SIEMENS

Totally Integrated Power

Technical Series, Edition 11

The Energy Management Standard DIN EN ISO 50001

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Reason for DIN EN ISO 50001, objective and procedure

Reason of the standard

Organisations[1] of various types and sizes increasingly want to reduce their energy consumption. This call is driven by the need or wish to

- Reduce costs
- Contain the effects of rising energy costs
- Hit self-imposed or governmentally imposed emission targets
- Reduce the dependency on fossil sources of energy and
- Improve the standing of the company on matters of responsibility within society.

Moreover, governments increasingly aim to reduce the greenhouse emissions of companies and citizens alike and have opted for a growing number of statutory regulations to cut emissions.

The driving countries were China, Denmark, Ireland, Japan, South Korea, The Netherlands, Sweden, Thailand and the USA. They drafted various energy management standards, specifications, and regulations.

Subsequently, the European Committee for Standardisation (CEN) developed *EN 16001:2009 Energy management systems – Requirements with guidance for use* as the first international energy management standard. It was published in July 2009 and replaced by ISO 50001 in April 2012.

In 2008, the American body for standardising industrial procedures started developing ISO 50001 in cooperation with its Brazilian partner ABNT.
Experts from over 40 countries rendered assistance. Thanks to the close cooperation with the European ISO member states, many issues and contents from the previous EN 16001 standard have been adopted and integrated into the revised ISO 50001.

ISO 50001:2011
Energy management systems – Requirements with guidance for use has been effective since 17th June 2011.

Objective of the standard

The fundamental objective of this standard is to continually improve energy performance and energy efficiency and to save on energy. This is achieved by a systematic approach to help companies in setting up systems and processes.

Consistent energy management helps companies open up unused energy efficiency potential and implement purposeful measures. They benefit from cost savings and make a significant contribution to environmental and climate protection, for example by reducing CO_2 emissions permanently.

Furthermore, the current energy concept of the German government envisages an energy management system being the requirement to obtain tax concessions.

The standard is to make employees and especially management an organisation more receptive for consistent, long-term energy management. This approach allows saving potentials to be fully exploited and both competitive benefits and a tremendous image gain for the company to be obtained.

[1] ISO 50001 uses the term "organisations" in this context instead of "companies".

Procedure

Energy management systems (EnMS) in accordance with DIN EN ISO 50001 are part of the quality management of an organisation and can be implemented by enterprises of any type and size. Referred to are all types of energy ranging from electricity to heat, cold, and primary sources of energy such as gas, coal, and oil.

Some enterprises, however, still lack transparency and the specific knowledge of how energy flows and how it can be broken down. Often, comparative values to derive quantifiable statements on whose basis decisions can then be made are also lacking. All companies introducing an EnMS stand for sustainable use of energy and cut their costs at the same time. Since 2013, energy management systems have been a mandatory requirement for energy-intensive companies wishing to profit from tax reductions.

The implementation of requirements set by DIN EN ISO 50001 is certified by special institutes and confirmed in recurring audits.

DIN EN ISO 50001 describes a continual improvement process for a more efficient use, monitoring and analysis of energy.

The principal structure follows the PDCA cycle as applied in the ISO 9000 standard: Plan – Do – Check – Act.

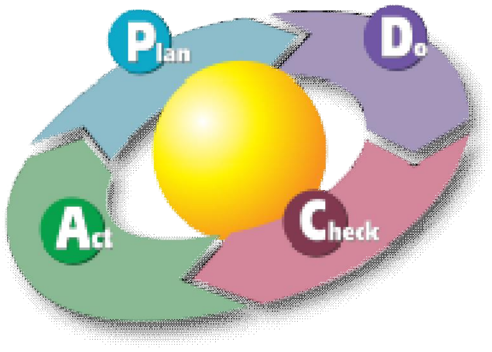
The circle starts with energy policy and planning, is continued with introduction and implementation which, in turn, is followed by nonconformities, corrections, corrective and preventive action, and afterwards optimisation is started anew after the internal auditing and management review phases.

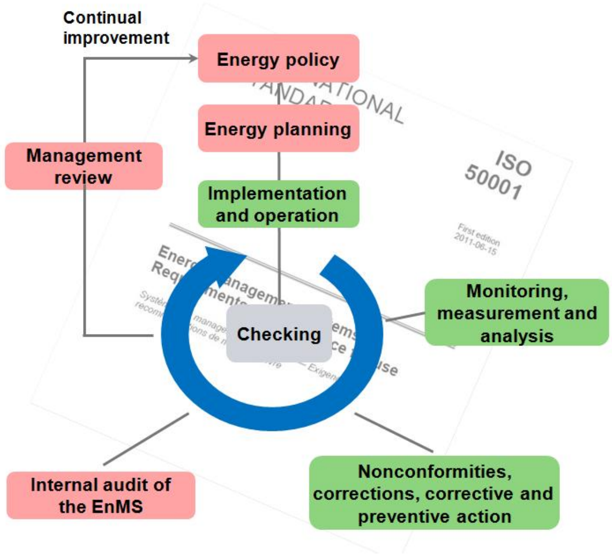
The EnMS process must be performed and monitored by those with all due competence. If the person is recruited from the internal operating staff he/she must hold a position allowing for a neutral and objective viewpoint.

The company executive is responsible for the objectives of energy policy. The contents of the following step - namely energy planning – must also be defined by the top management.

Internal auditing is to be performed by a person with authorization from the company executive.
Within the management review, the top management needs to revise the EnMS at certain intervals to ensure its continual suitability, appropriateness, and effectiveness.

Those EnMS steps of interest for planners are the phases of introduction and implementation, monitoring, measurement and analysis, as well as nonconformities, corrections, corrective and preventive action.





Phases relevant to the planner

Introduction and implementation

There is no doubt that all of the four main processes of a PDCA cycle are important for a continuous and successful optimisation process. However, at first glance it is introduction and implementation ("Do") which seems to be the most important process.

The focal points listed in the planning phase are described further in the introduction and implementation phase. The measuring instruments to be employed, their precision and mounting position as well as their evaluation systems must be clearly specified.

Capabilities, training, awareness

Besides the idea of automation, man as that part of the company who can actively influence the use of energy is also considered. In this context, ISO 50001 expects a sufficient degree of skill from those working in the company or for it. It can be acquired by way of suitable training, instruction, knowledge or experience. All those working on behalf of the company must not only understand how important it is to act in accordance with the EnMS, but must also be aware of the influence they have in actively detecting e savings and implementing them through their actions.

In this light, the target groups for training courses and their contents are appropriately defined.

Communication

Communication must also be considered in the introduction and implementation of an EnMS. It is mandatory to describe corporate communication, whereas the description of external communication is optional. Furthermore, its content and updating must be documented.

The introduction and implementation of a process for submitting proposals for EnMS improvements is compulsory and thus must be introduced.

All employees must be informed and included into the strategic direction of the company with regard to energy issues.

Documentation

A standard-true documentation comprises the following main areas:

- Scope and limits of the EnMS
- Energy policy
- Strategic and operative energy goals as well as action plans for reaching them
- Documents and records

Operational sequence control

Operational plans are derived from the strategic and operative energy goals and the defined action plans. They describe which plants/locations, processes, systems and facilities influence energy demand and how an optimized operation can be facilitated. This also includes maintenance measures for more efficient plant operation.

Design

Plants have a service life and, as such, are extended, restructured, and dismantled. Within this planning, energetic optimisation and appropriate operational control must also be prepared.

Procurement of energy services, products, facilities, and energy

The standard not only describes the corporate improvement process, but also expects the purchased resources to be considered. This means informing all suppliers about these activities. They can also be forced to submit relevant documents / characteristic values for the energy quantities delivered.

For example, if CO_2 emissions are to be reduced in line with the objectives of the energy policy, the electricity suppliers must disclose the CO_2 share per kilowatt-hour delivered. Only then can the Purchasing Dept. choose the optimal supplier.

Monitoring, measurement, and analysis

An essential requirement of review is ensuring that specifications are monitored, measured, and analysed at scheduled intervals.

