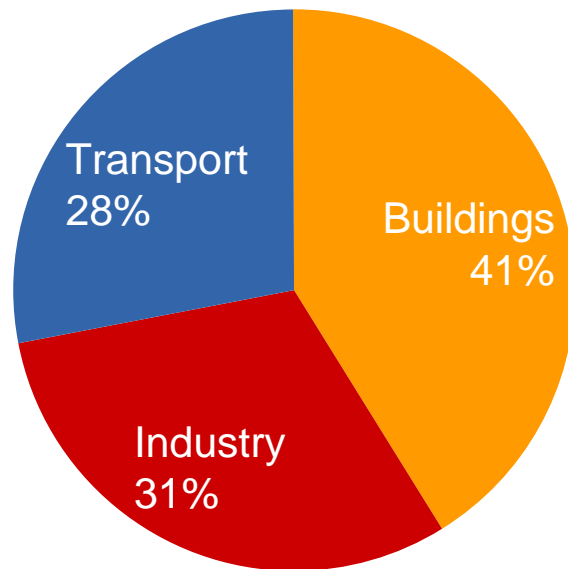


The impact of Building Automation on Energy Efficiency

Siemens with DESIGO and Synco
best in class

Energy is a major issue for the European Union

Primary energy use in Europe



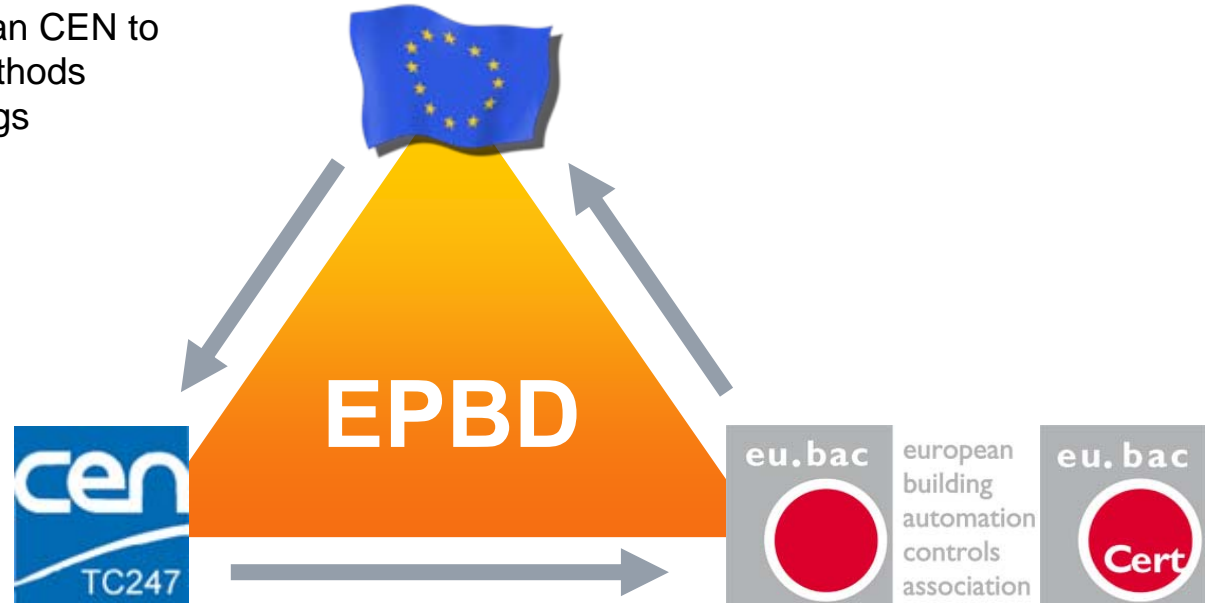
Impact of Building Automation

Efficiency improvement and modernisation can save up to 30 percent

- **Dependency**
Without provisions, dependency on external energy will rise to 70%
- **Environment**
Energy production and consumption create 94% of CO₂ emissions
- **Supply**
Influence on energy supply is limited
- **Cost**
Substantial increase within a few years

Legislation, standardization & certification

The EU mandated European CEN to standardise calculation methods for improving energy savings



CEN TC247

prepared and approved

- EN15232 impact of BACS functions on energy efficiency
- Product standards with energy performance criteria (e.g. EN15500)

eu.bac prepared the certification procedure and test method and proposed this certification to the European Community

CEN: European Committee for Standardization

EN: European Norm

EU and national legislation



SIEMENS

European Parliament and the Council on the Energy Performance of Buildings

European Union Directive for Energy
Performance of Buildings – EPBD

All EU-Members:

- Laws and Administrative regulations
- Calculation methods
- Energy certification of buildings

Starting 2006



Part L of the Building Regulations
and implementing the Energy
Performance of Buildings
Directive



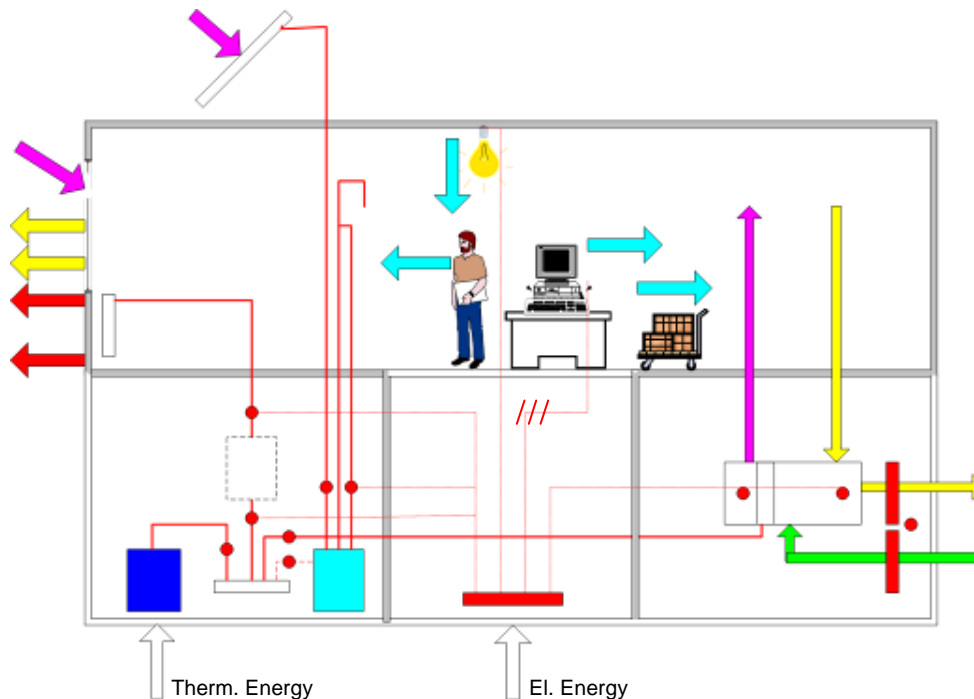
Energieeinspar-
verordnung –
EnEV

EPBD – Definition of Energy Performance of Buildings



SIEMENS

Energy performance of a building means the amount of energy actually consumed or estimated to meet the different needs associated with a standardised use of the building, which may include:



- Heating
- Hot water heating
- Cooling
- Ventilation
- Lighting
- Auxiliary energy

Standardisation related to energy efficiency



SIEMENS

EU mandate for CEN to standardise calculation methods for energy efficiency improvement

EN 15232 "Energy performance of buildings – Impact of Building Automation"

And

Product standards
(e.g. EN 15500, EN 12098)

- Terminology
- Product data's and **Energy performance criteria**
- Test procedure

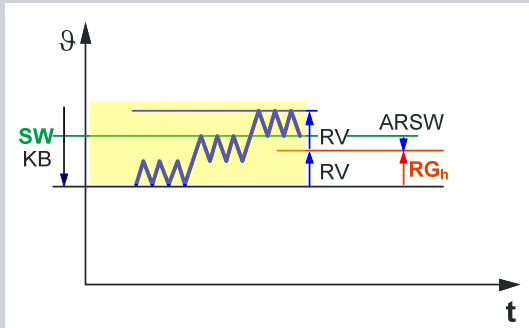


EU norms for Building Automation



SIEMENS

Product



EN 15500

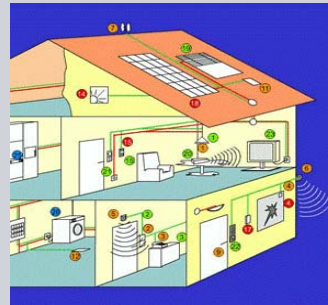
Electronic individual zone control equipment

EN 12098

Control equipment for hot water heating systems

Products are certified by eu.bac

System



ISO EN 16484

Building automation and control systems, incl. BACnet protocol

ISO/IEC DIS 14908

LonTalk protocol

EN13321, EN50090

KNX protocol

EN 15232

Impact Building Automation on energy efficiency

Building



European Directive

2002/91/EC

Main legislative instrument to achieve energy performance in buildings

BACS* are the brain of the building



SIEMENS

BACS monitor, optimise, interlock and control

- Heating systems,
- Air conditioning systems,
- Cooling systems,
- Lighting systems and blinds,
- Fire and security systems,
- Lifts, etc.

In fact BACS integrate the most important information of technical equipment in the building and act as a central point or "Brain" of the building



BACS functions influence

- The calculation of planned energy efficiency
- The real use of energy

* BACS: Building Automation and Controls System

Calculation procedures based on BAC efficiency factors – EN 15232



SIEMENS

BACS Energy Performance Classes



Class A:

- High energy performance BACS and TBM

Class B:

- Advanced BACs and TBM

Class C:

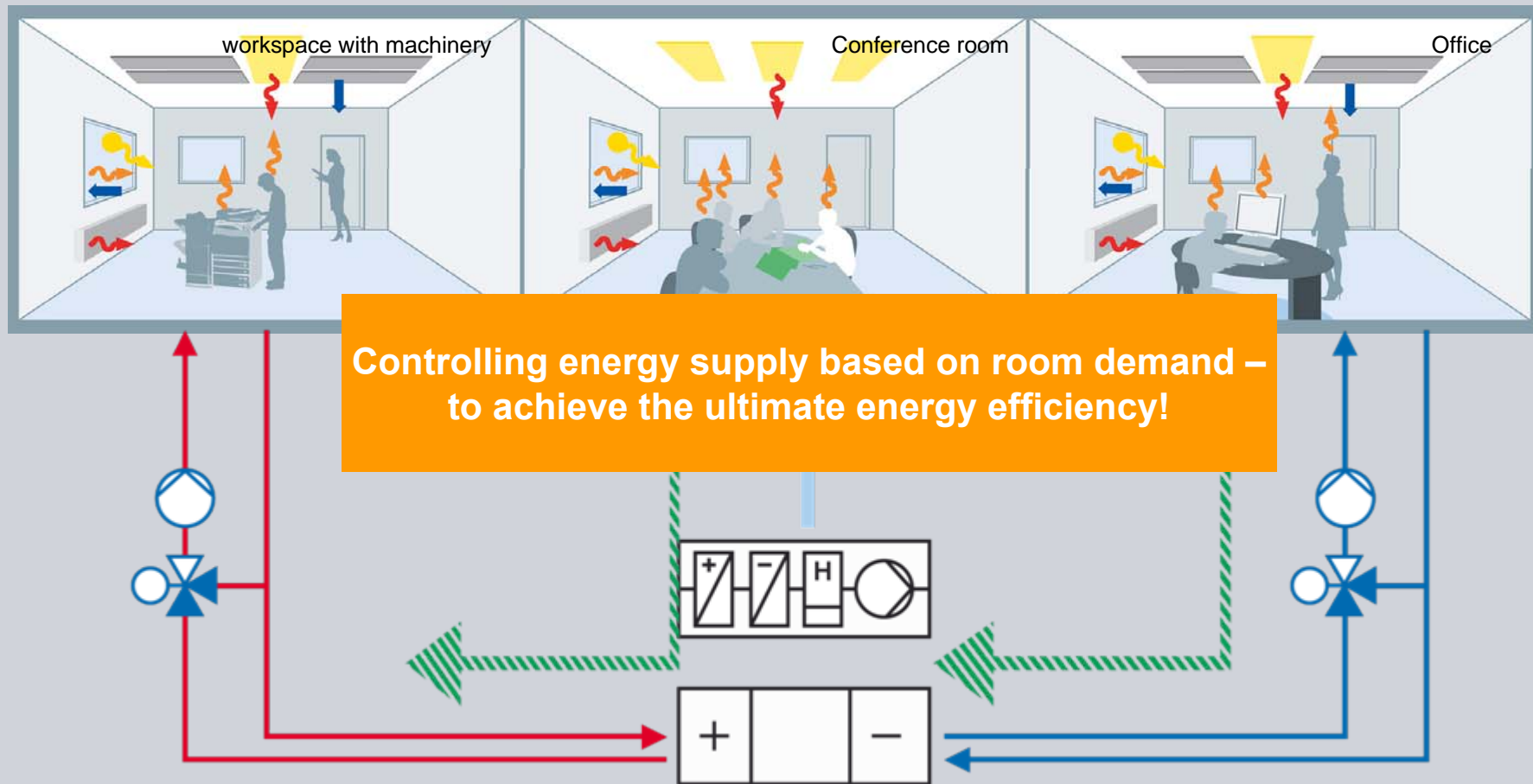
- Standard BACS
(is normally used as reference)

Class D:

- Non energy efficient BACS

Energy efficiency under EN 15232: Targeting integrated room automation

→ Demand control



Function list and assignment to energy performance classes – EN 15232



SIEMENS

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.)						
Control of distribution network hot water temperature (supply or return)							
Similar function can be applied to the control of direct electric heating networks							
0	No automatic control						
1	Outside temperature compensated control						
2	Indoor temperature control						

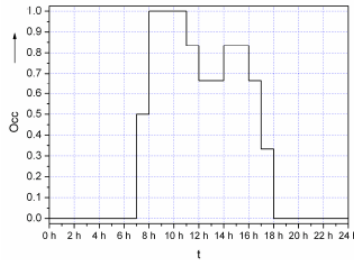
Unless differently specified by public authorities the minimum level of functions to be implemented corresponds to class C. Public authorities wishing to modify the minimum requirements shall adapt this table.

