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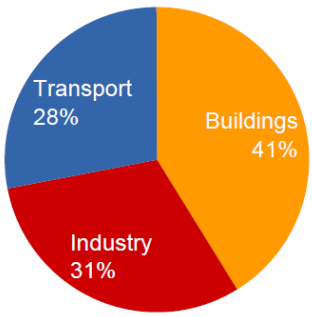
Energy efficient building technology

If we look at the picture of a town, we can see that it consists of very different types of buildings. These are mainly residential or office buildings, some of which have integrated shops or apartments ("mixed construction"), schools, theaters, sports arenas, hospitals, and factories. All of these buildings have one thing in common: They are intended to protect their users from outside influences and to ensure comfortable conditions.
People spend a lot of time inside buildings. The quality of this "indoor world" is therefore vitally important to their health and wellbeing. The significance of such indoor quality was only recognized as the number of sick-building syndrome cases began to increase. There are many causes of a reduced well-being sense. Some can be measured objectively, but many of the problems are also related to the individuals and their social environment. Objectively quantifiable causes include too high or too low room temperature or humidity level, poor indoor air quality, air drafts and unsuitable lighting. The human desire for comfort does not stop at own front doors or office doors: it extends to shopping malls, exhibition halls, sports arenas, fitness centers, museums, and theaters – all areas where acceptance is closely linked to perceived comfort conditions. Our own individual perception of comfort in buildings and rooms has a highly significant effect on our sense of well-being. To maintain all the comfort conditions, a lot of heat and electricity is used in engineering systems:

- Heating
- Cooling
- Domestic hot water
- Ventilation
- Air Conditioning
- Lighting
- Etc.

Buildings consume 41 percent of the energy – more than transport or industry.

Primary energy use in Europe



Impact of Building Automation
Efficiency improvement and modernization can save up to 30 percent

Worldwide, buildings also account for 21 percent of greenhouse gas emissions. Building owners face growing pressure to reduce energy consumption and minimize the impact of such consumption on the environment. This makes future-oriented energy concepts involving energy efficient buildings very attractive for building operators. The biggest energy consumers in a building are technical installations

and lighting fixtures, which account for 40 to 60 percent of total energy costs. This need not be the case. A refurbished building can reduce energy consumption by over 40 percent through optimizing the performance of its heating, ventilation and air-conditioning (HVAC) equipment. Furthermore the investment needed for these measures can be paid for from the savings in energy and operating costs.

Energy saving in buildings can be achieved with various measures:

Category	Measures, e.g.	Saving potential (%)	Pay back (years)
Building automation	▪ Installation and optimized tuning of energy functions ▪ Optimization during operation by ▪ Efficient use of BACS and weak point analysis ▪ Dynamic energy management	5-30	0-5
Techn. installations	▪ HVAC, refrigeration, lighting	10-60	2-10
Building envelop	▪ Insulation (windows, walls, roofs, etc.) ▪ Thermal bridges, construction physics	>50	10-60

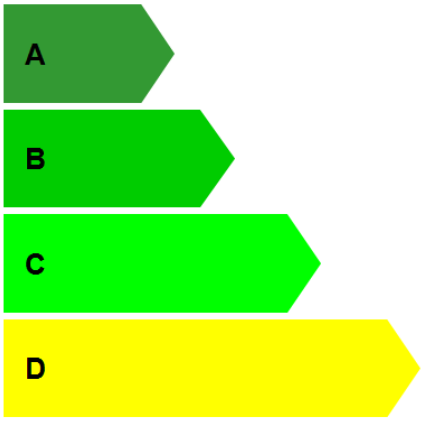
Building automation and control

Up-to-date measuring and control technology combined with a building automation and control system is a basis for good "building performance", which can be defined as the harmonious interplay of building architecture, system technology and indoor comfort. Despite the fact that most processes are "automated", scope for intervention by individuals is a key objective of modern building design strategies. New buildings should only be built with future-oriented low-energy standards and equipped with energy-saving building automation and control functions of BAC (Building Automation & Control). With regard to energy efficiency, we have to deal with a less-than-optimum building environment and do the best we can with the help of building automation and control.