This step specifically refers to the individual application in detail as to which energy type is recorded and documented using which measurements. The actual value and condition to be expected is described to include Energy Performance Indicators (EnPIs).

In the course of analysing these specifications, the procedure as well as compliance with the expected condition must be reviewed and documented in writing.

When the plan for energy measurements is prepared, ISO 50001 attaches considerable importance to integrating existing measurements. Measurements do not only include the pure measuring technique but also its measured value conditioning, measured value communication, data consolidation and data documentation (graphics, tables).

The continual improvement process may give rise to an adjustment of the measuring and metering equipment. This is the case, in particular, when in the course of energetic evaluation no dependable statements can be made about significant energy quantities in terms of their temporal or functional distribution.

It is important that the data is reproducible and error-free. The measurement calibration documents, freedom from errors and reproducibility of the overall system must be verified. Data must be checked for plausibility. If the data is not plausible, then action must be taken.

Results of monitoring, measurement, and analysis must be documented.

Nonconformities, corrections, corrective and preventive action

If a requirement from the introduction and implementation is not fulfilled, this is referred to as a nonconformity.

In case of a nonconformity, its reasons must be established and evaluated and corrections and associated measures initiated to prevent a recurrence of this nonconformity. The standard understands correction to be a measure for eliminating a detected nonconformity, and a corrective action to be a measure for eliminating the cause of a detected nonconformity.

Preventive actions are understood in the standard to be all measures for eliminating the cause of a potential nonconformity.

At all events, corrective and preventive actions must be documented.

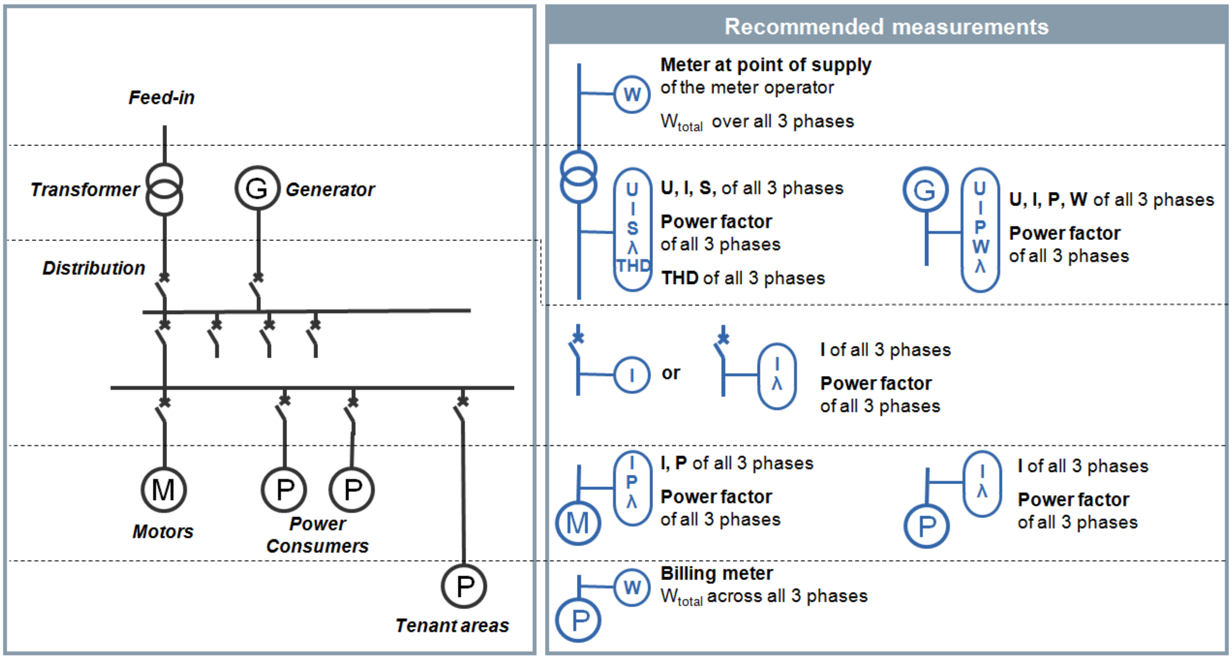
The effectiveness of the measures initiated must be verified. In the worst case, this may have effects involving even the change of the energy management system.

Consultancy in the relevant phases

Consultancy at the introduction and implementation stage

Even at the EnMS introduction and implementation stage, consultants can make a valuable contribution.

They can help the customer define measuring points, determine measuring intervals, and describe the internal communication in order to demonstrate which information is useful to which group or individual within the company.



Consultancy also includes the selection of the measuring devices and their placement within the power distribution system. At all events, feed-in systems and large power consumers are to be measured.
All feed-in systems for areas to be sublet require communication-capable energy meters. If measured values are to be the basis for invoicing, then meters with an MID (Measuring Instruments Directive) conformity mark must be used.

Feed-in system, transformers, and generators are dimensioned on the basis of their apparent power S in kVA. Currents I in A are crucial for the busbars, cabling, protection and switching devices integrated in the electrical power distribution system. Loads are always factored with their active power P in kW and associated power factor λ into the distribution dimensioning. If these electrical quantities, which served as the planning basis, are to be substantiated during operation, appropriate measuring devices need to be provided. When allocating the energy consumed to different cost centres, the quantity of work or energy W (in kWh) within the feed-in system – and for every power consumer to be allocated – must also be measured.

A generator is treated like a transformer, but in addition, the produced energy W must be measured in kWh. Leased or tenant areas are billed on the basis of electricity consumption W in kWh. An electricity meter records the consumption. However, it must be clarified here at the planning stage as to whether this meter needs to be a calibrated meter for billing purposes.

To ensure transparency of plant operation, it is useful to measure voltage U [V], current I [A], the power factor and the proportion of total harmonic distortion (THD) (total harmonic content both for voltage and current) at the transformer in addition to the above mentioned apparent power. In the distribution network, it suffices to measure the voltage once directly downstream of the transformer. For the distribution networks downstream of the transformer, just being aware of the voltage drop is quite sufficient. Based on the maximum current to be expected, voltage drop dimensioning is to verify the fact that every final consumer keeps within the permitted voltage limits (max. +10 % / -14 %). Here IEC 60038 (VDE 0175-1) specifies a permissible deviation of ±10 % for AC networks with a nominal voltage ranging between 100 V and 1,000 V. It points to the additionally permissible voltage drop of 5 % in a low-voltage system directly fed from a public power supply grid, and of 8 % in a low-voltage system supplied from a private power supply network as described in IEC 60364-5-52
(DIN VDE 0100-520, Annex G, for information).