BACS efficiency factors determined for different user profiles

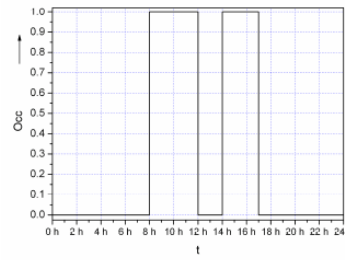


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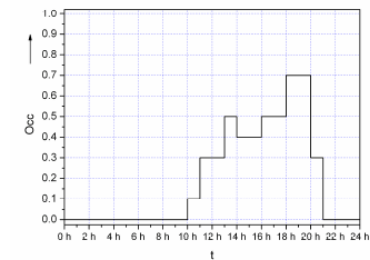
Office



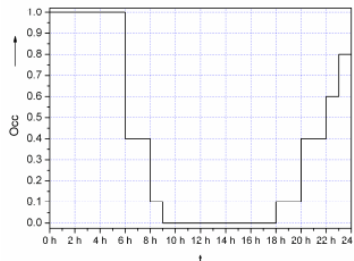
School



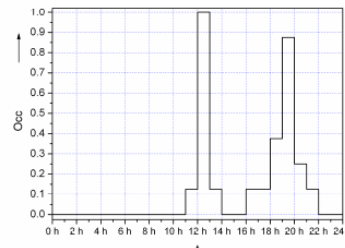
Wholesale centre



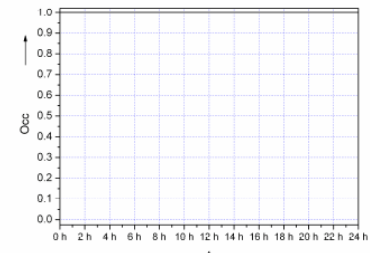
Hotel



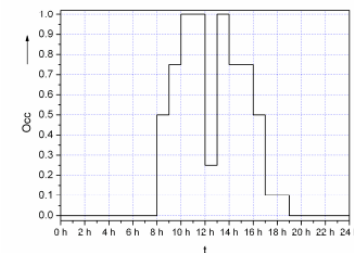
Restaurant



Hospital



Lecture hall



User profiles as defined by EN 15232

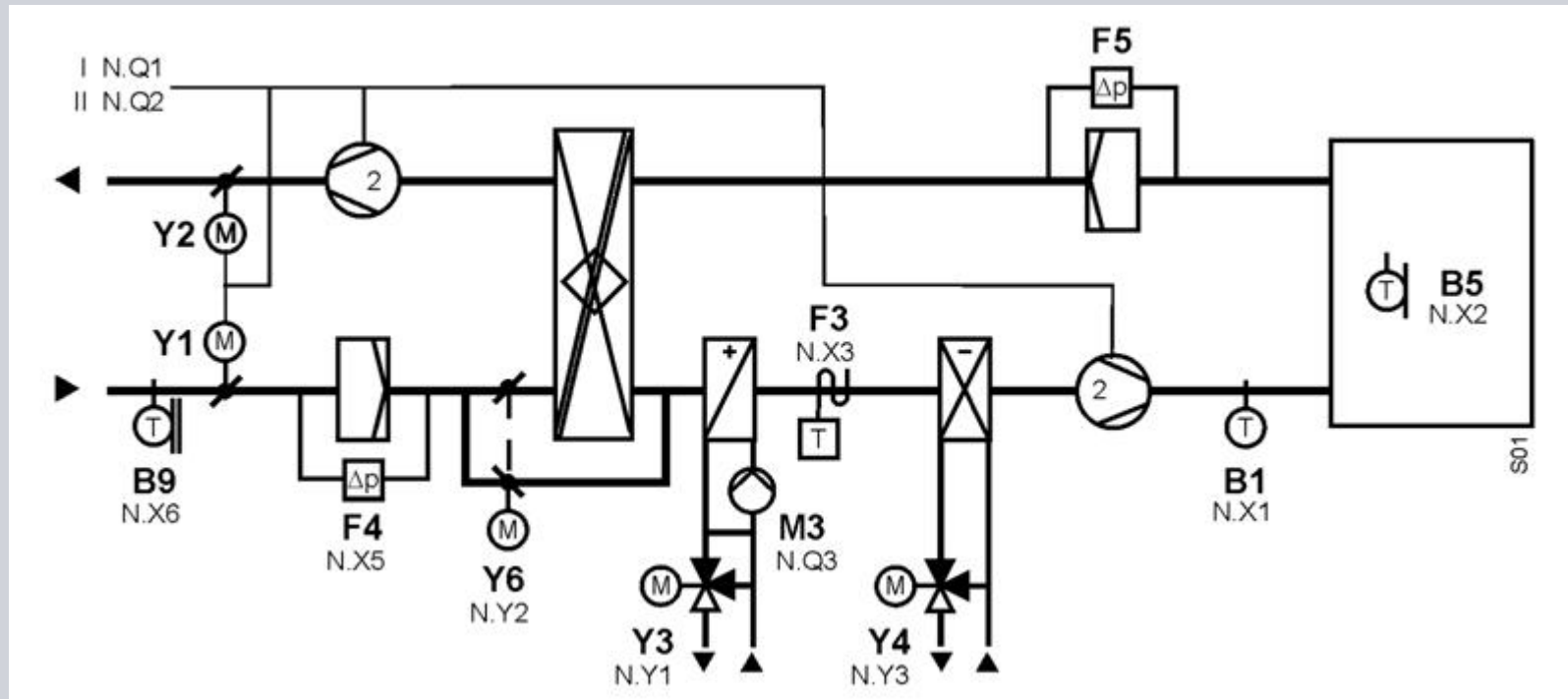
BACS efficiency factors – EN 15232



Class	Thermal energy				Electrical energy			
	D	C	B	A	D	C	B	A
Offices	1,51	1	0,80	0,70	1,10	1	0,93	0,87
Lecture hall	1,24	1	0,75	0,50	1,06	1	0,94	0,89
Education	1,20	1	0,88	0,80	1,07	1	0,93	0,86
Hospitals	1,31	1	0,91	0,86	1,05	1	0,98	0,96
Hotels	1,31	1	0,85	0,68	1,07	1	0,95	0,90
Restaurants	1,23	1	0,77	0,68	1,04	1	0,96	0,92
Wholesale & retail	1,56	1	0,73	0,60	1,08	1	0,95	0,91
Residential	1,10	1	0,88	0,81	1,08	1	0,93	0,92

