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control system

DOMAT
ENERGY MANAGEMENT AND CONTPORT

Energy under control

ENERGY MANAGEMENT AND CONTPORT

WHAT IS ENERGY MANAGEMENT AND WHAT IS IT GOOD FOR

Investors and property owners are well acquainted with the words „facility management“. Usually, they understand it as a comprehensive building maintenance including activities like cleaning and maintenance, security, gardening services, and the like. Concerning energy, their distribution and invoicing, a facility management provider usually covers meter readouts, cost allocation, and servicing of heating and cooling plants. The property owner has no idea if the consumed energy is appropriate to the size, age, and usage of the building; he seldom tries to move to another utility provider, and only exceptionally he considers replacement of building technologies before their lifetime is over, because this brings along unwanted costs.

However, there is another way how to operate buildings from the point of view of energy costs. It is called **energy management**. Under energy management we understand an expert service which offers a – and this is important – set of measures which relate to each other and complement each other. These measures are able to **decrease energy costs** while keeping or even improving the environmental comfort. It is mostly about heating, cooling and lighting energy, as they represent the most important part of the total building energy consumption.

For consumption evaluation and **benchmarking, derived parameters** are used. These are for example energy consumption per floor unit or day-degrees, energy consumption of a person per night in hotels, etc. Furthermore, other variables and constants must be available, such as number of accomodated guests, or occupancy of the offices. These values are processed, and from the results we are able to judge if the building operation is economical compared to other operated buildings or acknowledged standards.

Energy management in reality proceeds in **several steps**. In the beginning, the energy management provider carries out a **local inspection** and specifies which values are to be measured. At small properties, like retail shops or bank branches, usually the main consumption data of electricity, gas, heat and water, together with some environmental parameters, like reference room temperature, outside temperature, operation of main AHU unit, and supply and return water temperature, are enough. Either the measured values are read from the existing building control system, or the supplier must install his own sensors and a datalogger connected to the Internet. After the local inspection is finished, the supplier produces an **indicative quote**, so that the customer can see what and when he would receive for his money.

The energy management itself starts with an **energy audit**, which is a detailed report on the energy flows in the building. The auditor uses building plans, real consumption data from several years back, measured data from indicative measurings, and, last but not least, his own on-site experience. He or she must examine the usage of the building, patterns of the users, and their influence on energy consumption. At the end of the report there are **several variants of recommended measures** for energy savings, each of them containing expected return time and, of course, expected investment costs. All variants are proven by calculations. It is remarkable that significant savings may be achieved by **changing of local operating regulations**, which specify the proper way of building usage and operation. This kind of savings means little or no investment costs and thus it brings along short return time. Examples of these are resetting of setpoints and time schedulers, tuning of hunting control loops, control strategy based on weather forecast, etc. The next step is the implementation of the agreed measures at the sites, installation of sensors and dataloggers, and introduction of the control mechanism: energy management software.

A general rule says that any technological changes, reconstructions etc. are implemented only if they show the **return time approved by the customer**. It showed up that operation cost savings in size of 20 to 30 % must be achieved by implementing of more small-scale, low-cost measures, which bring improvements in percents. It is necessary to work with the building in the timespan of **several years**, to understand its behavior, and follow step by step. A good example of this is **stepwise reconstruction** of the building control system: the system is replaced in stages to protect investments, disassembled components are used as spare parts for the existing panels, and the refurbished panels are integrated into a remote access SCADA. At some installation, it is also possible to replace the process station only, and get the application software under control while preserving all peripherials and power part of the panel.

The advantage of a professional energy management is that the **auditor is independent** from suppliers of technologies for eventual reconstruction, which guarantees objectivity. The report does not aim to make the customer invest into a particular product of a particular manufacturer. It was proven that recommendations concerning operating regulations, which are made by an external consultant, are acknowledged to be better than if derived from internal sources.

To be able to achieve and prove the operational savings, an **easy-to-understand tool** is essential.

CONTPORT

ContPort is a **cloud service** which collects data from building control systems of different manufacturers. It processes the data and works with them in the way the energy manager needs. Apart from processing the energy data from the field, ContPort is able to **archive documentation** of technologies, plan **maintenance inspections**, and operate a ticketing system including **service costs allocation** to individual technologies and their parts. The users have a unique overview on total operation costs: both energies and services are displayed in a single view.

