Intranet-based Building Management System

Major energy savings with minimal investment

The GEWOBAG, one of the largest housing associations in Berlin, has connected 76 boiler units with a total output of 60 MW to its control centre via the MPLS intranet-based data network. Due to continuous monitoring a fast reaction time is guaranteed in case of breakdowns, and remote access opens up new possibilities in terms of energy optimization.

Experts estimate that online monitoring of central heating installations in the housing sector can result in energy savings of over 20 %. As a first step, the set points and actual values are documented and the boiler efficiency is assessed as the most important indicator for the energy efficiency of a heating system.

Building technology installations run out of control if they are not permanently monitored.

This fact has been proven time and time again. 20 to 30 % more energy is used in central heating installations that only undergo occasional routine maintenance – and nowadays this is more the rule than the exception.

The reasons for higher energy consumption are equally attributable to the technical aspects of the installation as well as the setup of thermostats and heat regulation components.

Typical examples of high energy consumers are:

- Undiscovered defects in pump relays, motor valves and thermostats
- Heating regulators where the set point is are set too steep (reason: to avoid tenant complaints)
- Deficits in the quality assurance of building services provided by third parties.

Moreover, tenants tend to be more demanding these days, and sometimes document deviations of agreed heating times and room temperatures very precisely in order to claim rent reductions. This trend has become more pronounced with increasing energy costs (i.e. higher heating-inclusive rents).

Monitoring via modem

Since the 1990s the GEWOBAG has monitored the majority of its heating installations with the aid of an analogue modem connection, which was at that time an innovative method of remote monitoring. However over time, modem monitoring proved to be comparatively slow and prone to failure. Especially after power cuts there was often a data overflow, since many modems were trying simultaneously to send failure reports to the server. The dial-in and selection procedures of each single modem connection proved over time to be extremely time- and labour ntensive and rather poor in terms of the data provided. Since it was purely a failure report system and more data would be needed in the future

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The GEWOBAG now monitors the efficiency of the heating systems of 76 properties via an MPLS network.

GEWOBAG - „Rathausstraße“ pilot project

The energy monitoring of the residential property in Rathausstraße, Berlin, had a major influence on the decision of the GEWOBAG to install an intranet-supported remote monitoring system. What prompted the inspection of the on-site central heating system was a sudden, inexplicable rise in energy consumption following the shift from using heating oil to natural gas. The energy-use monitoring data revealed an efficiency of only 68% - clear evidence that the installation, despite recent renovation, was not running at optimal performance. The main reason for the higher energy consumption proved to be incorrect regulator adjustment of the unit after the replacement of the burners. By optimizing the sequential switching of the boilers, lowering the temperature level of the entire installation, adjusting the heating curve and re-constructing the one-stage burners into two-stage modulating burners the losses in heat production could be reduced by 15%, and those in heat transmission and distribution by 8%. A repeated examination revealed a further saving potential of 4% through an even more efficient sequential switching of the boilers. For the GEWOBAG, the pilot project was definitely worthwhile:

With an investment of only €10,000, CO2 emissions could be reduced by 600 tonnes, and about €70,000 could be saved in energy costs.

Within less than two months the investment had paid off.

For Mario Richter, team leader of the Department for Technical Building Management at the GEWOBAG, the result was so convincing that in future he plans to have the efficiency of the GEWOBAG heating systems (overall output: about 60 MW) permanently monitored.

Karl Rückert Building Management Systems - a short overview

1998: Karl Rückert Gebäudeleittechnik GmbH was founded in Berlin-Kreuzberg.

Official, authorized partner of Siemens Building Technologies in Germany

Areas of expertise:

- Project planning, programming and commissioning of building management technology systems
- Optimization of existing building management systems
- Conversion and modernization of existing building management systems and building automation systems (Visonik, Desigo Insight, BPS, PRU, EKX, PRV, PX, TEC and BACnet, LON, KNX systems)
- Home Automation System Synco Living
- Installation of WEB-based building automation systems
- Energy-saving concepts for heating, ventilation, air conditioning and cooling units

Major customers:
- GEWOBAG
- Messe Berlin
- Tetra Pak and others

for a more qualified monitoring of the residential properties, in 2006 the GEWOBAG decided to look for a more future-proof alternative.