Example: Ventilation plant restaurant

Schematic diagram



Example: Ventilation plant restaurant

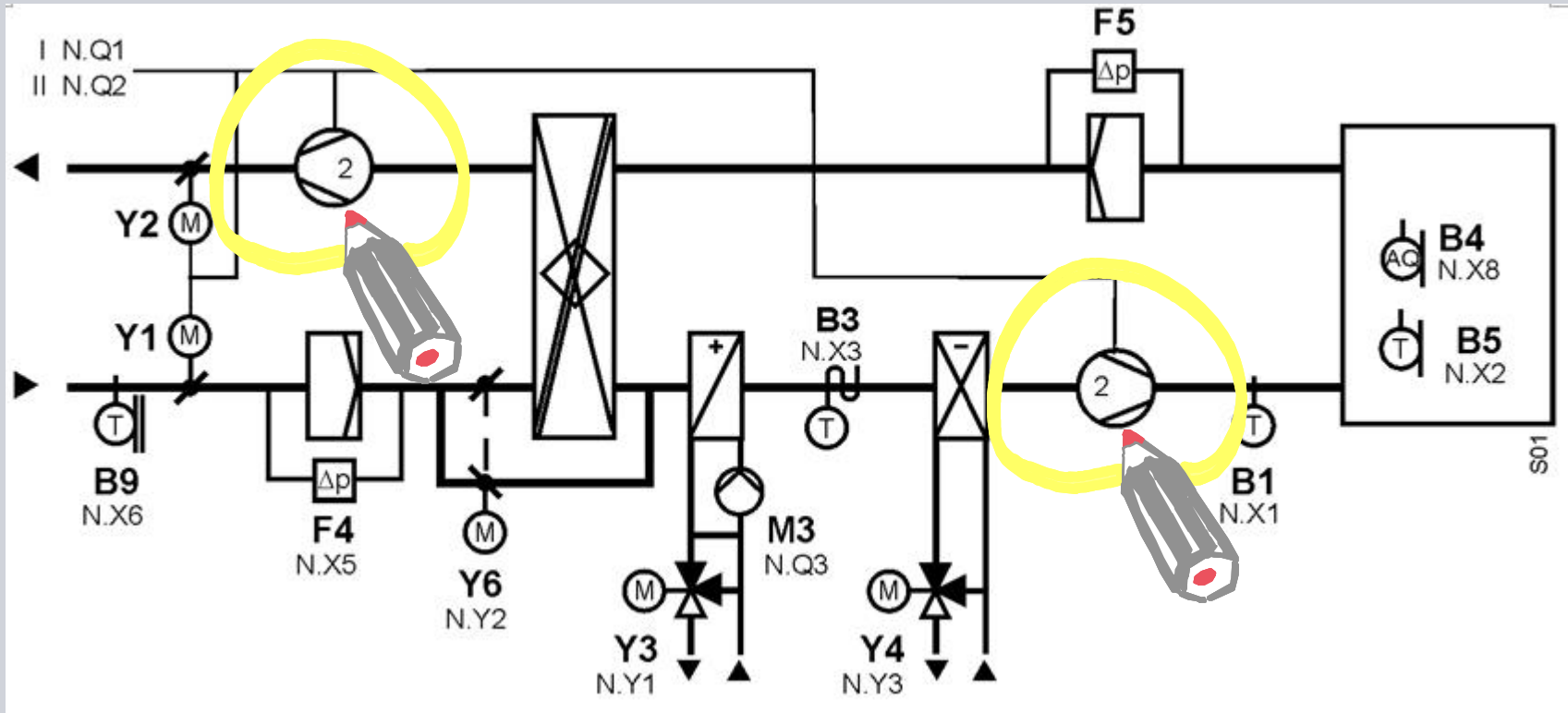
VENTILATION AND AIR CONDITIONING CONTROL		BT	Definition of classes										
			Residential				Non residential						
			D	C	B	A	D	C	B	A			
Air flow control at the room level		9, 10											
0	No control												
1	Manual control												
2	Time control												
3	Presence control												
4	Demand control												
Air flow control at the air handler level		11											
0	No control												
1	On off time control												
2	Automatic flow or pressure control with or without pressure reset												
Heat exchanger defrost control		12											
0	Without defrost control												
1	With defrost control												
Heat exchanger overheating control		13											
0	Without overheating control												
1	With overheating control												



Example: Ventilation plant restaurant

Air flow control

Variable speed drive instead of fan 2-stage



Example: Ventilation plant restaurant

VENTILATION AND AIR CONDITIONING CONTROL		BT	Definition of classes										
			Residential				Non residential						
			D	C	B	A	D	C	B	A			
	Air flow control at the room level	9, 10											
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	Heat exchanger defrost control	12											
0	Without defrost control												
1	With defrost control												
	Heat exchanger overheating control	13											
0	Without overheating control												
1	With overheating control												



eu.bac – Certification for BACS



SIEMENS

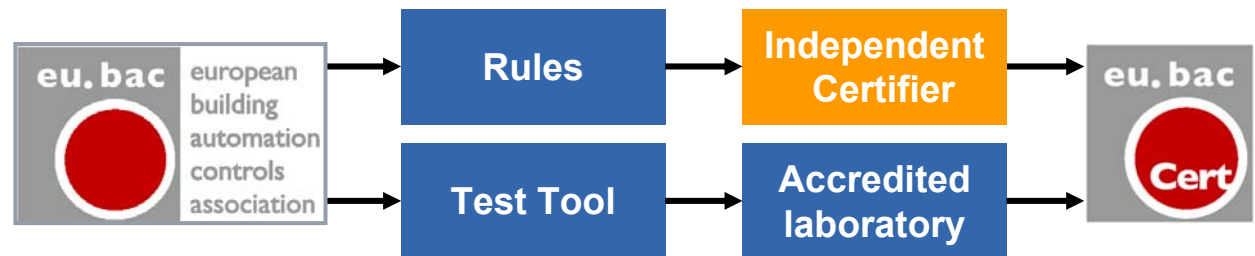
EU Mandate for CEN to standardization of Calculation methods for energy efficiency improvement

TC247: EN 15232
"Energy performance of buildings – Impact of Building Automation"

and

Product Standards

- Terminology
- Product data's incl. energy performance criterias
- Test procedure



Why eu.bac?



SIEMENS

The European BACS industry joined forces and competences to propose practical solutions:

- For the reduction of greenhouse gas emissions in buildings
- For a European Quality Assurance system for energy efficient building automation and controls equipment
- For the introduction of a legal framework for energy savings performance contracting in buildings
 - Based on eu.bac Cert equipment and systems



Initiated by Siemens and first presidency

eu.bac Cert Implementation plan



SIEMENS

First certified products in September 2007

- Individual zone controllers
- Stepwise release of various applications (e.g. hot water radiator heating, chilled ceiling, VAV etc.)