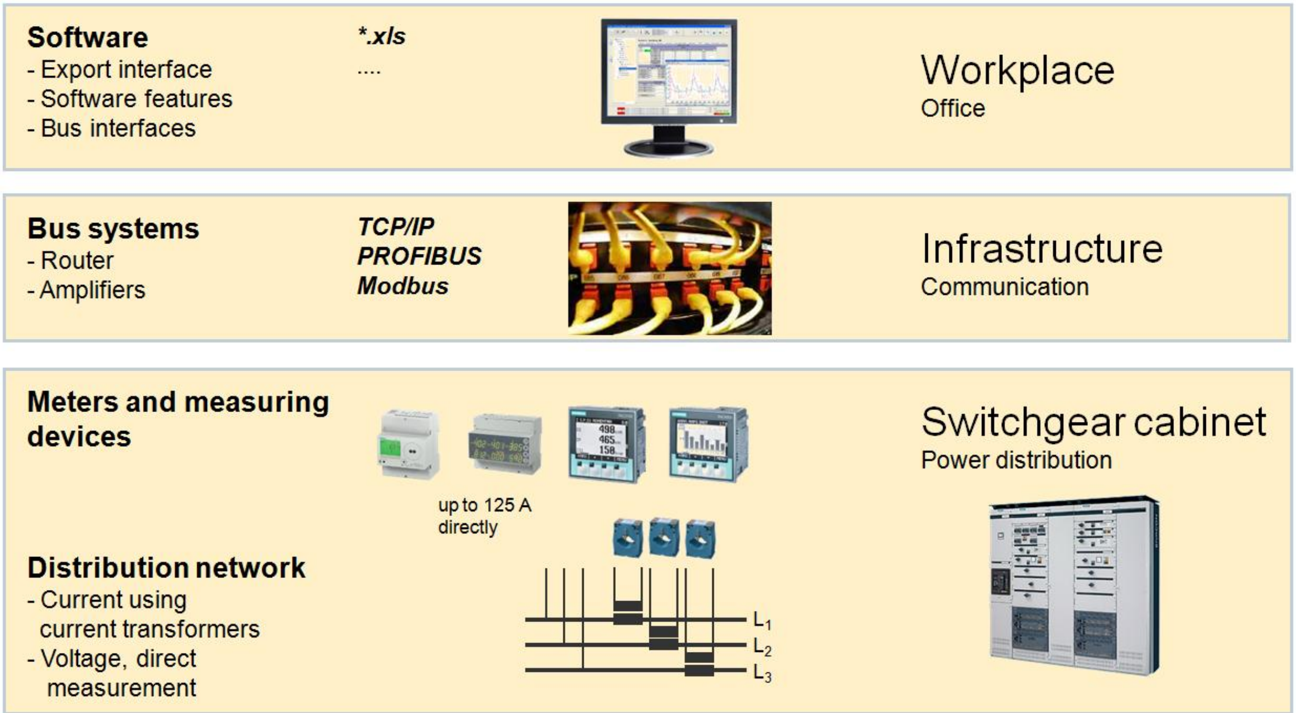
Equipment for energy transparency and energy management

Siemens offers multi-function measuring devices (7KM PAC), meters (7KT), and devices for measuring the power quality (SICAM P or Q). At the low-voltage level, voltages can be directly acquired by the measuring instruments and currents through current transformers, which supply the current as 1-A o 5-A standard current to the measuring instrument.
An exception are meters which measure directly up to 63 A.

Besides pure measuring instruments, motor protection and control devices (SIMOCODE), and protection devices (3WL, 3VL, NJ) now also have measuring features.

Besides electrical measurements, the SITRANS product range provides measuring options for non-electrical media.

A bus system infrastructure such as TCP/IP, PROFIBUS or Modbus is required for the transmission of measured values for further evaluation, analysis, and archiving. The existing bus environment is usually resorted to for this purpose.



Software for energy transparency and energy management

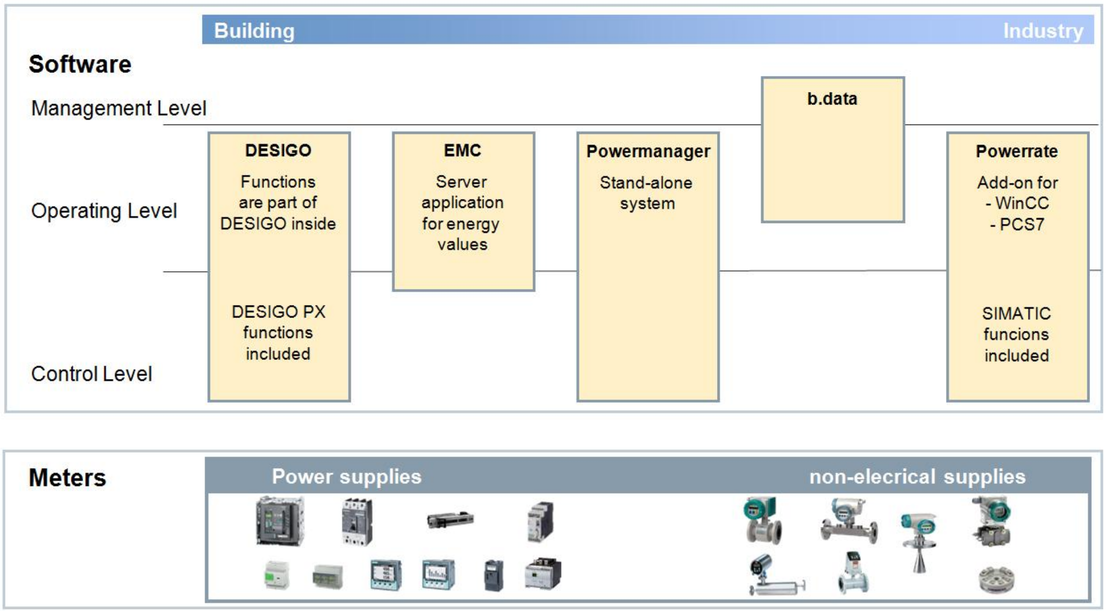
Siemens has developed various software packages for different applications.

For buildings, our Building Technologies Division has developed **DESIGO** for the entire range of building installations and **EMC** (Energy Monitoring and Controlling) as a server application for energy values.
DESIGO provides direct access to the measuring devices and EMC has a database interface.

B.data and **powerrate** come from industry with B.data covering parts of the management level and operational level. Powerrate as a WinCC or PCS7 application can directly access measured values through SIMATIC. Only here is a load management system available.

The **powermanager** as a stand-alone system has a direct access to measurements and makes energy flows transparent.

All systems do not only feature the acquisition and representation of electrical values but enable the mapping of all types of energy.



