper respective and lower lines.

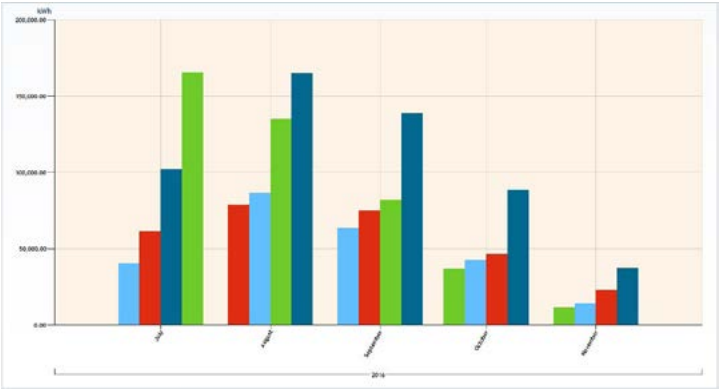


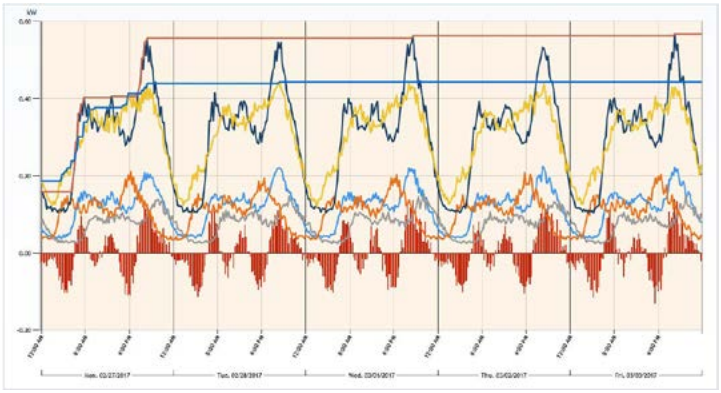
CARPET PLOT

The carpet plot or grid diagram shows the measured values over a longer period like a year for example. The individual days are shown on the x axis. The time of day is arranged on the y axis. Each measured value is represented via configurable colour scheme of the user depending on the value.

ABC-ANALYSIS

All data series are analysed automatically. They are sorted according to their consumptions within the selected interval. This sorting considers the timeline of course. Therefore, the sorting can be set and edited either for a whole period of time (which was the largest consumer on the weekend) or for individual sections within the selected period of time (how does the sorting change from weekday to weekday).



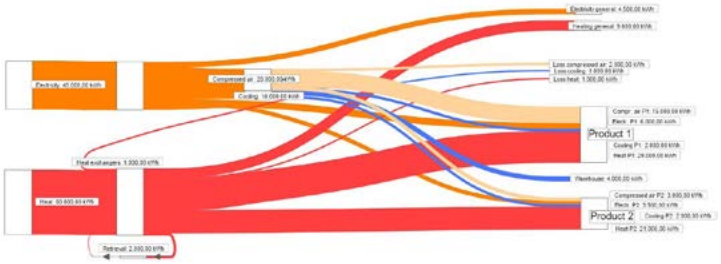


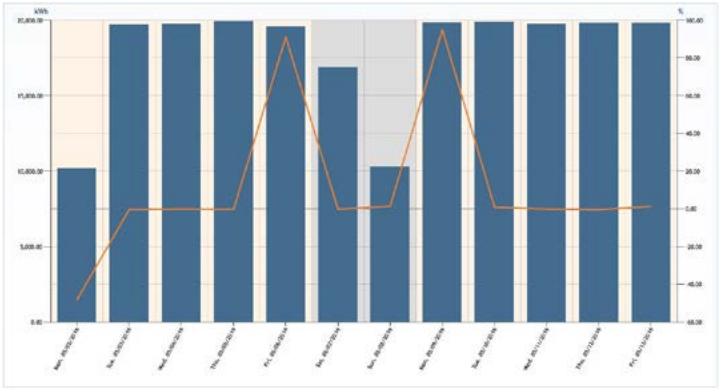
LOAD TRANSFER

The individual load curves of different consumers are combined to one cumulative curve. The hence ensuing result is displayed as a load maximum. These individual load curves can be shifted in a timely manner with the help of mathematical methods within the formula editor in order to display new, optimised load maxima.

SANKEY DIAGRAM

The user has access to features regarding Sankey diagrams in order to display connections and relations between individual producers and consumers. These connections can either be based on measured data or on virtual data series.





TIME COMPARISON

Within the system a time comparison can be established with a few mouse clicks. The user only has to enter the previous period of time (last month, last week, etc.) with which the current data set is supposed to be compared and if the result is supposed to be displayed as absolute (absolute deviation) or relative (percentage deviation). The calculation is carried out ad hoc for each individual value in the chart. The result is shown as an additional data series.

DASHBOARDS

The simple and clear presentation of many data, current states or even complex contexts is a core requirement of energy management. There are often many different data. Therefore, a mathematically and process-related relation needs to established in order to easily present and make those data available for different users. Dashboards or cockpits are the tools for compiling these evaluations and data sets.

Dashboards can be optimised for paper reports as well as for monitor representations by using different representation definitions in form of page formats or pixel numbers. An individual output format can be defined depending on the application goal of the dashboard.

For many dashboards views form the basis- chart evaluations which are saved and equipped with a time axis. The desired views can be selected with just a few clicks and freely positioned within the dashboard.

In addition to graphical evaluations, all other data evaluations can be included in the dashboards. A combination of different evaluations is possible.
Individual data series or calculation results can be displayed in form of traffic lights, object attributes or display instruments for example. The integration of additional information from attributes and elements is possible as well.

Dashboards can be presented in a more appealing way by using text and style elements, placeholders, line spacing and object images. The use of maps, overview plans or installation views is possible as well. These form the graphical background on which the values, calculation results or states are cross-faded.

Update cycles of dashboards and included values can be defined for the evaluation of live values. These cycles are ranging from monthly to every minute or smaller depending on the application.

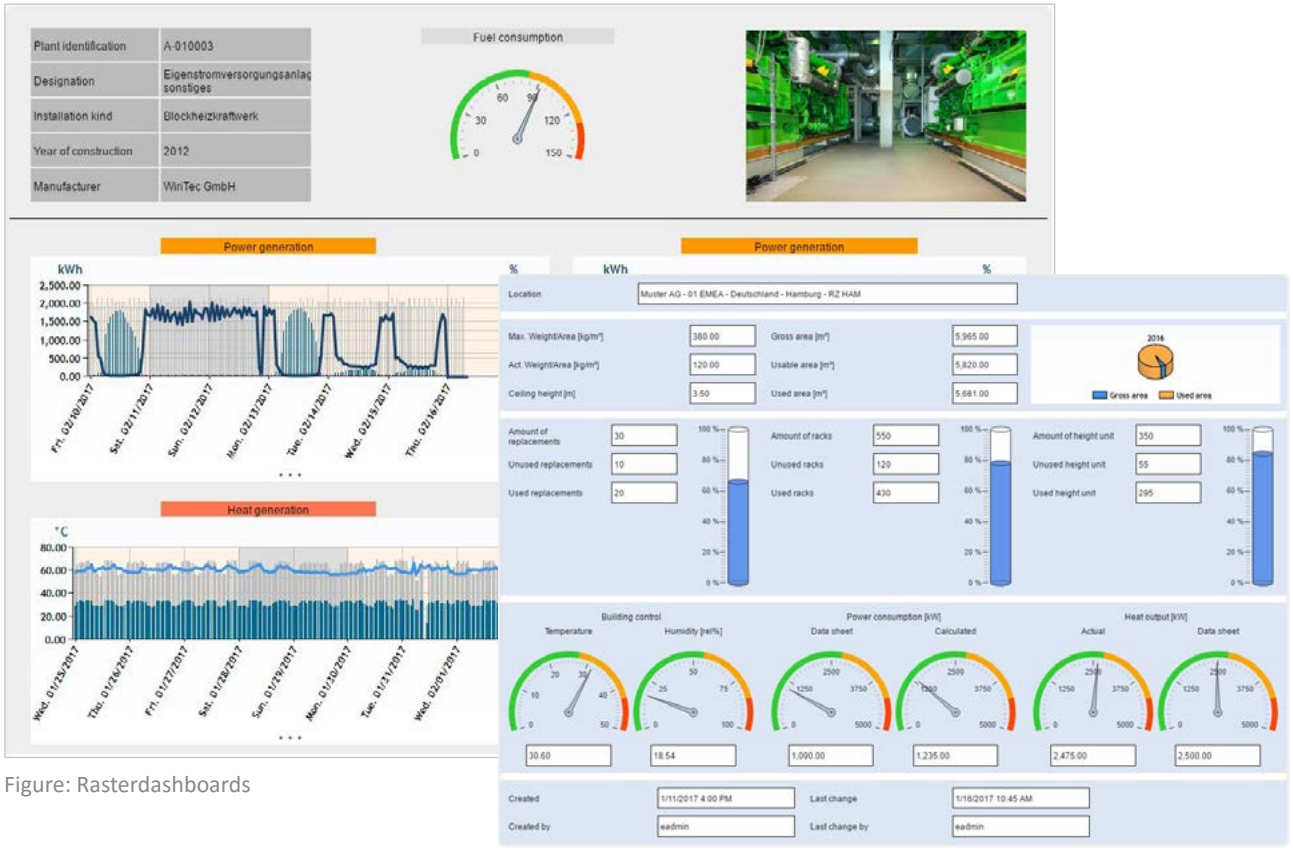


Figure: Rasterdashboards

DATA ANALYTICS

The formula editor is an innovative and high-performance tool for the profound analysis of measurement data as well as the representation of mathematical contexts between measurement data and attributes of buildings, machines and installations.

The formula editor is based on a programming language (C #). It can be configured easily by trained users without programming knowledge via using pre-defined functional components / modules.

Interfaces are implemented for important calculations such as minimum and maximum, time shift of data series, corrections (weather conditions, calorific value, CO2), moving average etc. in which corresponding parameters just have to be entered.

Simple features for summations, subtractions and impact factors like those necessary for the calculation of sum and residual value meters or transformer and performance losses can be used easily by untrained users. The whole logic is implemented while using the formula editor. Therefore, there is no need to take care of the differences in data series. Thus, data series with different intervals, different units and time-changing attributes can be calculated automatically with each other. This comfort is highly appreciated by our customers.