Further products under pre- paration by eu.bac

- Heating controllers incl. optimiser
- Field components (temperature sensors, valves and actuators, etc.)
- Building Automation Systems




Schweiz AG
The eu.bac mark for the product
RXC21.1
Application(s)
Unit System
Operation rules of eu.bac
Certificate 02002
Date on 29 October 2012



K. Brandt
Managing Director Winfried Brandt
eu.bac
European Building Automation and Controls Association - eu.bac
Frankfurt am Main - Germany



Test Report Summary

Product Information	
License Number:	020705
Licensee:	Siemens Schweiz AG
Product Family and Model Number	Designo RXC21.1
Test Specifications	
Tested Application:	Fan coil unit system 4 pipes
Temperature Sensor:	
- Type:	NTC 10 Kohms
- Time Constant:	8 min
Actuator:	
- Type:	Motoric
Valve	
- Characteristic:	Exponential
Test Result	
Temperature Control Accuracy CA	Heating mode 0,2 K Cooling mode 0,1 K

31 March 2008
Frankfurt am Main


 Managing Director Winfried Brandt
eu.bac

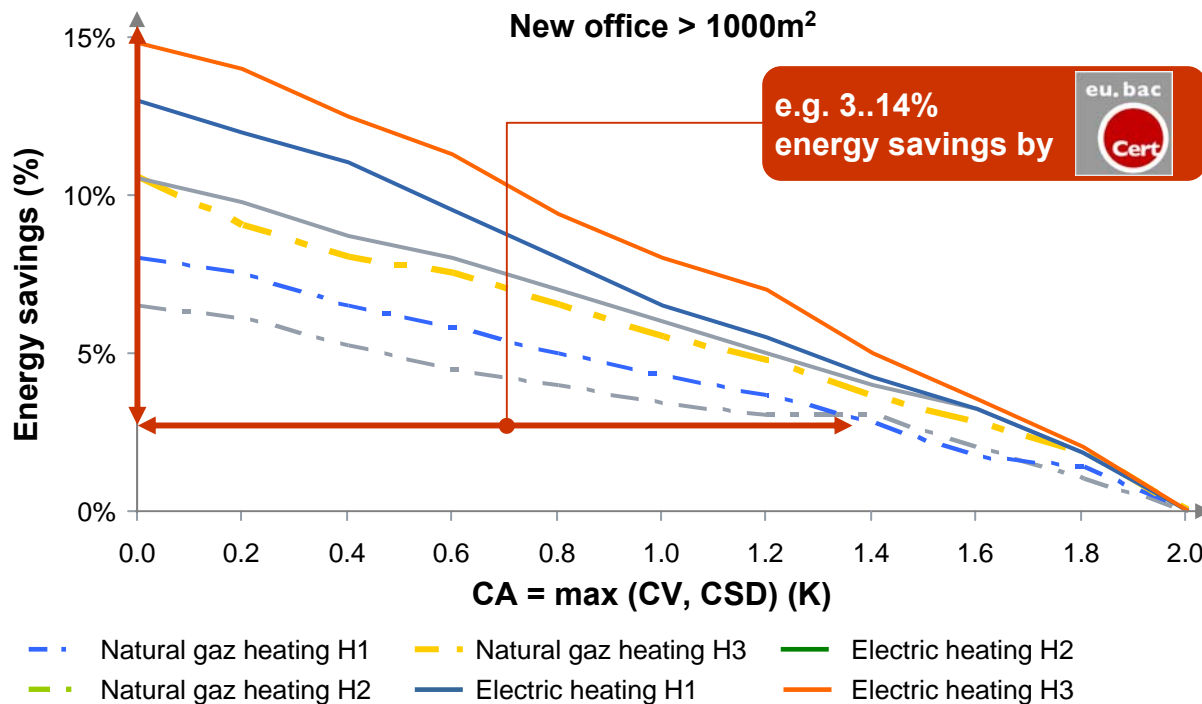
european building automation and controls Association - eu.bac
 Lyoner Straße 18 - 60528 Frankfurt am Main - Germany

Impact on energy savings of high quality room controllers

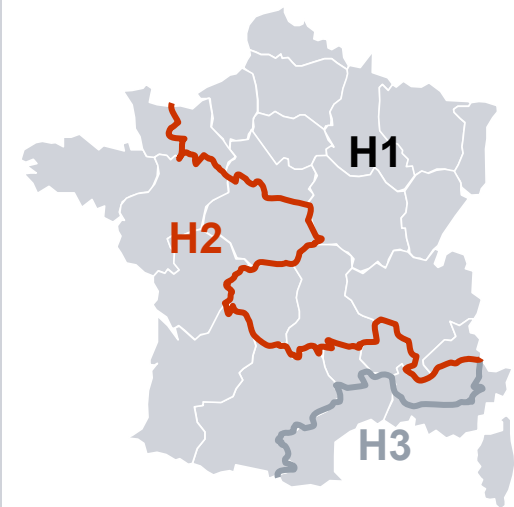


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Energy savings



France



Temperature control accuracy compliancy CA:

- Eu.bac: $\leq 1.4K$ (radiator heating)
- EN15500: $\leq 2.0K$

Siemens Building Technologies ...

- Achieves EN 15232 efficiency class A and eu.bac Cert with high performance
- Delivers even higher system functionality than required under energy performance class A (EN15232)



Siemens grants for EN 15232 efficiency class A and eu.bac Cert with high performance

SIEMENS

Synco living

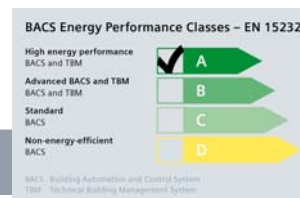
Synco700

DESIGO

Management level

Energy efficiency functions:

- Energy consumption report
- Alarm and status reports
- Trend reports
- Easy-to-use time schedulers, set points, etc.



Automation level

- Generation control with variable temperature dependent on outdoor temperature or load
- Sequencing of diff. generators based on various inputs
- Interlock heating / cooling
- Optimum start / stop
- H,x directed control
- Individual room control with central operation and data link to primary heating or cooling plant



Field level

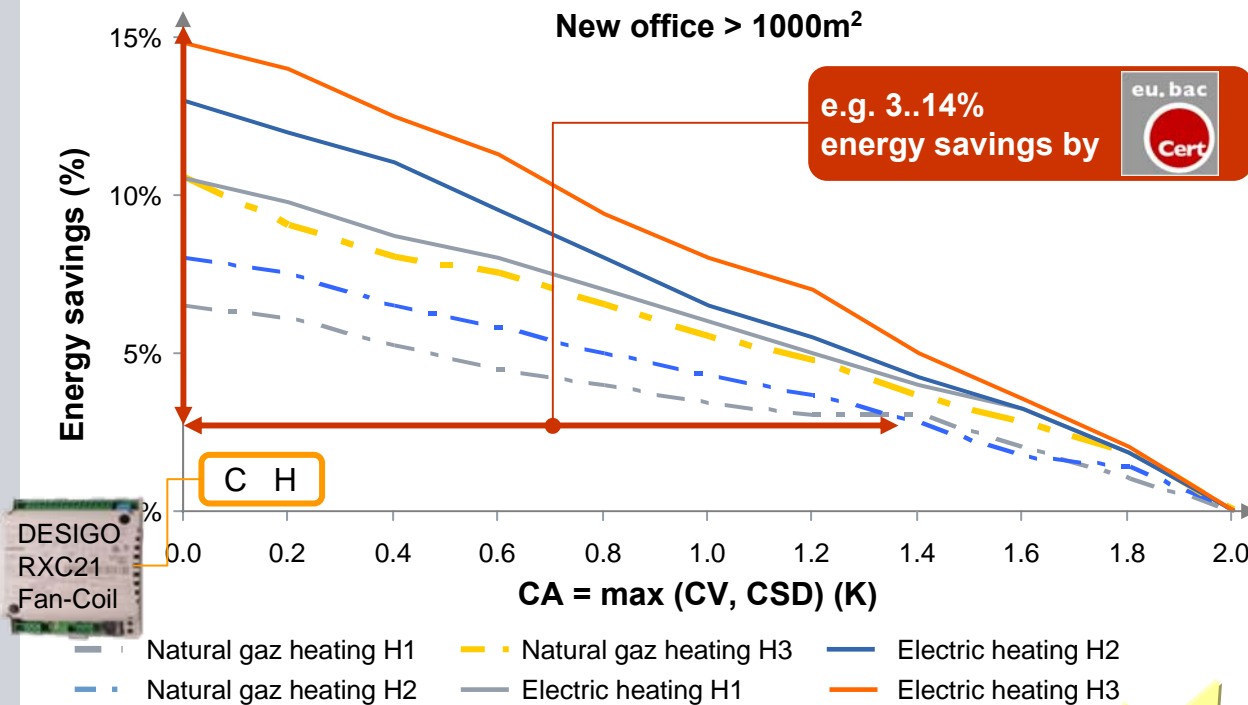
- Demand control with CO₂ or presence sensors
- Lighting and blinds control
- Variable speed pump and fan control