ContPort also contains predefined and **customized reports**, which are generated over a selected time range, or on an automatic basis at regular intervals. It is possible to save data sheets, floor plans, and other information which help the engineers to fix the problems in a fast and efficient way. Predefined **regular events** notify about expiring inspection intervals, while a quick overview of current data, as well as trend data is provided by **dashboards**.

Regular reporting as well as online access to current and trend values are necessary for a **transparent relationship** between the energy management supplier and the customer. With ContPort, the facility managers and energy managers always have the operation cost data at hand.

ENERGY CONSUMPTION OPTIMALIZATION

WEATHER FORECAST BASED CONTROL

When creating a control strategy, information on weather conditions during today or the next day are very helpful. It will help to compensate the heating system time delay. RcWare Weather, a service that acquires the weather forecast data, is able to bring these values into the control system. There are 12 values computed at the server level: wind speed and direction, minimum and maximum temperatures, precipitations, air humidity, air pressure, cloud covering, etc. All values are forecasted in a mathematical model for any location in Europe*) with additional extension to other regions as an option. The variables adhering to one licence are then bound to the geographical coordinates which were entered when the licence was ordered.

Each variable carries the information on how many hours in advance it should be computed; time periods from 1 to 72 hours are used. It is also possible to declare more variables in the system, which forecast one value with different times, such as outside temperature changes within the next hour and/or within 6 hours. The most utilized value is temperature 2 meters above ground, e.g. for heating curve optimization which prevents overheating (if outside temperature rise is expected, the heating water temperature is controlled to a lower forward temperature in advance, so that the energy is not wasted in the system), or for cooling accumulation control strategy.

PREDICTIVE CONTROL OF TECHNOLOGIES

A MPC (Model-based Predictive Controller) uses weather forecast and mathematical model of the controlled building to minimize the planned energy consumption while keeping the required indoor comfort level. Thanks to high performance of today's technologies, it is possible to compile a model of the building, then calculate the trends of indoor temperatures based on measurings of indoor and outside temperatures together with other values, such as solar irradiation and wind speed. The computations take place at remote servers; only the setpoints are communicated to the PLC, such as hot water temperature setpoint.

Together with the Department of Control Engineering of Czech Technical University in Prague, predictive control has been tested at the university campus buildings, using SoftPLC control software. Since four years, heat consumption savings up to 26 % have been achieved. A similar MPC project is being executed in Hasselt, Belgium, in the Hollandsch Huys building.

ENERGY CONSUMPTION OPTIMIZATION

LOAD SHEDDING

The load shedding controller limits the 15 minutes electrical energy consumption so that the agreed limit is not exceeded. Unlike commonly used systems, it is able to monitor the operation of currently active groups over contact inputs or a communication bus. Non-operating groups will then be skipped. All actual values and parameters are accessible over a LCD display, communication bus, SCADA, or web interface: they can be changed dynamically. The web pages also show last 15 minutes consumption, and consumption trend in time.

The controller is freely programmable. The application software may be adapted according to the requirements of a particular installation. It is possible to set maximum off times, minimum on times, and other parameters of 8 groups. The complete load shedding system is easy to integrate into a building control system or 3rd party programs, e.g. SCADA or ERP system.

METER READOUTS

Thanks to its open system, Domat offers many possibilities how to read values from energy meters: from interfaces with web access over a freely programmable DDC process station to data acquisition into powerful databases with open interface for 3rd party applications, such as invoicing and cost allocation systems. The process station may perform other functionalities, like peak shaving in district heating networks. All commonplace meters with M-Bus or Modbus interface are supported, and for the system it is no problem to integrate heat meters together with water, gas and electricity meters and thus provide a complete overview of energy consumption in a building or technology – regardless if current values, or historical data.

We always select the solution which fits the task best. For hundreds of small-scale technologies (heating stations, retail shops), a small communicator M007 with Internet communication is often used. At larger projects, like blocks of flats and office buildings, a process station with 4 ports for up to 1000 metering devices is a more suitable solution. Again, the process station may perform precalculations if necessary, which may decrease the amount of necessary meters, or provide more detailed consumption data. Together with energy data, information about operation of technologies may be recorded, so that the energy manager is able to evaluate the situation and optimize the configuration of machinery and other technologies.

*) or other focus areas

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