The methods of the formula editor are available in the area of graphical and alphanumerical analysis as well as for the calculation of virtual rows.

The sky is the limit regarding the evaluation via implementation of complex analysis programs. All mathematical features of the programming language C # including logical operators are available. Existing external programs can be used additionally.

Another powerful analysis tool is the regression analysis. The main focus of the regression analysis is the forecast and the identification of complex dependencies.

Often an overview of a large number of data series is needed. Not every single data series can be checked manually over longer periods of time. To do this, we have a quick evaluation in order to write the most important information about data series in an Excel table. These include: number of values, minimum and maximum, intervals without values, greatest differences of consecutive values and much more. For one

This method is essential for the quality assessment and a first quick overview especially for existing data as well.

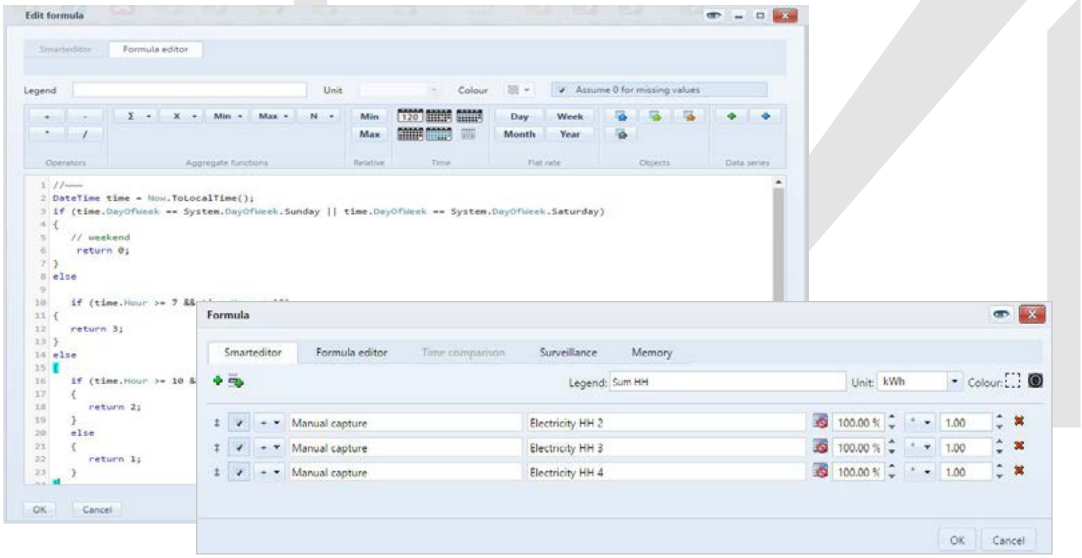


Figure: Formular editor / Smarteditor

GRAPHICAL SIMULATION

An important component of energy management is to visualise energy and resource flows and changes via new requirements. Dynamically moving diagrams in the sense of a SCADA system are the visual foundation. The visualisations can be activated at any workplace due to the realization as a browser application.

The basis for the simulation is a network of so – called nodes and lines. The nodes typically represent objects such as consumers, suppliers or conversion units. These may be defined freely by the user. The lines are the logical or technical connection between individual nodes. Both the lines and the nodes are connected to the associated data series or calculation formulas. In these lines all underlying load curves and consumption values are saved. In addition, the integrated formula editor which has access to all attributes of the energy system, allows extensive calculations for all relevant points in time.

Objectives of these evaluations are the approximate calculation of memory sizes, the detection of over- or under-dimensioned installations or the determination of causes of load peaks. Furthermore, these simulations are to be used effectively if new consumers or producers need to be integrated in existing networks.

All simulation results can be represented on the network graphics in form of numbers and tables, charts, dynamic icons, colouring and display instruments. They provide a good overview of critical situations. Even an unexperienced user can manage the results by using these display options.

The above-mentioned display methods can be used for the transparent display of live data and states as well. Therefore, current data such as consumptions, sensor values or states can be represented directly and meaningfully in these live cockpits with the help of round instruments, display bars, traffic lights and other similar instruments. Forecasts can be calculated based on live data with the help of the formula editor; early faults and overloads can be implied by these trends.

However, in the tool does not necessarily need to be worked with the network representation. It is possible to use other graphical representations such as maps or factory layouts, installation charts or flow charts as well.
Critical states can be displayed clearly and directly in an existing flow chart via traffic lights or round instruments for example.

Since cockpits always extract data from the energy data server, previous situations can be displayed and evaluated at any time via timeslider.

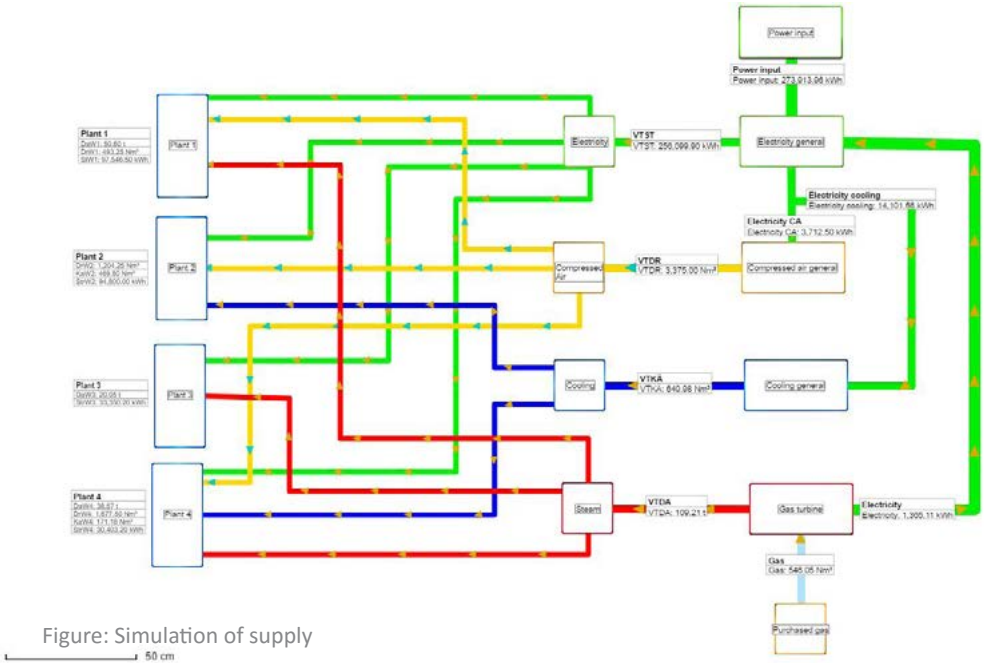


Figure: Simulation of supply

ALPHANUMERICAL EVALUATION

The WiriTec C user has three different options which serve different applications for alphanumerical evaluations.

1 TABLES

Basically, it is always possible to change to a tabular view within the graphical chart evaluation. The selected data series are displayed automatically as columns of a table. For each data set the respective time stamp will be shown if several time axes are active.

These tables can easily be exported (for example to Excel) and are available for further processing.

2 QUICK EVALUATIONS

The data quality of one or several measurement series for a freely selectable period of time can be checked with the so-called quick evaluation. For this purpose, there is a more specialised Excel report which creates an evaluation of data available in the database by pushing a button. This report analyses the database both formally and qualitatively. Therefore, it constitutes a starting point for the search for outliers or data gaps.

The formal data evaluation lists basic source attributes such as energy carriers, measured unit and type of data collection. Furthermore, formal details such as the total number as well as the remaining number or zero values are displayed. The report evaluates automatically the largest and smallest period of time between two data sets as well as the number of intervals without values in order to check data gaps.

The qualitative data check considers the minima and maxima for different intervals, the largest gradient or lowest drop between two values as well as various average values.

3 THE CUBE

The cube facilitates the compilation of any data on 3 axes: X, Y and Z. Therefore, the term cube is used for this tool. The user can create evaluations and he can relate data of different areas to each other via interface.

Objects and attributes are selected for this purpose. Data can be output in tabular form similar to Excel. Several spreadsheets behind each other form the third dimension of the cube for example in order to apply the same evaluation for different buildings.

Comparisons can be drawn on the spreadsheet by using rules- for example if deviations of more than X% are being displayed in a different colour. The axes can be exchanged. Therefore, the user can relate data of different spreadsheets via one mouse click.

A typical application for the cube is an accounting or cost centre report divided into small sections for example. Changes over several periods of time can be evaluated with the help of the timeline on the z-axis.

REPORTS

In all enterprises, the energy and resource consumptions, incurred costs but also savings effects or other relevant data and information need to be communicated both internally to different departments or cost centres as well as externally to customers or partners. We, the WiriTec GmbH, have a variety of different methods and procedures for these reporting requirements.

The standard reports are the first to be mentioned since we are always delivering those to customers. These reports are different consumption-comparison reports, building and installation reports or meter readings for example. These standard reports which we have developed based on our long- term project experience, can be adjusted to different customer requirements with very little effort.

The system has a very powerful report generator in addition to these standard reports. Most organisations have very individual reports which often have been grown over years and regularly have been distributed to the diverse organisational units and hierarchy levels. They are very complex and are based on many different data. Since these reports are well-known and widespread in the organisations and associations, they cannot be changed in format and appearance. In such cases, this integrated report generator can exploit its strength.

The basic structure is transferred into templates in order to ensure that reports maintain their form. These templates determine the look and contents and will be filled automatically with relevant data for the reporting period.

We are using so-called placeholders which are filled with a programming code among other things in order to ensure that different data end up at the right place. This facilitates the high dynamics which is necessary to create reports automatically which are based on very complex, different data types and data structures with only one template. Text fragments which describe data as well outliers, missing values or other deviations can be displayed automatically in the report. This report generator is really flexible. Therefore, it can display all reports from simple energy consumption reports, extensive multi-page cost centre reports with integrated calculation features up to large certification reports.

In addition, any ad-hoc reports for any point in time can be directly created from the system. The data sets, time intervals and evaluation methods which were compiled within the chart component can be exported directly from the system with one click to Microsoft Excel or PDF. The system can access a template, so that even these ad hoc report logos or design elements are included and therefore, existing corporate design requirements are fulfilled.