Test results for Siemens room controllers

Example: Fancoil with motoric actuator

Energy savings



Temperature control accuracy compliancy CA:

- Eu.bac: $\leq 1.4K$
- EN15500: $\leq 2.0K$

Best in class

DESIGO™ RX



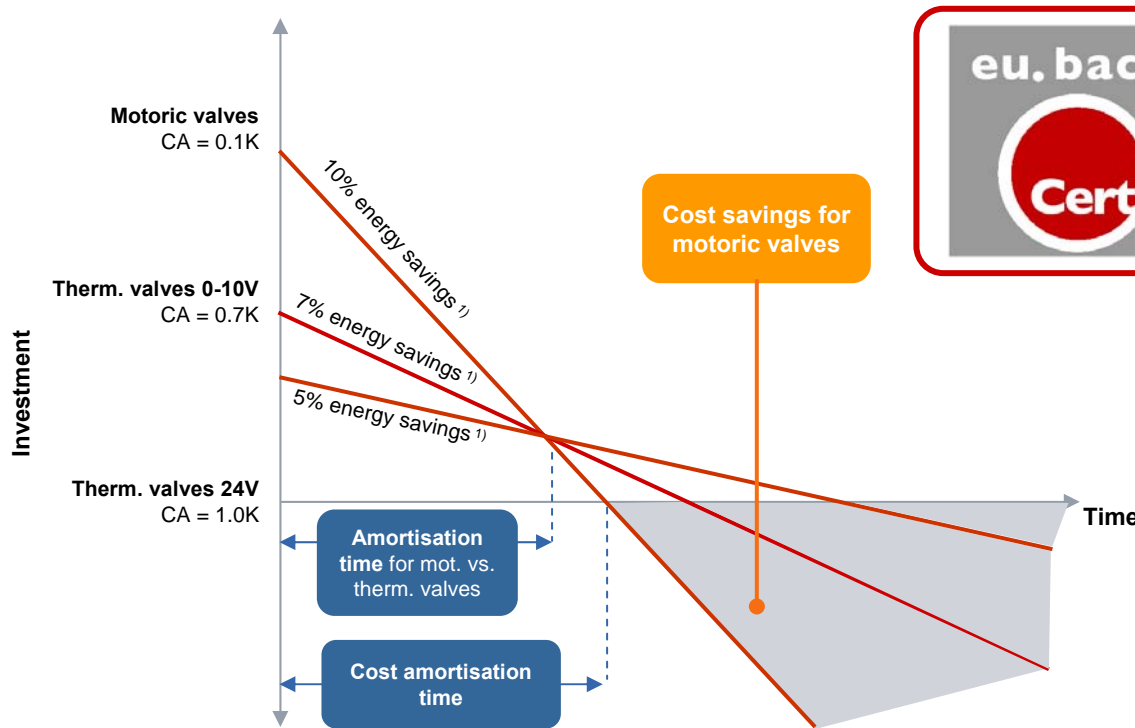
eu.bac



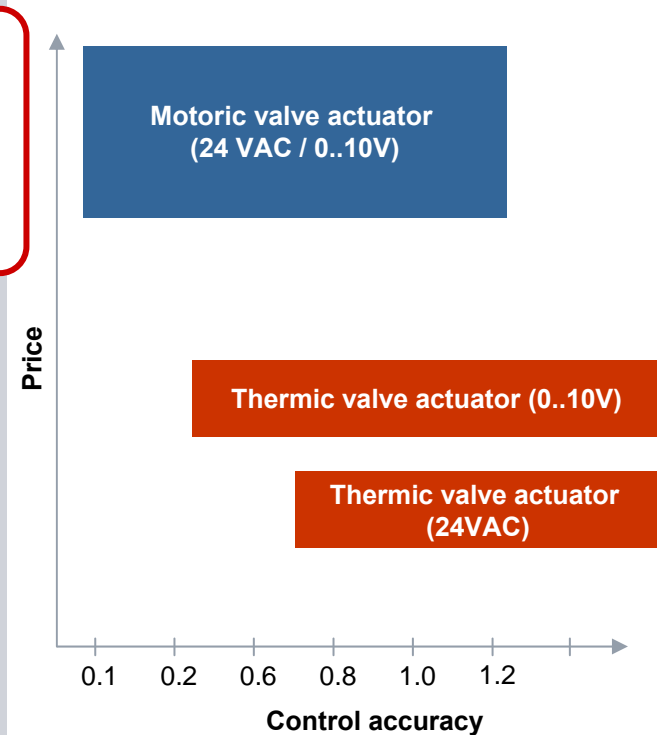
eu.bac Certification

Amortisation time & cost savings

Amortization time



Positioning of actuators



1) Compare to EN 15500 for natural gaz heating in South France

DESIGO™ V4

Predictive and adaptive heating controller

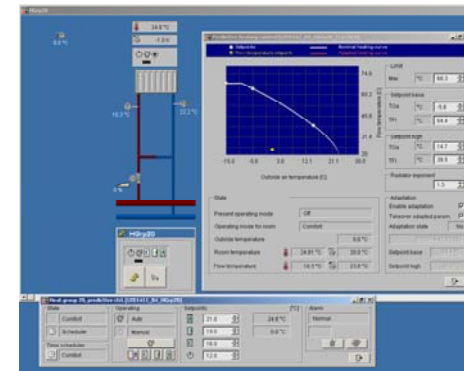
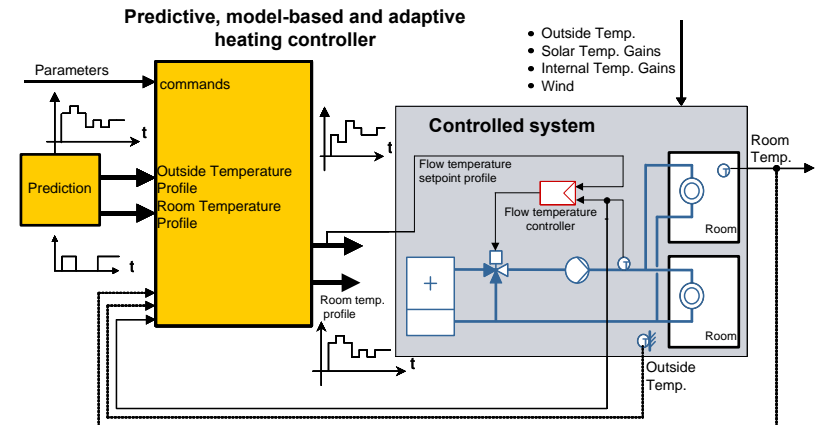


