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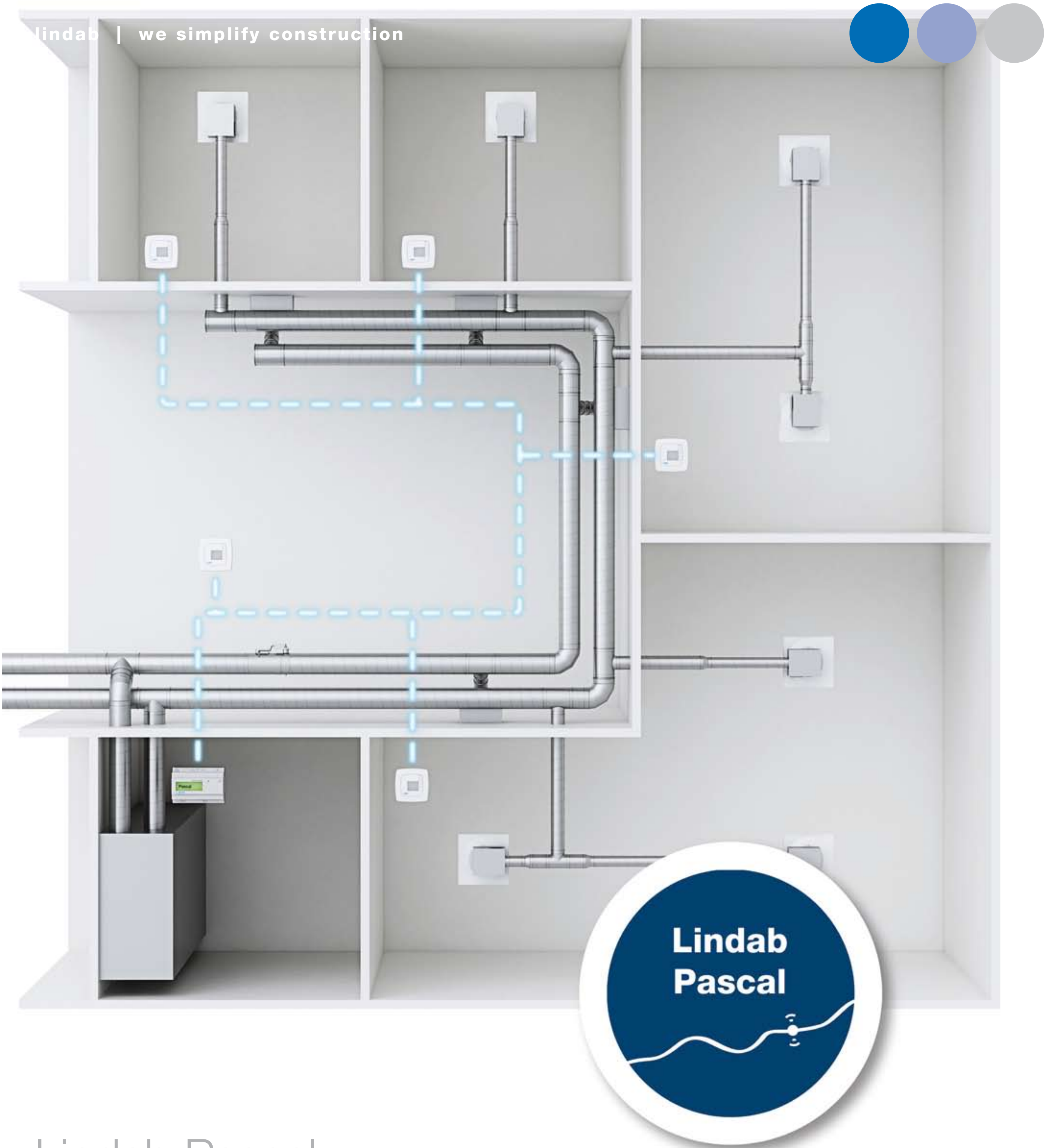

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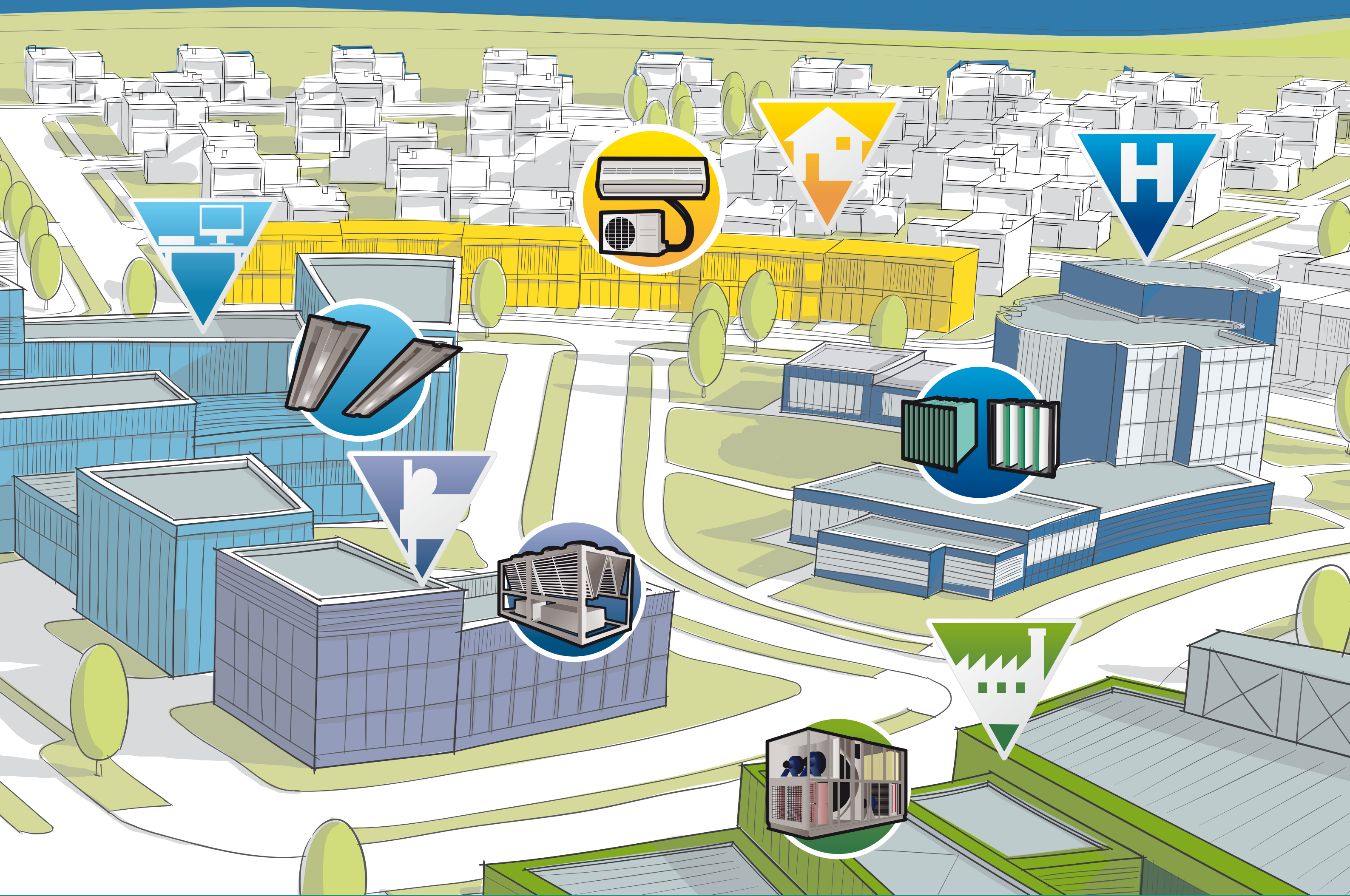

The European Parliament voted for binding energy efficiency targets

OLLI SEPPÄNEN
Professor
Editor-in-chief

The European Commission has proposed the EU climate and energy policy framework for 2030, which sets a target to reduce greenhouse gas (GHG) emissions by 40% below the 1990 level but abandons binding targets for energy efficiency and renewables. These targets have guided R&D work in the building sector for more than 10 years. Abandoning the energy efficiency target could stop the progress and destroy the leadership of the European industry.

REHVA and many other professional organisations are deeply concerned about the EC proposal. After the release of the proposal, REHVA Technical Committee quickly prepared 'the REHVA position paper on the European Commission 2030 climate and energy policy'. It is published on page 48 and was sent to members of the Parliament and several Directorates in Brussels. The position paper says, "REHVA is deeply concerned about the lack of binding targets for energy efficiency, and strongly believes that only with the three balanced and ambitious targets for GHG, renewables and energy efficiency it is possible to ensure a successful overall climate and energy framework for Europe for 2030 and beyond".

The Parliament and its important ENVI and ITRE did not agree with the proposal of the Commission; instead, they requested in their report for more stringent binding targets in the future EU energy policy. The proposal of the Commission will still be discussed during the spring in the European Council, and also at the new Parliament later this year. It is important that Member States take a position that supports the continuing policy for better energy efficiency of buildings with binding targets, and that REHVA members in EU support this position in their countries. Europe has claimed to be a leading body in the fight against climate change, and it should keep this position. In many cases the saved energy is the cheapest, and brings at the same time new innovations and job opportunities.

Implementation of directives takes time, and it is important to give time to Member States. The EU policy has to be consistent and farsighted. Implementation may be slow, but the issue is extremely difficult as all Member States have their own national legislation and standards. Cooperation and harmonisation are needed. The EPBD directive requires the MS to set targets for Nearly Zero Energy Buildings. The summary on page 6 shows huge variation of targets between the MS. Harmonisation is needed, at least to specify which segments of energy use are included in the target numbers and what units are used.

An important step towards harmonised implementation was taken when the Commission gave a mandate to CEN to revise the EPBD standards. The work is now in progress in several working groups with more than 100 working items, preparing more than 40 EBPD related standards, which will be drafted by April and published for comments after the summer. Final voting is expected in spring 2015. It is important for these standards to be approved, as they are valuable tools for national implementation of EPBD and a step towards common European practice.

REHVA now has an official liaison position in CEN (see page 49) and has the opportunity to participate in the work in various working groups. This is an opportunity for REHVA to have an independent, professional impact on the European standards.

nZEB definitions in Europe

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Within European neZEH project, national nZEB definitions were collected. Ten available definitions revealed to be remarkably different by content and ambition level. Not all of them were based on primary energy, and values between 20 and 200 do not allow meaningful comparison. The situation calls for European level guidance and shows the need to harmonize basic principles of energy calculations.

Keywords: nearly zero energy buildings, cost optimality, energy use, energy performance, energy targets.

From cost optimal performance to nZEB

Cost optimal calculations according to European methodology [1] were reported in last year and presented in EPBD Concerted Action meeting in October. The results were consistent as the performance levels of optimal solutions were quite similar in countries with similar climate. The coherence among results obtained by different institutions in different countries demonstrates the power of European delegated regulation that provided a common calculation methodology at the EU level – harmonization happened immediately and most of Member States (MS) were capable to conduct a large set of demanding calculations with many combinations. However, the philosophy of cost optimality as a first step towards nZEB seems not fully utilized in MS. Cost optimal calculations included high efficiency and renewable energy cases, relevant for the definition of nZEB, but the results of the calculations and analysis have not had much effect on the national nZEB defintions. In fact, the similar coherency cannot be found among the national applications of the definition of nZEB submitted by MS in last year. This was done as a part of national plans for increasing the number of nZEBs where MS were required to report the detailed application of the definition of nZEB including a numerical indicator of primary energy expressed in kWh/m² per year. Based on these national plans, the Commission published a progress report of nZEB 7.10.2013 [2] highlighting that 10 MS had more or less a full definition in place. More detailed information was available from the report of the EPBD Concerted Action meeting [3] and also from national codes, where some countries have already included nZEB values.

Based on these references, the available data of nZEB definitions was grouped according to ECOFYS classification [4] into five European climate zones as shown in **Figure 1**, in order to study the variation in primary energy values and other relevant parameters within comparable climate zones.

National nZEB definitions

An overview of the currently available definitions is shown in **Table 1**. The data covers primary energy and renewable energy share (RES) indicators, as well as inclusion of energy flows in different building types. The majority of countries (7 out of 10) are using primary energy indicator, but in some cases it covers only heating. In 3 countries out of 10, all major energy flows are included, i.e. in these countries the calculated energy use is comparable to measured energy use. In the rest of countries, mainly appliances and also lighting