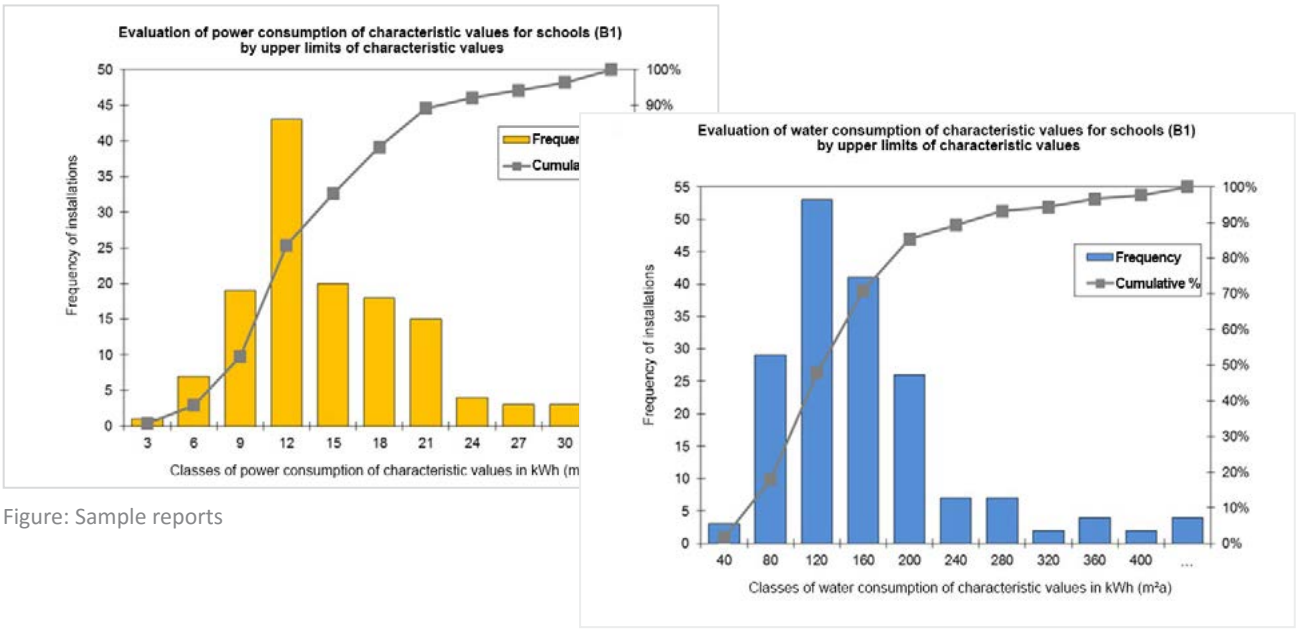
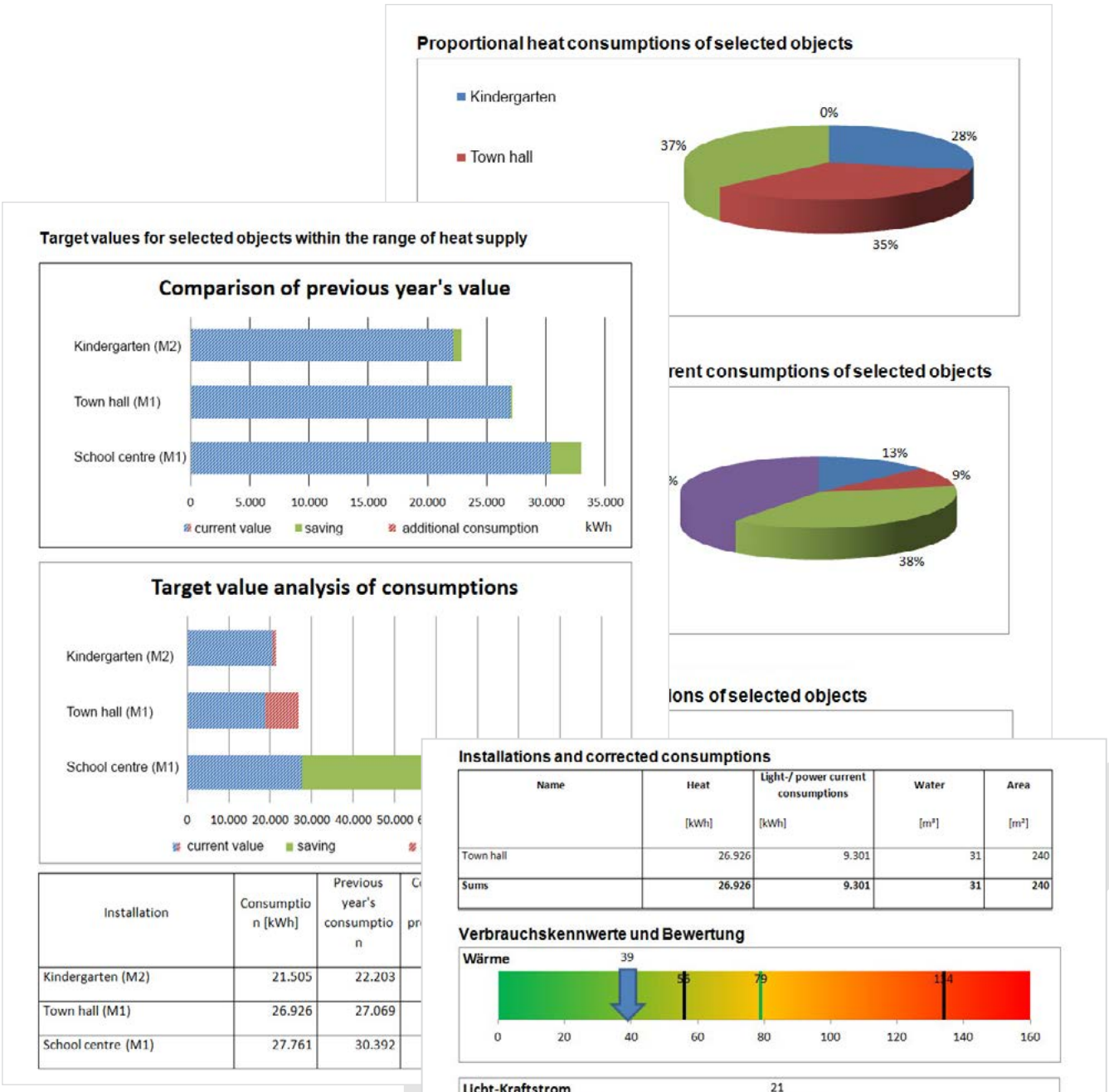


Figure: Sample reports



Installation	Consumption [kWh]	Previous year's consumption
Kindergarten (M2)	21.505	22.203
Town hall (M1)	26.926	27.069
School centre (M1)	27.761	30.392

Figure: Sample reports

Accounting methods and pay-as-you-go system
The high costs of energy and resources force companies to pass them on to consumers. We have developed methods that make a usage-based cost allocation possible.

Measure management and documentation
In addition to the purely informative documentation of savings measures, you can ensure with our tools that the taken measures are effective and that the savings are achieved and documented.

Energy and process performance indicators
Since the absolute energy consumption does not say anything about efficiency, characteristic values are mandatory; a simple dividing of energy quantity by area or production quantity is not sufficient.

Demand forecasts and forecasts
It only can be purchased at favourable conditions if you know when and how much energy is needed. Furthermore, the negotiating position can be improved towards the suppliers.

Environmental management / waste management
We have developed a corresponding module in order to simplify and optimise the collection of waste quantities, emissions and recycling rates.

Operational management
Support of contracting models.

Life Cycle Management
Questions about the state and future costs of objects managed by you can be answered with our life cycle management.

Fault message and notification management
Detect faults and notifications automatically.

Help and service desk
Safe processing of notifications and monitoring of initiated measures.

SECTION 4

COMMERCIAL PROCESSES

In addition to technical processes such as operational management or maintenance, commercial processes must also be mapped and substantiated with appropriate resource consumption data. For the different processes, we have developed customised solutions which support the workflow in a perfect way. Therefore, we are able to simplify our customers´ life in many places.

ACCOUNTING METHODS AND PAY-AS-YOU-GO SYSTEM

It is indispensable to allocate costs to different consumers due to high costs for energy and resources. The resulting transparency is also an important (educational) factor for energy savings in addition to pure further cost allocation.

In practice, the meter structures rarely correspond with utilisation structures. This means departments or tenants are supplied only proportionally by one or more meters. This is due to the fact that meter structures have not been changed over the years and utilisation structures are not permanent. Furthermore, meter structures are oriented towards buildings, floors, machines or installations and not at the current usage situation. In practice, total energy costs from utility calculations are mostly allocated via area percentages or other very imprecise keys. Therefore, a usage-based allocation is foiled. The WiriTec developed different tools for the resource accounting in order to solve these problems and to facilitate a fair and precise cost allocation.

The internal cost allocation is implemented with the help of more or less static allocation formulas or area percentages although they are imprecise and not necessarily user-based. The WiriTec offers a range of tools since these simple accounting methods may cause a considerable workload for responsible employees. Normally, the different cost rates or tariff rates of suppliers are stored centrally and are available throughout the system for accounting. Furthermore, necessary calculations are saved as completed formulas or virtual data series. Therefore, the controller is able to conduct the accounting via button. The controller obtains transparency directly of the implemented allocations by using specialised evaluation methods.