Solution:

- Outside temperature prediction (integrated)
- Model-based optimisation of supply water temp.
- Start / stop optimisation
- Adaptation of model parameters, incl. adaptive heating curve
- Optimization of supply water temp. set point for min. energy consumption without sacrificing comfort

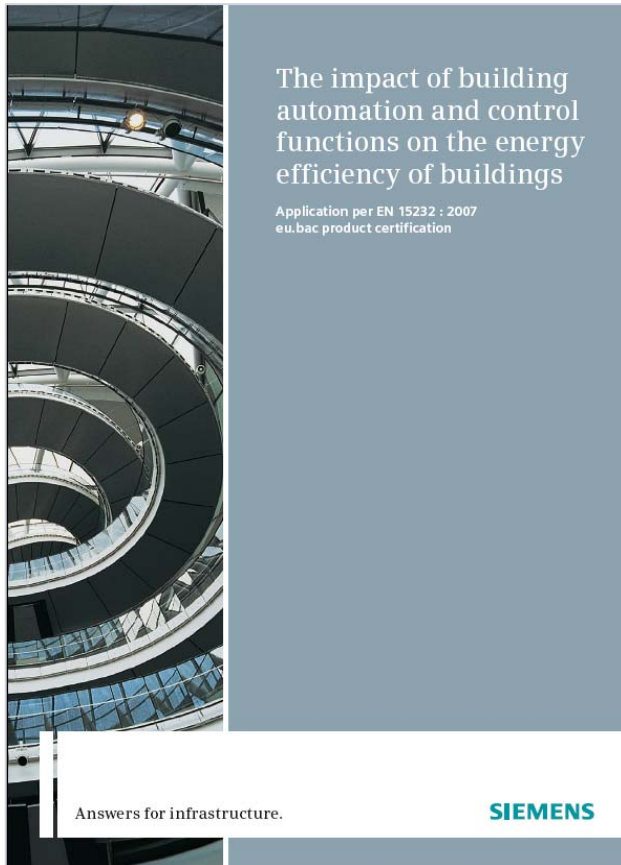
Benefits:

- ✓ Comprehensive control concept
- ✓ Comprehensive functionality with few settings
- ✓ One (fully adaptive) function to replace conventional solution consisting of separate functions (Heating curve, heating release algorithm, optimum start stop control)
- ✓ Proven standard solution



A new Siemens brochure: Supports the Building Automation planning phase

SIEMENS



CM110854

Target groups:

All persons involved in planning phase of buildings and specifically Building Automation

Target and benefits:

- To become familiar with EN 15232 "Energy performance of buildings" – "Impact of Building Automation, Controls and Building Management"
- To become familiar with the benefits of product certification by eu.bac (European Building Automation Controls Association)
- To be able to select the BAC functions according to their impact on energy efficiency of buildings

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Siemens EPC Tool - supports classification of Building Automation and Controls Systems



BACS Energy Performance Classification Tool

According to European Norm EN 15232

BACS Energy Performance Class - EN 15232

High energy performance

BACS and TBM

A

Advanced

BACS and TBM

B

Standard

BACS

C

Non energy efficient

BACS

D

BACS Building Automation System
TBM Technical Building Management System

The European standard EN15232 "Energy performance of buildings - Impact of Building Automation, Control and Building Management" is one of a set of CEN standards, developed within a standardization project sponsored by the European Community, whose aim is to support the Directive of Energy Performance of Building (EPBD) to enhance energy performance of buildings in the member states of the EU.

It specifies methods to assess the impact of Building Automation and Control System (BACS) and Technical Building Management (TBM) functions on the energy performance of buildings, and a method to define minimum requirements of these functions to be implemented in buildings of different complexities as follows:

- A structured list of control, building automation and technical building management functions which have an impact on the energy performance of buildings.
- A method to define minimum requirements regarding the control, building automation and technical building management functions to be implemented in buildings of different complexities.
- Detailed methods to assess the impact of these functions on the energy performance of a given building. These methods enable to introduce the impact of these functions in the calculations of energy performance ratings and indicators calculated by the relevant standards.
- A simplified method to get a first estimation of the impact of these functions on the energy performance of typical buildings.

Basic Information

Selection

Building Type

Office

This tool is a "wizard" that enables you to assess the BACS Energy Performance Classification of your building. The wizard screens allow you to select what type of energy generation and control equipment is (or will be) installed in the building. The tool can make two assessments: i) the BACS classification of the building today, and ii) the future classification if equipment upgrades are made. Finally the tool estimates how much energy and CO₂ emissions could be saved when you invest in such upgrades, and shows the payback period and the financial net present value.

Start the wizard, by selecting your Building Type ▲ in the box above, and then press the "Next" button below ▼

Language

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Next ►

Conclusions

Impact of building automation on energy efficiency



Typical categorization of energy saving potentials in buildings

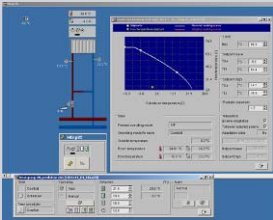
	Category	Measures, e.g.	Saving potential [%]	Amortisation [years]
	Building automation	<ul style="list-style-type: none"> Installation and optimised tuning of energy functions Optimisation during operation by <ul style="list-style-type: none"> efficient use of BACS and weak point analysis dynamic energy management 	5-30	0-5
	Technical installations	<ul style="list-style-type: none"> HVAC, refrigeration, lighting Controls, motors, actuators, Power generation 	10-60	2-10
	Building envelope	<ul style="list-style-type: none"> Insulation, windows Thermal bridges, construction physics 	>50	10-60

Conclusion: Invest first in building automation and control!
 → Results in highest ROI quickly

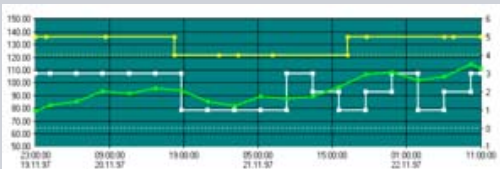
Building automation and building management life cycle

Adapt the operational parameters

Decide on additional automation



Monitor and analyze the building operation and technical installations



Specify and install energy functions with BACS (EN15232) and devices with

	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 class 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.)							✓	
Control of distribution networks (hot water temperature (supply or return) similar function can be applied to the control of direct electric heating networks)									
0	No automatic control								
1	Outside temperature compensated control								
2	Indoor temperature control							✓	

Conclusions about optimizing building operation

Even with building automation, you still need

- To identify optimisation potential
- To know the synergies between the building, the technical installations, the environment and the user
- To master guidelines, directives and laws
- A willingness to constantly face new challenges!

