Building Automation

The Edge is the most sustainable office building on earth with a BREEAM-NL rating of 98.36%

Source: Jeroen Meijer

Advanced Building Energy Saving Technologies

Building Automation and Controls (BAC) enhance comfort and productivity while using less energy, thus reducing costs and bills. Acting as stand-alone and related to individual technical building systems, such controls can save vast amounts of energy in the average building. These savings further rise when control systems interact with each other, such as via a building energy management system (BEMS). Moreover, such a system would early detect faults in operation and diagnose defects in technical building systems..

All too often, energy improvement in buildings is only focused on the building fabric (such as insulation) and the installed equipment (like LEDs or high-efficiency boilers), but overlooks the opportunities in more efficient and dynamic operability. This is where advanced controls and automation enter the picture.

Examples of energy reduction measures that can be realized with improved building automation and controls:

- **Smart HVAC (1)** controls use sensors to limit energy consumption in unoccupied zones

- **Automatic hydronic balancing (2)** continuously adjusts the flow and pressure in the piping system and radiators to optimize generation, distribution and emission of heat throughout the building

- **Sensors and drives (3)** enable variable demand control of ventilation optimizing the level of indoor air quality at minimal energy cost
- In sanitary hot water, **advanced controls (4)** can reduce the temperature without causing health risks because of legionella

- **Advanced lighting controls (5)** avoid overuse by dimming functions that adapt to daylight and occupancy

- **Solar shading (6)** manages the amount of solar heat and daylight that enters the building

Acting as stand-alone and related to individual technologies, such controls can save vast amounts of energy in the average building. Moreover, such a system would detect early faults in operation and diagnose defects in technical building systems. Building technologies also interact with the energy system – outside the building. A smart building can automatically adapt (within preset individual preferences) according to changing energy needs and price fluctuations. The (automated) building stock facilitates the use of renewable energy sources and increases the overall grid stability by providing the grid with massive load shifting and storage capabilities.

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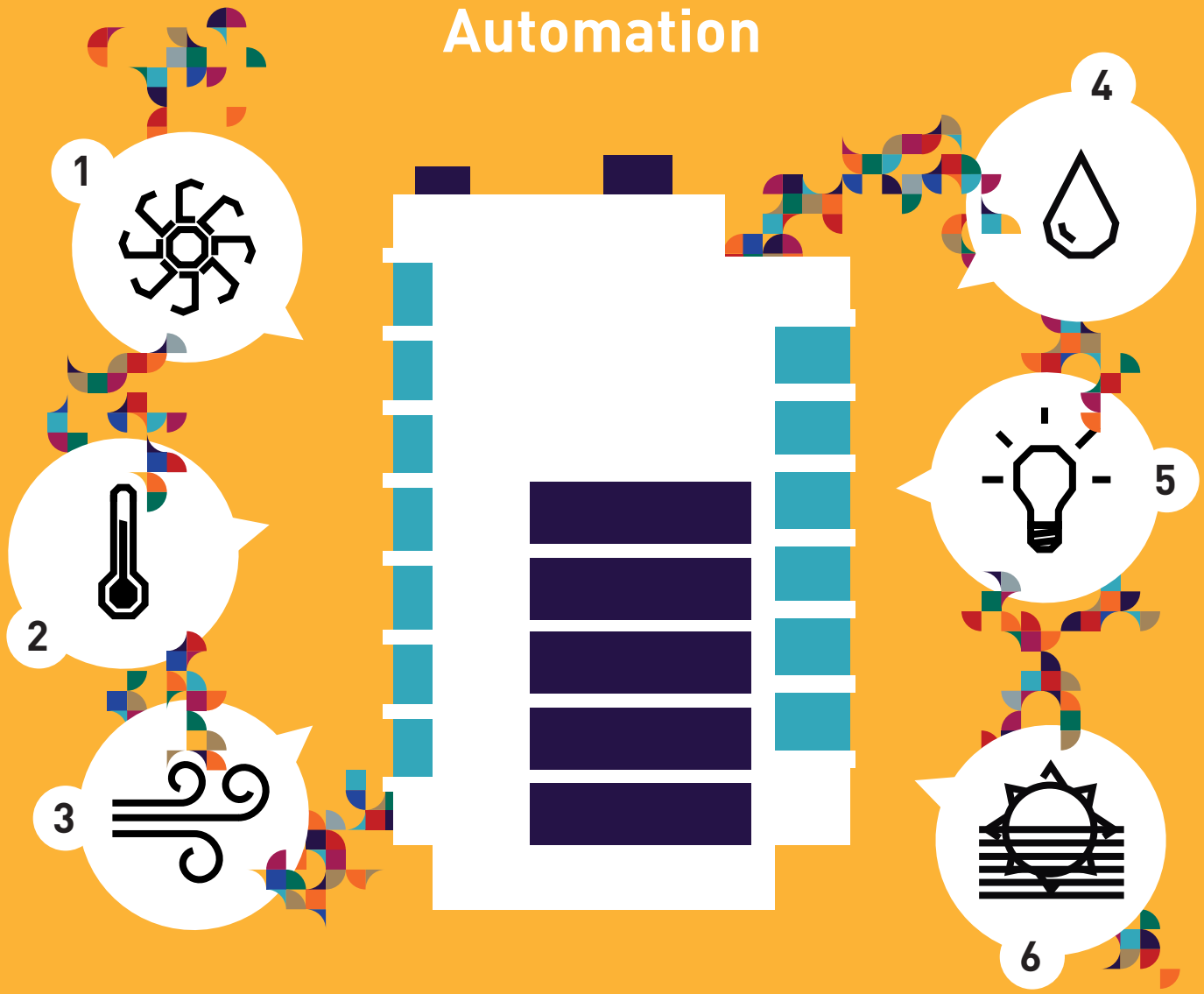