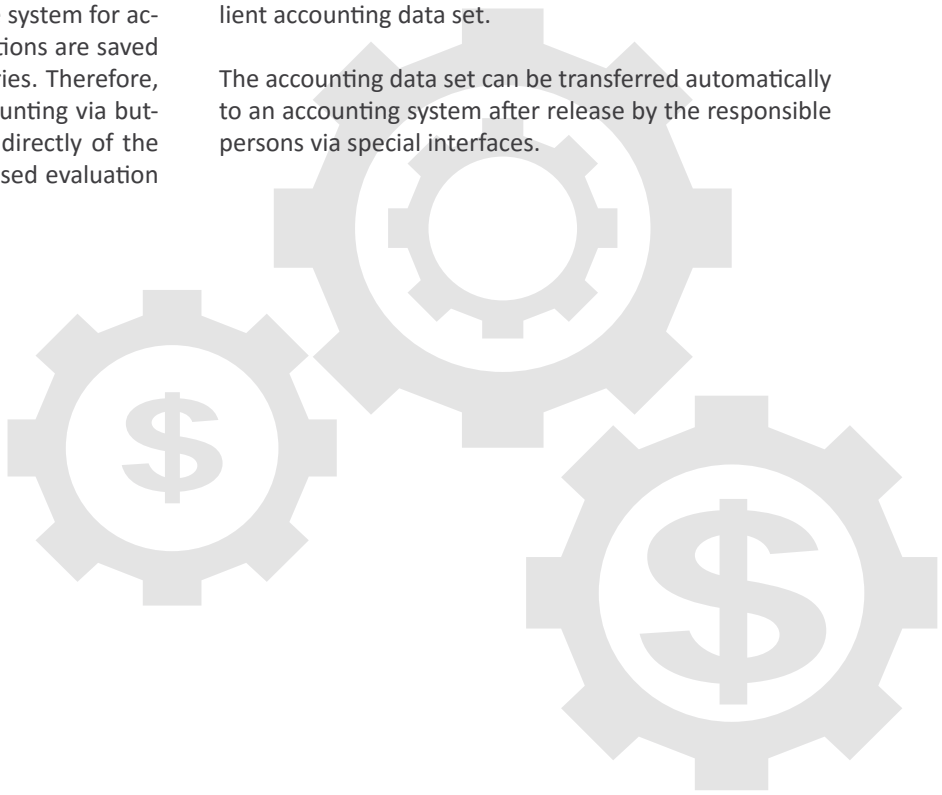
Corresponding accounting and allocation reports are often generated directly from the system and transmitted to the accounting system or other process participants.
The module WiriTec BL is available for more complex, multi - level accounting processes with many different process participants.

Actual measured consumptions can be equipped with additions or reductions in order to represent production downtime or process specifications. Physical line and conversion losses (e.g. for transformers) are allocated via defined keys to the individual cost centres with the help of residual value distribution.

A factor-dependent distribution allows special cases automatically to be considered like increases in production or additional shifts by using corresponding factors. This refers to the cost allocation. Each accounting during individual processing steps is made available for audit and approval via corresponding rights definitions.

The approval and audit processes which exist within the organisations can be displayed easily.
WiriTec automatically ensures that the workflow of the accounting process has been properly followed but also with the inclusion of necessary iteration loops due to approval procedures. The result is supposed to be a resilient accounting data set.

The accounting data set can be transferred automatically to an accounting system after release by the responsible persons via special interfaces.



MEASURE MANAGEMENT AND DOCUMENTATION

A definition of internal energy politics comes along with increased attention for energy efficient behaviour- but also with the certification according to ISO 50.001. A global energy savings target is specified by this policy which needs to be met in the following years in addition to many other topics. A typical goal is the reduction of power consumption by 20% by the year 2020 for example.

These guidelines always entail savings which need to be planned and documented. After successful completion these savings need to be retraced, monitored and evaluated. This documentation is required partially within the framework of the ISO 50.001 and to a much lesser extent in the DIN 16247.

Initially, measures are created as a corresponding object with its individual attributes in the system in order to document and manage measures.

The measure objects can be customised like all objects in the WiriTec system in order to provide measures with information which will be needed in different processes and evaluations later on. In addition to classic attributes such as description, responsibility or cost centre assignment, the measure object can contain different plan values such as expected savings or the amortisation period. These can be used for the controlling later on.

If you want to ensure that investments in energy savings bear fruits, a pure documentation of measures will not be sufficient. This means that the planned and carried out measures are compared with measured consumptions and the actual achieved savings. Furthermore, the resulting amortisation times are compared with previously made consumptions.

We are working with so-called saving elements in order to facilitate this controlling. These elements establish a connection between measure objects and data series which are affected by the measure.

The saving elements automatically compare media consumptions before and after the execution and calculate the actual resource savings of the measures.

A measure can contain a variety of these saving elements since in practice many measures are influencing more than just one energy carrier and are in interaction with other cost factors as well. This means a conversion of a heater from oil to gas causes additional gas consumption, an elimination of heating of oil consumption as well as the reduction of CO2 emissions caused by the lower CO2 freight.

The system has several tools in order to monitor and evaluate savings. Cube evaluations facilitate the processing of different assumptions and effects of measures. They can be made available for users in an Excel-like overview.
In addition, there are special chart tools which can be used to evaluate graphically the additional consumption or under-consumption in comparison to any reference period.

Nowadays measures are being taken without comparing these to actual costs or consumptions. In practice this leads to a planned ROI which is realized too late or in the worst case scenario not at all. In practice we have developed a tool in order to make a statement regarding the actual ROI to be expected even before the measure was executed.

For this purpose, the measure characteristics are entered in the tool, connected to the affected data sets and the calculation is started. The tool provides information on how long the ROI will be in this particular case, how much it is supposed to cost to ensure a given amortisation time. Moreover, the tool provides information on which measure combination will have the largest monetary or ecological effect.

ENERGY AND PROCESS PERFORMANCE INDICATORS

The absolute consumption of energy and resources does not say anything about the efficiency of the use. Only if energy or resource consumption is put into relation to the terms of use, a significant index number can be obtained: an energy or process performance indicator.
In the simplest case, today's energy consumption is referred to an area. An initial statement can be made about efficiency while comparing similar used buildings with similar facilities.

Most energy benchmarks as well as most common certification methods start here.

The approach is very similar for the production performance indicators – the production volume is taken as a parameter instead of an area.

This simple approach in most cases is sufficient for an annual report or a global performance indicator. This approach can be used for an initial evaluation of several similar production installations with similar production conditions.

These methods fall short for a more detailed consideration of installation or production performance since many important influencing factors are left out such as product information, machine utilization and idle times. Without a corresponding consideration of individual frame parameters, there is a comparison of apples and oranges regarding the performance indicator consideration.
The system offers different options in order to prevent these problems of comparability.

The formula editor is always used for all calculations since any mathematical calculations can be conducted.

In addition, all available data sets in the system - both measurement series and numeric attributes - are included in the calculations. The different installations and machines can be described and characterised with various attributes by default. For a performance indicator calculation, installations can be filtered and grouped according to these attributes. The different attributes can be merged for very detailed analyses. The energy consumption can only be integrated in the performance indicator calculation if the producing installation had a certain status or produced a minimum for example.
Therefore, it can be ensured that only the energy demand is added to the final product which was actually caused by production.

On the other hand supported energy consumptions such as cooling capacity during production can be added directly to a final product by using these factors.
The accrued energy consumption of an installation while not producing is often interesting as well. These idle energy consumptions account for a not inconsiderable proportion of costs.

All these above mentioned formulas and virtual data series can be managed and edited by the customer since installations and production constellations are often changing.

DEMAND FORECASTS AND FORECASTS

Reliable and accurate forecasts about future energy and resource demands in companies with high energy costs are absolutely mandatory. It only can be purchased at favourable conditions if you know when and how much energy is needed. Furthermore, the negotiating position can be improved towards the suppliers.

We have developed various forecasting tools in order to support our customers in this important issue. Basically, we distinguish between three different approaches. These are partly overlapping and depending on the requirement may be used together.

1 TREND ANALYSIS

A linear consumption trend for the future (set trend interval) is calculated on the basis of past consumptions via trend analysis. The user can define how many historical values are used for the trend analysis. The trend analysis can be combined with profile monitoring in order to monitor trends and behaviour towards the target.

A corresponding message can be issued if the analysis tool detects that the maximum consumption is exceeded at the end of the time interval. The time intervals for trends can be changed and adjusted to new situations at any time.

2 FORECASTS

A forecasting model is built for the second model based on media consumptions of a past period. On the one hand, the forecasting model is based on targets (e.g. reduction of x %). On the other hand it standardised past values by influencing factors like temperature. As past values, any measurement series can be used as individual series, sums or other calculated series. It is only important that influencing factors are corresponding with measurement series. The standardised past consumption is impinged or reduced with the planned quantity change and allocated with the expected influencing factors for the determination of the future consumption. The factors come from weather forecasts or other somehow reliable future prospects for example. The underlying features can be calculated automatically if several external factors influence consumption.

The actual values as soon as they are available are automatically mirrored against the forecast and deviations are reported automatically in order to control the forecast, The forecasting features can be calculated automatically and therefore can be sharpened if unexplainable deviations occur regularly.

3 REGRESSION FORECAST

The third method is based on parameters which influence the energy demand.

These parameters such as temperature, usage intensity, duration of use and runtimes are compared to the measured energy quantity. With the help of the regression analysis a formula is calculated based on these. This forecast will be trained over several periods and sharpened until it is stable enough to predict the energy consumption due to estimated parameters.

Experience has shown that an accuracy of 1 to 2% can be achieved by using appropriate parameters.

ENVIRONMENTAL AND WASTE MANAGEMENT

Nowadays, most medium-sized and large companies need to provide information about their consumption of energies and resources as well as produced waste and emissions and report them accordingly. The reporting itself is often standardised and automated or was being outsourced to an external service provider. Therefore, the actual collection of underlying data puts the companies in a position of considerable investments and difficulties. This applies particularly for large companies or those with many distributed locations.

This is due to the fact that especially data on waste or business trips are often documented in form of costs in the ERP system but the actual accrued quantities are rarely digital.