Energy saving potential with building automation and control

Building automation and control systems are the building's brain. They integrate the information for all the building's technology and control the heating and cooling systems, ventilation and air conditioning plants, lighting, blinds as well as fire protection and security systems. The building's brain is thus the key for an effective check of energy use and all on-going operating costs. Intelligent and integrated building and room automation can produce considerable energy savings without reducing comfort. The higher the level of building automation, the bigger the possibility to derive energy saving from engineering systems. The European Norm EN 15232 ("Energy performance of buildings – Impact of building automation") and Russian GOST 54862-2011 developed on basis of the European Norm describe building automation effectiveness that fall into four energy-efficiency classes, from A to D.

BACS Energy Performance Classes



Class A:
- High energy performance BACS and TBM

Class B:
- Advanced BACs and TBM

Class C:
- Standard BACS (is normally used as reference)

Class D:
- Non energy efficient BACS

In the high energy-efficiency class A, for example, energy savings in office spaces can reach 30 percent in relation to the reference class C. The standards make it possible for building owners to evaluate the success of their optimization measures and realize potential savings.

Function list and assignment to energy performance classes – EN 15232

		Definition of classes							
		Residential				Non residential			
		D	C	B	A	D	C	B	A
Automatic control									
Heating control									
Emission control	The control system is installed at the emitter or room level, for case 1 one system can control several rooms								
0	No automatic control								
1	Central automatic control								
2	Individual room automatic control by thermostatic valves or electronic controller								
3	Individual room control with communication between controllers and to BACS								
4	Integrated individual room control including demand control (by occupancy, air quality, etc.)								

Building Automation and Control System (BACS) and Technical Building Management (TBM) have impact on building energy performance from many aspects. They provide effective automation and control of heating, ventilation, cooling, hot water and lighting appliances etc., that leads to increase of operational and energy efficiencies. Complex and integrated energy saving functions and routines can be configured on the actual use of a building depending on the real user needs to avoid unnecessary energy use and CO_2 emissions. Building Management System provides information for operation, maintenance and management of buildings especially for energy management – trending and alarming capabilities and detection of unnecessary energy use.

Room Control – the key to energy saving

The highest energy performance (Class A) can be achieved with high-quality room control. It allows to provide the accurate and energy efficient room climate and eliminate unnecessary readjustments

of the room temperature set-point. A set-point reduction of only 1°C generates energy savings of up to 6%. It ensures energy saving of up to 14%. If a room is to be kept at a constant temperature, internal heat sources (people, devices, lighting, solar radiation etc.) must be taken into account. During the entire heating season internal heat sources can be used as heating energy. Total Room Automation systems also control replacement of air on actual demand and lighting upon human presence. The demand response principle improves energy efficiency via feed-back from energy consumers in rooms to central energy generators in buildings.

Advantages for room occupants:

- Individual and comfortable room climate and optimal air quality
- Optimal and adequate lighting of work place
- Ability for easy and individual influence of the room climate and lighting

Advantages for Building Owner:

- Reliable, cost saving and energy efficient operation without limitation of the optimal room climate comfort
- Protection of the investment throughout the entire life cycle/

Interaction between HVAC, light & blind disciplines are a key factor to increase energy efficiency, room comfort and flexibility.

Intelligent buildings

The highest energy efficiency and comfort can be achieved in intelligent buildings. Such a building integrates intellectual subsystems for optimizing the entire chain of all energy-generation and energy-consumption components of a building, from the local alternative energy sources to individual consumers at workplaces. As the world's biggest single energy consumers, buildings offer enormous saving potential. They can be made more efficient by integrating into a smart grid and modern building automation systems. As intelligent and local participants on the grid, the buildings perform an important balancing function within the smart grid. Building operators and users benefit from this because it is cost-effective, reliable, environmentally friendly and future-oriented. Intelligent and sustainable solutions shape the buildings that are able to protect their users from outside influences and to ensure comfortable conditions.