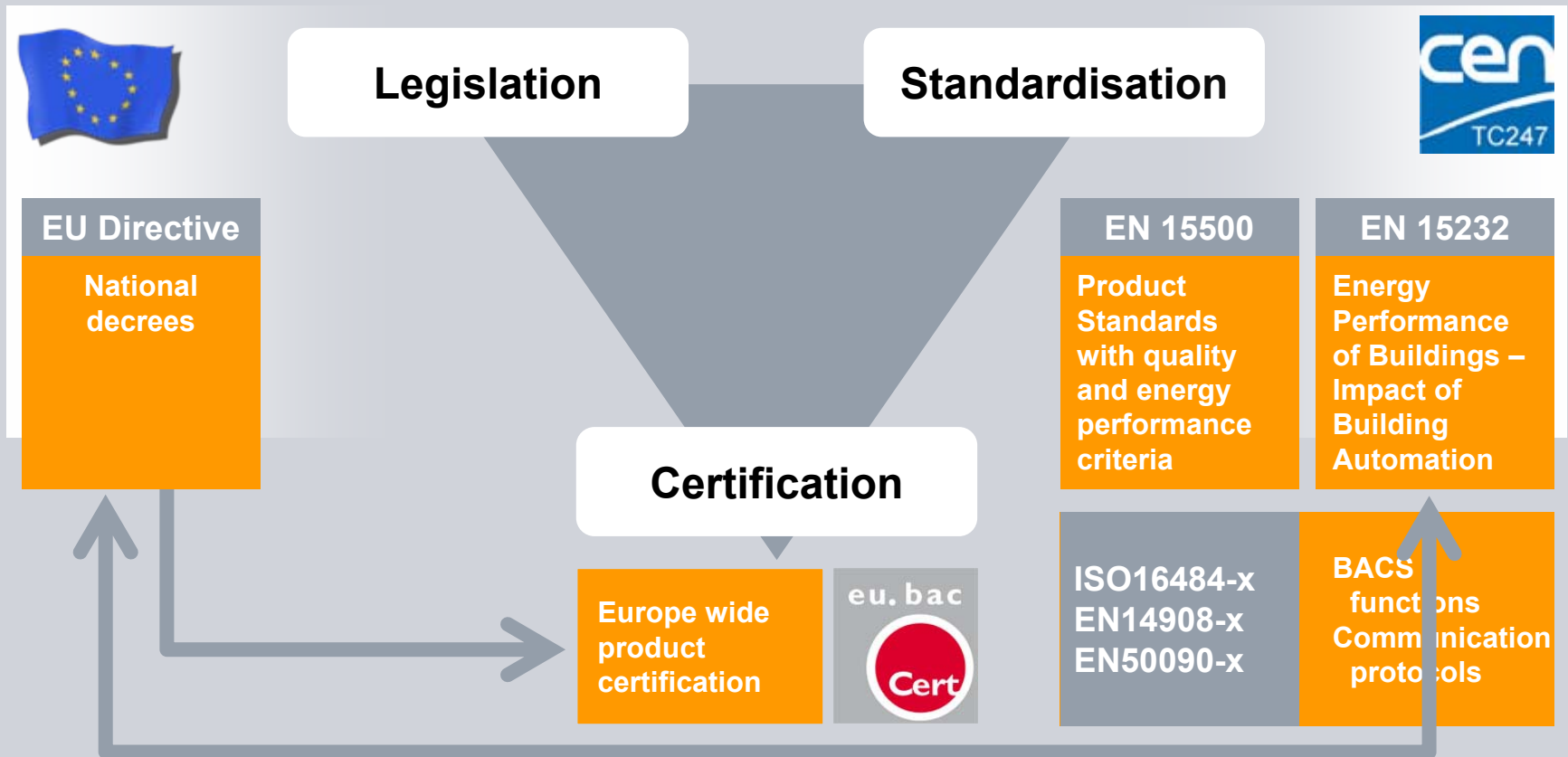
The brain is still sitting in front of the monitor!!



Summary: Legislation – Standardization – Certification



SIEMENS



Building Automation industry can highlight the value of BACS

The value of BACS = Saving potentials by intelligent use of Building Automation (EN 15232)

SIEMENS

Hotels



Th.32% EI.10%

Education



Th.20% EI.14%

Hospitals



Th.14% EI.4%

Residential



Th.19% EI.8%

Restaurants



Th.32% EI.8%

Shopping C.



Th.40% EI.9%

Offices



Th.30% EI.13%

Determined by means of building simulation / FH Aachen DE

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Siemens reference project: City of Boras, Sweden – school campus Erikslund

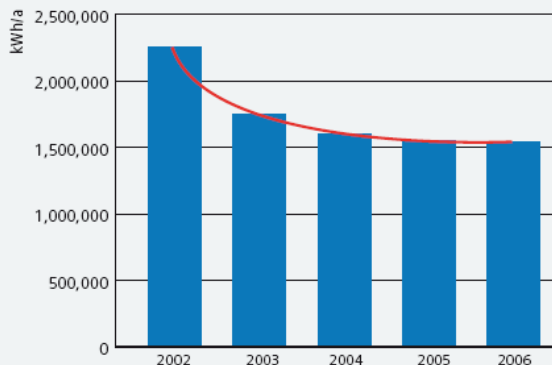
SIEMENS

Measures taken:

- Control parameters and set point values optimized, time programs adjusted
- Demand controlled energy production; The district heat connection was turned off during the summer months
- non-functioning dampers replaced, that were letting in too much fresh air

School for
1'100 students
with heated area
of 12'600 m²

Development of heat consumption form 2002 to 2006
(Weather Adjusted)



Result:

Energy reduction for
Heating (DGD adjusted):
707'000 kWh → 32%
Electric:
100'000 kWh → 14%
CO₂: - 824t

Amortisation < 1 year

Siemens reference project: Hospital in Belgium - Algemeen Stedelijk Ziekenhuis Aalst

Polyclinic: 5'000 m²

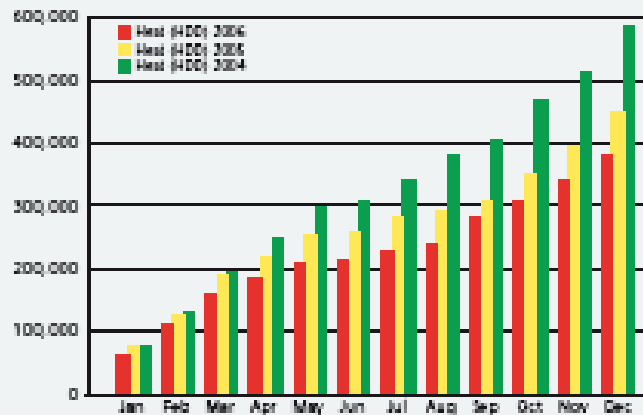
Measures taken :

- Set point values and time programs adjusted
- Optimized control of the heat exchangers, pumps and valves
- Implementation of an OSTP algorithm
- Improved control strategy for cooling generation and distribution



Amortisation 6 months

Heat consumption (HDD corr.) year comparison cumulative (in kWh)



Result:
 Energy reduction for
Heating (DGD adjusted):
341'098 kWh → 35.7%
Electric:
295'376 kWh → 15.8%
CO2: - 22%

Ian Ellis

Marketing Manager

Control Products & Systems

President – Building Controls Industry Association

Sir William Siemens Square, Frimley, GU16 8QD

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E-Mail: ian.ellis@siemens.com