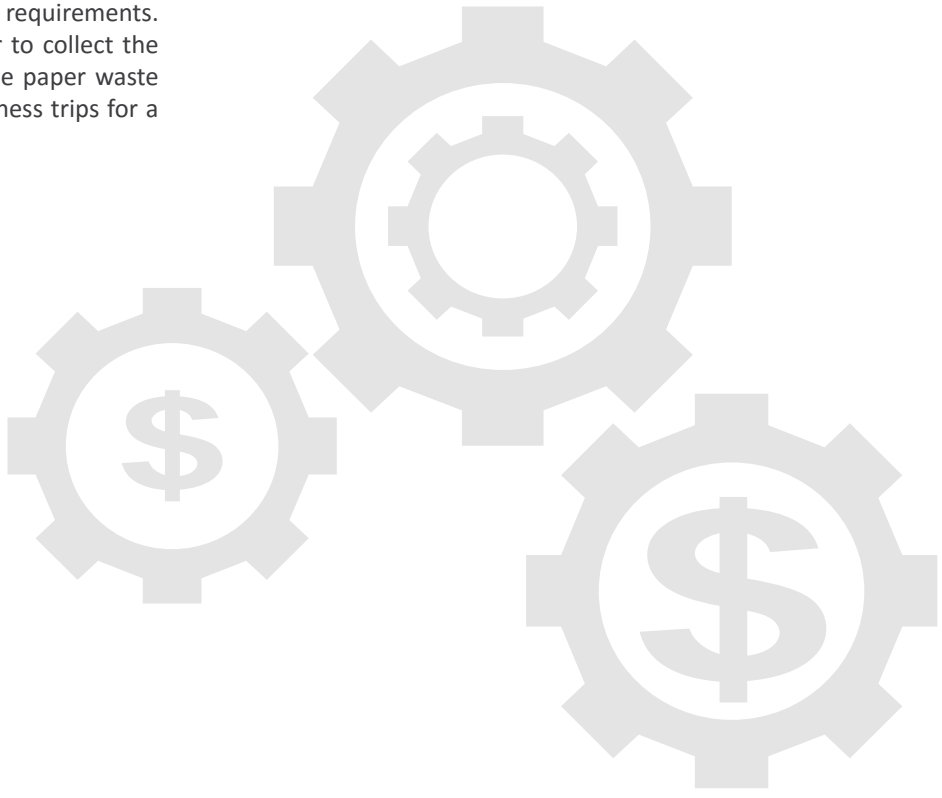
Since the quantities and not the costs are mandatory for the reporting, these must be manually transferred from the invoice to the reporting system. This annual (typical reporting period) data collection is not only very time-consuming but also very error-prone.

We have developed an application with which quantities of consumed resources of all kinds can be decentrally collected and centrally documented in order to support this data gathering process. Data for individual buildings, entire sites or even for countries and business units can be collected depending on the customers´ requirements. A mixed form is possible as well in order to collect the power consumption for each building, the paper waste for the site and CO2 emissions from business trips for a whole region.

The quantities may be entered at any time as well as for any intervals. The internal calculation methods determine automatically the required monthly or annual values. Therefore, it is completely sufficient to import just the quantities of the invoices. The user does not have to do any further calculations. This automatically applies to all further conversions such as kWh power in tons of CO2 according to applicable factors.

Data are often collected sporadically and by untrained software users. Therefore, the software has corresponding input masks in order to allow data to be easily entered. Furthermore, data that have been collected elsewhere can be imported automatically via interfaces. Energy consumptions which often exist digitally and need to be reported in aggregated form for the environmental management are a typical example.

All collected data will be permanently and centrally stored and can be analysed graphically and alphanumerically with our standard methods. Year comparisons, comparisons of different locations or business units or even the development compared to internal guidelines can be easily created. Existing internal or external reporting tools can be filled with the required data via standard interfaces.



OPERATIONAL MANAGEMENT

IT support for operational management models is gaining importance as more and more contracting agreements are concluded. These contracts have long durations while boundary conditions which were originally decisive for the contractual conditions are changing immensely.

The contractor has to provide optimal service for his installations while being confronted with an additional challenge: He has to deal with new conditions. A good data situation which documents changes in the process flow and serves as evidence helps him. Here, the management software from WiriTec / speedikon demonstrates its strength.

Basis is the smooth documentation of energy and resource consumptions for years combined with process and environment information which are the decisive fundament for consumption. Running, automatic monitoring processes with intelligent features can detect trends and deviations. Therefore, it can serve as an early warning system for the contractor. At the same time, it is made transparent for the end customer how its energy and resource consumption is changing. The technical and maintenance and care processes are important in addition to economic aspects which are aimed at the optimisation of costs.

For this purpose, the current installation master data form the basis. All technical measures, energy and resource consumptions as well as all costs must be directly assigned to the installations.

Only in this way life-cycle considerations can be made and attachments can be compared to each other in benchmarks. The efficient installation operation is supported by our software solution as well as state and fault management. The contractor is particularly concerned with fault management. A high need for documentation is especially needed for the contractor in the area of fault management. SLAs are often specified in contracts whose violation can also have significant financial consequences. This means that in case of occurring faults, a qualification according to importance and reaction time must be carried out.

The evaluable documentation of faults and the repair process are highly significant since they provide the basis for the installation condition and provide a non-negligible cost item. With the help of these data, alternative maintenance strategies can be identified and their costs for upcoming years can be predicted. The IT-supported simulation of maintenance and lifecycle strategies leads generally to good forecasts.

Another important aspect is the real time monitoring of the most important parameters. Our dashboards have proven their effectiveness since they can display any context dynamically.

The representation is done with graphics, lists and traffic light systems. We attach the greatest importance to keeping the user close to the current data and the deducted insights in form of performance indicators and comparisons.

Many important data are generated on the field level especially in the control and measurement technology. A lot of special technology is necessary in order to get this data into the management and monitoring system.
We are well prepared to provide measurement data in real-time and in high-quality because of the used energy and resource data management which imports already several hundred thousand of measuring points from various field devices.

The measuring intervals can be up to one second. Therefore, the data accuracy is sufficient for the so-called condition monitoring applications. This means that machines and installations based on continuous measurements will be monitored automatically.

A operational management system is composed of different, highly integrated applications which are defined and configured according to the task.

Figure: Scheme operational management

LIFECYCLE MANAGEMENT

We have been working intensively with our customers for some time regarding the topic of lifecycle management. Therefore, we developed several modules which facilitate a lifecycle perspective of real estate and installations and focus on costs. We pursue a very practical approach which consists of different methods that our customers have already been successfully applied.

We consciously set ourselves apart from existing certifications which are usually related to additional effort, the use of significant resources in the company as well as the factor that only standardised results and no individual evaluation is offered. The goal of our methods is to make users quickly realize what their real estate and installations cost regarding maintenance and how the individual cost blocks are distributed.

The basic principle is that the data are stored in the system for several years. Therefore, it is possible to get an immediate overview of the real development. We are able to get a future perspective by inspecting the current state of a building or an installation and by taking the remaining service life of associated components into account.

In this way, long-term planning even over 20 or 30 years can be realised efficiently. Maintenance backlogs which strain budgets can be avoided in advance.

The focus of our approach to lifecycle management is consciously not on a sustainability certification but rather on practical cost optimisation, maintenance of assets, security and transparency in the operational management as well as optimisation of used resources.

Basis for the evaluation are cost-relevant processes which nowadays are only IT-supported for logical reasons. The processes include maintenance, project and order management, rental management, cleaning and all processes for supply with media as well as for the smooth process of the core business.

Since IT support is never integrated into one IT system, there is a high demand for integration performance in order to provide all relevant data which are important to the lifecycle management at the right time, in the necessary quality and in a consolidated and evaluable form. Once this is achieved, the data are flexibly and diversely usable.

The costs which are made available show cost drivers and indicate possible maintenance backlogs. Through the consistent structuring of the data they are simultaneously the basis for benchmarks and for any kind of sustainability certification.

This information is supplemented by processes and the state documentation in order to facilitate forecasts and projections which put portfolio decisions to a strong foundation.

The causal connection between lifecycle management and energy data management results from the fact that energy consumptions and the frequency of faults strongly depend on the qualitative state of a building or an installation. The integration of energy data management into the lifecycle management expands the database and improves the informative value.

FAULT MESSAGE MANAGEMENT (AND NOTIFICATION MANAGEMENT)

In complex buildings and installations a large number of faults, warnings or other procedural and status messages can occur which need to be interpreted and evaluated immediately.

Often there is no uniform source of interference but a variety of installations, control technologies and monitoring systems from various manufacturers with different and often proprietary protocols and methods for message dispatch and administration. This means for the responsible employees that they need to use and bear in mind several different notification systems. This problem will become more severe in the course of developments in the field of industry 4.0 since more and more systems will communicate with each other and are supposed to send more warnings and fault messages.

The WiriTec GmbH created a system with its reporting management which centrally gathers all notifications from various sources and interprets comprehensively in order to unknot this Babylonian language chaos.
The system has a very high level of flexibility with regard to device, bus, field level and IT interfaces in order to facilitate a connection to different data sources. Therefore, all customary and standard installations and control technologies as well as existing Helpdesk systems can be easily connected and integrated. Even analogue notifications can be collected, interpreted and imported into the system.

Filters and pre-processings can be configured at different points of the interference processes in order to control the number of incoming notifications.

Follow-up notifications resulting from faults can be detected automatically and filtered out if notifications already exist via appropriate configurations. The reporting flood is contained with these procedures. Moreover, it is ensured that only relevant and important notifications are transmitted immediately to the appropriate persons or processes. All original notifications remain unchanged for later traceability and evaluation.

The energy data management system also generates its own notifications via monitoring of measured consumption and sensor data in addition to direct notifications received from the installations. Usually, the monitoring intervals are not less than 5 minutes, so that monitoring mechanisms can run on the energy data server. Therefore, the advantage is the central availability of all data and that they can be compared to each other. Profile monitoring is an important and efficient tool to detect malfunctions and abnormal consumptions in addition to the monitoring of minimum and maximum values of data series. Profile monitoring is based on a consumption profile that changes over the day or during the week. It results by superimposing a real load curve over an idealised border profile. Therefore, typical, varying with time consumptions can be displayed very well.

All faults and profile violations are entered into the central „event table“ and are available for further processing or interpretation. Therefore, no notifications are lost and the processing process can still be understood later on.

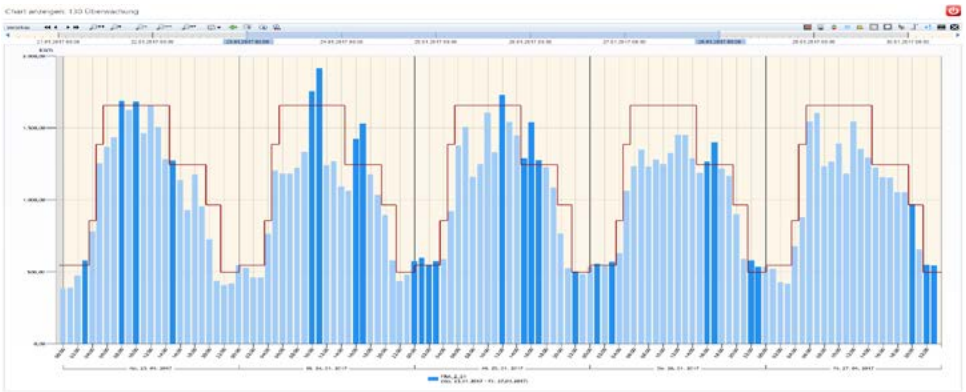


Figure.: Profile violation

HELP- AND SERVICEDESK

Help and service desk systems in which the organisational processing of faults takes place, are closely connected to fault notifications.