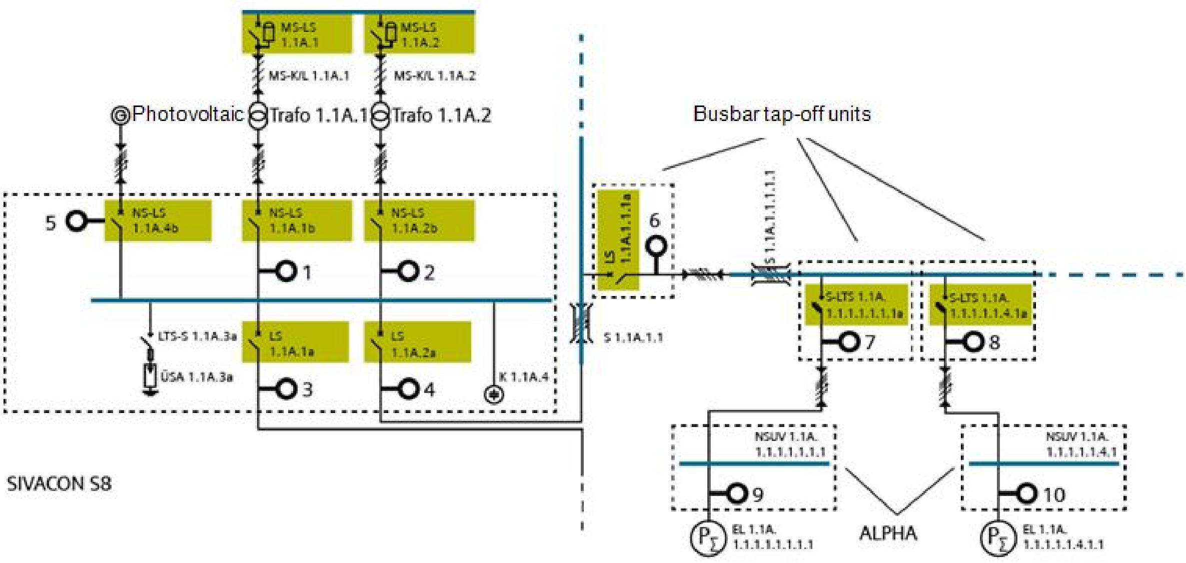
Power management concept

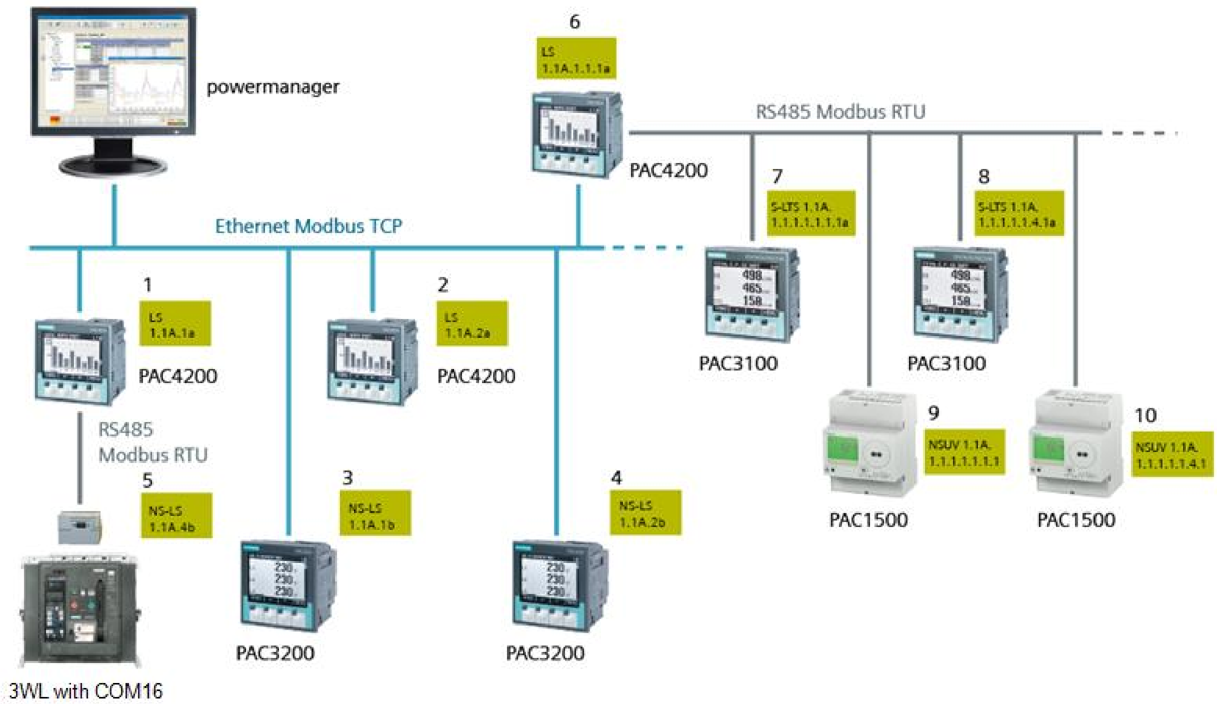
To create energy transparency with the aid of representations, characteristic values and evaluations, a power management system concept is drawn up which by way of example is limited to the distribution levels and a storey distribution spur. In so doing, the SIMARIS design configuration is resorted to. Core elements are presented in extracts. Other storeys can be joined up in a similar way as can other storey distribution boards.

As the power quality is to be recorded, multi-function measuring instruments of the 7KM PAC4200 type are chosen for the inputs of the SIVACON S8 switchboard. In addition, an Ethernet connection is needed for communication link-up to the data lines in the building. This entails using the 7KM PAC4200 gateway function. The transferred data is evaluated on a Windows PC with the aid of the powermanager software.

The Modbus RTU effects communication to the gateway between the cubicles. By way of the 3WL air-circuit-breaker, the photovoltaic system is metrologically integrated with a COM16 module suitable for Modbus. Two 7KM PAC3200 monitor the supply data at the two outputs of the SIVACON S8 switchboard.

As the data is transmitted by Ethernet to the powermanager software from each storey, a 7KM PAC4200 is also needed as a gateway in each instance. It not only monitors the data of the storey distribution boards but also passes on the information transmitted via Modbus from the busbar tap boxes (measuring instruments: 7KM PAC3100) and distribution boards (7KT PAC1500
3-phase meter).


MS-LS 1.1A.1
MS-LS 1.1A.2
MS-K/L 1.1A.1
MS-K/L 1.1A.2
Photovoltaic
Trafo 1.1A.1
Trafo 1.1A.2
Busbar tap-off units
NS-LS 1.1A.4b
NS-LS 1.1A.1b
NS-LS 1.1A.2b
LS 1.1A.1.1.1a
S 1.1A.1.1.1.1
S-LTS 1.1A.1.1.1.1.1.1.1a
S-LTS 1.1A.1.1.1.1.4.1a
LTS-S 1.1A.3a
ÜSA 1.1A.3a
LS 1.1A.1a
LS 1.1A.2a
K 1.1A.4
S 1.1A.1.1
NSUV 1.1A.1.1.1.1.1.1.1
NSUV 1.1A.1.1.1.1.4.1
SIVACON S8
ALPHA
EL 1.1A.1.1.1.1.1.1.1.1
EL 1.1A.1.1.1.1.4.1.1


powermanager
LS 1.1A.1.1.1a
PAC4200
RS485 Modbus RTU
Ethernet Modbus TCP
S-LTS 1.1A.1.1.1.1.1.1.1a
S-LTS 1.1A.1.1.1.1.4.1a
PAC3100
PAC3100
LS 1.1A.1a
PAC4200
LS 1.1A.2a
PAC4200
NSUV 1.1A.1.1.1.1.1.1.1
NSUV 1.1A.1.1.1.1.4.1
PAC1500
PAC1500
RS485
Modbus RTU
NS-LS 1.1A.4b
NS-LS 1.1A.1b
NS-LS 1.1A.2b
PAC3200
PAC3200
3WL with COM16

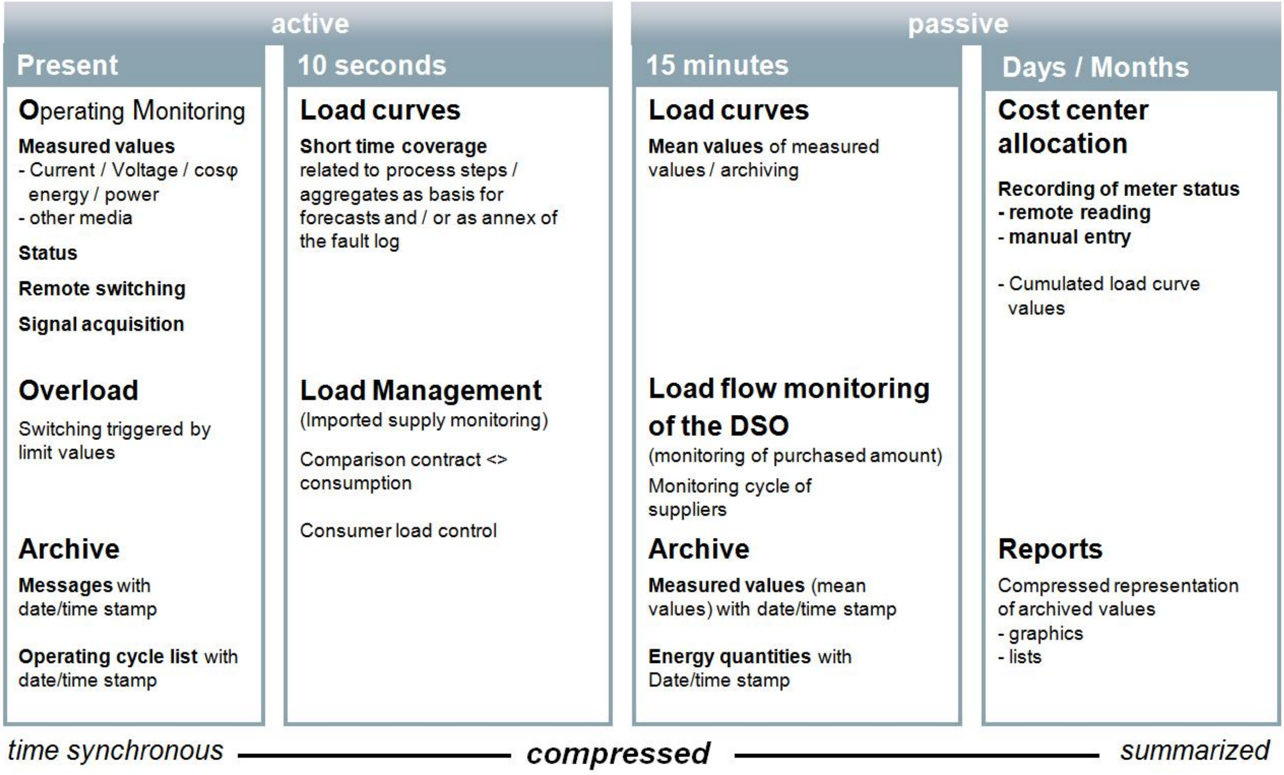
Consultancy for monitoring, measurement, and analysis

Monitoring, measurement, and analysis are the operational tasks.