1. Buildings account for **40%** of Europe's energy consumption, more than any other sector.

2. About **26%** of total public and commercial buildings (floor area) in the EU is thought to have building energy management systems (BEMS) (operational capacity) installed.

3. **2/3** of Europe's buildings standing today are expected to remain in use in 2050

7. Only about half of the installed building management systems (BMS) have more than an elementary energy-management capacity.

8. Proper application of building automation would save between **22-30%** of the total energy consumption in European buildings. The import of natural gas could also be reduced up to **13%** [without taking into account additional energy savings potential that could be achieved by changing inefficient heat generators, or chillers].

Proper application of building automation could reduce between 156 to 419 million tons of CO_2 emissions per year.

4. Leading European countries producing Building Automation products products include Germany, Switzerland, France, and Italy.

5. An estimated **250,000** direct jobs could be created by 2030 across Europe... indirect jobs could reach over 3 million.

6. Building automation deployment across Europe reduces greenhouse gas emissions as much as removing **82 to 220 million cars**.

9. Improving the energy performance of buildings would increase housing affordability and could address social imbalances by helping between **0.5 to 3.2 million** European households to emerge from energy poverty.

10. Building automation and controls are low capital investments (typically 30€/m^2 in non-residential buildings and 12€/m^2 in residential buildings), with a fast payback period (2-5 years).

Sources: EC , Waide Strategy Efficiency, ECI, Ecofys, eu.bac

1. Enforce existing requirements like Article 8 of Energy Performance of Buildings Directive (EPBD).

A regulatory framework exists but nothing is happening on the market. Member States are simply not implementing the existing regulatory framework. Guidance principles for Member States to implement the EPBD need to be published and supported by best practice examples for different building types; nonetheless, there will be no overcome of the market and regulatory failures without a legislation setting basic binding requirements on key functionalities, such as continuous monitoring, benchmarking efficiency, optimizing generation, distribution and use of energy.

2. Increase energy performance transparency to drive demand and facilitate enforcement.

Assessing and documenting the energy performance of technical building systems can increase awareness of possible efficiency gains and help drive demand, while the introduction of a Smartness Indicator would stimulate market uptake. Track progress via the collection of data at national levels on the state of technical building systems in existing buildings and modernize building systems in national renovation strategies with KPIs.

3. Harmonize building system standards across Europe.

Revise existing standards to focus on system performance and clarify energy performance requirements for technical building systems and the key functionalities. A simple glossary with clear terminology can help with standardization.

4. Clarify the contribution of technical building systems for full decarbonization.

Optimize technical building systems in staged deep renovation strategies with a comprehensive ranking of all available measures based on a) how fast they can deliver cost and carbon savings and b) how effectively they will facilitate the implementation of subsequent measures. Highlight the role of control systems in balancing the minimized energy losses, the internal gains and the remaining energy needs for nearly zero-energy buildings (nZEBs).

5. Unlock 10 billion euros of public and private funds until 2020.

Pursue, implement, and communicate the Smart Finance for Smart Buildings initiative to a) encourage the more effective use of public funds, including through the development of flexible energy efficiency and renewable financing platforms, b) to help project developers bring good project ideas to maturity, and c) to make energy efficient building projects more attractive to investors, builders, and owners.

Dr. Peter Hug

Managing Director of the European Building Automation and Controls Association

How are Building Automation and Control Systems (BACS) cost-effective for decarbonizing Europe's energy system?

BACS are low capital investments (typically 30€/m^2 in non-residential buildings and 12€/m^2 in residential buildings) – for procurement, installation and commissioning. The payback period is short: on average 3 years. In a scenario from now to 2030, the monetary benefits are 9 times higher than the costs.

When we talk about reducing CO_2 emissions, we have figures from several studies telling us that optimization of Europe's building stock (residential and non-residential) through BACS would lead to yearly savings of around 111 million tons of CO_2 emissions (equivalent to Belgium's gross domestic energy consumption in 2014).