Our affiliate company, the speedikon FM AG, has adapted many systems to meet individual customer requirements which support the whole process up to orders, material orders and personnel deployment as well as the placement of orders.

Manually posted notifications such as the failure of a heating system are overlapping with automatic fault notifications from the affected installations themselves. In separate notification systems the coordination is difficult to impossible. Our centralised service desk system can coordinate these contexts very well. Therefore, duplications of effort are avoided and detectors receive a well-founded and satisfying feedback. A central and evaluable platform for all fault notifications is highly relevant for all further processes such as maintenance, lifecycle inspections and investment decisions.

Important goals for help and service desks are the complete traceability of faults and notifications, the statistical evaluation and the exact assignment to the person responsible.

It is precisely the last point, the assignment to the persons responsible which provides information on the reliability and stability of individual installations and machines and the associated costs and risks.

Investment decisions can be substantiated and tested for efficiency during the further procedure.

This tool has established itself as a platform for transparency in technical processes in many companies. Insights increasingly influence future investments and process adaptations.

Database for the digitisation
Industry 4.0 is only possible if the variety of data can be collected, processed and analysed - our methods create this basis.

Monitoring of large amounts of data
High-frequency mass data collection in the millisecond range is checked during insertion.

Batch management and optimisation
The methods for batch management allow profound analysis of energetic production efficiency.

SECTION 5

DIGITISATION AND INDUSTRY 4.0

Industry 4.0 and the digitisation of the production offer many companies the possibility to make their processes more efficient and bear them in mind with the help of data. On the following pages, we will be presenting various solutions in order to help you make your production processes and production-supporting processes fit for the digital future.

DATA BASE FOR DIGITISATION

The digitisation of the industry is based on the fact that all installations, machines or other involved processes communicate with each other and exchange data with a central. This automatically requires a data flood which can be handled only with appropriate methods.

This data handling starts with the collection of data in the field, extends to the storage and processing of data and ends with corresponding evaluation and analysis methods.

We have combined our know-how from energy management with the experience of countless projects of our affiliate company speedikon FM AG to create opportunities in order to solve these problems.

HIGH-FREQUENCY MASS DATA COLLECTION

Modern machines and production installations can generate already today a variety of measuring data, sensor data or other information. Older installations can be digitalised and put into the position of communicating with the help of retrofittings.

These data are the basis for later evaluations of production and manufacturing processes. Scales divided into very small sections and high-frequency measurement data of temperatures, pressures, flows and other meters and sensors are necessary for reliable and meaningful analysis and considerations.

We are using the so-called WiriBox HF for the direct reading of meters, sensors or machines in the field. For this purpose, we combined our many years of experience with data collection with the latest IT hardware to facilitate a high-frequency and yet cost-effective data collection. The software of the WiriBox HF is specifically designed for high-frequency sensors in order to collect data in the corresponding intervals.

If additional sensor technology is required, we will make use of available technology on the market. Since the field of sensor technology has changed dramatically in recent years, a variety of industrial suited and cost-effective sensors and measuring devices are available.

The WiriBox HF transmits collected data directly to a highly specialized time series database which is designed to handle data in the area of milliseconds.

Already existing data sources or logs can be connected directly to this time series database without the detour via WiriBox HF in order to take existing installations into account. Typical logs such as OPC UA, SNMP, BACnetIP or even Mod- BUS TCP are used as they are fast enough to handle the data volumes.

STORAGE OF MASS DATA – EDGE-COMPUTING AND THE INFLUX DB

The data collected in the field need to be available for a defined period of time or even an indefinite period. Although storage media are not a cost factor anymore, a strategy is necessary since no one wants to sink in a data graveyard.

This starts with the unambiguous assignment of data to sources and persons responsible. It always needs to retraced on which machine - which sensor - and when a data record was generated and provided.
The features and methods from speedikon® C allow devices, installations, sensors and measuring devices to be displayed in a hierarchy or network with the necessary features. This technology represents the installation logic and is the basis for later evaluations. The time data series (the measuring values) are closely connected to this structure.

A relational database is only conditionally suitable for the storage of time series. That is why we place emphasis on a „time series database“.

We have chosen InfluxDB, which falls under the category of NoSQL databases. InfluxDB is capable of saving time series more compact. On the one hand, this saves physical storage space and on the other hand a high performance regarding data collection and evaluation is available.

During normal operation, we reach import rates of 10,000 up to 30,000 data sets per second with a WiriBox® equipped with SSD memory, depending on the import method. The collection of high-frequency data mainly serves the „retention of data“. Only one fraction of data is ever needed but is not known in advance which data it will be. If data are necessary, they need to be available as quickly as possible. Searching in archives or extreme storage can be ruled out.

It is therefore appropriate to keep high-frequency time series data on the field level data processor. Only evaluations and aggregated data should be imported to the central energy data server. The field level data processors can be designed redundantly with increased safety requirements.

This concept corresponds to edge computing and has the goal of relieving networks and the central energy data server.

EVALUATION OF MASS DATA

Special methods are necessary for the evaluation of high-frequency measurement data. Therefore, these methods allow a good overview of large data volumes and the identification of critical points in load curves or sensor measurement series.

Therefore, an aggregated series can be examined and displayed e.g. the minimum and maximum of monthly values in the 10-second grid. Critical points can be reached by successively increasing the resolution via our drill down method.

In addition, all features of the integrated chart engine are available for the evaluation of distributed measurement data as well. It is basically known to the data series where the measurement data are stored and from which interval width the access to another data processor (e.g., field level data processor) needs to take place.

The user does not notice anything; he processes its data series as usual and only retrieves a higher accuracy. The charts are basically designed for all supported intervals regarding the collection. Configurable barriers ensure that measured values cannot be artificially stilted (e.g., an hourly value in representation of seconds).

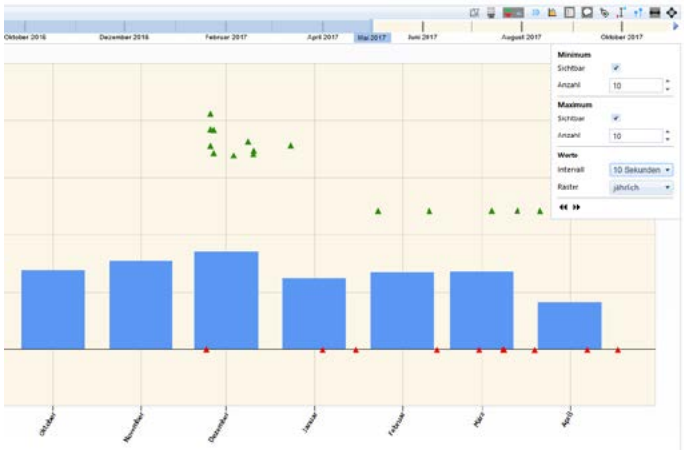


Figure: Chart in milliseconds

The calculation of data series to characteristic values and reference values or significant reference series requires our mathematical features which are specially adapted to data series within analytics. These work unrestrictedly with regard to distributed data up to the millisecond range. The proven methods that are used in energy management can therefore be widely transferred to high-frequency data from production and manufacturing.

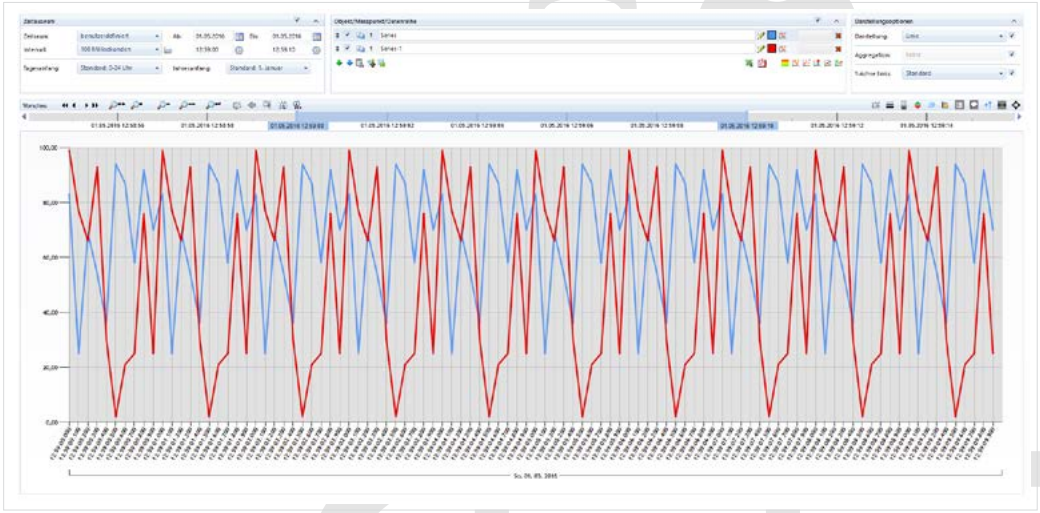


Figure: Chart in milliseconds

MONITORING LARGE DATA VOLUMES

In projects of „high-frequency“ digitisation, monitoring in life stream is necessary. In contrast to energy management where data series usually exist only up to ¼ h values and are monitored in this interval.

This means that any value that is imported to the data processor from the field level needs to be tested. We are dealing with digital real-time systems which make some demands on hardware and software concepts.

The nature and the extent of monitoring are filed in regulations. These are assigned to machines and installations to be monitored. It has proven useful to build a digital twin of the machine which contains all necessary information. The twin is not only the basis for monitoring its consumptions and sensor values but serves as a data basis for all other technical processes.