In this phase, Siemens can bring in its know-how and create the basis for analyses through the transparency brought about by the conditioning and specific presentation of measured values.

To this end, it must be established what is to be checked in which way and which time intervals are to be considered appropriate for checks. Load curves, for example, can be shown on a day or shift-related basis.

For the purpose of monitoring, it should be clear as to how the measured values are to be processed.



There are different measuring intervals and different methods of representation. On the right, you will find longer intervals, such as days or months as commonly used in reports. If data is acquired in 15-minute intervals, then the investment for measuring instruments and monitoring is more expensive. These methods are only passive and merely suitable for data evaluations.

If the goal is, however, to run an active load management, the cycles will become even shorter: For actual values this time is cut to at least 10 seconds. For applications on the left, the measuring equipment, bus infrastructure, and software are of a higher quality – something which incurs higher costs.

The effects of measuring instruments are only being applied for a passive evaluation rules out any further active management. Whereas if measuring instruments for active management have been installed, it will always be possible to read out data for passive analyses. It is important that you are aware of this when a decision on the installation of measuring equipment is to be made.

Hence, all measurements relevant for ISO 50001 must be considered and planned as early as in the planning stage for the installation of electric power distribution systems. The costs are much lower if measurements are already implemented during plant erection as a result of well targeted planning than if equipment is to be retrofitted during plant operation.

Consultancy for nonconformities, corrections, corrective and preventive action

As the expected result is compared to what is actually found in the phase of nonconformities, corrections, corrective and preventive action, deviations must be analysed and documented and consequences drawn from the findings. For example, the mode of operation must be evaluated from an efficiency point of view and optimised. This can be done by comparing load curves during different phases of operation.

Documentation of these analyses is divided into three sections – consumption pattern, rhythm of use, and controlling aids.

Consumption pattern

Energy consumption is mapped by different types of load curves from which the consumption pattern is then derived.

Load curves are graphs of measured values in their chronological order. Time is entered on the X axis and measured values are entered on the Y axis.

A one-year load curve starts with the measured value of the first day of the year at 00:15 a.m. and ends with the value of the last day of the year under consideration on 24:00 p.m. The mean values are entered at 15-minute intervals, beginning with the full hour. For performance curves, the average power output of a 15-minute interval is entered over the corresponding period. Typical analyses permitting a load curve to be shown are:

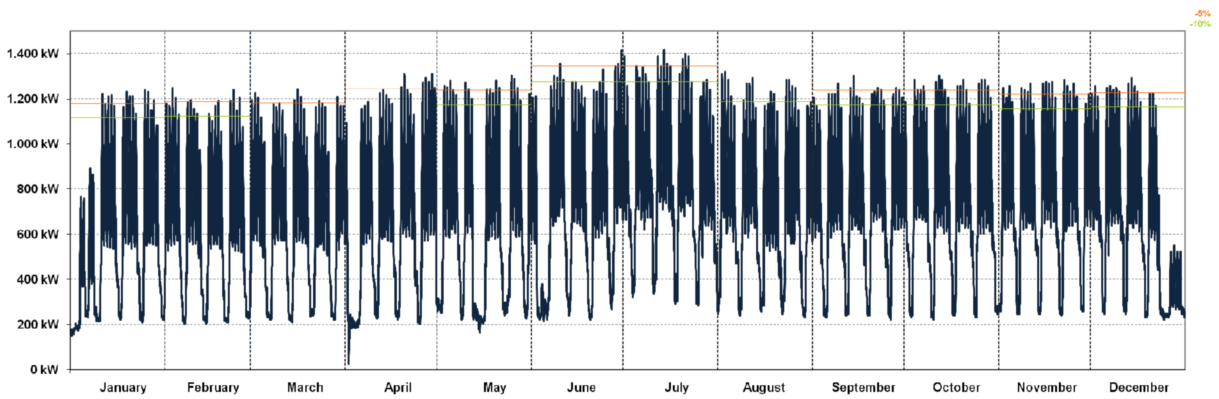
When was it necessary to purchase considerable quantities of power?

- Is there a typical consumption pattern (e.g. a typical time/power pattern)?
- Are there correlations over time with pronounced changes in the measured power values?
- How high is the base load?

Depending on the resolution of the time axis, even more specific interpretations, such as consumption behaviour in special situations or trends, become feasible.

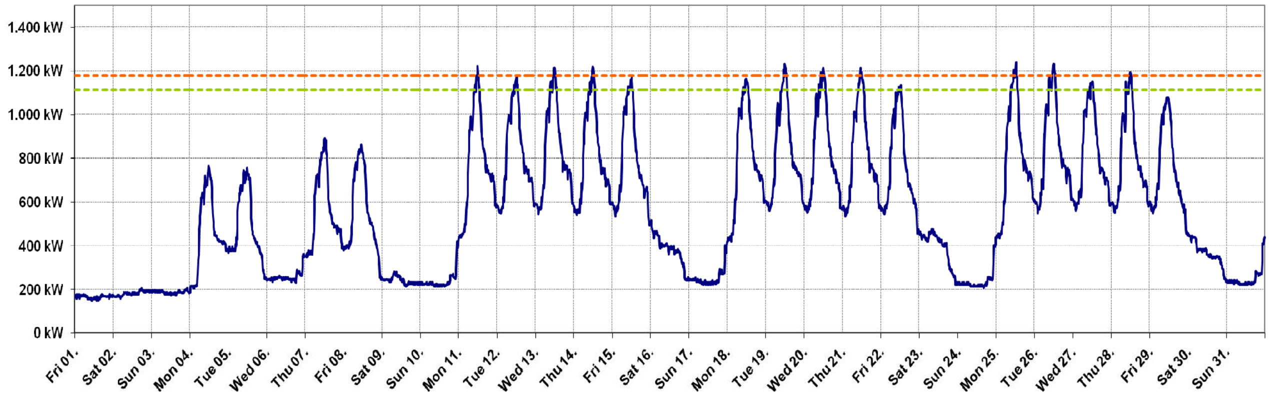
The evaluation of yearly load curves is suitable for providing an overview on:

- Load pattern
- Continuity over months
- Electricity peaks at certain times over the year
- Seasonal variations
- Company annual closures and other special operating situations
- Minimum performance requirements as load base



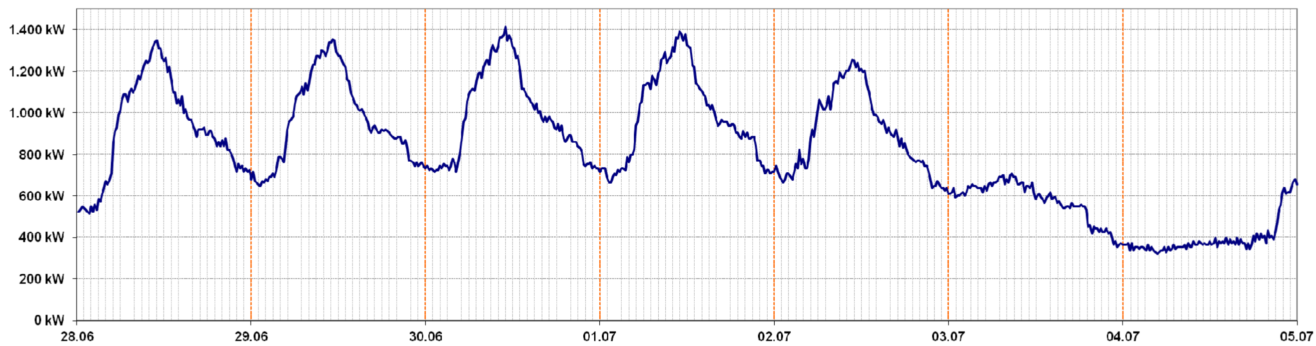
A monthly load curve graph can be utilized to demonstrate a possibly typical behaviour:

- Similarities of power purchase
- Continuity at the weekends
- Purchased power over night (i.e. power consumption)
- Base load
- Bank holidays /bridging days/ weekends and other 'operations closed' days



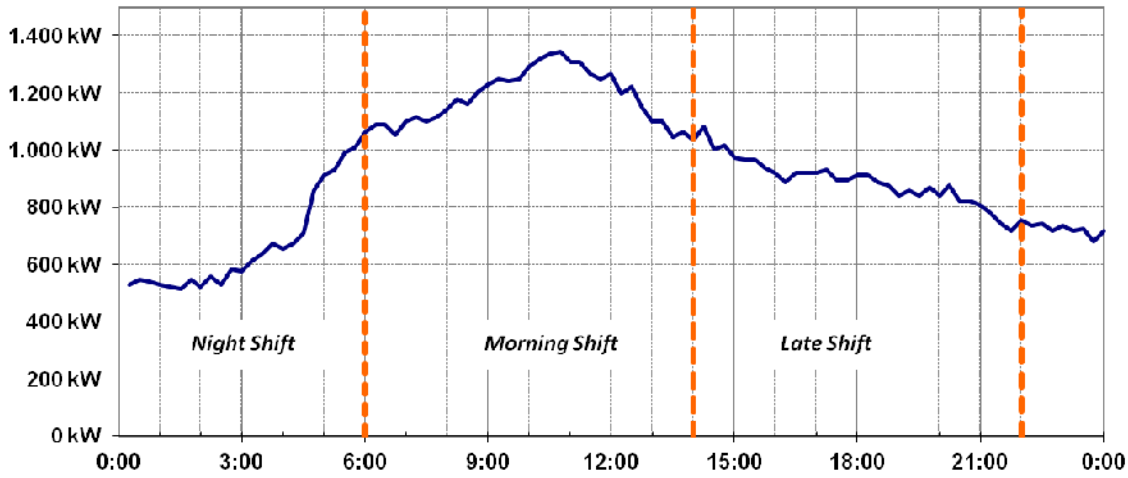
The weekly load curve brings out clear day-specific differences:

- Daily demand
- Daily variations
- Typical work-shift patterns
- Demand peaks



Individual 15-minute intervals are entered in the daily load curve for recognition, for instance, of the following points:

- Precise representation of the daily demand and moments of change
- Breaks
- Work-shift changes



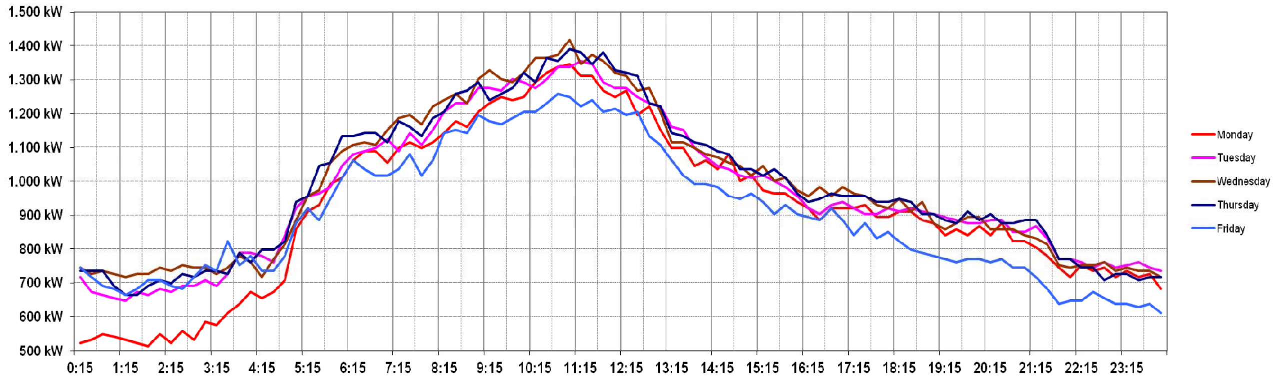
Rhythm of use

In order to evaluate the continuity of energy purchase, the load curves of different days are plotted over 24 hours.

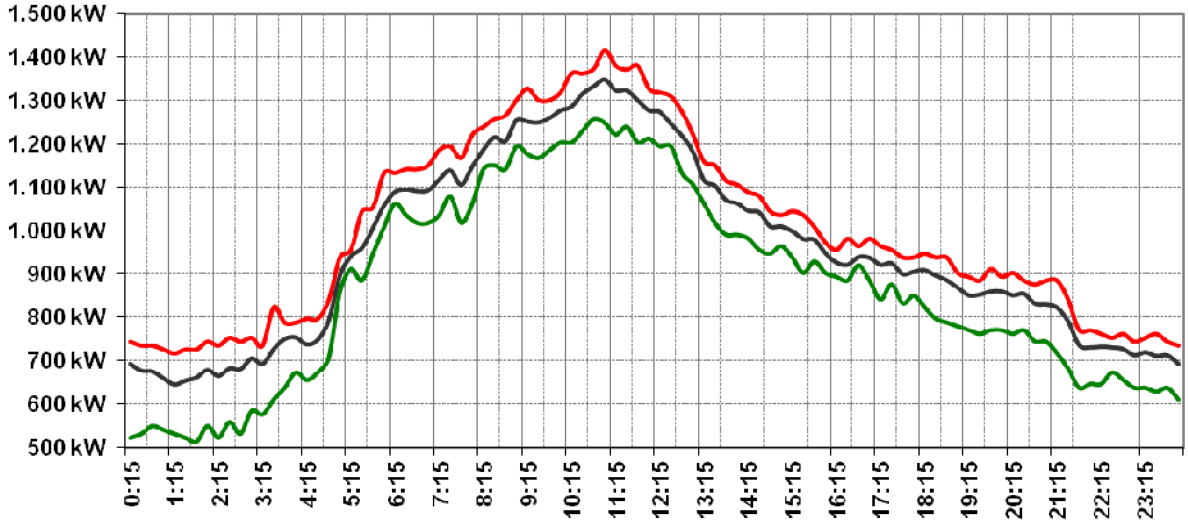
The merging of data into overlaying load curves now allows more statements about the rhythm of use to be made.

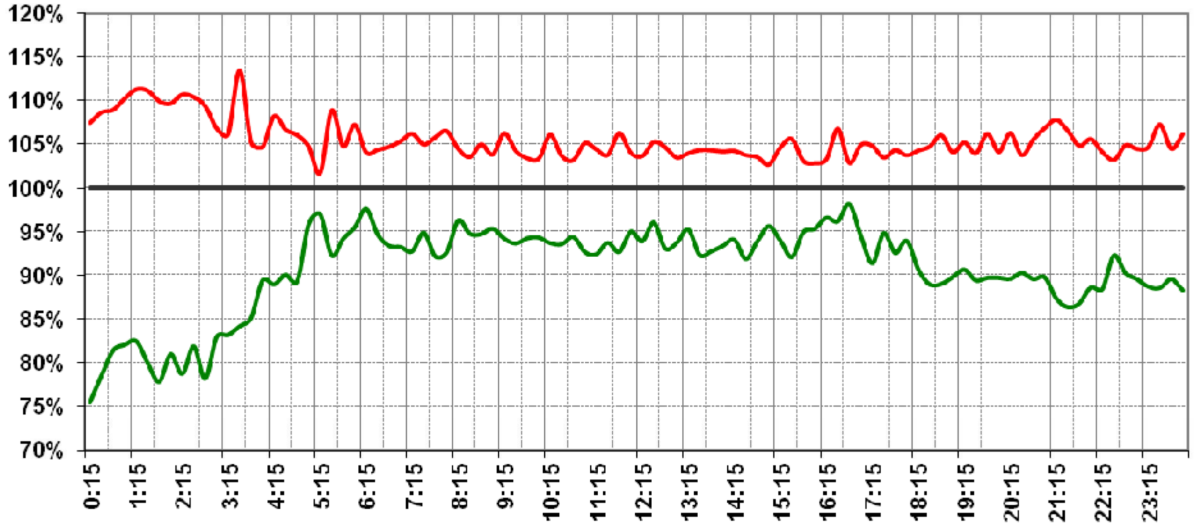
In the process of overlaying load curves, identical periods (e.g. days, as is here the case) are shown in a graph. They provide proof as to whether the consumption pattern during the periods under review is really similar. Defined periods can relate to months, weeks, days, as well as to bank holidays, bridging days or company annual closures.

