INDOOR AIR MEASUREMENTS

Get control of your building system

Buildings must be made smarter to save energy and keep their inhabitants happy and healthy. To achieve sustainable results, building system control needs to be based on reliable indoor air measurements. Vaisala, a global specialist in products and services for environmental and industrial measurement, offers some pointers.

Population growth, urbanisation and climate change are driving the need for energy efficiency to curb the growing demand for power.

Buildings, commercial and residential, are one of the biggest consumers of energy. According to the US Energy Information Administration, they accounted for about 40 percent of total US energy use in 2015, which makes them an obvious target for potential energy savings.

People are also becoming more aware of the environment and their impact on it. Many want to optimise energy use to protect the environment, but at the same time their expectations are rising when it comes to the quality of their living and working environments.

To address both demands, buildings are becoming smarter.

What is a smart building? Definitions vary, but there is a consensus that in a smart building, different systems providing heating, ventilation, air-conditioning, lighting and access control are connected to each other and form one integrated system.

The goal is to optimise the conditions inside a building and to ensure comfort and safety to its users or residents, by keeping indoor air quality high. Optimisation also helps keep the building's energy consumption to a minimum, which reduces the building's environmental footprint.

McGraw Hill Construction published a SmartMarket Report stating that intelligent buildings use 20 to 40 percent less energy and result in 8 to 9 percent lower operating expenses with valuations 7.5 percent higher than those with legacy systems.

Overall, smart buildings can provide a variety of benefits to their owners, occupants, as well as society and the environment as a whole.

Optimisation for the long term

Optimising the conditions indoors requires integrated control systems, and they can only work properly and to their full potential when their operations are based on accurate and reliable measurements.

Even the most sophisticated control algorithms and systems are of no use if their operation is based on inaccurate data. Flawed measurements lead to insufficient building automation, which can then lead to problems with indoor air quality and wasted energy.

Even more important is the stability of the sensors used to measure indoor conditions. The instruments used in building automation are often left to their own devices for years on end, so they need to be able to produce consistent and dependable results year after year.

However, the end users and owners often have no choice but to rely on measurement instruments the builders and system integrators have selected. In today's cost-driven world, the instruments are frequently chosen simply based on their price, and used for years or even decades.

While this may keep the initial costs to a minimum, in the long run, it can be difficult to keep maintenance costs down. Additionally, this approach is less likely to lend itself to all of the advantages that come along with smart buildings – such as energy savings and a comfortable, healthy environment for the building users.

This is why special attention must be paid to the design of smart buildings and the selection of instruments that serve the interests of the building owners and users in the long term.

One example where these considerations come into play is areas where walls need to be kept intact or there are obstacles to running cables. In this situation, a long-range wireless solution is required, to be able to install the measurement instruments without disrupting building structures.

Taking the outdoors into account

Going forward, buildings can be made even smarter by including outdoor data – on weather and air quality – in the equation.

Even today, the most advanced buildings have their own weather stations, providing information that helps optimise air intake and process the air – heating, cooling, drying, or humidifying it.

Smart buildings of the future are likely to have access to other weather data, too, as weather information can even be used to tweak building automation settings in advance. For example, if a system knows the sun will start shining in an hour, it can proactively turn down the heat, taking the sun's warming effect into account.

Weather also impacts another factor that is becoming increasingly important: air quality. Pollution gases, like carbon monoxide, nitrous oxides, sulphur dioxide, hydrogen sulphide and ozone, as well as particles are of great concern, as they have serious negative health effects.

Smart air condition systems base their operation on reliable indoor air measurements to improve air quality and save in energy costs. Picture: Vaisala.

For example, particle pollution needs to be filtered from the outside air as it is brought into a building. When the particle content is high, you want to bring in as little air as possible. Carbon dioxide measurements indicate exactly how much fresh air is needed.

Using a combination of measurements from outdoors and indoors, buildings can become more intelligent and work autonomously to optimise comfort and energy at the highest level.

Stable and accurate indoor air measurements are essential especially in large building complexes, as flawed measurements may lead to problems with indoor air quality and to wasted energy.

Air quality, humidity, temperature and CO2

In a building, many different factors have an impact on indoor air quality and energy consumption. In a typical building under normal conditions, (i.e. excluding cases with indoor air pollutants), the most important parameters to monitor are carbon dioxide, relative humidity and temperature.

A carbon dioxide level is a good indicator of proper ventilation in a space. Elevated carbon dioxide levels are not usually a health hazard, but they can lead to complaints of stiffness and odour, and in higher concentrations drowsiness, so it may indicate a need for additional ventilation.

Relative humidity in a building can also affect the health of its inhabitants. For example, people working or living in mid-range relative humidities are less likely to experience respiratory infections. Allergenic mites and fungal populations are also directly dependent on relative humidity.

To minimise the majority of adverse health effects, indoor levels of relative humidity should ideally stay between 40 and 60 percent.

Relative humidity in indoor air also affects how temperature is perceived; people feel colder in dry air than in humid air. So, keeping humidity at an optimum level helps keep the temperature slightly lower and therefore save energy.