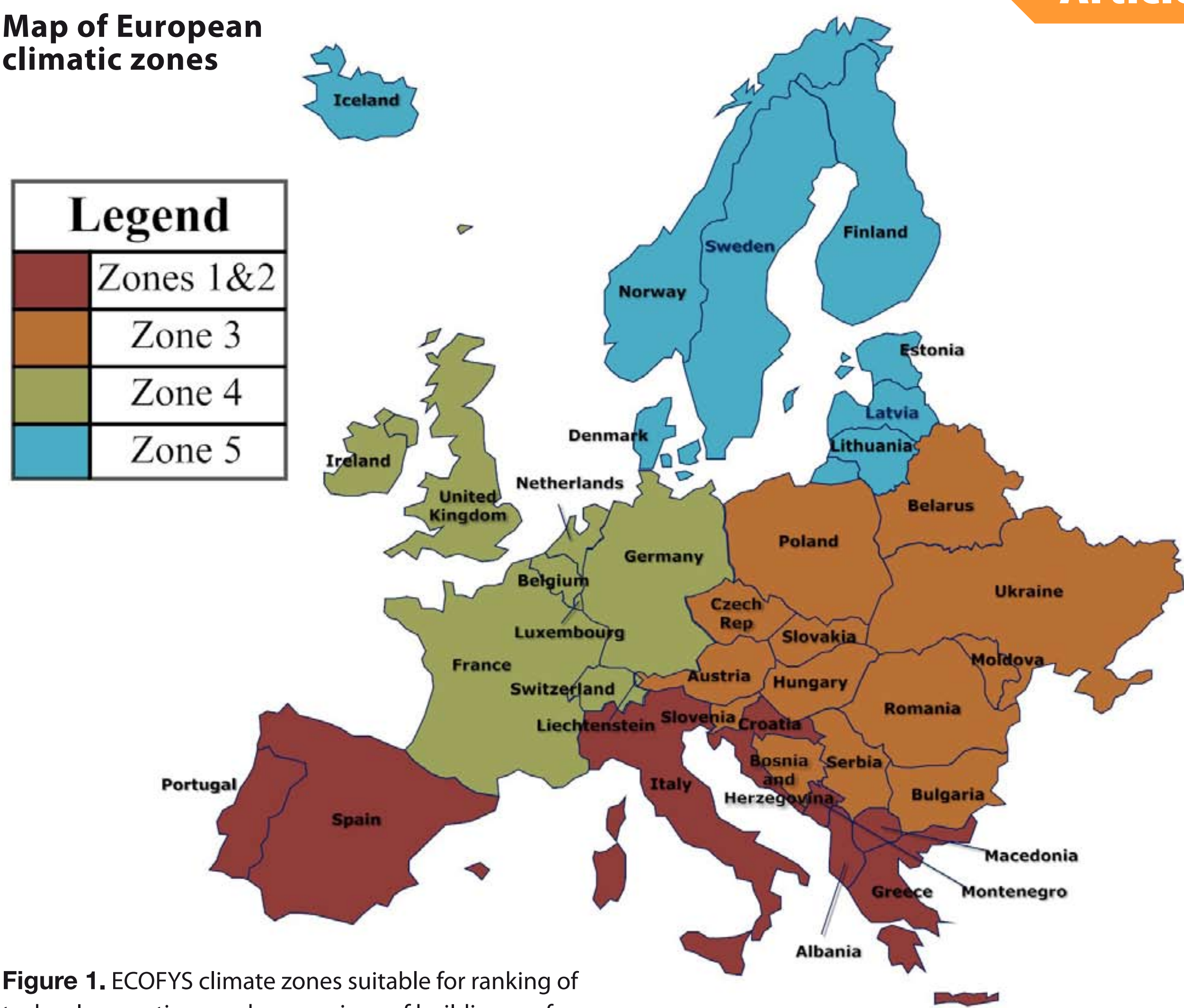

Figure 1. ECOFYS climate zones suitable for ranking of technology options and comparison of building performance.

in residential buildings were not included, despite of increasing importance of these components in the energy balance. In nZEB non-residential case studies (some examples are shown in **Table 2**) the appliances have become a major component in energy balance, often accounting for 40–50 kWh/m²y primary energy. Some countries have not yet implemented RES calculation (on site renewable energy production) to present calculation frames, and half of countries have set specific indicator for RES in nZEB definition.

The ambition of nZEB definitions may be assessed with comparison to current minimum energy performance requirements. Such comparison was straightforward for Denmark and Estonia, where current EP requirements are:

- Denmark 71.3 + 1650/A kWh/m²y for non-residential buildings, where A is gross floor area;
- Estonia 160 kWh/m²y for office buildings.

In Estonia, nZEB value of 100 kWh/m²y means the reduction by factor of 1.6. In Denmark, changes in primary energy factors are also to be taken into account. Current factors of 2.5 and 1.0 for electricity and district heat will change to 1.8 and 0.6 respectively in 2020. This results as the reduction by factor of about 2.0.

nZEB definitions were set in most countries for residential and non-residential buildings, i.e. based only on two primary energy values. Considering non-residential buildings as a single category it means that all buildings are calculated with same occupancy, ventilation rate, lighting, appliances and operation time. This approach will make no difference between offices, hospitals, schools or retail buildings, which easily show a variation in energy use by factor 3 because of different uses. If design solutions would be selected based on nZEB primary energy requirements and standard "non-residential" use of a building, in many cases optimal solutions will not be found. Such "non-residential" use will eliminate for instance the effect of lighting in shopping malls (the highest energy use component in reality) as well as the effect of demand control ventilation in schools and other rooms with high occupancy and ventilation rate. Consequently the calculated heating and cooling loads

Table 1. Overview of the NZEB numerical definition currently available in Europe.

Zone	Country	NZEB definition								Reference		
		Energy Performance (EP)							RES	National legislation providing the nZEB definition	References used for the table	
		EP-value	Unit	RES in the EP calc.	Metric	Energy uses included	Building type				Ref. for EP	Ref. for RES
Zone 1-2	Cyprus	180	kWh/m^2y	NO	Primary energy	heating, cooling, DHW, lighting		Residential	25%	NZEB Action Plan	[5]	[5]
		210	kWh/m^2y	NO	Primary energy			Non-residential	25%		[5]	[5]
Zone 3	Slovakia	32	kWh/m^2y	N.D.	Primary energy	heating, DHW	Apartment buildings	Residential	50%	-	[3]	[3]
		54	kWh/m^2y	N.D.	Primary energy		Family houses		50%	-	[3]	[3]
		60	kWh/m^2y	N.D.	Primary energy	heating, cooling, ventilation, DHW, lighting	Office	Non-residential	50%	-	[3]	[3]
		34	kWh/m^2y	N.D.	Primary energy		Schools		50%	-	[3]	[3]
Zone 4	Belgium BXL	45	kWh/m^2y	YES	Primary energy	heating, DHW, appliances	Individual dwellings	Residential	-	Brussels Air, Climate and Energy Code	[5]	-
		95 - 2,5*(V/S)	kWh/m^2y	YES	Primary energy	heating, cooling, DHW, lighting, appliances	Office buildings	Non-residential	-		[5]	-
		95 - 2,5*(V/S)	kWh/m^2y	YES	Primary energy	heating, cooling, DHW, appliances	Schools		-		[5]	-
	Belgium Walloon	60	kWh/m^2y	N.D.	Primary energy	heating, DHW, appliances	Residential buildings, schools office and service buildings	Residential/ Non-residential	50%	Regional Policy Statement	[2]	[5]
	Belgium Flemish	30	$kWh/m^2/y$	YES	Primary Energy	heating, cooling, ventilation, DHW, auxiliary systems		Residential	>10 kWh/m^2y	Energy Decree	[5]	[5]
		40	kWh/m^2y	YES	Primary Energy		Office buildings, schools	Non-residential	>10 kWh/m^2y		[5]	[5]
	France	50	kWh/m^2y	NO	Primary energy	heating, cooling, ventilation, DHW, lighting, auxiliary systems		Residential	-	RT2012	[5]	
		70	kWh/m^2y	NO	Primary energy		Office buildings non-air-cond.	Non-residential	-		[5]	
		110	kWh/m^2y	NO	Primary energy		Office buildings air-cond.		-		[5]	
	Ireland	45	kWh/m^2y	N.D.	Energy load	heating, ventilation, DHW, lighting		Residential	-	Building Regulation Part L amendement	[5]	
	Netherlands	0	[-]	YES	Energy performance coefficient (EPC)	heating, cooling, ventilation, DHW, lighting		Residential/ Non-residential	not quantified, but necessary	EPG 2012	[5]	
Zone 5	Denmark	20	kWh/m^2y	YES	Primary Energy	heating, cooling, ventilation, DWH		Residential	51% - 56%	BR10	[5]	[2]
		25	kWh/m^2y	YES	Primary Energy	heating, cooling, ventilation, DHW, lighting		Non-residential	51% - 56%		[5]	[2]
	Estonia	50	kWh/m^2y	YES	Primary Energy	heating, cooling, ventilation, DHW, lighting, HVAC auxiliary, appliances	Detached houses	Residential	-	VV No 68:2012	[6]	-
		100	kWh/m^2y	YES	Primary Energy		Apartment buildings		-		[6]	-
		100	kWh/m^2y	YES	Primary Energy		Office buildings	Non-residential	-		[6]	-
		130	kWh/m^2y	YES	Primary energy		Hotels and restaurants		-		VV No 68:2012	
		120	kWh/m^2y	YES	Primary energy		Public buildings		-		VV No 68:2012	
		130	kWh/m^2y	YES	Primary energy		Shopping malls		-		VV No 68:2012	
		90	kWh/m^2y	YES	Primary energy		Schools		-		VV No 68:2012	
		100	kWh/m^2y	YES	Primary energy		Day care centres		-		VV No 68:2012	
		270	kWh/m^2y	YES	Primary energy		Hospitals		-		VV No 68:2012	
	Latvia	95	kWh/m^2y	N.D.	Primary energy	heating, cooling, ventilation, DHW, lighting		Residential/ Non-residential	-	Cabinet Regulation N° 383 from 09.07.2013	[3]	-
	Lithuania	<0,25	[-]	N.D.	Energy performance indicator C	heating		Residential/ Non-residential	50%	Building Technical Regulation STR 2.01.09:2012	[5]	[3]

Table 2. Energy data from four nZEB office buildings. Delivered heating is in first building a fuel and in last one district heat. Two other buildings have heat pumps, and delivered heating is electricity. Delivered cooling is in all buildings electricity. On site electricity generation is with PV in three buildings and bio-CHP in one building. All values in the table are in kWh/m²y.

Climate zone	City, country	Delivered energy Heating	Cooling	Fans&pumps	Lighting	Appliances	On site electricity	Primary energy
4	Dion France	10.5	2.4	6.5	3.7	21.2	-15.6	**44**
4	Gland Switzerland	6	6.7	8.1	16.3	26.8	-30.9	**66**
4	Hoofddrop Holland	13.3	3.3	17.5	21.1	19.2	-40.4	**68**
5	Helsinki Finland	38.3	0.3	9.4	12.5	19.3	-7.1	**96**

and energies can be very far from reality. The wide gap in energy use between different non-residential building types is illustrated in the **Table 1** with the Estonian values, showing a variation between 100 and 270 kWh/m²y for seven non-residential building types.

In setting nZEB targets the experience from nZEB pilot buildings is worth to utilize. In the following, detailed energy data of four nZEB office buildings located in climate zones 4 and 5, published in [7], are reported with the aim to compare national nZEB values to the values of real case studies. **Table 2** shows a summary of delivered and primary energy of these buildings. From the first building, measured data is used, from others simulated energy use is reported. To be comparable, for all buildings the following primary energy factors were applied:

- 0.7 for heating (district heat or biomass);
- 2.0 for electricity.

Remarks and conclusions

The review of available national nZEB definitions shows remarkably high variation in nZEB primary energy values being between 20 and 200 kWh/m²y in ten countries. The high variation applied even within the same building type in countries with similar climate. It is partly due to different energy uses included and partly due to different level of ambition in the definitions.

Energy data reported in available nZEB case studies of office buildings was supporting with some reservations Belgian and French (zone 4) and Estonian (zone 5) nZEB values. Generally, energy data of nZEB case studies seem to provide more reliable benchmarks than that from first national nZEB definitions, which in many cases seem suffering under inconsistent calculation methodologies and do not account all energy flows. The latter leads to situation where calculated energy use could represent only a small fraction of measured energy use in real buildings.

Compared to current energy performance minimum requirements of office buildings, nZEB primary energy values showed a reduction by factor of 1.6 in Estonia and by about 2 in Denmark if changes in primary energy factors were also accounted. For other countries, enough detailed data to calculate the reduction percentage was not available.

It can be concluded that Member States need more guidance in order to set consistent and comparable nZEB values with equal ambition levels. For some reason, the European cost optimal methodology seems not utilized in all countries when defining nZEB – it could be speculated that existing energy calculation frames and methodologies are too different to enable easy implementation of those calculation principles.

Very limited number of building types used in national nZEB definitions, often just residential and non-residential, was alarming and shows that majority of countries cannot tackle the eight building types specified in EPBD recast Annex [8].

Definition of standard uses for common building types would be an important task for European standardisation, which can be addressed in ongoing revision of EPBD standards, expected to be completed due 2015. Hourly profiles for occupancy, appliances, lighting and domestic hot water would be required to calculate how much of on site renewable energy production could be utilized in the building and how much needs to be exported. Without this information, alternative design solutions cannot be adequately compared in nZEB buildings. ■

References

Please see the complete list of references of the article in the html-version at **www.rehva.eu** -> REHVA Journal

Construction Products Regulation (CPR) applies also to HVAC products

According to the new Construction Products Regulation (CPR) "**construction product**" means any product or kit which is produced and placed on the market for incorporation in a permanent manner in **construction works** (buildings and civil engineering works) or parts thereof and the performance of which has an effect on the performance of the construction works with respect to the basic requirements for construction works.

Keywords: construction product directive, CPD, construction products regulation, CRP, CE marking, declaration of performance, DoP.

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Most of HVAC products are used in buildings, in order to provide healthy and comfortable indoor environment without wasting energy. Therefore, HVAC products can generally speaking be regarded as construction products.

According to the Regulation, construction products are subject to obligatory CE marking, which means that CE marking is affixed to construction products for which the manufacturer has drawn up a declaration of performance (DoP) and thus taking a responsibility for the conformity of the product.

However, in order to be able to declare the product conformity, the product must be assessed according to a harmonized European Standard (generally) or European Technical Assessment. In the case of HVAC products, this is today possible for still very few products, like radiators or fire and smoke dampers.

More on http://ec.europa.eu/enterprise/sectors/construction/legislation/ (called "CPR front page" hereafter in this article)

From Directive (CPD) to Regulations (CPR)

The Construction Products Directive 89/106/EEC, of 21 December 1988 was published in the OJ No L 40 of 11 February 1989.

The Directive, however, left a lot of freedom to Member States in its implementation. For example, CE marking was not compulsory in all Member States, the preparation of European Standards to support the implementation of CPD was also very slow, and so also the progress towards a single European market was too slow.

Finally, the Construction Products Regulation (EU) no. 305/2011 (CPR) was adopted on 9 March 2011. CPR is replacing the Construction Products Directive 89/106/EEC (CPD) is laying down harmonized conditions for the marketing of construction products.

Some elements of the CPR came into force on 24 April 2011. The first changes apply to notified bodies and technical approval bodies and the way in which they operate. The full legislation relating to manufacturers, importers and distributors came into force on 1 July 2013, when the CPD was replaced.

The provisions of the new Regulation seek to:

- Clarify the affixing of CE marking: By affixing the CE marking to a construction product, for which the manufacturer has drawn up his Declaration of Performance, manufacturers indicate that they take responsibility for the conformity of that product.
- Introduce simplified procedures enabling costs borne by enterprises (especially SME's, some further simplifications to micro-enterprises under certain circumstances), to be reduced and to impose stricter designation for organisations responsible for assessing the performance of construction products and the verification of the products' constancy.