Due to the continuous course of the curve of the Monday to Friday working days, this chart clearly shows that consumption is similar over 24 hours at the week days. Peaks and troughs occur at identical times.



The curve for the absolute deviation is derived from the envelope curve of the overlaid daily load curves. To this end, three curves are created: the red maxima curve, the black average curve, and the green minima curve. This figure shows minimal deviations only – no definite statements can as yet be made. For this purpose, a representation of the relative deviation is required.





The mean value is set to 0 %. Then, the minimum and maximum values are shown as a percentage deviation of the mean values. Deviations between +10 and -25 % can be noticed. The greatest deviations occur between 6 p.m. and 6 a.m.. When this is traced, it becomes clear that the deviations originate from the Monday between 0 a.m. and 6 a.m. and from the Friday between 6 p.m. and 12 p.m.

It would be as well to investigate further into these deviations and find out where they come from.

In this context the possibility of adjusting the mode of operation by way of employees learning from the best control centre operator through Best Practice Sharing should be looked into.

Controlling aids

Controlling aids are, inter alia, characteristic values which provide an overview and comparisons for cyclical reports in order to meet the requirements of ISO 50001, for example, for KPIs and EnPIs.

Characteristic values represent the key points of the review.

The 15-minute measured values are the basis of these characteristic values. Tables and charts list month- or year-related maximum, average (arithmetic mean) and minimum values.

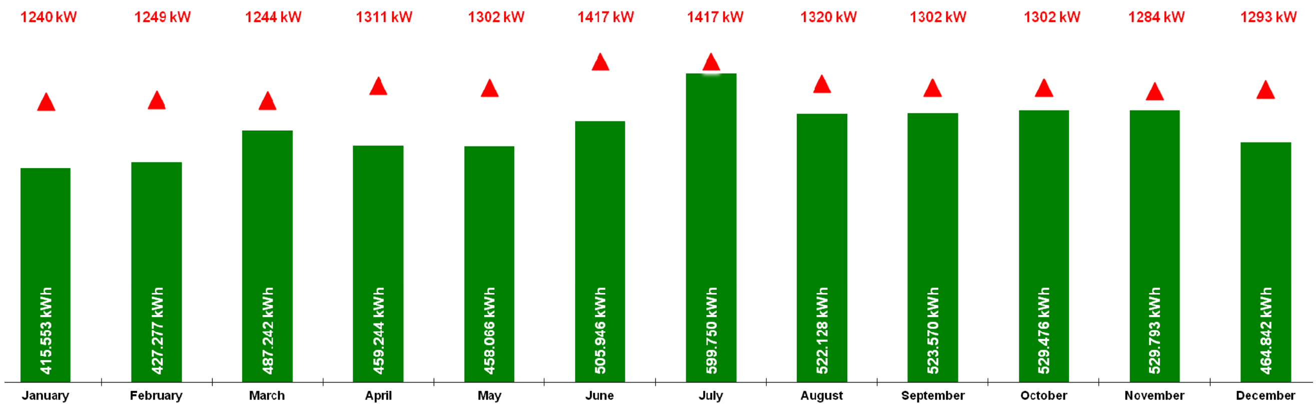
Energy is shown as an absolute as well as a cumulated figure in a month- and year-related manner.

The use period is represented as a quotient of energy and maximum purchased power in hourly values in a month- and year-related manner. Percentages are calculated from the hours of use related to the monthly and yearly hours.

In order to evaluate the energy consumed, the number of days per month and its respective number of work days are listed.

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Delivered Power													
- Maximum	1.240 kW	1.249 kW	1.244 kW	1.311 kW	1.302 kW	1.417 kW	1.417 kW	1.320 kW	1.302 kW	1.302 kW	1.284 kW	1.293 kW	**1.417 kW**
- Average	559 kW	636 kW	655 kW	638 kW	616 kW	703 kW	806 kW	702 kW	727 kW	712 kW	736 kW	625 kW	**676 kW**
- Minimum	151 kW	204 kW	208 kW	27 kW	164 kW	213 kW	257 kW	230 kW	221 kW	221 kW	239 kW	221 kW	**27 kW**
Work	415.553 kWh	427.277 kWh	487.242 kWh	459.244 kWh	458.066 kWh	505.946 kWh	599.750 kWh	522.128 kWh	523.570 kWh	529.476 kWh	529.793 kWh	464.842 kWh	
- acumulate	415.553 kWh	842.831 kWh	1.330.073 kWh	1.789.316 kWh	2.247.382 kWh	2.753.328 kWh	3.353.079 kWh	3.875.207 kWh	4.398.777 kWh	4.928.252 kWh	5.458.046 kWh	5.922.888 kWh	**5.922.888 kWh**
Peak (Load) - Facto	2,22	1,96	1,90	2,05	2,11	2,02	1,76	1,88	1,79	1,83	1,75	2,07	**2,10**
Operating life													
- Hours	335 h	342 h	392 h	350 h	352 h	357 h	423 h	396 h	402 h	407 h	413 h	360 h	**4.180 h**
- % per month	45%	51%	53%	49%	47%	50%	57%	53%	56%	55%	57%	48%	**48%**
CO_2 Foot print													
600 g CO2/kWh	249 t CO2	256 t CO2	292 t CO2	276 t CO2	275 t CO2	304 t CO2	360 t CO2	313 t CO2	314 t CO2	318 t CO2	318 t CO2	279 t CO2	**3.554 t CO2**
Day													
- Total	31	28	31	30	31	30	31	31	30	31	30	31	**365**
- Monday to Friday	21	20	23	22	21	22	22	22	22	21	22	23	**261**
- Sum Workdays													

The characteristic monthly values for energy consumption are here shown graphically as green bars. The red triangles represent the maximum power purchased. The ratio of consumption to maximum power is that much better, the closer the triangles are to the bars.



For the n highest yearly/monthly values of power purchased, the values are listed in table form with their absolute power values in decreasing order.

The date/time column documents the times at which they occur. The power values of peak reduction refer to the highest 15-minute value. The difference of the highest n values relates to the last of the highest n values to the highest 15-minute value.

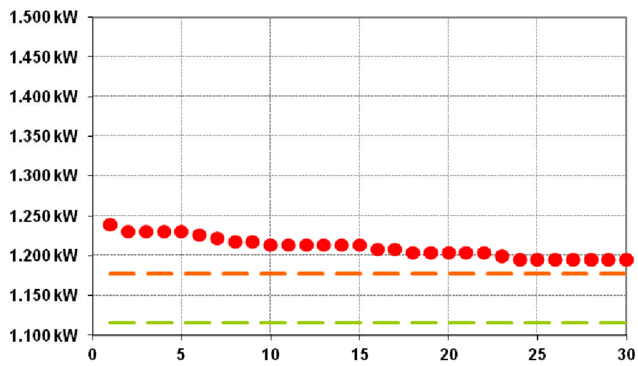
In the chart, the sequence of the n highest values is entered on the X axis and the 15-minute power values on the Y axis.

In addition, the peak reductions by 5 % and 10 % are drawn as continuous lines.

