Google

GOOGLE INTELLIGENTLY CONTROLS ENERGY USE AT ITS EURO HQ

GOOGLE is one of the most innovative and fastest-growing companies in the world. Its mission is to organise the world's information and make it universally accessible and useful. Its European headquarters are based in Barrow Street, Dublin 4 – its largest operation outside the US.

Google is strongly committed to sustainability since it is "good for the environment, but it makes good business sense too". While saving resources such as electricity and water, it finds that these actions generally lead also to reduced operating costs. The Dublin headquarters provides a range of technical, sales and operations support, and financial and shared services to Google's customers in over 35 countries. In 2004, Google acquired a single building at Barrow Street in Dublin 4. In 2005, it expanded into a second block. The company now employs about 1,500 people on site, from over 40 nationalities.

A FLEXIBLE SOLUTION

Google's emphasis on innovation and commitment to cost containment means that it is concerned about the resources it uses to deliver its services. It is keen to use new technologies to limit energy waste. In this initiative, it decided to use an artificial-intelligent Building Management System (BMS) at Gas Works House, its European headquarters in Dublin.

In general, a BMS is designed to model standard operational strategies. If it lacks the flexibility to organically change with the building services requirements, unnecessary energy usage can result.

Using advanced artificial-intelligent techniques, key environmental data from a building is collected and analysed in order to develop its unique thermodynamic 'footprint'. The BMS uses this data to optimise the building services.

Gas Works House consists of a 1,858m^2 building housing technical, sales and operations support for both internal and external customers.

Vector FM, which provides facility-management services to Google, recognised that the Google offices could benefit from an artificial-intelligence system provided by Lightwave Technologies, which offers real-time web-enabled energy-saving solutions for commercial buildings. Vector FM presented details of Lightwave's energy-control system, Intelligent Control of Energy (ICE), to the company.

After evaluating the system, Google was impressed with what could be achieved and agreed to install the system at Gas Works House. The installation was part-funded under Sustainable Energy Ireland's Industrial Best Practice Initiative.

The aims of the system installed at Google were to:

- Reduce energy consumption
- Protect the environment by reducing CO_2 emissions
- Improve occupant comfort
- Enable better, faster and reduced maintenance frequencies
- Provide information on the building's performance

The estimated annual energy savings for Google are €56,700 (at 2007 prices), based on reductions in:

Energy consumption: 425,000 kWh per annum
CO_2 emissions: 146,500 Kg C

Google's European headquarters at Barrow Street, Dublin

HOW THE SYSTEM WORKS

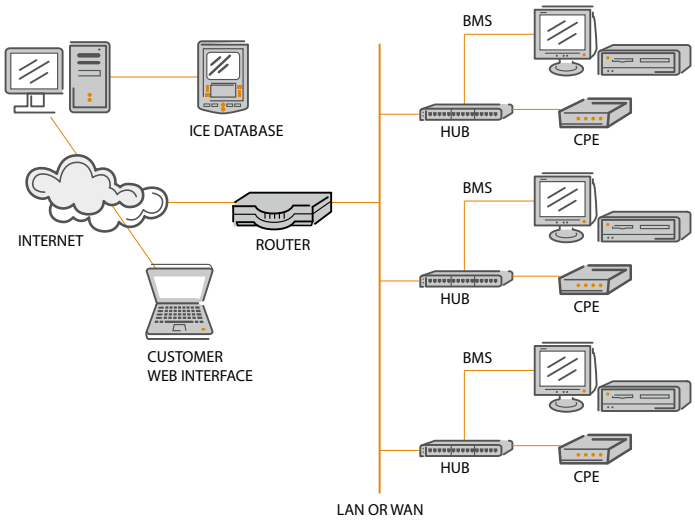
The system remotely collects (via the internet) key environmental data from the Google building. This is analysed using proprietary mathematical/data-mining/fuzzy-logic tools, to develop the building's unique thermodynamic 'footprint' and learn how the building and its plant (boilers, chillers, etc) behave according to seasonal and occupancy parameters.

The system then sends control signals to the building's existing BMS in order to optimise the sequencing of the heating, cooling and other HVAC systems, and thus minimise the building's energy demand. This achieves significant energy cost savings, while maintaining customer-defined comfort levels. The process is depicted graphically in Figure 01.

THE FACILITIES

Gasworks House has a mostly glass façade and is split into two blocks of seven and eight floors. The building has a HVAC system; components include boilers, heat pumps, chillers, chiller pumps, air handling units (AHUs), fan coil units (FCUs) and a domestic hot-water system. All floors are supplied with fresh air from AHUs located on the roof and fan coil units located on each floor to control temperatures.

Figure 01



THE INSTALLATION PROCESS

The installation followed a four-step process:

Step 1 Control and energy audit

- Determine the operational characteristics of the existing BMS system in the building
- Determine the number of sensor inputs to the BMS
- Physically inspect the premises and building plant

Step 2 Hardware installation

- Install equipment, including a communications interface, an ADSL line and firewall, temperature/humidity sensors, a weather station and solar radiation sensors, two new electricity meters and pulse output added to existing gas meters

Step 3 Software integration

- Collect data & monitor
- Pre-process data to determine the building's thermal characteristics
- Set up supervisory mode, to enable optimal predictive start/stop functionality of the BMS controls

Step 4 Ongoing energy saving

- Set up full automatic mode, whereby a neural network relays information back to a central database, allowing the control system to continuously adjust and refine equipment operating parameters to maximise energy saving

After full installation, the system monitors and continuously updates the controls to ensure they are working at their highest level of efficiency. All information is logged and alarms are set up to inform Lightwave of any issues that may arise.

SAVINGS AND BENEFITS

Energy savings

Significant savings are achieved through controlling the boiler and chiller operating times, altering the speed control on FCUs, and monitoring and forecasting solar radiation to reduce the heating load and cooling demand on the building. Annual energy savings are estimated at 425,000 kWh.

Reductions in CO_2

In line with Google's environmental commitment, 146,500 Kg CO_2 will be saved per annum.

Maintenance

Due to data-logging and alarm programmes, the system can be monitored for problems and faults so that they can be quickly and easily found and often prevented. This, in conjunction with reduced operating times, will help reduce maintenance needs.

Occupant comfort

Overheating and under-cooling can be eliminated by using sequential starting and stopping to reduce the amount of heating or cooling entering the building and by using programming to avoid overshoots in the desired temperature conditions.

CONCLUSION

The Google building demonstrates that conventional BMS can be improved by adding an artificial-intelligent control system. Energy savings of 14% are on schedule at Gas Works House, and it is estimated that significant savings are possible in similar large commercial buildings.

'I am very pleased with the outcome of the project. It clearly demonstrates the savings possible in large office buildings when better or more advanced control of existing building management systems is applied.'

Sean Dooley,
Google Facilities Manager,
Vector FM

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NDP National Development Plan 2007 - 2013

Sustainable Energy Ireland is funded by the Irish Government under the National Development Plan with programmes part financed by the European Union.