The implementation of the CPR does not impose any additional technical requirements on products. However the requirements for CE marking and the accompanying documentation have changed and must now comply with the requirements of Article 9 of the CPR.

The Declaration of Performance (DoP)

The Declaration of Performance gives the product manufacturer the opportunity to deliver the information about the **essential characteristics** (those characteristics of the construction **product** which relate to the basic requirements for construction **works**) of his products. Declarations of Performance (DoP) must be available, for each product, product family or any other grouping of products decided by the manufacturer. If the product had been placed on the market before the 1st July 2013, it can be later made further available without a DoP. Annex III of the CPR specifies the items to be included in the DoP.

In addition to a DoP generated under the CPR, CE Declaration of Conformity may still be required according to other applicable EU Directives such as Electromagnetic compatibility, Low voltage, Machinery, ATEX, etc.

The manufacturer shall draw up a DoP when a product covered by a harmonised standard (hEN) or a European Technical Assessment (ETA) is placed on the market. See http://ec.europa.eu/enterprise/sectors/construction/declaration-of-performance/index_en.htm for further information.

Basic requirements for construction works

According to Annex I of the CPR, "Construction works as a whole and in their separate parts must be fit for their intended use, **taking into account in particular the health and safety of persons involved throughout the life cycle of the works.** Subject to normal maintenance, construction works must satisfy these basic requirements for construction works for an economically reasonable working life."

The basic requirements are otherwise the same as in the replaced CPR, but a new requirement on sustainability has been introduced.

1. Mechanical resistance and stability
2. Safety in case of fire
3. Hygiene, health and the environment
4. Safety and accessibility in use
5. Protection against noise
6. Energy economy and heat retention
7. Sustainable use of natural resources

Harmonized product standards under the CPR

Page http://ec.europa.eu/enterprise/policies/european-standards/harmonised-standards/construction-products/ gives a full and updated list of all harmonized European Standards under the CPD and CPR.

Harmonized products standards are available for e.g. radiators and convectors, wastewater products, chimneys, sanitary appliances, gas boilers, smoke ventilators, smoke control dampers and fire dampers.

For many products, especially in the field of ventilation, standards may exist but developed on voluntary basis without a standardization mandate from EU, and thus these standards are not harmonized standards.

Each harmonized product standard shall include Annex ZA, which is the mandatory part of the standard for the CE marking purposes. Annex ZA also transforms all or part of a European product standard into a harmonized European product standard.

Only product standards include Annex ZAs; supporting standards do not. The Annex ZA identifies those clauses of the standard which cover the essential characteristics included in the mandate and considered in the answer to the mandates prepared by the TC and accepted by the Commission. Alternatively, the Annex ZA may refer to similar clauses in another standard.

For products not covered or not fully covered by a harmonized European product standard, a European Technical Assessment (ETA) can be requested by the product manufacturer. More information about ETA can be found at http://www.eota.eu/en-GB/content/what-is-an-eta/18/

National CPR product contact points

Under the Construction Products Regulation (Art. 10) Member States shall give information on rules and regulations for construction products. These product contact points had to be established by 1 July 2013. A link to the product contact points can be downloaded at the CPR front page. ■

This article is published based on the bilateral memorandum of understanding between REHVA, Chinese Committee of CCHVAC and China HVAC media. The MoU encourages the information exchange between Europe and China.

Smart Micro Energy Network for Eco-Communities

The main objective of energy planning in green eco-communities is to achieve maximum urban energy efficiency, and to use clean energy, renewable energy sources and end-use energy-saving to alternate the fossil fuel energy. This paper introduced the concept of micro energy network, and presents a comprehensive analysis of the architecture and configuration for the core layer, the framework layer and the management layer, respectively. The paper introduced the new technology concepts such as smart grid, smart-grid ready heat pump, distributed heat pump systems, energy bus, and the ubiquitous control network protocol. Under existing conditions, the micro energy network technology is completely achievable and landing-available.

Keywords: green eco-community, energy planning, smart micro energy network, smart grid-ready heat pump, energy bus, ubiquitous control network protocol.

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In 2012, China's urbanization rate has reached 52.6%. At the next two or three decades, China's urbanization will be a critical period. The speed and scale of China's urbanization is unprecedented in the history of mankind. Almost all new development zones or industrial parks have developed a low-carbon eco-development planning. The special plan for energy is an important component of low-carbon eco-development planning. Differing from past supply-side energy planning for electricity, gas and heat supply network, this special energy planning is a demand-side planning, its main function is:

- Setting strategic energy efficiency goals and key performance indicators for the community.
- Integrated application of renewable energy and low-grade renewable heat.
- Take the client's energy-saving as a virtual carbon-free alternative energy resources.
- Efficient use of low-carbon natural gas fired distributed energy cogeneration.
- Achieving cascade utilization and heat recovery of fossil energy resources.
- Diversifying investments of community energy system, marketizing energy management, promoting the Clean Development Mechanism (CDM).

Concepts of the Smart Micro Energy Network (SMEN)

There are three levels of SMEN:

(1) Core layer: the on-site power generation system, such as photovoltaic, small wind turbine, fuel cells, natural gas or biomass gas fired small micro-CHP systems (combined heating & power), as the core of SMEN.

(2) Framework layer: distributed heat pumps, energy bus integrating a variety of low-grade heat source / heat sink, and thermal storage facilities as the framework of SMEN. The heat pump is an important link between Core layer and demand-side client users.

(3) Management layer: using the information and communication technologies, such as internet technology, internet of things, and cloud technology, to support interactive community energy management systems. This kind of energy management essentially is a service.

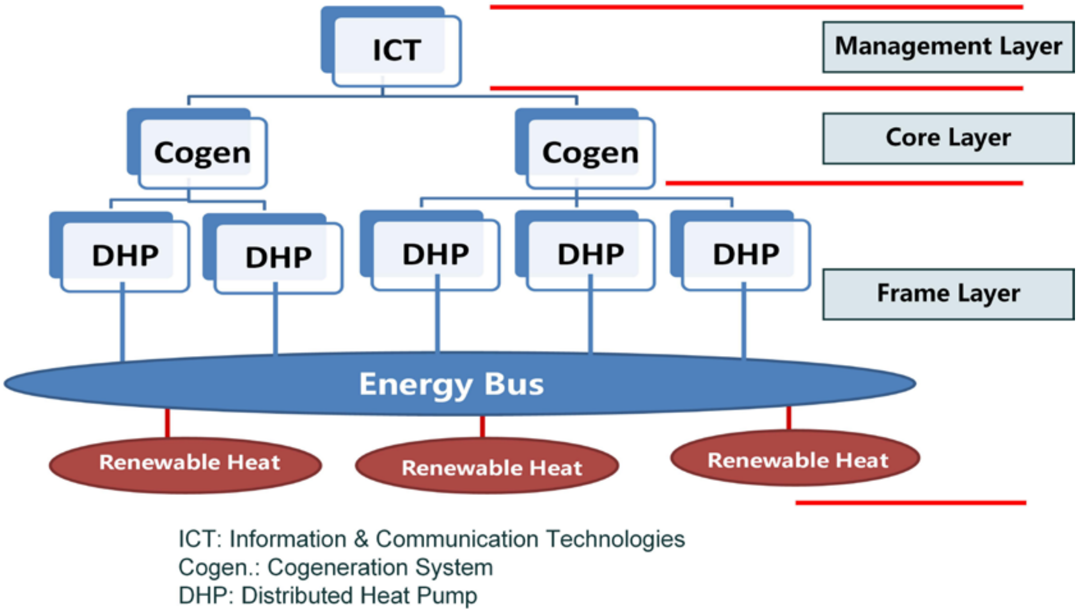


Figure 1. Three levels of Smart Micro Energy Network (SMEN).

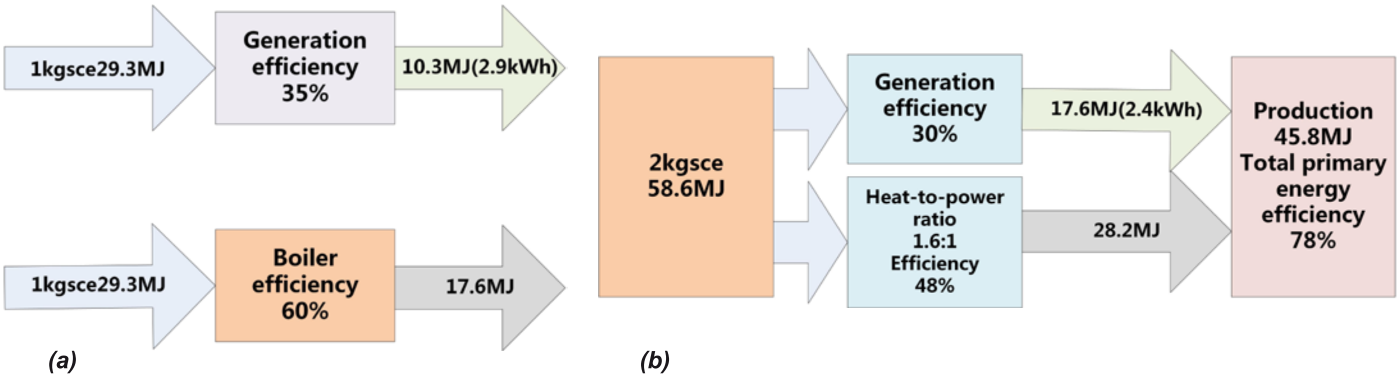


Figure 2. The efficiency of separate generation (a) and cogeneration (b).

The most important feature of on-site power generation by renewables and clean energy is its instability, especially the mismatch between supply (generation) and demand (load) and the inconsistency of the time and the power. There is another mismatch for cogeneration systems, namely heat and electricity. For building energy use in urban area, it is never to spent electricity and heat synchronously. According to the current technologies, large-scale electricity storage has not been used in commercial operation. But all cogeneration equipment has a certain heat-to-electric ratio range, if the electricity from cogeneration has neither been use up nor connected to grid, the system will shut down, and therefore to affect heat production.

Core layer of SMEN - matching between on-site generation and demand

Economic analysis

In China, the connecting of electricity from on-site distributed generation system to the grid always a policy bottleneck plagued the development of distributed energy. According to the current policy, the power from distributed energy system should be locally utilized, and could be connected to the grid at the voltage of 10 kV and below. The total installed capacity of individual plants is not allowed more than 6 MW of power. Calculating by current purchasing price of connected distributed electricity to grid and market prices of natural gas, the investors of distributed energy will be absolutely no return.

From the economic point of view, we should focus on how to play the value of electricity generated. If we just to consider connecting the electricity, the high-grade energy, to the grid, it is tantamount to sell the Mao-tai at the price of industrial alcohol.

Energy efficiency

As can be seen from **Figure 2**, because of the use of small generation power plant, power generation efficiency of the distributed energy plant is lower than the system of separate generation of heat and power, but its total efficiency can be reached up to about 80%. Its energy production efficiency is also increased by 64%.

Cogeneration of distributed energy system has prerequisites for success: ① a stable heat and electricity demand; ② heat and electricity can be all spent in a certain area. This is not difficult to achieve for traditional manufacturing demand. But in urban communities the client-users are building heating and cooling. If only consider to use the heat from cogeneration but ignore how to use the electricity, it actually reduces the efficiency. Because the most efficient heating device is condensing boiler (above 90% efficiency), while the most efficient natural gas combined cycle power generation technology (above 50% efficiency). Integrated thermal efficiency and power generation efficiency of all DES (distributed energy system) technologies are impossible to higher than the two techniques. Thus, if only for the purpose of building heating and cooling, it is no necessary to use cogeneration systems with investment.

But cogeneration can mainly generate electricity, while electricity is high-grade energy. It cannot simply be measured by thermal efficiency. For cooling and heating of buildings, the electric driven heat pump can be used. Also the absorption heat pump can be used to improve thermal efficiency.

The most high efficiency heat pump is that with Magnetic Bearing Chillers (MBC). The COP of MBC is 6.3 on cooling mode and 5.6 on heating mode (with water temperature up to 60°C). Normally the COP of absorption heat pump can reach to 1.6 ~ 2.4 (with LiBr refrigerant and water absorbent).

Using MBC heat pump and absorption heat pump to combine cogeneration, the energy efficiency can be very high. As shown in **Figure 3(a)**, the primary energy efficiency of the heating system with absorption and electric-driven heat pump can reach to 232%. In the hot summer and cold winter zone and hot summer and warm winter zone in China the cooling load is dominated. Thus the system configuration should be depended on winter heating load. The lack of cooling load in summer could be undertaken by electric-driven magnetic bearing centrifugal chillers connected to the grid (see **Figure 3(b)**). The primary energy efficiency of the cogeneration system can achieve 250% (or 260% if the heat is included), and the total system efficiency can reach to 254%.

The progress of cogeneration + heat pump system configuration (as shown in **Figure 4**) includes three steps:

(1) To determine the type of prime mover and heat pump. To draw energy flow chart. To calculate the system integrated thermal efficiency.
(2) According to the building heating/cooling load and the system integrated thermal efficiency, to calculate the fuel requirements to be provided to the prime mover.
(3) According to the thermal efficiency of the prime mover, to determine the system's power generation and size of generators.