Optimal application of building automation and controls throughout Europe's building stock would cost roughly €6 billion per year, which is very little compared to the amount the EU pays on energy imports (more than €200 billion per year). Furthermore, BACS facilitate the integration of on-site renewable energy sources, particularly in near zero-energy buildings (nZEBs), maximizing self-consumption.

Is Europe leading or following BACS? What should be done to ensure EU leadership?

The Energy Performance of Buildings Directive (EPBD) review proposal from the European Commission clearly highlights Building Automation and Control Systems as one of the key technologies for achieving energy savings in a cost-efficient way. However, this proposal is not enough to overcome the market failures and barriers that currently hamper building optimization, such as split incentives between building owners and tenants, lack of awareness and insufficient regulatory framework. The only way to do this would be to introduce market-oriented measures fostering minimum requirements to ensure that larger buildings are well equipped with certain functionalities such as continuous monitoring, benchmarking efficiency, optimizing generation, distribution and use of energy.

How do BACS impact the end user of the energy system?

In residential buildings, automatic room temperature controls complement metering and billing information. In their absence, citizens would know how much they are spending, but remain largely unable to take effective action. This can have a huge impact on fighting energy poverty which, according to the EU Survey on Income and Living Conditions (EU SILC), affects more than 54 million European citizens (11% of the EU population).

In commercial buildings, BACS monitoring and automation functions help staff to maintain availability, lower consumption and run a building against budgets / measures taken. Moreover, let's not forget that BACS improve the indoor environment quality, with positive impacts on health, well-being, comfort and productivity.

> the European institutions should be more ambitious in the frameworks regarding energy efficiency.

What is the key to engage end users more in the energy transition?

We have plenty of impressive figures on the benefits that BACS bring to everyone. It's a win-win situation. Therefore, we are quite often asked why these benefits are not already being achieved by the market. One of the biggest obstacles are the split incentives between landlords and tenants. It is a clear issue that has already had negative consequences on the market and must be addressed and resolved at European level. Furthermore, as the Ecodesign framework successfully demonstrated it can make sense to define mandatory minimum requirements at European level. This approach is working for the Ecodesign framework and I think that the European institutions should also be more ambitious in the frameworks regarding energy efficiency.

What other conditions need to be in place for BACS to thrive?

Besides the minimum requirements for BACS implementation, in terms of a definition of the functionalities that technical building systems and building automation systems have to perform in larger buildings, both residential and non-residential, I think that the Smartness Indicator proposed by the European Commission in the EPBD review can be a very useful tool. It should cover flexibility and demand response and intelligently connect features with enhanced energy saving capabilities. These features are increasingly important, in particular for nZEBs, as they facilitate the matching of the expected and actual energy performances by adapting energy use to actual part load conditions and individual needs. It should complement and not be merged with the information that is currently displayed on the Energy Performance Certificates.

eu.bac european building automation controls association

HOTEL MANAGEMENT EFFICIENCY
United Arab Emirates

The Crowne Plaza Abu Dhabi on Yas Island achieved a 240% return on investment in operational savings within the first 12-month period. This impressive result was reached due to the 24/7 web-based monitoring of the facility, collecting data from the building management system and highlighting when the building was running outside the desired conditions. A monthly report translated the data captured into recommendations and actions to improve the operational efficiency of the facility. Other recommendations included the replacement of defective sensors and the need to change logical programming of air handling units to enable a more consistent temperature throughout the hotel.

HYDRONIC BALANCING & CONTROL
Sweden

After analysis by Danfoss, the housing association in Mjölby, Sweden, decided to implement an automatic balancing solution for the heating system and to install new thermostatic valves on all radiators. With the new solution implemented, the housing association now saves more than 20% on the energy bill every year with a 3-year payback time after implementing automatic balancing and thermostatic radiator valves. Apart from the energy savings, the housing association was pleased to be able to provide an improved indoor comfort to the residents.

MODERN ENGINEERING AND SUSTAINABILITY

Netherlands

The Edge office building in Amsterdam is designed according to 'The New World of Work' principles and consists of a glass exterior and large, open floor plans situated in a U-shape around a 15-story, north-facing atrium. The atrium is surrounded by balconies and residents can easily move between levels to gather in naturally-lighted areas. The Edge is a net-zero energy building. The south façade is fitted with solar panels on all non-window surfaces. Additionally, aquifer thermal energy storage (approximately 130 meters below ground) generates all energy required for building heating and cooling. Rainwater harvesting, electric vehicle charging stations, and motion-sensored ventilation are some of the other eco-friendly features at The Edge.

The Edge not only sets a new global benchmark for the built environment, but also prioritizes the comfort, health and productivity of its occupants. Real-time energy consumption and efficiency data gathered from Schneider Electric's EcoStruxure Building solution is shared with building occupants and visitors via a dashboard on a video screen located in The Edge lobby.

(Left) Crowne Plaza Abu Dhabi. Source: Honeywell
(Middle) Residential building in Mjölby, Sweden. Source: Danfoss
(Right) The Edge – the "world's most sustainable office building". Source: Schneider Electric