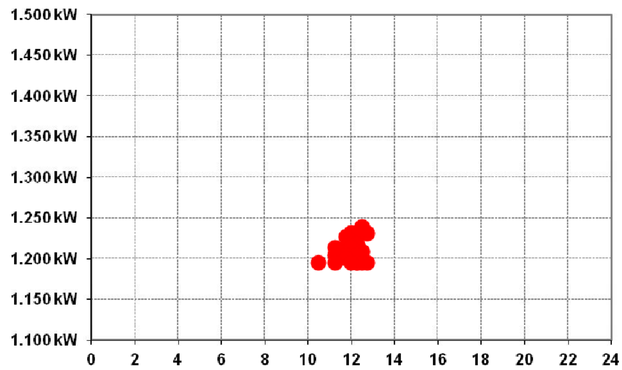
In the daily distribution, the distribution over time of the n highest values during the day and their accumulation is shown. In the daily distribution of the n highest values, the time is entered in full hours on the X axis, and the power on the Y axis.

These two charts serve to evaluate whether it would be worthwhile considering a load management system.

Highest values



Daily distribution



1/4h value	Date / Time	1/4h Value	Date / Time
1.240 kW	25.01.2010 12:30	1.209 kW	19.01.2010 12:30
1.231 kW	19.01.2010 12:00	1.209 kW	26.01.2010 12:30
1.231 kW	25.01.2010 12:45	1.204 kW	14.01.2010 11:45
1.231 kW	26.01.2010 12:00	1.204 kW	19.01.2010 11:15
1.231 kW	26.01.2010 12:15	1.204 kW	19.01.2010 11:45
1.227 kW	26.01.2010 11:45	1.204 kW	25.01.2010 11:15
1.222 kW	11.01.2010 12:00	1.204 kW	25.01.2010 12:15
1.218 kW	14.01.2010 12:00	1.200 kW	20.01.2010 11:45
1.218 kW	19.01.2010 12:15	1.196 kW	19.01.2010 12:45
1.213 kW	13.01.2010 11:45	1.196 kW	20.01.2010 10:30
1.213 kW	13.01.2010 12:00	1.196 kW	20.01.2010 11:15
1.213 kW	13.01.2010 12:15	1.196 kW	20.01.2010 12:15
1.213 kW	14.01.2010 12:15	1.196 kW	20.01.2010 12:30
1.213 kW	20.01.2010 12:00	1.196 kW	21.01.2010 12:15
1.213 kW	21.01.2010 11:15	1.196 kW	28.01.2010 12:00

Max. month		1.240 kW		
Peak reduction			**Difference**	44 kW
to 5%	**to**	1.178 kW	**max. to**	3,57%
to 10%	**to**	1.116 kW	**30. value**	

Analysis of downstream feeders

Should irregularities become evident during the evaluation process, then further analysis is required.
A comparative assessment of the downstream feeders helps in narrowing down the cause of these striking features.

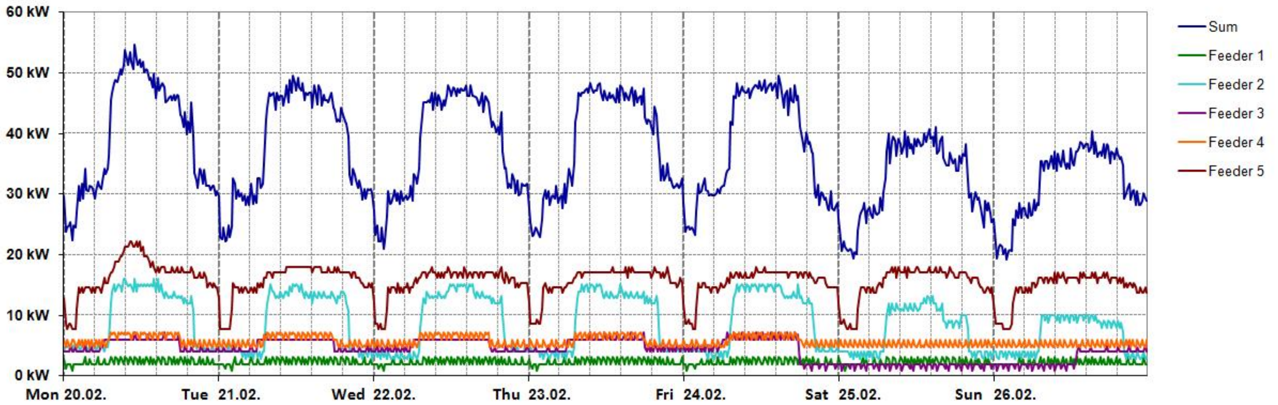
The two charts below show the load curves for one feeder (sum of) and its subfeeders (feeder 1 to 5).

If you only look at the summated load curve in chart 1, you would basically see a continuous pattern.

Only by examination of the subfeeders, it becomes evident that the higher peak on Monday is largely created by a peak of feeder 5.

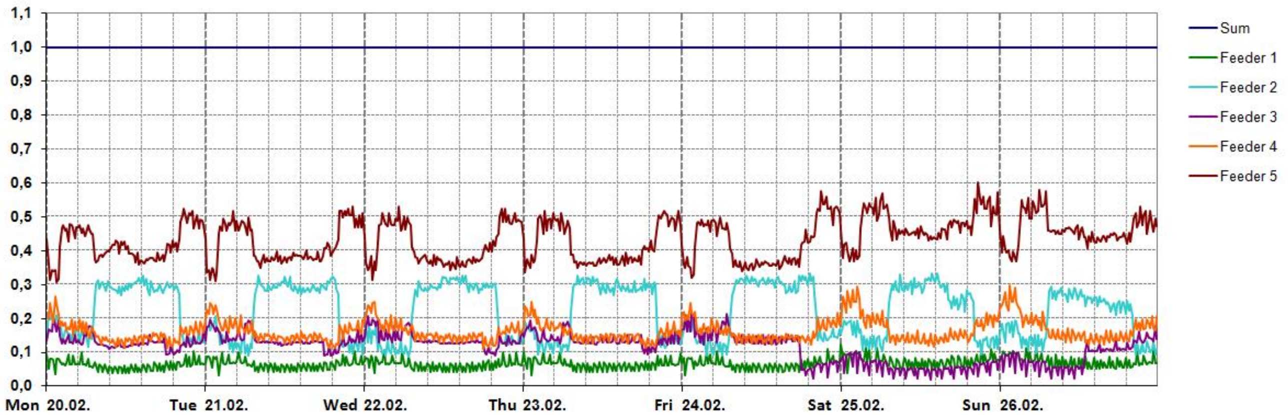
It is only this subdivision which makes it clear, where various effects originate from. This knowledge can be used to investigate further into the relevant feeders and introduce optimisations if necessary.

This presentation is always very enlightening when certain processes can also be operated temporally shifted instead of running in parallel, which results in a reduction of load peaks.



In order to visualise the percentage share of feeders in the supply a relative presentation is the method of choice.

The sum total of feeders corresponds to 100 % and the subfeeders are put in relation to it.



Conclusion

The targeted presentation of measured data in various curves and graphics is essential for creating transparency. This does not only apply to one series of measurements but also to the energy flows within the plant. For an initial analysis, it is sufficient to look into the measurement series of the feed-in system.

The interpretation of the tables, curves, and load curves additionally requires the know-how of plant operation.

If the statements about energy policy and planning are integrated into this assessment, potential nonconformities may result.

Knowledge about production and plant utilisation lies with the customer. Specific data conditioning is part of data acquisition and assessment. Know-how of both components constitutes effective energy management on the basis of ISO 50001.

To comply with this standard, creating transparency by means of regular energy data evaluations is indispensable. Based on this, optimisations can then be implemented in a tightly focussed manner. At Siemens, TIP Consultants can render support in preparing and interpreting these analyses.

For further reading:

Reese, K. (2012). DIN EN ISO 50001 in der Praxis, Vulkan-Verlag GmbH, Essen, Germany

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