Potential for improvement in boiler efficiency

In search of a faster and more efficient procedure for remote monitoring, various interest groups instigated the measurement of boiler efficiency in typical Berlin residential properties. The results hinted at a significant potential for saving energy. Thus the initiators of the "Energy Contracting in the Berlin housing sector" study came to the empirically-proven result that with professional management of central heating units in rented apartments, an energy-saving potential of up to 37% can be realized. Moreover, the introduction and testing of the "Energiemonitor" measuring kit revealed that even relatively new boiler units often only reach an efficiency of 70%. It emerged that the reasons for low efficiency were over-sized boilers, wrongly adjusted thermostats and easily-overlooked defects in the actuators and sensors. The GEWOBAG "Rathausstraße" pilot project is considered a textbook example for the optimizing potential of central heating boiler units in large residential properties. In this project, the structured metrology of the energy monitoring procedure allowed a reduction in energy losses of 15% in a heating unit that was adapted from heating oil to natural gas, and the energy losses though distribution and transmission were reduced by 8%. With an investment of about €10,000 for energy analysis and optimization measures, €70,000 could be immediately saved on the annual energy costs. The energy-saving investment paid for itself in less than two months (see GEWOBAG box).

Online monitoring of boiler efficiency

As a consequence of the positive experiences with the "Rathausstraße" project it became clear that a sustainable management of the GEWOBAG central heating boiler units was only possible via online operation. In cooperation with the Siemens Solution Partner, Karl Rückert Building Management Systems, the GEWOBAG in-house technicians developed a remote management concept on a BACnet/IP basis which guarantees – at about the same cost as the hitherto existing modem solution – a permanent online connection to all connected properties, but also provides far more data and allows direct access to the functions of the thermostat. To briefly recapitulate: BACnet is the standard protocol for building automation. This standard defines a number of services and objects that are used for the communication between building automation devices. It was fortunate that the GEWOBAG had recognized the advantages of a "one product policy" at an early stage and used almost exclusively building automation stations by Siemens and Landis & Gyr/Landis & Staefa in its properties.

Virtual networking on MPLS standard

The search for a network provider revealed that Versatel AG could offer the GEWOBAG a network solution that is economical, sustainable and secure. The basis of the concept is a so-called MPLS network (Multi Protocol Label Switching) that enables a connection-oriented transmission of data packages in a connectionless network (internet/intranet) along a path that has been previously established. This network will be operated by Versatel independent of the internet and meets high security requirements. Moreover, applications can be prioritized, for example the transmission of failure reports. The network is routed using components by Cisco; the monitoring up to the LAN port of the router is provided by Versatel. For the connection of the building automation stations with the heating units, Versatel provides ADSL connections with a bandwidth of 1024 kbit/s to 256 kbit/s. The connection of the management station (control centre) at the GEWOBAG is via SDSL, with a transmission rate of 4 Mbit/s.

The interface between the on-site controlling and the control centre is taken over by a DSL router (Cisco) which is provided by the telecommunications provider Versatel.

Wherever it is possible and economical, gas and heating meters with a meter pulse are re-fitted to monitor the efficiency of the boilers.

FOTOS: SBT

One of the low-investment energy-saving measures is checking the hydraulics and the pump runtimes.

The IP addressing of individual automation stations is taken on by Karl Rückert Building Management Systems. For the distribution of addresses, a further expansion of the remote management has already been taken into consideration.

The secured MPLS network and the public internet are connected via a firewall.

Thus the GEWOBAG management system server can be accessed via every public internet access using an SSL client. Access via PC allows a quick reaction when problems arise and an online analysis of the cause of the problem. This function is supported by forwarding the problem via SMS to the GEWOBAG technician on duty or to the contracted service company.

In order to protect the MPLS network against attacks from the public internet, a firewall is implemented which also serves as a VPN server. This server "creates" the MPLS network as a logistic partial network in a physical network using the so-called tunnel technique: it is configured individually and thus a virtual private network (VPN). In order to keep the costs under control and to be able to pass them on to the tenants as regular additional costs in accordance with current legislation, the fees per DSL router/connection are regulated in an outline contract.

The rule of three in energy saving

One of the most important functions of the latest remote management is, besides the reporting of failures, the constant monitoring of boiler efficiency. To this end, gas and heating meters with a meter pulse were re-fitted wherever possible and economically viable. Following the "as simple as possible" rule, the actual boiler efficiency is calculated via rule of three from the quotient from energy transfer and gas consumption and then documented. If an installation does not achieve the specified target value of 90%, an examination is undertaken to establish the possible cause of the loss.

The long-term measurement of the efficiency, the documentation of the exhaust-gas temperature, the outside temperature, the forerun temperature and the pump runtime, the definition of target temperatures (20 to 21°C for apartments, 22 to 24°C for retirement homes and similar institutions) and the documentation of temperature lowering times provide the basis for an expandable energy management. The evaluation of long-term data currently serves primarily to reveal structural weaknesses and hidden defects, although it also serves to prove correct forerun, return and domestic hot water temperatures when there are differences of opinion with tenants. Furthermore there is the possibility to acquire additional software to systematically analyse the data on the Desigo Insight management station: this data can then be rendered in the form of charts and reports.