Frame layer of SMEN - the energy bus integrating low-grad renewable heat sources

From the viewpoint of the energy balance, the heat produced by electric-driven heat pump composed by two parts:

(1) Drive energy (electricity);
(2) Ambient energy (air, surface water, soil, ground water, sewage etc.);

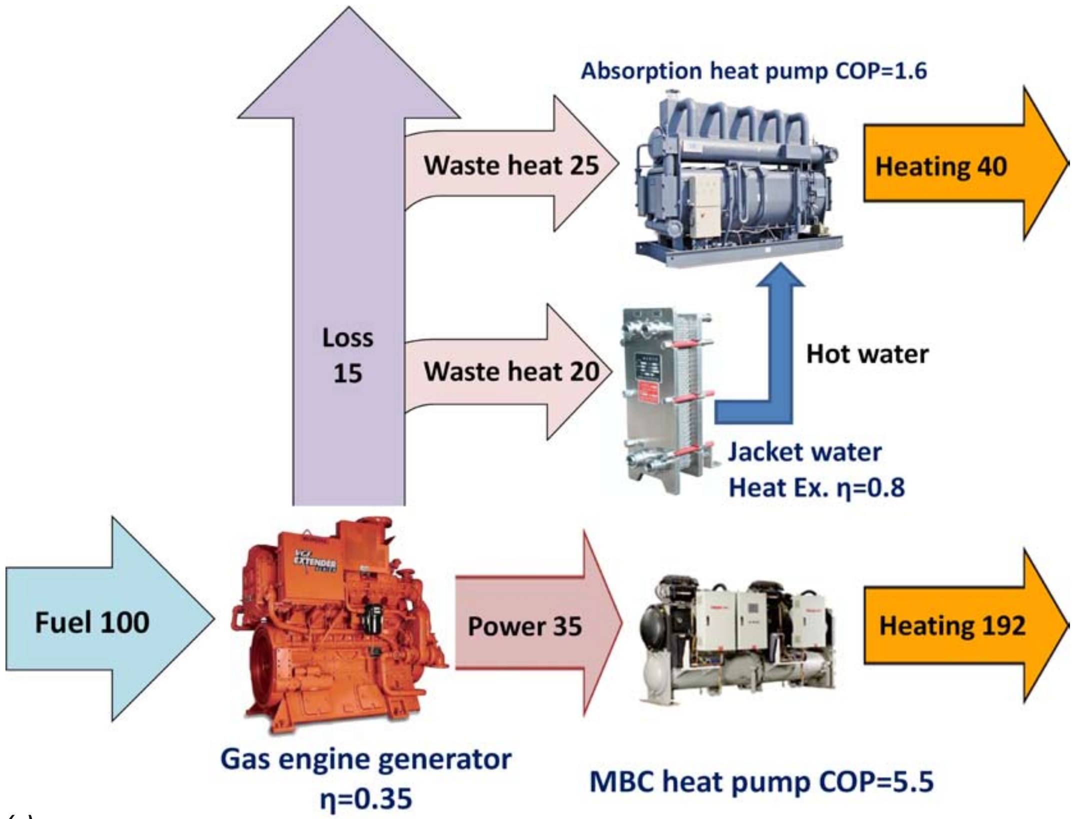
Since the grade of ambient energy (temperature) was lower, it must be consumed some high-grade energy (such as electricity) to increase the temperature. While the ambient energy consists of two parts, namely:

(1) Recovery of heat extraction from thermal power plant;
(2) Low grade renewable heat source.

It can continually maintain the heat pump running at higher efficiency, to find a suitable and stable supply of renewable heat. If the power generation efficiency is 35%, and the COP of air-source heat pump is 2.6, then the primary energy efficiency of the heat pump system is only 90%, just same as the efficiency of a gas boilers.

Energy Bus system is a pipe network system that will integrate multiple renewable heat source or heat sink, transport water through a pipe network (as infrastructure of community) to distributed water source heat pumps.

Due to use of multi-source multi-sink, it can adopt good points and avoid shortcomings of various source/sink. For example, in eastern China, the temperature of surface water is lower in winter, the soil coupling



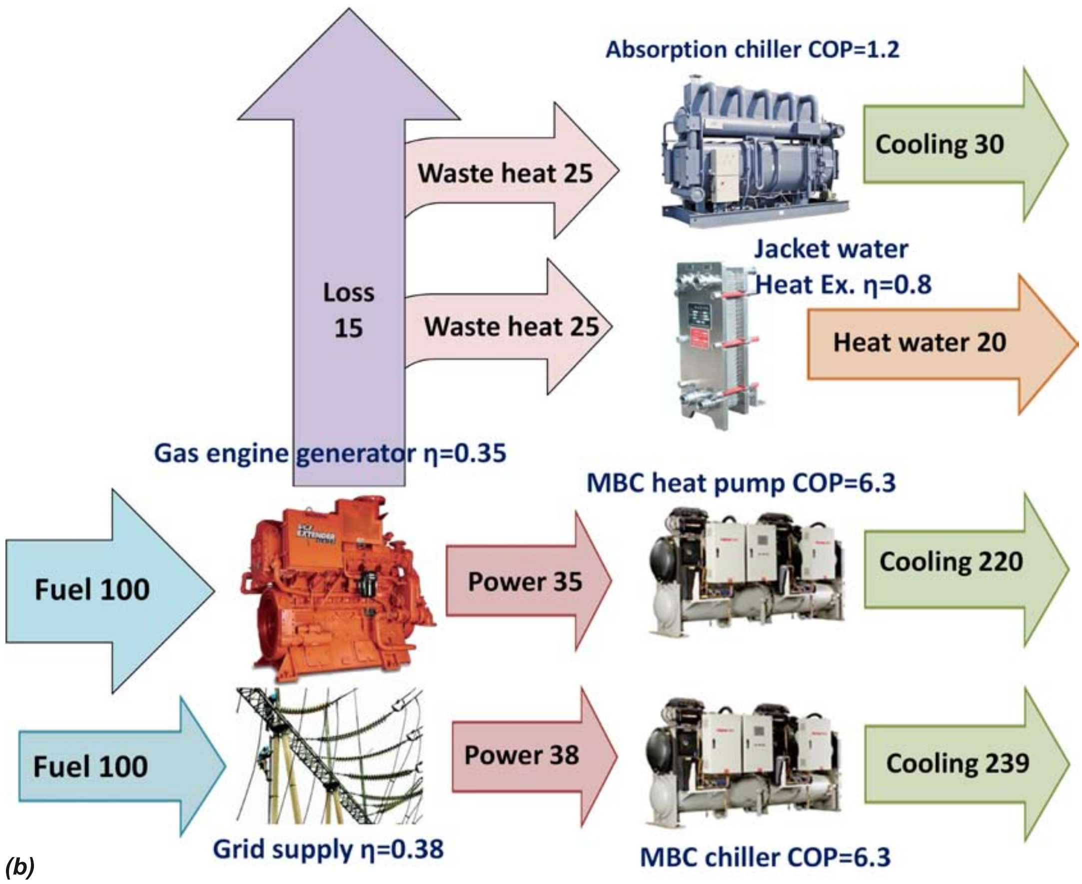


Figure 3. Relative energy flow in heating mode (a) and cooling mode (b) for cogeneration plus heat pump system.

heat exchanger should be a main heat source. While in summer, the surface water or even cooling tower could be as the auxiliary heat sink. According to the cooling load profile it can be considered that the cooling towers bear base load, the surface water bears intermediate load, and soil coupled heat exchangers bear peak load. Thereby the heat accumulation in soil can be avoided, and giving "breathing" time to soil.

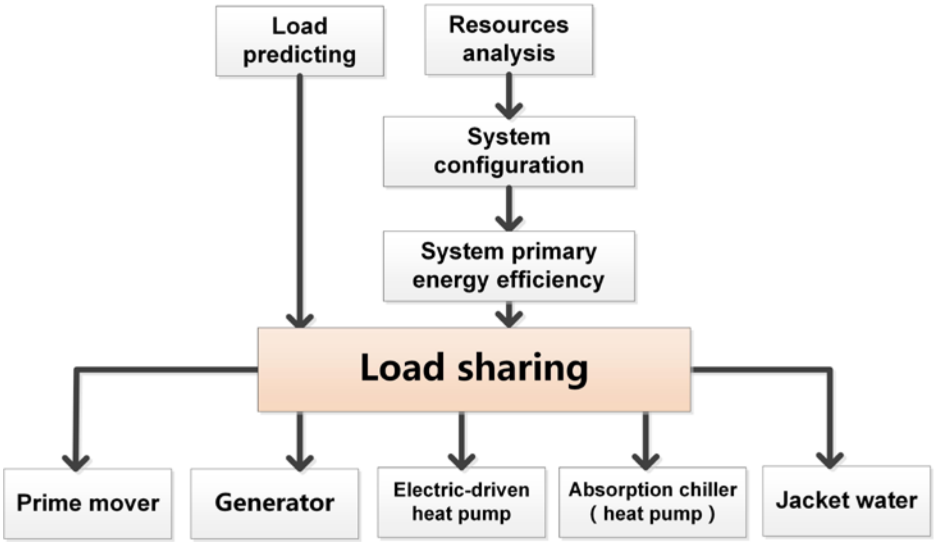


Figure 4. Program of system configuration.

If the modular energy stations with magnetic centrifugal heat pump are configured to end users, the system will have a high energy efficiency. Moreover, the share of the cooling tower in energy bus system and the use of natural water sources make the exergy loss of energy bus are also lower than that single building conventional cooling systems.

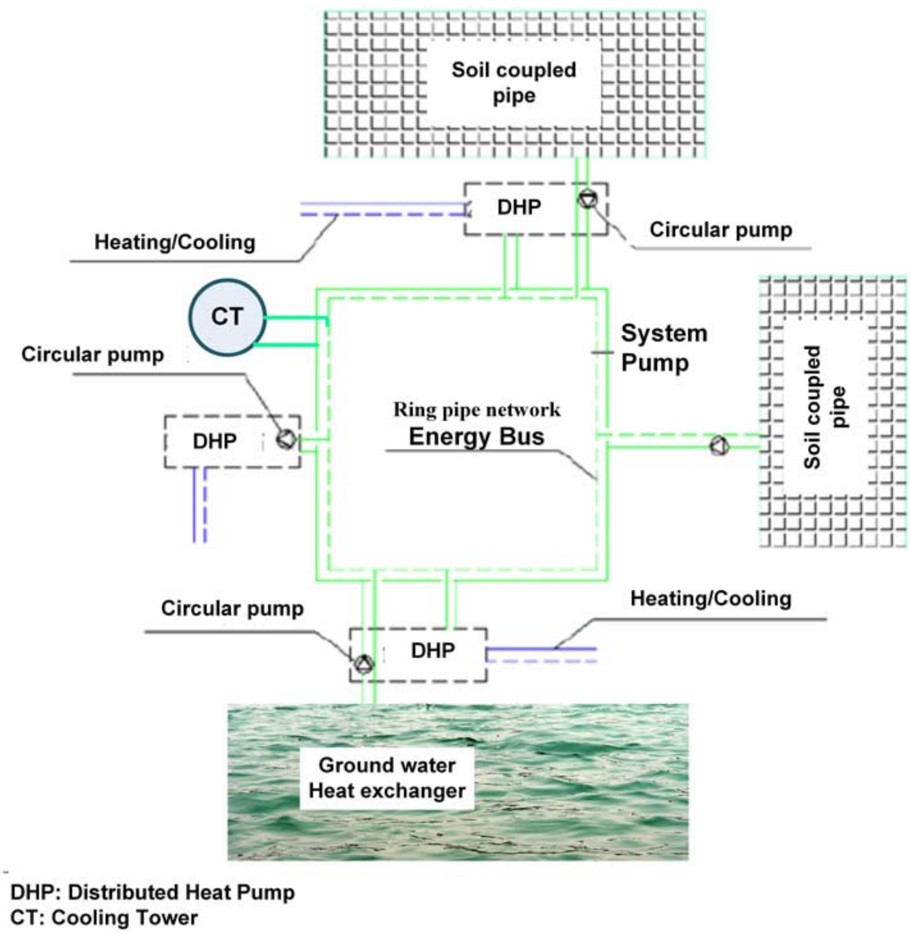


Figure 5. Schematic diagram of community energy bus.

Management layer of SME - the EMS based on Ubiquitous Control Network Protocol

With the "heart (core)", and with the "skeleton (framework)", then we need to have a "brain". In the past, only have monitoring systems on the level of urban communities. It is difficult to establish a unified control system. This is mainly because for various brands of equipment and various types of systems they have their own different control protocol. It is currently known as LonWorks, ModBus and BACnet, which are mainstream system.

In 2011, approving by the U.S. Institute of Electrical and Electronics Engineers Standards Association (IEEE-SA), the IEEE1888 standard (Ubiquitous Green Community Control Network Protocol) which has been prepared under leading of a Chinese enterprise, has offi-

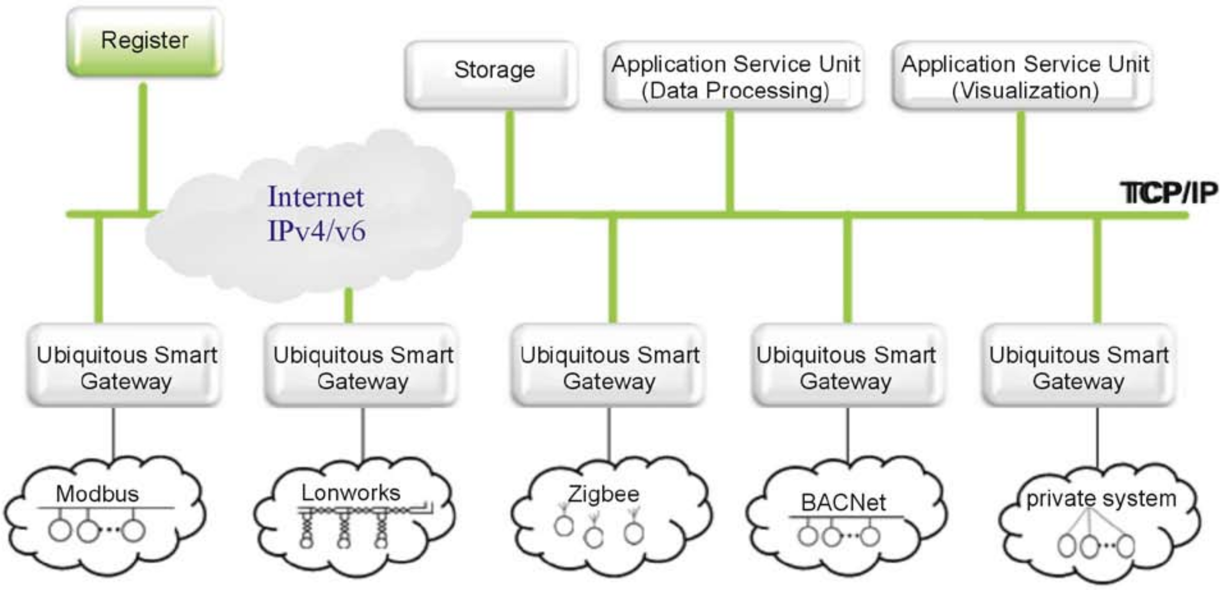


Figure 6. Systematic network architecture of IEEE 1888.
(From BII Group Holdings Ltd. http://www.biigroup.com/en/jishubiaozhun.asp?ArticleID=614)

cially released. This is a functional network architecture in order to achieve the purpose of green community and energy saving, based on Internet technology (TCP/IPv6), via a remote network and sensor networking, to achieve unified management and intelligent control of energy facilities within the community. The purpose is to achieve energy efficiency and rational use. IEEE1888 is compatible with BACnet, LonWorks and ModBus, and other industrial control protocol.