Data monitoring takes place in 3 steps depending on the complexity and the target:

1. Monitoring of individual data series on the field level data processor
2. Monitoring of multiple dependent data series on the field level data processor.
3. Complex monitoring of multiple dependent data which are collected from different field level data processors.

A helpful tool for monitoring is the capacitor which is closely connected to the InfluxDB. In order to ensure the high monitoring frequency, the capacitor is integrated into a C # program which controls actions in case of rule violations and contains filters which prevent too frequent hits. A program generator ensures that changed boundary conditions which are stored as simple attributes in the digital twin, are automatically integrated into the C # programs and control the capacitor.

It is up to the configuration of the system which actions are triggered in case of violations or malfunctions.

These actions can be notifications for persons responsible, general fault notifications in a service desk system or the direct trigger of a repair or service order.

The important aspect here is that we do not interfere with instrumentation and control technology of machines. The goal is to detect and report trends of faults at an early stage. In addition, all measured data are available to analyse the cause of a fault.

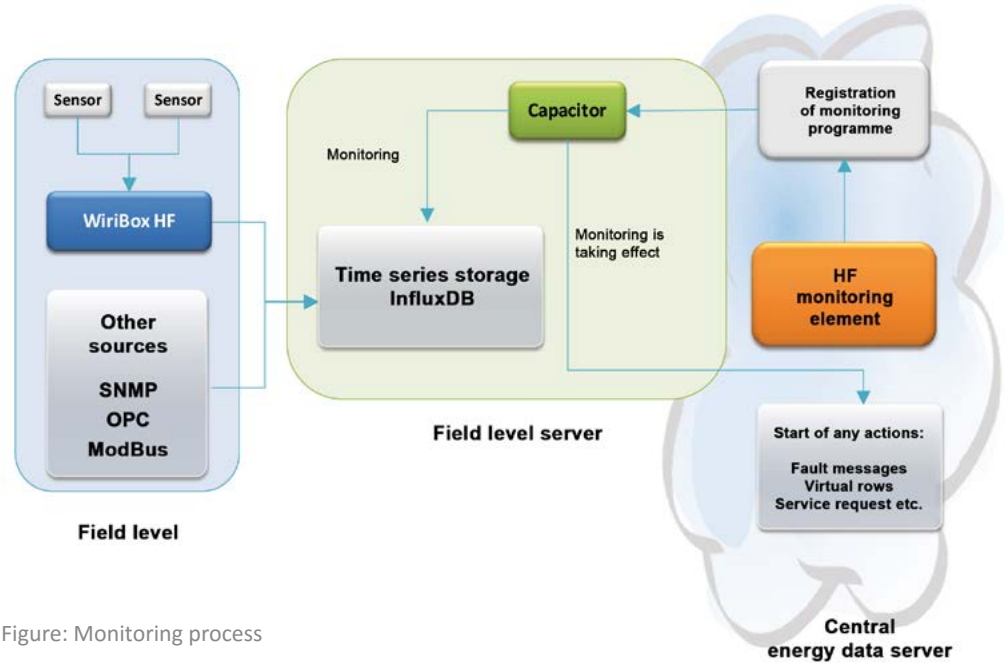


Figure: Monitoring process

BATCH MANAGEMENT AND OPTIMISATION

The determination of the energy demand for production processes are challenges that companies which are serious about energy efficiency need to face.

Strategies for energy optimisation can only be developed if it is known which amounts of energy and resources are spent for individual production steps.
On the one hand, it needs to be determined under which circumstances and at which process stage a more detailed view is worth to consider. On the other hand, the suggestibility plays a decisive part. Serious process changes are rarely a subject for discussion as this intervention in the core business of a company often cannot be justified by saving energy.

Therefore, further correcting variables are needed which can be changed without affecting the process in order to reduce energy consumption. The energy demand depends strongly on batch quantities and is in most cases not proportional to quantity changes. This context can also affect specific production costs with regard to energy-intensive productions.

The interdependencies between production processes, produced quantities, used production installations and energy consumptions are very complex and can no longer be easy overlooked. To make matters worse, processes are not continuously consume energy and resources but are subject to load curves. Therefore, the temporal resolution of consumption is indispensable.

Often analyses and calculations are conducted on the basis of maximum, minimum or average values due to lack of measurement data. These do never reflect the real situation. They are too vague, often lead to over-dimensioning or under-dimensioning and therefore to false assumptions for energy optimisation.

The measured or calculated consumption data do not provide any information about efficiency of systems. They can only be interpreted professionally if underlying processes are known.

Normally, the entire process cycle including individual process steps is known and documented in the corresponding instrumentation and control planning systems. Data on chronological sequence, residence time in individual steps and the concrete assignment to installations and machines are often not easily available. These information are embedded in control systems but they are not available in the registers for easy data output.

It has been shown that the process cycle can be well tracked and documented by means of simple tools. It can be worked with equivalent variables which allow conclusions to be drawn about temporal process cycles. Therefore, the monitoring of status values, energy load curves, on-off circuits and much more have to be proven to be effective. The collection of these measured variables is relatively simple and cost-effective.

The entire data collections for energy and resource consumptions as well as process cycles are based on the fact that all variables are related to a time axis.

There are different ways to determine the savings potential. The most effective is the determination of the physically necessary energy quantity for the process step. This is easily possible. This value will never be reached in practice though. Nevertheless, this value shows the theoretically possible savings potential and gives a first indication if it is worth taking a closer look under the assumption of a realistic degree of efficiency.

If the energies used for the process are secondary energies which conversion of primary energies is influenceable, an all-embracing analysis is always worth. The improvement of efficiency for the „production“ of secondary energy (here mostly steam, cold and compressed air) has a natural effect on all associated processes. Therefore, this lever definitely needs to be considered.

SECTION 6

SPEEDIKON® C DAMS

The DCIM (Data Centre Infrastructure Management) is a powerful 3D solution for planning, operation and monitoring of any data centre. The cabling and the energy supply are considered in addition to the hardware such as racks, servers, PDUs, etc. A high degree of integration and comfort is ensured since DCIM and energy management run on a joint platform.

SPEEDIKON® C DAMS

The economically meaningful and ecologically oriented operation of data centres is becoming more and more of a challenge for the persons responsible. Technological progress in hardware, the constant expansion of performance, a growing need for security and the requirements through new software and the intranet / internet require constant change. Additional topics are including the use of space, energy efficiency and environmental compatibility which are discussed as part of the Green IT.

The energy demands increase considerably with increased performance and packing density of data centres. This eliminates a significant proportion of running costs both on the power supply as well as air conditioning.
The speedikon Facility Management AG offers with speedikon® C DAMS (Data Centre Asset Management Solutions) a powerful tool to meet the challenges of the present and the future. Speedikon® C DAMS supports the most important processes of data centre planning and administration in the business. All information on the IT assets is stored in the central and easily evaluable database.

These are both commercial and cost-relevant data as well as extensive technical information. The implementation of Green Data Centre strategies is actively supported with this solution. We completely customised the WiriTec® C methods specifically to the needs of modern data centres within the speedikon® C DAMS performance monitoring module.

We are able to provide a powerful online DCIM solution in order to collect and visualise all important and measurable parameters of a data centre. DAMS can collect any existing data source of the data centre in addition to PDUs. This includes temperature or humidity sensors as well as status information like those of doors or racks. The data are defined and read out in necessary and meaningful time intervals which are important for the process and stored in the energy data server.

Daily, weekly, monthly or annual consumption values are formed per data point, rack or for the whole data centre. Minima and maxima are calculated simultaneously over any period of time. The system generates meaningful energy key performance indicators as well as resulting CO_2 emissions on the basis of aggregated values.

Load profiles for the data centre or an individual rack give reliable information about actual consumed electricity in a certain period of time. Therefore, load peaks can be quickly recognized. This information serves as the basis for the planning of energy supply and provides the indispensable decision basis for savings. The efficiency of a measure can be controlled precisely via long-term consumption measurement.

Information about temperature and humidity are an inherent part of energy management of speedikon® C DAMS. Temperature development, -maxima and minima are evaluated over any period of time and related to consumptions. This facilitates meaningful analyses.

Energy consumptions as well as other measured values can provide reliable data centre key performance indicators like PUE, DCE, CUE or EUE. They can be documented accordingly. Characteristic values are created regularly on the basis of respectively collected values. Therefore, a consideration and evaluation of the development of the data centre over a long-term time horizon is facilitated. The user can quickly conclude achieved effects of measures that have been taken.

In addition to measurement and sensor values, all other available information can be queried and imported directly from field devices via SNMP. The respective statuses of rack or cage- closures are particularly important. Every opening or closing of the door is registered and documented with additional information in the system via SNMP Trap. Therefore, it is possible to evaluate at any time which rack was opened and when it was opened. Furthermore, it can be evaluated when and which employees had access to which cage. This detection principle via SNMP can also be turned around if necessary: the authorised user can unlock individual racks with just one click on the web interface.

All available data in the system can be graphically represented within the 2D as well as 3D view of the data centre. The values of PDUs, racks or sensors can be monitored automatically with the help of WiriTec monitoring methods. Deviations from specified profiles trigger a corresponding notification and can be visualised in the graphical view.

Project procedure
We developed a procedure model which ensures the project success based on the large number of projects we implemented.

4-step concept
We developed a 4-step concept for energy efficiency based on our comprehensive project experience.

SECTION 7

PROJECT IMPLEMENTATION

The next logical step in the holistic view of energy and resource consumptions is the aspect of consumption causing technical supply systems and production machines. In this chapter we would like to introduce our tools to support technical processes associated with installations.