„Alliance for Unit Efficiency“ wants to achieve high energy savings at low investment

Energy saving with low investment has been an important issue for the members of the BBU (Berlin and Brandenburg Federation of Housing Companies and Housing Cooperatives) for a long time. The reason housing companies aim for low investment is that they can only pass on savings though investments in heating efficiency measures on a very small scale or often not at all. On the other hand, tenants increasingly enquire about the additional costs, that is the heating costs, before renting an apartment.

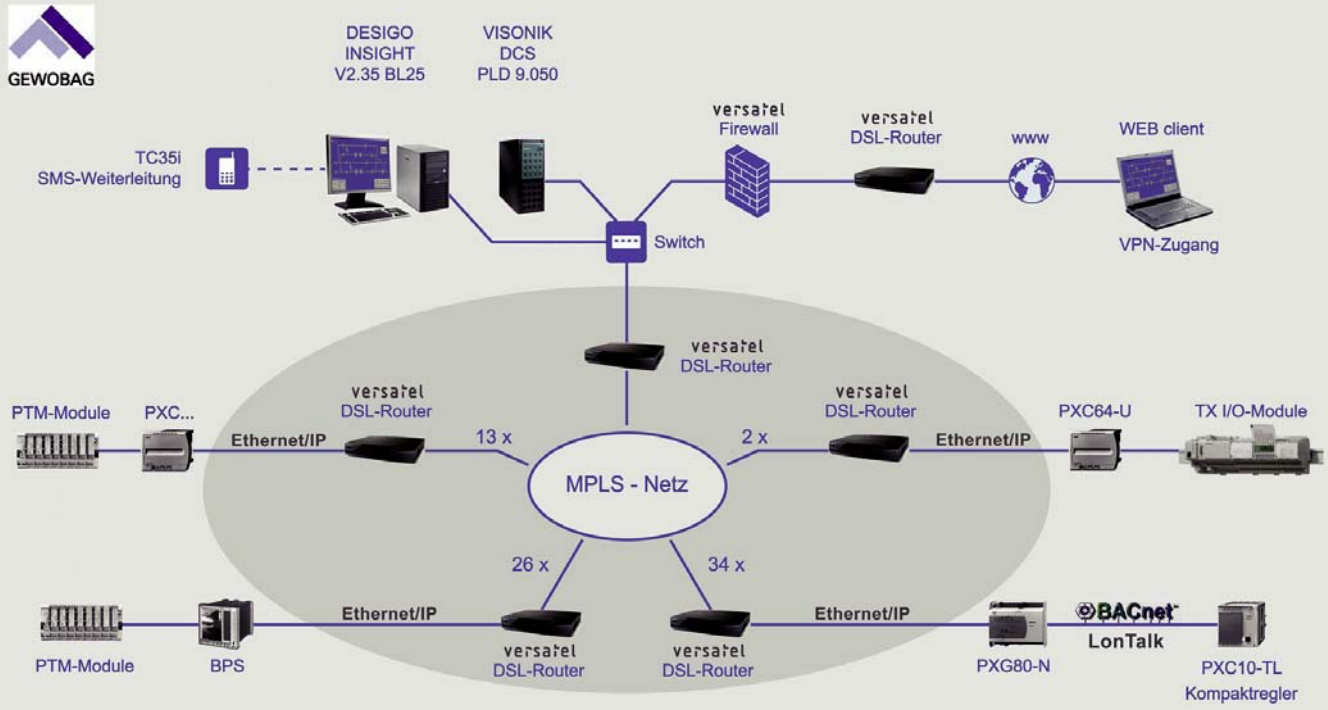
The BBU therefore started the ALFA (Alliance for Unit Efficiency) project in order to realize greater energy-saving potential in the low investment sector with the help of new analysis methods, and innovative products and technologies.

The aim is, with the help of commercial partners, that specialized craftsmen acquire the knowledge required for analysis and optimization measures and qualify as partners of the BBU members.

On the other hand, the housing companies will be enabled, through corresponding requirement profiles, to better choose qualified companies.

The primary issue here is the qualification to understand cross-sector functions, to coordinate them and to identify malfunctions.

A crucial consideration is the coordination of hydraulics, FU regulated pumps and thermostat settings. "Alliance for Unit Efficiency" will achieve great energy savings at low investment.



Topology of the MPLS network of the GEWOBAG for the monitoring of heating units. The "virtual private network" (VPN) can be extended at wish.