Ubiquitous control network protocol becomes the basis for constructing community energy management systems. The SMEN management system should achieve the following control functions on a uniform platform:

(1) Power dispatching at core level;
(2) Heat storage control;
(3) Clients' electrical energy production and marketing control, metering and billing;
(4) Energy Bus source / sink coordination control;
(5) Energy-bus pipework control;
(6) Operation management of energy plant;
(7) Clients' consumption of heating and cooling metering and billing;
(8) Community energy consumption monitoring, statistics and analysis;
(9) System diagnostics;
(10) Real-time demonstration of energy system operating and efficiency.

Conclusion

Using SMEN, two goals can be achieved: first, to improve the energy efficiency of high-grade fossil energy with cascade utilization; second, to improve the utilization ratio of low-grade renewable energy (or renewable heat). In the progress of rapid urbanization in China, the SMEN will have a good development prospects. ■

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Total economy of windows and facades in low energy office buildings

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Facade performance including windows, opaque elements and shadings has strong impact on heating, cooling and electric lighting energy as well as on daylight. For low-energy office buildings some general guidelines of façade design can be given regarding energy-efficiency, daylighting and cost effectiveness.

Keywords: Façade design, daylight, nZEB, nearly zero energy buildings, cost optimality, energy simulations.

In office buildings, often large windows have been used without special measures, resulting in high heating and cooling needs, high investment cost and often poor solar protection and glare. Evidently low and nearly zero energy buildings will need careful design to optimize the facade performance. It is important to assure daylight and views outside which both have proven evidence on occupant satisfaction and productivity. Several studies have shown that lowering window to wall ratio (WWR) improves energy performance, but on the other hand it also reduces daylighting.

In this study we derived cost optimal design principles for a cold climate regarding window sizes, solar protection, thermal insulation and daylight leading to optimized total energy performance of office buildings. Some analyses were also conducted for Central European climate. Special attention was paid to highly insulated glazing elements with U-values of 0.6 W/(m² K) and below and high visible light transmittance of about 0.5–0.7. Energy and daylight simulations for calculating heating, cooling and lighting energy were conducted for model office space representing typical open plan offices. Window to wall ratio, solar heat gain coefficient, visible transmittance, solar shading and external wall U-value was varied in order to analyze energy performance. Lower limit of window size was determined by the average daylight factor criterion of 2%, but cases with larger windows were also analyzed. Investment cost of windows and external walls was compared to generate simulation cases so that optimal insulation thicknesses would be used with each glazing variant. More thorough information about the study can be found in [1] and [2].

Simulation model

Energy simulations with the climate of Tallinn, Estonia using IDA ICE 4.5 were conducted on the basis of a generic open-plan office single floor model that was divided into 5 zones, from which 4 orientated to south, west, east and north respectively and in addition one in the middle of the building (**Figure 1**). The initial data of simulation model is shown in **Table 1**.

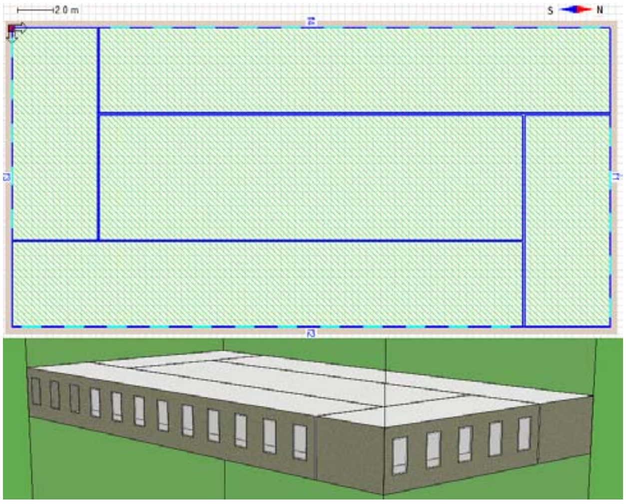


Figure 1. The plan and 3D view of the simulation model of IDA ICE. The longer zones consisted of 12 room modules of 2.4 m and shorter ones of 5 room modules, resulting in inner dimensions of the floor 33.6 x 16.8 m.

Daylight requirements

It is usually well known among building designers that large windows cause high energy bills, however it is uncertain up to which extent window area can be reduced. This uncertainty impedes negotiations between architects standing for the visual appearance of the building and engineers concerning for energy efficiency and indoor environment quality. Pr BS 8206-2 [3] states that average daylight factor should not be below 2% in office rooms. Daylight calculations were made assuming that average daylight factor 2% would be assured up to 4 meter distance from the external wall and that the office room consists of 2 modules resulting in room width 4.8 meters. The minimum window-to-wall ratios (WWR) depending on the visible transmittance have been shown in **Figure 2** and the window sizes in case of different glazing variants have been shown in **Table 2**. Window height was in all cases 1.8 m.

Table 1. Input data of office rooms and HVAC systems for energy calculations.

Occupants, W/m²	5
Equipment, W/m²	12
Lighting, W/m²	5
Temperature set point for heating and cooling	+21 and+25°C
Air flow rate	1.5 l/(s·m²)
Illumination setpoint, lx	500
Total irradiance on facade above which solar shading is down, W/m²	200
Heating system (radiators) efficiency, -	0.97
Heat source (district heating) efficiency, -	1.0
Cooling system losses, % of cooling energy need	10
Mechanical cooling SEER, -	3.0
Ventilation SFP, kW/(m³/s)	1.3

Required glazing area can be calculated with the following formula:

$$A_W = \frac{D \times A \times (1 - R^2)}{T \times \theta \times m}$$

Where,
A_w – total glazed area of windows (**not** including window frames), m²
D – desired average daylight factor, 2%
A – total area of all interior surfaces (incl windows), 109.4 m²
R – mean surface reflectance, 0.5
T – scattered light transmittance of glazing (equals to 90% of visible transmittance τ), -
θ – sky angle, 80° (angle of visible sky from the center of window)
m – clearness of the glazing, 0.9

Optimal insulation thickness

External wall thermal resistance is mainly determined by the U-values of both windows and external wall and a good balance has to be found between investments for high performance glazing and insulation thickness. Combinations of several window types with minimum sizes and insulation thicknesses ranging from 150 to 390 mm were simulated. Combined with investment cost calculations, 20 year net present values were

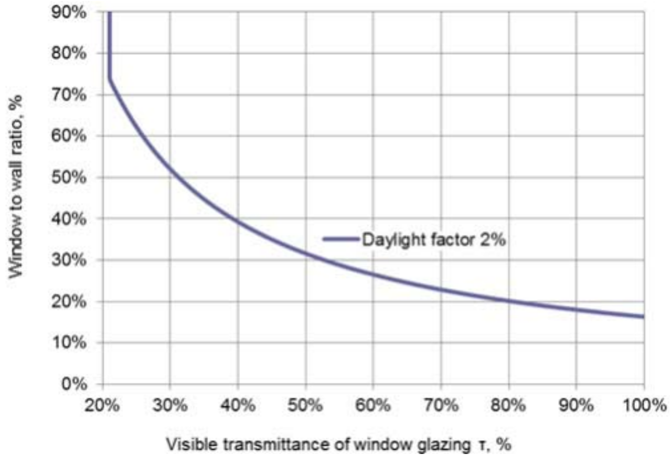


Figure 2. Minimum window-to-wall ratio (WWR) depending on visible transmittance of window glazing.

calculated and the results are shown in **Figure 3**. The insulation thickness which resulted in lowest NPV was 200 mm (U-value 0.16 W/(m²K)) for most cases, however compared to case with quadruple glazing and 200 mm insulation thickness both the investment cost and primary energy was lower for façade with triple windows and 300 mm insulation thickness. This made using 4 pane windows with 200 mm wall insulation insensible and 250 mm (U-value 0.13 W/(m²K)) was chosen for final analysis of 4 pane glazing. A similar situation appeared in case of 5 window panes, which required 390 mm of insulation thickness (U-value 0.09 W/(m²K)) to show lower primary energy than that of best 4 pane case. Cost analyses of glazing units showed that double glazing and simple triple glazing investment cost did not differ significantly from the best available triple glazing, which could be partly explained by high volumes of the latter one. Thus there is no point in using worse glazing than the best performing triple glazing.

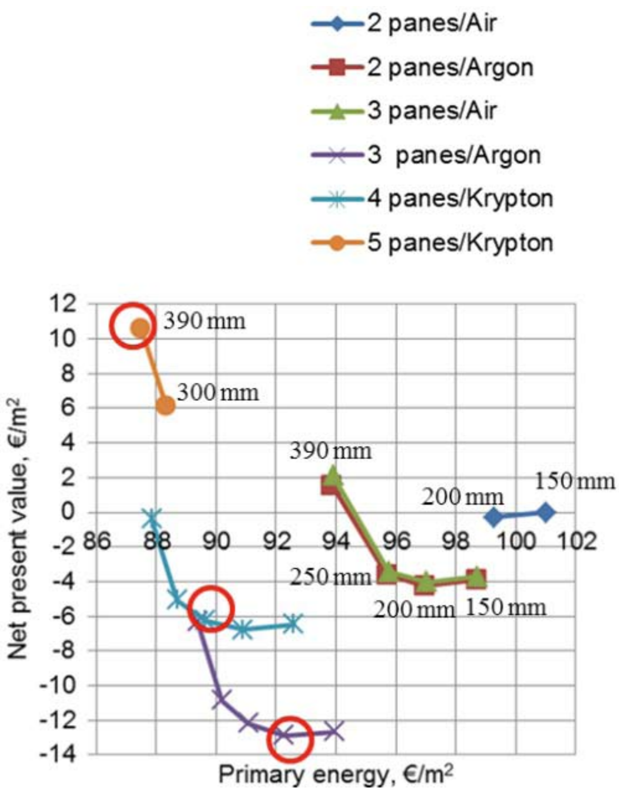


Figure 3. Net present values of 20 years and primary energy as a function of window type and insulation thickness. The points of each curve represent the insulation thicknesses 150, 200, 250, 300 and 390 mm from left to right if not otherwise specified. The most sensible insulation thicknesses at different insulation levels have been marked with red circles, while 3-panes/200 mm show the cost optimal.

Optimal fenestration solution

Results in **Figure 3** were calculated with minimum WWRs shown in **Table 2**. These results were refined so that the financially most feasible window sizes for each glazing type and orientation were determined as shown

Table 2. The properties and minimum window sizes of a selection of highly transparent glazing variants.

No of panes /Gas between panes	Glazing					
	U-value, W/(m² K)	No of low-E layers	Solar factor g, -	Visible transmittance τvis, -	WWR, %	Window width, m
2/Air	1.4	1	0.61	0.78	21.6	0.95
2/Argon	1.1	1	0.61	0.78	21.6	0.95
3/Air	1.1	1	0.52	0.71	23.9	1.05
3/Argon	0.54	2	0.49	0.70	23.9	1.05
4/Krypton	0.32	3	0.36	0.63	26.1	1.15
5/Krypton	0.21	4	0.24	0.56	29.5	1.30

in **Figure 4**. Generally window to wall ratio of 37.5% was most feasible solution for triple and quadruple windows mainly due to reduced lighting needs, however in case of triple glazing the WWR 23.9% resulted in best energy performance and only slightly higher NPV. Increasing quintuple windows proved too expensive and minimum sizes proved to be financially most feasible despite the fact that WWR 60% resulted in lowest primary energy use. In addition, the effect of external shading revealed too small to be financially reasonable. The description and key performance indicators of the mentioned cases are shown in **Table 3.**

Even though triple clear glazing windows with a WWR of 37.5% were found to be cost optimal, it was actually recommended to use triple glazing with a WWR of 23.9%. This was because smaller windows resulted in significantly smaller cooling loads (50 vs. 70 W/m^2), which in turn results in better indoor climate and smaller investment on the cooling system.

Facade performance in Central Europe

We ran some simulations with the climate of Paris to find out to what extent the results might apply for the temperate climate of Central Europe. Cost optimal and the most energy efficient cases in Estonian climate were run without changes. For these cases U= 1.1 $W/(m^2 K)$ was used for windows, and the less insulated external wall (150 mm) with U-value of 0.20 $W/(m^2 K)$ was used. The results showed that the cooling energy started to dominate and also proportion of lighting energy increased. Due to larger cooling energy use the effect of external shading was positive in all the cases. However, similarly to Tallinn's results, smaller sizes of double and triple windows resulted in better energy performance. The situation could be different with higher internal gains, but this study used modern appliances and lighting suitable for nZEB buildings. Triple glazing showed significantly better results in primary energy than double glazing as can be seen in **Figure 5**. However, the performance of the case with Estonian most energy efficient façade was not achieved. This indicates that also in Central European climate, there is a need for façade components with improved thermal insulation. Indeed the solutions feasible in a cold climate could not pay back because of lower heating need.

Conclusions

Daylight factor calculation is good method for setting the lower boundary to window sizes while analyzing different facade cases. The optimal solution for an office building façade in a cold climate revealed to

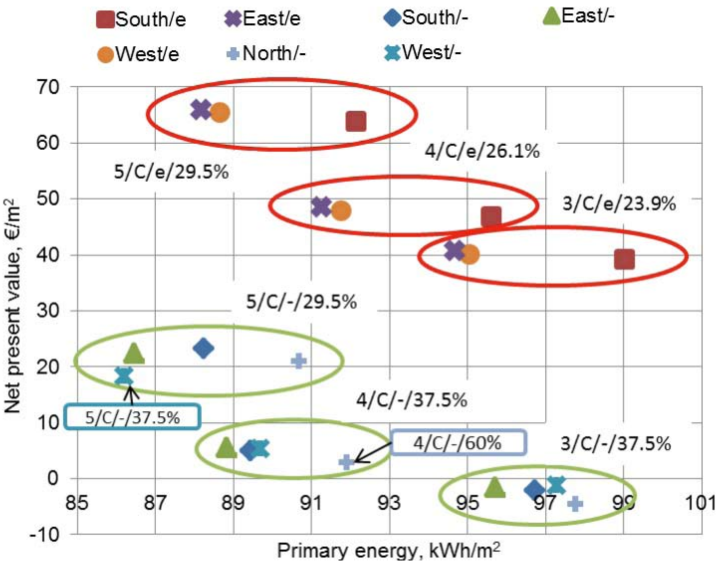


Figure 4. Net present value and primary energy for the facades. Code - 4/C/e/26.1% means quadruple (4) highly transparent (C) window with external shading (e) and WWR 26.1%. Cases with external shading (marked with red circles) appeared to be at significantly higher cost level.