PROJECT PROCEDURE

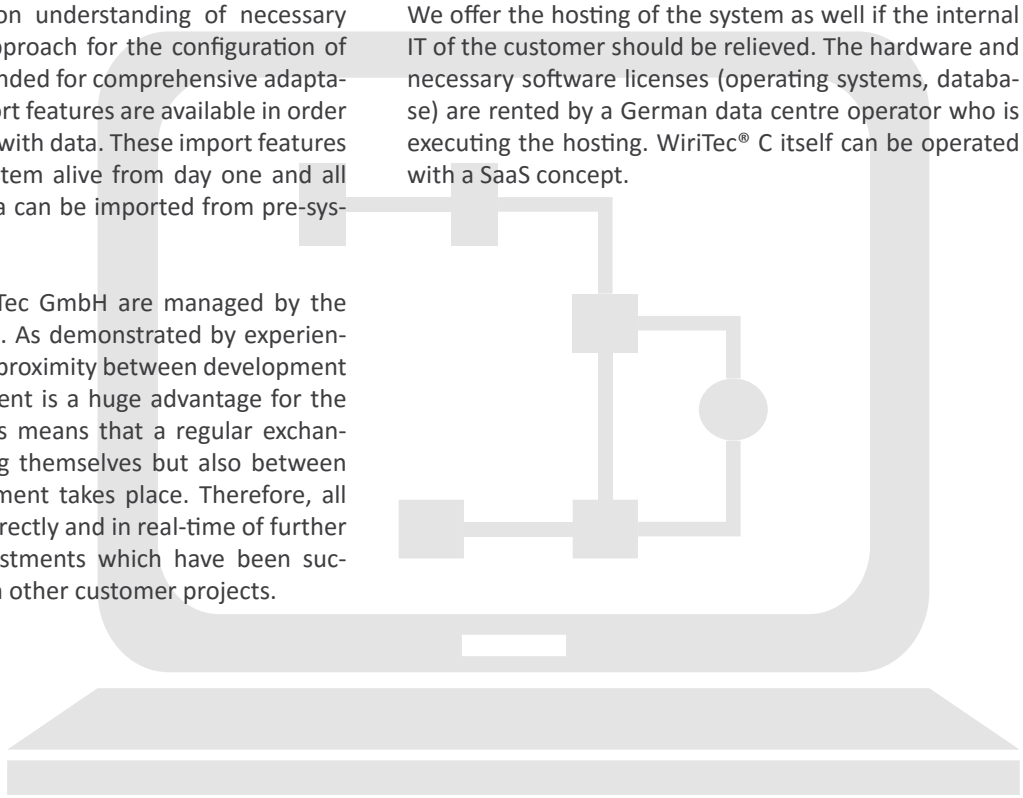
Our diverse implementation projects always make new demands since organisational structures are different for each customer. We can take up different positions within a project based on our experiences from many successfully implemented projects: consultants, project managers, project staff and developers. The tasks range from consulting with emphasis on processes as well as the collection of data, the implementation of workshops and the creation of requirement specifications, the IT- and process technological implementation of software solutions with interfaces to external systems, project support as well as trainings and support.

Prototypes are used in the initial phase of a project in order to gain a common understanding of necessary adaptations. An agile approach for the configuration of applications is recommended for comprehensive adaptations. Standardised import features are available in order to fill the system quickly with data. These import features ensure to keep your system alive from day one and all necessary inventory data can be imported from pre-systems.

All projects of the WiriTec GmbH are managed by the head office In Bensheim. As demonstrated by experiences in the past, the local proximity between development and consulting department is a huge advantage for the project progression. This means that a regular exchange of consultants among themselves but also between consulting and development takes place. Therefore, all customers will benefit directly and in real-time of further developments and adjustments which have been successfully implemented in other customer projects.

The goal of each training is to provide future users of the system with the required knowledge and for the operation necessary skills in high quality while optimising time and costs. The training courses can be carried out as teacher-centred trainings; better results are obtained with a „hands-on“ training though. This always applies to administrator trainings; but this procedure is recommended for user trainings as well. Furthermore practice has shown that a first training at an early stage of the project progression is beneficial since the customer can already participate during the introductory phase. Another training with customised contents or questions can be carried out at a later date if necessary.

We offer the hosting of the system as well if the internal IT of the customer should be relieved. The hardware and necessary software licenses (operating systems, database) are rented by a German data centre operator who is executing the hosting. WiriTec® C itself can be operated with a SaaS concept.



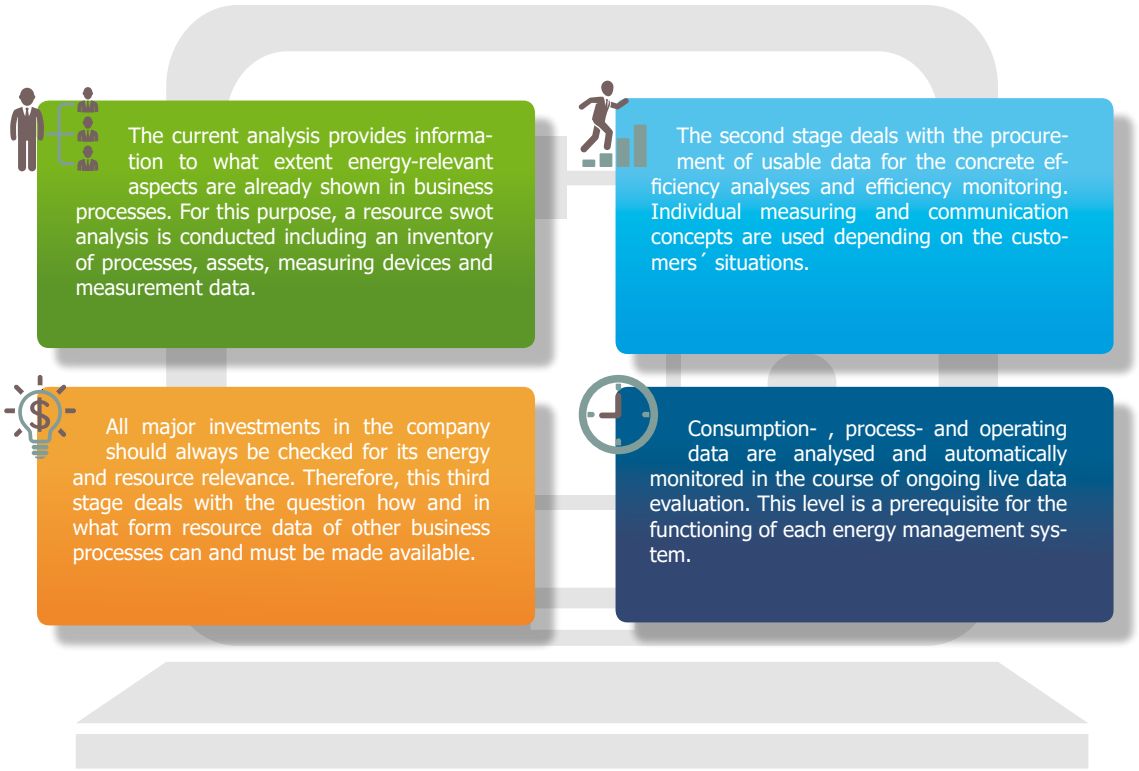
4-STEP CONCEPT

Each company whose cost can be traced back to a substantial proportion to energy and resource consumption needs to deal with an increase of efficiency and therefore with a reduction of costs or at least with a reduction in cost increases.

For this reason we developed the 4-step concept for energy efficiency based on our experiences from numerous energy management projects.

Many companies are not prepared for this with regard to human resources and know-how as previous experiences have shown. Therefore, we undertake all activities which cannot be performed within the company. We are using our own experts or specialist partners in order to relieve your employees.

Depending on the company situation, the individual steps of our concept can be defined more or less whereby individual stages can overlap each other temporally.



OPC UA is a registered trademark of the OPC Foundation, 16101 N. 82nd Street, Scottsdale, AZ 85260-1868 USA.

ABB is a registered trademark of ABB Asea Brown Boveri Ltd, Affolternstrasse 44, 8050 Zurich, Switzerland.

Bluetooth is a registered trademark of Bluetooth SIG Inc., Kirkland, WA 98033, USA.

Elster is a registered trademark of Elster GmbH, Steinernstrasse 19-21, 55252 Mainz-Kastel.

Finder is a registered trademark of FINDER GmbH, Hans-Böckler-Strasse 44, 65468 Trebur-Astheim.

Görlitz is a registered trademark of GÖRLITZ Aktiengesellschaft, August-Thyssen-Strasse 32, 56070 Koblenz.

Hydrometer is a registered trademark of Diehl Stiftung & Co. KG, Stephanstraße 49, 90478 Nuremberg, Germany.

JCI is a registered trademark of JCI Beteiligungs GmbH, Industriestraße 20-30, 51399 Burscheid.

Kieback & Peter is a registered trademark of JKieback & Peter GmbH & Co. KG, Tempelhofer Weg 50, 12347 Berlin.

Landis & Gyr is a registered trademark of Landis + Gyr GmbH, Humboldtstrasse 64, D-90459 Nuremberg.

Linux is a registered trademark of Linus Torvalds.

Microsoft, SQL Server, Excel, and PowerPoint are registered trademarks of Microsoft Corporation, One Microsoft Way, Redmond, WA 98052, USA.

Neuberger is a registered trademark of Neuberger Gebäudeautomation GmbH, Oberer Kaiserweg 6, D-91541 Rothenburg.

NZR is a registered trademark of NORDWESTDEUTSCHE ZÄHLERREVISION, Aug. Knemeyer GmbH & Co. KG, Heideweg 33, 49196 Bad Laer.

Oracle is a registered trademark of Oracle Corporation, 500 Oracle Parkway, Redwood Shores, CA 94065, USA.

OSIsoft PI is a registered trademark of OSIsoft Europe GmbH, Voltastrasse 31, Frankfurt am Main.

Saia is a registered trademark of SBC Deutschland GmbH, Siemensstr. 3, 63263 Neu-Isenburg.

Sauter cumulus is a registered trademark of Sauter-Cumulus GmbH, Hans-Bunte-Str. 15, 79108 Freiburg, Germany.

Siemens is a registered trademark of Siemens Aktiengesellschaft, Wittelsbacherplatz 2, 80333 Munich, Germany.

TÜV and TÜV Süd are registered trademarks of TÜV SÜD AG, Westendstraße 199, 80686 Munich.

Wago is a registered trademark of WAGO Kontakttechnik GmbH & Co. KG, Hansastr. 27, 32423 Minden.

Zenon is a registered trademark of Ing. Punzenberger COPA-DATA GmbH, Karolingerstrasse 7 B, 5020 Salzburg, AUSTRIA.

WiriTec GmbH | Berliner Ring 103 | 64625 Bensheim
Tel.: +49 62 51 / 5835 - 0 | Fax: +49 62 51 / 5835 - 299

Internet: www.wiritec.com
E-Mail: information@wiritec.com

www.wiritec.com