GRAFIK: KARL RÜCKERT

Short-term realization without disturbance for the tenants

Conventional energy-saving measures, such as additional insulation, replacement of windows and replacement of boilers often mean long lead times, structural changes, disturbances for the tenants and high costs that take a long time to amortize. IP-based remote management systems however can be realised on a short-term basis without disturbing tenants. At the GEWOBAG, a new remote monitoring system was routed and 76 heating centres were migrated and connected within just six months. This was carried out as follows:

- Migration of the existing Visonik Insight management station for the connection of existing automation stations of series PRV2 and BPS
- Installation of the master Desigo Insight management station for the connection of the new Desigo PX automation stations
- Replacement of existing modem connections with network connections
- Migration/replacement of obsolete thermostats and boiler control systems with Desigo PX automation stations
- Routing of the network through Versatel and Telekom
- Configuration of the routers
- VPN access/firewall installation
- Operational launch

Mario Richter, team leader of the Department for Technical Building Management at the GEWOBAG, wants to compensate increasing heating costs with the energy efficiency measures.

FOTOS: SBT

Karl Rückert: "No housing company can afford to constantly send someone to check the heating units. Monitoring via MPLS net is efficient and amortises itself within one year."

The new remote management system is currently connected to 76 properties with approximately 8500 residential and commercial units which have a combined boiler output of 60 MW (483,000 m2 of heated area).

The costs for migration, networking, routing and new Desigo management station totalled about €128,000. If one calculates an average energy saving of 20%, with the aid of professional monitoring of efficiency levels, the investment can amortise in under 12 months. But over and above these potential savings, by using the appropriate software tools the new remote management system will in future enable GEWOBAG technicians to analyse the units even more precisely in order to detect new energy-saving potentials. So far, experience has proven that fine tuning of heating units can result in energy saving of a further 4 to 8%. The replacement of obsolete heating boilers with new ones, the shift from heating oil to natural gas or the replacement of oil/gas burners alone will not automatically guarantee energy-saving operation.

Gebäudemanagement Praxiswissen

76 GEWOBAG properties are currently connected. The MPLS network can be routed cross-regionally via tunnelling.

KARL RÜCKERT Gebäudeleittechnik

GRAFIK: KARL RÜCKERT

Pilot projects based on the "Energiemonitor" measuring kit used by the GEWOBAG have revealed that the boiler efficiency of central heating units is often less than 70% even if monitored via modem. The installation of an MPLS network and the connection of currently 76 residential properties with a building automation system enables GEWOBAG technicians to constantly monitor important installation parameters, in particular boiler efficiency. At relatively low investment cost (about €1685 per connection) considerable reductions of climate-damaging CO2 emissions can be achieved.

With CO2 emissions of over 21,000 tonnes per year, reductions of at least 2000 tonnes per year are considered realistic for connected properties.

The intranet-based building automation system is a tool for the GEWOBAG to gain even more efficiency from its existing heating boiler units – to the benefit of all its customers.

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Berlin Housing Companies Sign Climate Protection Agreement

On January 13th 2009, six municipal housing associations declared their intention - within the framework of a climate protection agreement - to reduce the CO2 emissions of their 268,000 apartments by 2010 by at least 10% in comparison with 2006. This will mean a reduction of about 56,000 tonnes per year. In December 2007 the BBU (Berlin and Brandenburg Federation of Housing Companies and Housing Cooperatives) signed a comprehensive climate protection agreement with the federal state of Berlin within the framework of the Federal Energy Programme 2006-2010 in order to support Berlin in achieving its climate protection goals. According to this agreement, CO2 emissions shall be reduced by 30% by 2010 in comparison to 1990. From 2006 to 2010, in all 695,000 apartments administered by BBU member companies, CO2 emission are to be reduced by 106,000 tonnes. Individual agreements with the six municipal housing companies: DEGEWO, GESOBAU AG, GEWOBAG, HOWOGE, Stadt und Land, WBM Wohnungsbaugesellschaft Berlin-Mitte mbH, will now be ratified through the current agreement.

Major gains at minimal cost

"Up to now, 85% of the apartments managed by municipal housing associations have been completely or partly modernised. However, there are still further possibilities for saving energy," says Michael Niestroj, director of Stadt und Land Wohnbauten GmbH and spokesman for the municipal housing associations. "We count on the profitability of the measures. Energy saving has to remain affordable, otherwise we over-burden our tenants." The main focus of future activities is increasing energy efficiency in the residential buildings. units, shifting to climate-friendly energy sources and by improving insulation, fitting new windows and purchasing green electricity, more climate protection potentials could be achieved, says Niestroj. "The main beneficiaries of this will be our tenants, because it enables us to counteract increasing service costs." The municipal housing companies are contributing to climate protection by vigorously improving entire residential areas. Since 1990, the municipal housing companies have invested €12.1 billion in the maintenance and modernisation of their apartments. By 2005 alone they had reduced the CO2 emissions of their 268,000 apartments by over 243,000 tonnes to about 704,000 tonnes.

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