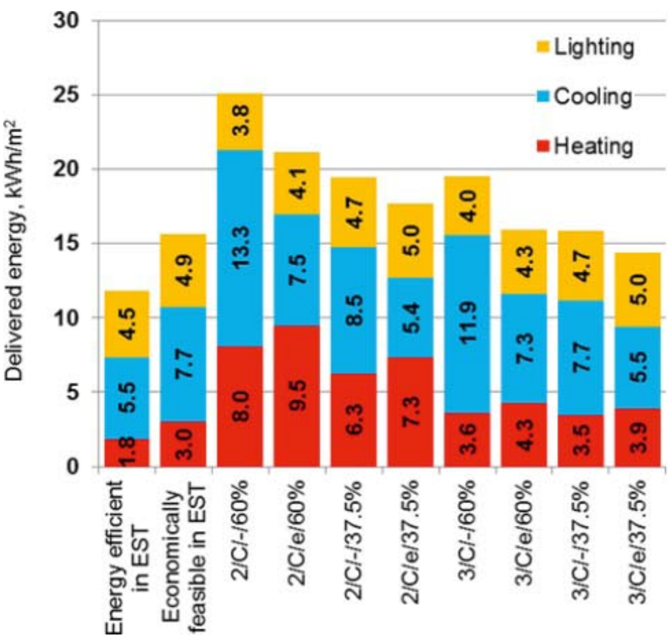
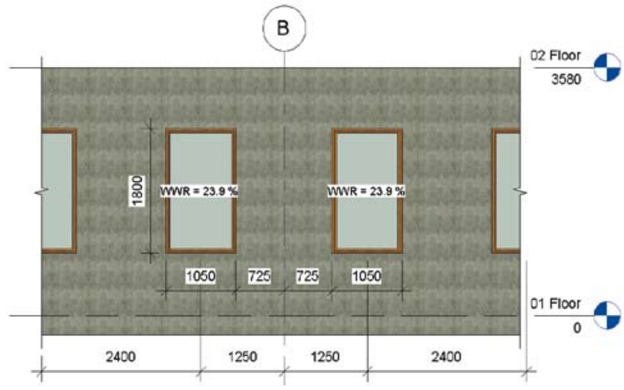
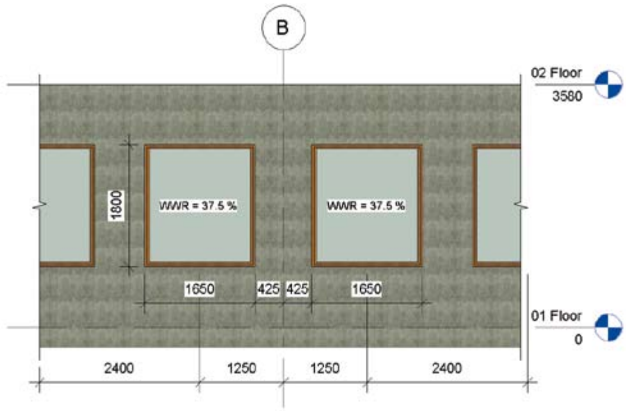
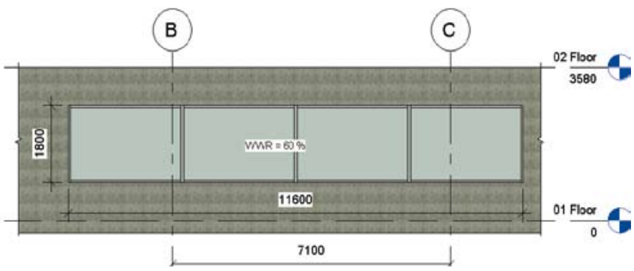


Figure 5. Delivered energy in Paris. In two first cases the cost effective and most energy efficient façade solutions in Estonian climate are used. Code: - 3/C/e/37.5% means triple (3) highly transparent (C) window with external shading (e) and WWR 37.5%.

Table 3. Summary of fenestration design solutions for a low energy building.

Solution case	Technical details	Key performance indicators
Low Energy Building, ≤130 kWh/m²		
A. Recommended solution within cost optimal range that provides better indoor climate: triple glazing and 200 mm thick insulation  	**Windows:** • Triple glazing • WWR: 23.9% • U value: 0,54 W/(m²·K) • Gap filling: 90% argon • Solar factor g: 0.49 • Visible transmittance τ_{vis}: 0.70 • Cost per unit: 122 €/m² **Wall:** • Insulation thickness: 200 mm • U value: 0,20 W/(m²·K) Cost per unit: 122.00 €/m²	Investment: 95.7 €/m² Primary energy: 109,9 kWh/m² Total energy cost per year: 8.50 €/m² NPV: 295.70 €/m²
B. Next sensible solution: quadruple glazing and 250 mm thick insulation (north facing façade: see the figure for solution C)  	**Windows:** • Quadruple glazing • WWR: 37.5% and North 60% • U value: 0,32 W/(m²·K) • Gap filling: 90% krypton • Solar factor g: 0.36 • Visible transmittance τ_{vis}: 0.63 • Cost per unit: 176.88 €/m² and North 144.68 €/m² **Wall:** • Insulation thickness: 250 mm • U value: 0,13 W/(m²·K) • Cost per unit: 227.9 €/m²	Investment: 107.80 €/m² Primary energy: 109.1 kWh/m² Total energy cost per year: 8.19 €/m² NPV: 300.50 €/m²
C. The most energy efficient solution: quintuple glazing and 390 mm thick insulation. All orientations have windows with a size of 11600x1800 mm (figure below)  	**Windows:** • Quadruple glazing • WWR: 60% (11.6 m) • U value: 0,21 W/(m²·K) • Gap filling: 90% krypton • Solar factor g: 0.24 • Visible transmittance τ_{vis}: 0.56 • Cost per unit: 230.95 €/m² **Wall:** • Insulation thickness: 390 mm • U value: 0,093 W/(m²·K) • Cost per unit: 363.4 €/m²	Investment: 160.50 €/m² Primary energy: 103,4 kWh/m² Total energy cost per year: 8.03 €/m² NPV: 349.40 €/m²

be triple windows as small as daylight requirements allow (WWR=23.9%) and wall insulation thickness 200 mm. If better energy performance is required, quadruple windows with window to wall ratio approximately 40% and 250 mm insulation thickness is an option. The use of external shading was not justified as windows with reasonable size provided enough solar protection.

Limited number of simulations with Central European climate showed that similar solutions to Estonian cost optimal clearly outperform conventional design with double glazing, although cooling energy dominated instead of heating energy and also external shading was an effective means of reducing primary energy. Triple glazing with slightly larger size (WWR=37.5%) resulted in best energy performance and larger windows showed worse results. ■

Tallinn University of Technology (TUT) chair of heating and ventilation, prof Hedrik Voll, educates architects and engineers for daylighting and direct solar radiation with scale models and heliodon direct solar radiation table.

"We have discovered that building design through daylight seems to be the conversation topic that is of interest to both sides – architect and engineer. For architects, daylight is a very important element in designing. For engineers, daylight is nothing more than kW and kWh, which ultimately determines a large share of a building's energy efficiency. If the said approach is used in parallel for training both architects and HVAC engineers, we will find common ground and thus be able to negotiate the maze of designing and engineering low or near zero energy buildings."

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Articles

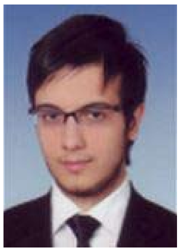
This article is based on the paper presented in CLIMAMED 2013 Congress in Istanbul and was invited to be published in the REHVA Journal *(CLIMAMED - VII Mediterranean Congress of Climatization, Istanbul, 3-4 October, 2013).*

The performance assessment of fuel cell technology in residential application

The article describes the status of fuel cell technology for domestic applications nowadays according to the comparison methodology. Fuel Cell system integrated with conventional system and heat pump has been designed for a resident in four temperate zone of Turkey. This study shows us Fuel Cell system applicability changes in different climatic zones.

Keywords: fuel cell, fuel cell system, domestic fuel cell application, SOFC, PEMFC.



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The background of the Fuel Cell system needs

Domestic applications comprise a large portion of energy consumption. Engineers are looking for more efficient technologies for providing less consumption. So, fuel cell systems have become important to use in applications. Advantages and disadvantages of this system are discussed in many applications at the present time. The findings of the research reviewed for an explanation of the discussions. From past to present, investment cost of fuel cell systems has been the biggest difficulty. The main question has been "Developments in fuel cell technology sufficient to apply today?" yet.

Introduces Fuel Cell systems

Fuel cell systems have high efficiency conversion technologies with high conversion rate and there is no harmful environmental effects of fuel cell systems. Due to the increasing demand for small powers, fuel cell systems have been used for domestic applications as the power source. Therefore, fuel cell systems can be used as resources to help for long-term use of renewable energy sources. [1]

The best way for the fuel cell system design is using real data from an annual energy demand for residents. In general, the energy demands of residents can be categorized as electrically and thermally. [3]

There are two main parameters that determine the performance of a fuel cell system. Efficiency is the first and most important of them. The second parameter, decrease in system performance. [1]

Table 1. The general properties of a fuel cell unit can be used in residential applications.

Output (kWh)	Electricity	1
	Heat	1.3
Efficiency (%)	Electricity	34
	Heat	44
Source		Natural Gas
Size (mm)	Height	800
	Width	500
	Depth	580

The most easily available sources are natural gas for the fuel cell. Fuel cell using natural gas has lower efficiencies at partial loads. Initially, it requires pre-heating and cannot respond quickly to unstable demands. [2] **Table 1** shows the general properties of the domestic fuel cell unit.

Literature review

Several fuel cell systems have been proposed and analyzed in the literature. Both solid oxide (SOFC) and proton exchange membrane (PEMFC) fuel cells can be used for residential applications.

Krist and Gleason analyzed the feasibility of fuel cell cogeneration systems for residences [6]. The analysis suggests that fuel cell based cogeneration systems are suitable for residential applications. However, the analysis by Krist and Gleason only considered the load requirements of the residence in peak summer and winter days, and the analysis of the system is based on the performance in these conditions. Fuel cells are considered as a very good alternative to current technologies in many power generation applications.

Hirschenhofer [7] and Kordesch [8] describe the basics of PEMFC systems. The companies claim that their products will produce electricity competitive with current residential electricity rates and that they will introduce significant cost savings, especially at locations where electricity is more expensive and natural gas cheaper than the national average [9].

As a result, in future, if the provision of housing by the hydrogen distribution networks, widespread use of fuel cells will become houses. [2]

Comparison methodology

The method includes a fuel cell and a conventional energy supply system. Systems have been designed with the same reference residents in four climate zones. Benefits of fuel cell has been identified in each zone.

Four climatic zones exemplify different heating degree days (HDD) and cooling degree days (CDD). The first zone located in the warm climate. This zone has 983 HDD and 627 CDD, 130 days are below 15°C and 137 days are over 22°C per year. The second zone located in the moderate climate. Second zone has 1702 HDD and 169 CDD, 186 days are below 15°C and 88 days are over 22°C per year. The third zone is good example for cold climates. The zone has 2327 HDD and 165 CDD, 204 days are below 15°C and 68 days are over 22°C per year. The fourth zone is a terrestrial climate. This zone has 4665 HDD and 2 CDD, 286 days are below 15°C and 5 days are over 22°C per year.

The benefits of fuel cell are operating costs and carbon emission. Operating costs represent a reduction in natural gas use and also a sign that more efficient use of resources. Carbon emission represents environmental pollution.

Annual energy demand has been identified for the reference resident. Energy demand has been comprised of heating and cooling loads, hot water and electricity for appliances. Saving of operating costs and carbon emission have been calculated in annual and 15-year period. The net present value method has been used in long term calculations. Carbon emission values have been computed from international carbon footprint data. The simple payback period method has been used for calculating payback period.

The reference resident is double-decker, four persons live and the living area is 206 m² (**Figure 1**). Daily electricity demand value is 16 kWh and the average domestic hot water usage is 300 liters.

The conventional system comprises a condensing boiler for heating and domestic hot water, a chiller unit for cooling. In the reference resident, fan-coil units are used for heating and cooling. Electrical demands met by the city network.

The fuel cell system (**Figure 2)** comprises a heat pump for heating, domestic hot water, cooling and electricity. In the reference resident, fan-coil units are used for heating and cooling. The fuel cell unit provides electricity to the heat pump and the fuel cell unit to produce electricity from natural gas.

Carbon emission comprises the whole process of production. The whole process involves natural gas and electricity producing to use.

All these data have been used in Hourly Analysis Program to compute the heating and cooling loads. Hourly Analysis Program (HAP) is an energy simulation program from Carrier©. HAP is an internationally recognized and uses ASHRAE standards with databases.

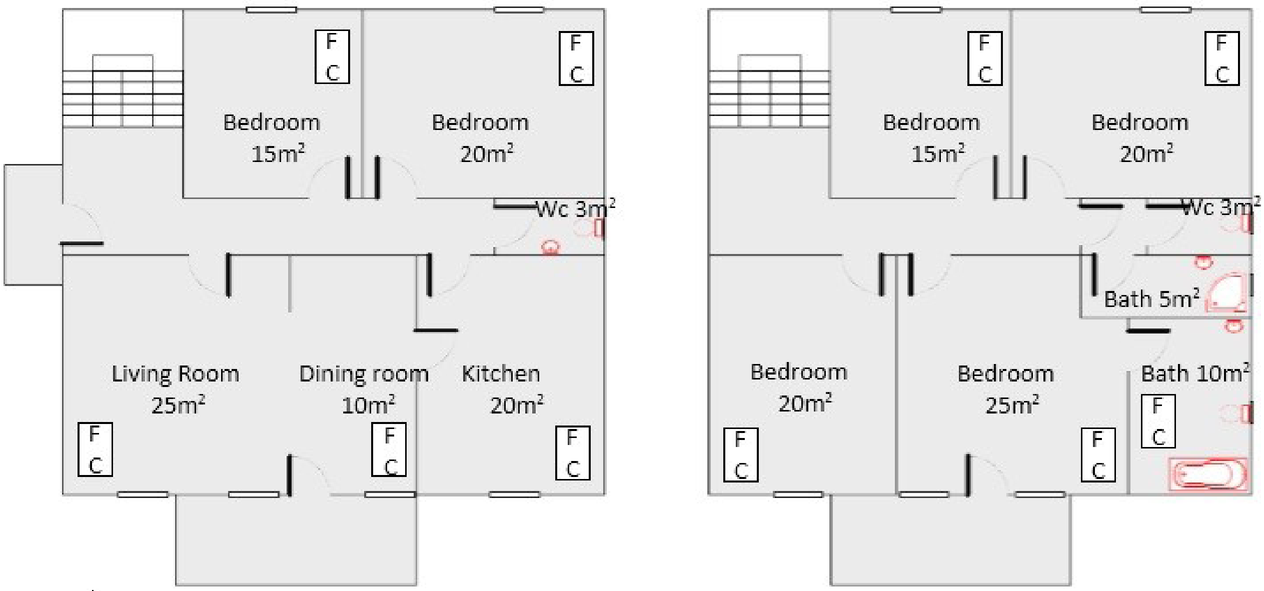

Figure 1. The reference resident plan has been designed for study.

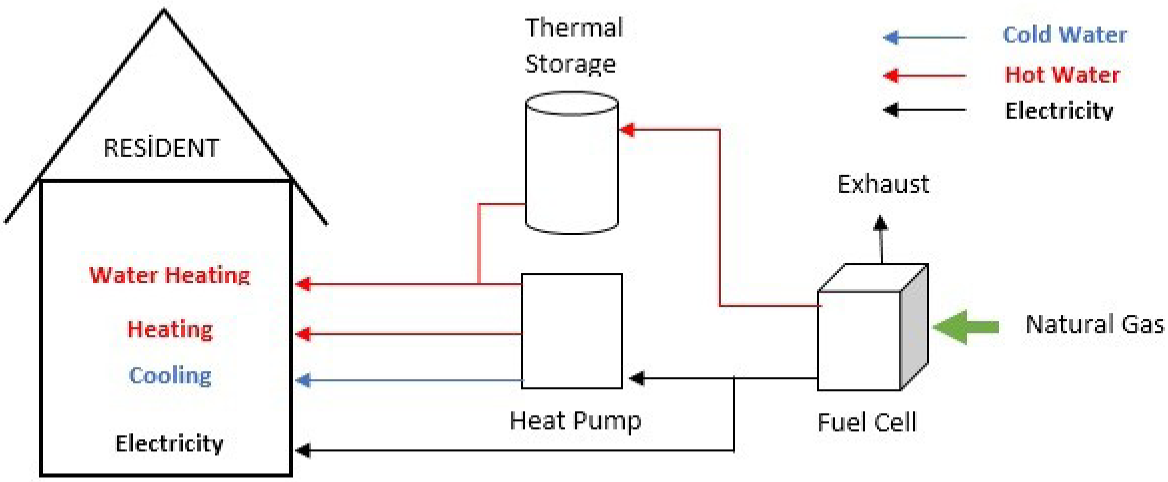

Figure 2. Schematic explanation of fuel cell system implementation and additional system elements.

Comparison results

According to the **Figure 3,** heating loads by climate zones show significant differences. Third and fourth zones illustrates terrestrial climate, so the annual heating requirement for the third and fourth zones is more than first and second zones.

In contrast, cooling has become more important than heating in the first and second zones due to the climate conditions. Since the first and second zones are in moderate climate zones.

Savings characterize differences in operating costs between a conventional system and fuel cell system. The savings are a direct function of the amount of heating and cooling loads (see **Figure 4**). Fuel cell tech-

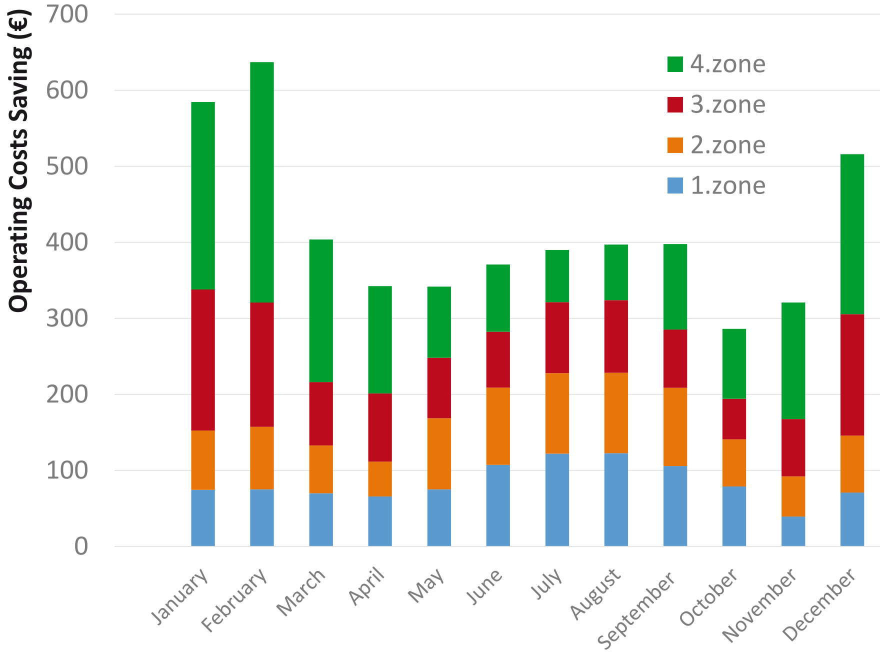

Figure 4. Monthly operating cost savings with fuel cell system in four climate zones, each climatic zone has been shown with one color.

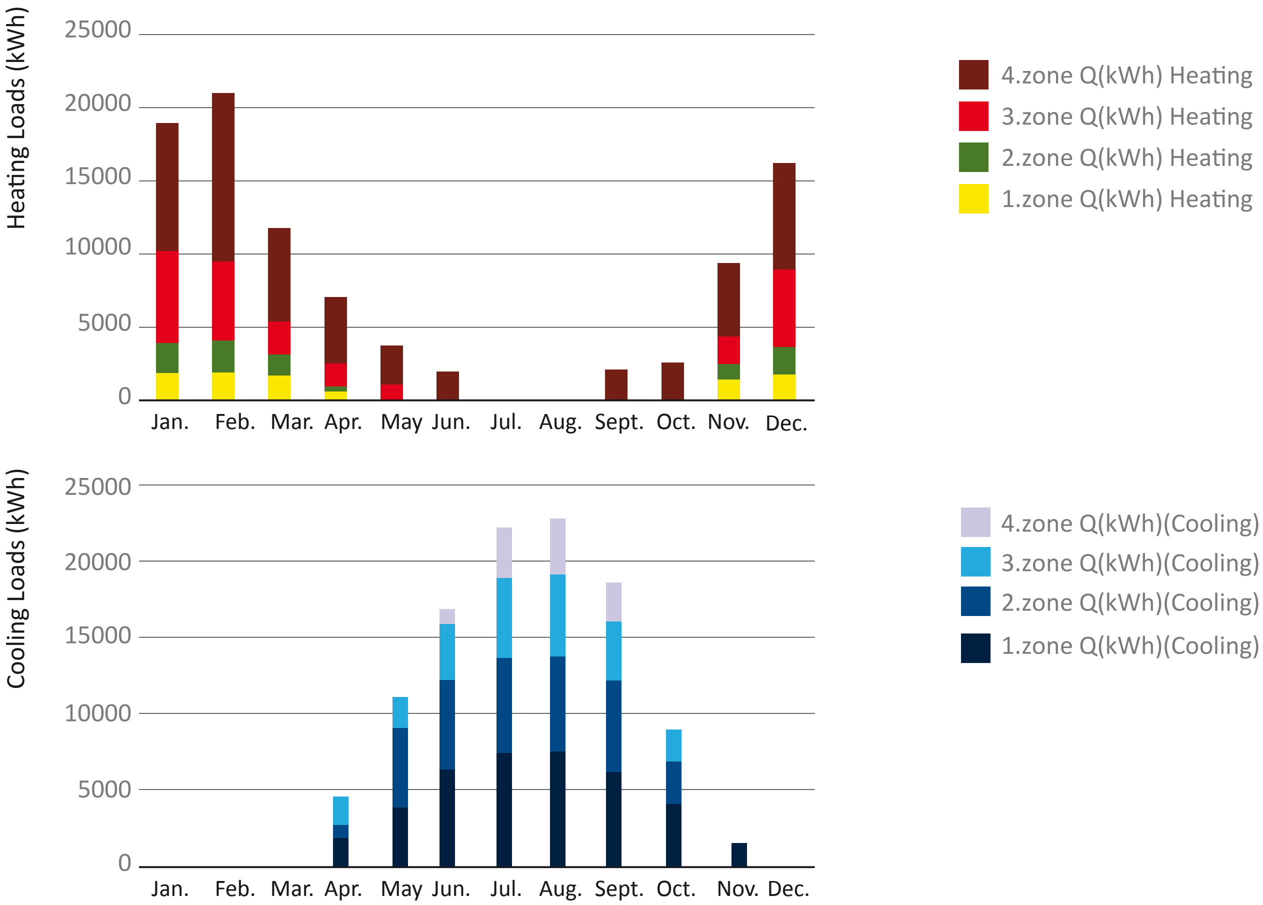

Figure 3. Monthly heating and cooling loads computed with HAP, each climatic zone has been shown with one color.

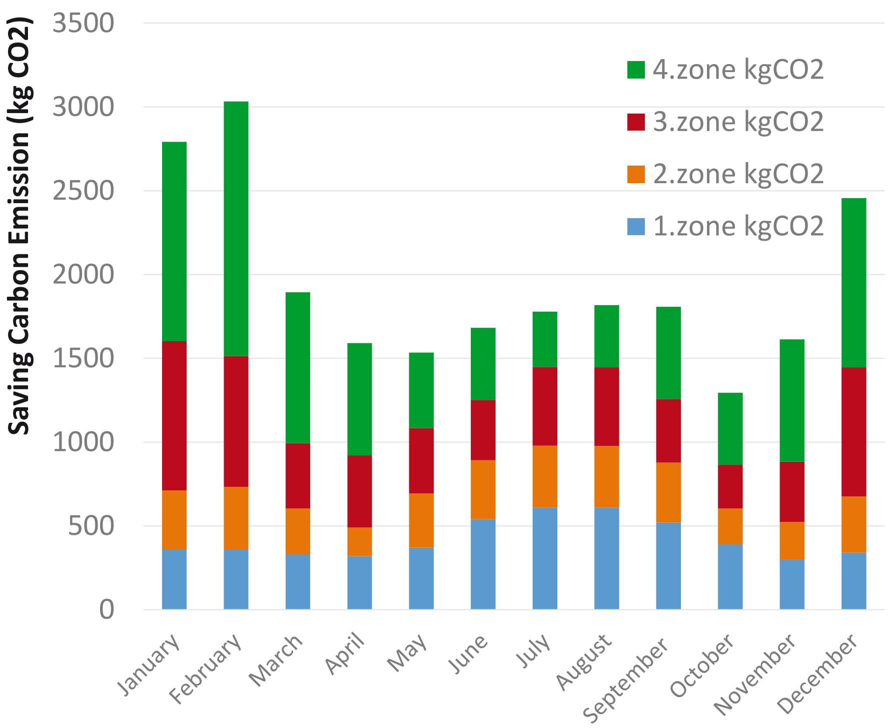

Figure 5. Monthly carbon emission saving values with fuel cell system in four climate zones.

nology is more advantageous in terrestrial climates since heating loads. In moderate climate zones, the advantage of fuel cell system depends on the cooling requirement. Fuel cell systems have provided highly variable financial benefits for domestic applications.

The fuel cell system has an enormous impact on the reduction of carbon emissions (see **Figure 5**). Moreover, carbon emission increases with high heating demand. Therefore, terrestrial climate zones having high heating demand have more carbon emission.

Table 2. Investment costs, operating costs, carbon emission and payback periods have been seen annual and 15-year period.

Climate	System Type	Investment ($)	Operating Cost ($/15years)	Net Present Value ($/15years)	Simple Payback Period ($/year)	Carbon Foot Print (kgCO2/ 15years)	Payback Period
1.zone	Conventional	5110	32937	14190	2196	162300	**11,7 years**
	FCS	16940	17826	7680	1189	86550	
	Saving	*–11830*	*15111*	*6510*	*1007*	*75750*	
2.zone	Conventional	5110	30930	12990	2063	141990	**12,2 years**
	FCS	16940	16405	6888	1094	86295	
	Saving	*–11830*	*14525*	*6102*	*969*	*55695*	
3.zone	Conventional	5110	35566	15323	2371	174150	**9,6 years**
	FCS	16940	17148	7388	1143	84900	
	Saving	*–11830*	*18418*	*7935*	*1228*	*89250*	
4.zone	Conventional	5110	46297	19946	3087	225150	**6,6 years**
	FCS	16940	19535	8416	1302	96450	
	Saving	*–11830*	*26762*	*11530*	*1785*	*128700*	

The great investment values and also the savings of fuel cell system have been seen for all climate zones in **Table 2**. Consequently, if the payback period is acceptable in terrestrial climates, the same case will be valid in very hot climates. In a moderate climate, the payback period is longer and difficult to implement for the moment.

Equations

$$Bh_g = \frac{Q}{Hu \times \eta} \quad (1)$$

$$Bh_e = \frac{Q}{COP} \quad (2)$$

$$OC = Bh \times t \times UP \quad (3)$$

Where Bh_g is the mean amount, natural gas to be used, Bh_e is the mean amount of electricity to be used and Q is heating or cooling load, Hu is the mean lower heating value of the natural gas, η is the efficiency of the boiler and COP is coefficient of performance. OC is the mean operating cost, t operating time and UP is unit price.

$$NPV = Saving \times \frac{(1+i)^n - 1}{(1+i)^n \times 1} \quad (4)$$

$$SPP = \frac{Saving}{Investment} \quad (5)$$

Where NPV is the mean net present value, i is annual discount rate, n is operating year and SPP is the mean simple payback period.

Conclusion

Overall, energy demand is increasing in the world day to day and domestic applications comprise a large portion of consumption. As a result of this study, more efficient domestic energy applications have become imperative. One of the new technologies is the fuel cell system. In this study, fuel cell system has been applied to a resident and discussed the availability of the fuel cell system.

The fuel cell system is more efficient than conventional system. Operating cost has decreased approximately 50 percent. Another effect is decreasing on the carbon emission value. However, fuel cell systems have a great difficulty for domestic applications. The fuel cell is an expensive technology. In recent years, work on the fuel cell technology has increased and it will be cheaper in near future.

The topic of this paper was presented in CLIMAMED 2013 Congress and invited to be published in the REHVA Journal. ■

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Requirements for Seasonal Efficiency for Air-conditioning Units

Performance of air-conditioners used to be compared at a fixed condition. However, this condition does not represent the usual operating conditions of the equipment over a season, which becomes especially important for the calculation of the energy efficiency. Seasonal performance first appeared in Eurovent Certification programme for chillers in 2006. The European Commission defined a seasonal efficiency for residential Air Conditioners applicable since 1st January 2013; consequently Eurovent Certita Certification has updated its programme in accordance with this regulation.

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Keywords: air conditioning, seasonal efficiency, certification, SCOP, SEER, Eurovent Certita Certification, energy label

Launched in 1994, the Air Conditioners certification programme was the first programme of Eurovent Certita Certification (ex Eurovent Certification Company). After almost 20 years it is well recognized on the market as well as the mandatory energy efficiency labelling for air conditioners below 12 kW since 2003.

Scope of the programme

Air Conditioners certification programme concerns comfort units, air-to-air and water-to-air below 100 kW (nominal capacity in cooling mode). It also applies to units intended for both cooling and heating by reversing the cycle. Concerning multi-split air conditioners, only systems with two indoor units are included.

Process of Certification

The purpose of all Eurovent Certita Certification Certification Programmes is to encourage honest competition and to assure customers that equipment is correctly rated on the market. The purpose is achieved by verifying the accuracy of ratings claimed by manufacturers by continuing testing of production models, randomly selected, in independent laboratories.

One particularity of Air Conditioners programme is to apply the "**Certify-all**" principle, meaning:

All products of the relevant certification programme manufactured or sold by a Participant inside the defined scope must be certified. When applicable, "Certify-all" principle means at least "all products inside the defined scope presented, at least, on the European market".

"Certify-all" brings clarity and transparency and therefore increases the value of the whole system.

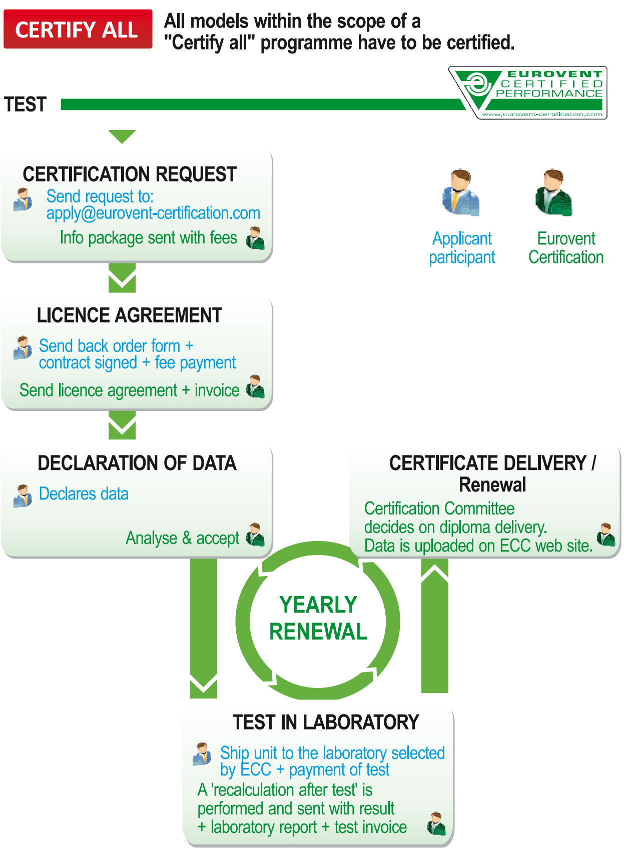


Figure 1. Steps in the certification process of the product performance.

Table 1. Requirements of minimum energy efficiency of air condition units with cooling capacity under 12 kW in the European market according to the EC regulation (see the definitions of abbreviations in the article by Sandrine Marinhas in this issue).

	Air conditioners, except double and single duct air conditioners	
	SEER	SCOP (Average climate)
If GWP of refrigerant > 150 for < 6 kW	4,6	3,8
If GWP of refrigerant ≤ 150 for < 6 kW	4,14	3,42
If GWP of refrigerant > 150 for 6–12 kW	4,3	3,8
If GWP of refrigerant ≤ 150 for 6–12kW	3,87	3,42

GWP = Global Warming Potential

Table 2. Energy Classification for Conditioners except double ducts and single ducts.

Energy Efficiency Class	SEER	SCOP
A+++	SEER ≥ 8.50	SCOP ≥ 5.10
A++	6.10 ≤ SEER < 8.50	4.60 ≤ SCOP < 5.10
A+	5.60 ≤ SEER < 6.10	4.00 ≤SCOP < 4.60
A	5.10 ≤ SEER < 5.60	3.40 ≤ SCOP < 4.00
B	4.60 ≤ SEER < 5.10	3.10 ≤ SCOP < 3.40
C	4.10 ≤ SEER < 4.60	2.80 ≤ SCOP < 3.10
D	3.60 ≤ SEER < 4.10	2.50 ≤ SCOP < 2.80
E	3.10 ≤ SEER < 3.60	2.20 ≤ SCOP < 2.50
F	2.60 ≤ SEER < 3.10	1.90 ≤ SCOP < 2.20
G	SEER < 2.60	SCOP < 1.90

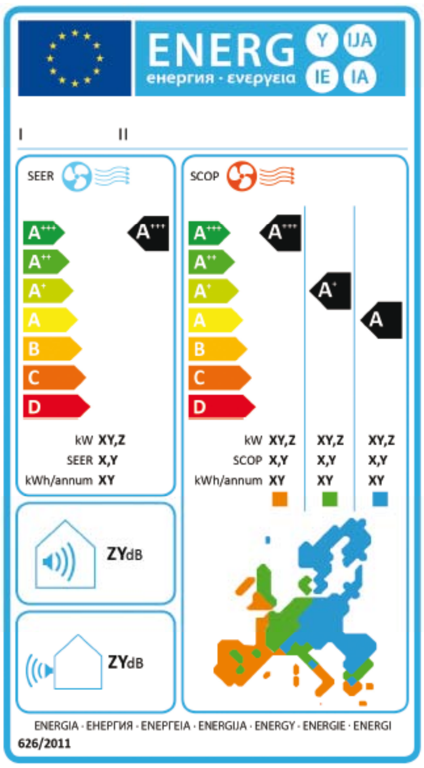


Figure 2. The model of the required energy label for all air conditioning unit in the European market from the beginning of 2013.

The certified performances depend on the product (below or above 12 kW) and the applicable EU Directives.

Directive Requirements for Air Conditioners below 12 kW

Commission Regulation (EU) No 206/2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to EcoDesign requirements for air conditioners and comfort fans gives requirements for all air conditioners with the cooling capacity under 12 kW (AC1) introduced on the European market after the 1st January 2013.

The Directive defines energy efficiency as shown in the **Table 1**.

Moreover, Commission Regulation (EU) No 626/2011 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of air conditioners makes mandatory energy labelling of all air conditioners with the cooling capacity below 12 kW introduced on the European market after the 1st January 2013. The Directive defines, for each function, the energy class going from A+++ (more efficient) to G (less efficient). The classification is given in the **Table 2**.

New Energy Efficiency Ratio and Standard for Air Conditioners below 12 kW

The SEER and SCOP, mentioned in the Directive, represent the usual operating conditions of the equipment over a season. This operating condition can be better assessed by comparing equipment at representative reduced capacities (**Table 3**).

European standard EN 14825 provides part-load conditions and calculation methods for calculating the SEER and SCOP of such units when they are used to fulfil the cooling and heating demands.

Other energy consumptions can occur when the unit is not used to fulfil the cooling and heating demands such as those from a crank case heater or when the unit is on standby. These consumptions are considered in the calculation methods for reference SEER and reference SCOP.

Fixed capacity air conditioners deal with varying loads by varying the operation time. The efficiency of the system is dependent on the effectiveness of the controlling thermostats. Variable capacity air conditioners, by continuous or step control of the compressor, can more closely match the varying load improving system efficiency.

Certification for Air-Conditioners below 12 kW

These Seasonal Energy Efficiency Ratio for cooling mode (SEER) and Seasonal Coefficient of Performance for heating mode (SCOP) came in addition, since the 1st January 2013, to the well-known Energy Efficiency Ratio (EER and COP).

Some new characteristics are currently being tested with a view of being certified, as the performances at Bivalent Temperature[1] or at Operation limit temperature[2], and also the annual electric power consumptions. These new items will better help customers to compare and make their choices.

The certified performances available on the Eurovent Certified Performance Website are listed in **Table 3**.

Figures 3 and 4 show the distribution of the Seasonal Performance in relation with the capacity.

Figure 5 shows the SEER in relation with the SCOP.

These graphs show that the requirements for the European regulation were more stringent for the heating mode than for the cooling mode, as the cut-off is more vertical than horizontal. Indeed, as shown in **Figure 5**, strong parallel requirements on both performances would have generated a more angular shape of the distribution.

SCOP limits SEER when SCOP is between 3.4 and 3.75. For a SCOP above 3.8 the amplitude of SEER is increased (SEER up to 7 to 8). Correlation between SCOP and SEER becomes chaotic for high SCOPs: these units are for sure on the radar screen of certification for verification of their high declared performance.

Certification for Air-Conditioners above 12 kW

Currently, the certified data are EER and COP at Standard Rating Conditions and Sound Power Level (**Table 4**).

[1] Bivalent temperature: lowest outdoor temperature point at which the heat pump is declared to have a capacity able to meet 100 % of the heating load.

[2] Operation limit temperature: lowest outdoor temperature at which the heat pump can still deliver heating capacity, as declared by the manufacturer.

Table 3. Testing conditions for rating of air conditioning units and the information available from the units tested and certified by the Eurovent Certita Certification.

Cooling Mode	Heating Mode
Performances in Standard rating conditions (according to standard EN 14511)	
Cooling Capacity @ 35°C EER @ 35°C	Heating Capacity @ 7°C COP @ 7°C
Seasonal Performances (according to standard EN 14825)	
Design Capacity	Design Capacity Bivalent Temperature Performance @ T°biv TOL (Operation limit temperature) Performance @ TOL
SEER Annual electric power consumption	**SCOP** Annual electric power consumption
Auxiliary Power consumption (Standby mode, Off mode...etc.)	
Sound Power Level (according to standard EN 12102)	

Table 4. Rating conditions and standards used to measure the performance of the air conditioning units with cooling capacity over 12 kW.

Cooling Mode	Heating Mode
Performances in Standard rating conditions (according to standard EN 14511)	
Cooling Capacity @ 35°C EER @ 35°C	Heating Capacity @ 7°C COP @ 7°C
Sound Power Level (according to standard EN 12102)	

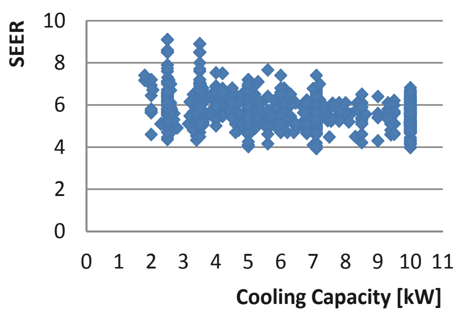


Figure 3. Seasonal Energy Efficiency Ratio for cooling mode (SEER). Each dot represents a different unit. (Eurovent 2013 certified data for Air conditioning units <12kW).

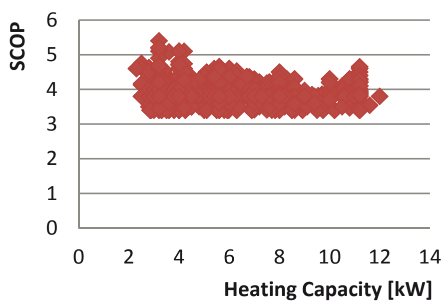


Figure 4. Seasonal Coefficient of Performance for heating mode (SCOP). Each dot represents a different unit. (Eurovent 2013 certified data for Air-conditioning units <12kW).

Seasonal Efficiency for Air Conditioners above 12 kW ongoing?

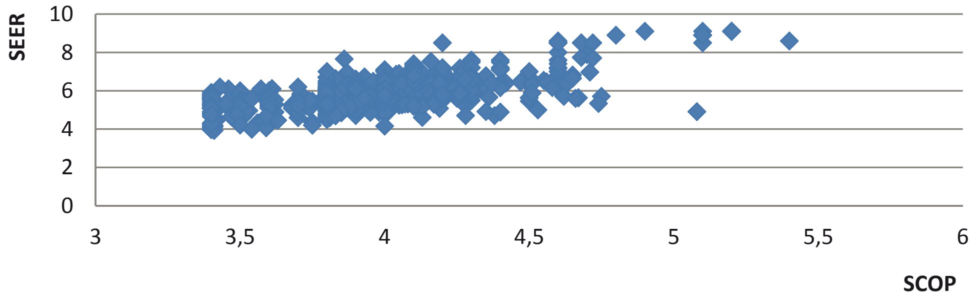


Figure 5. SEER vs. SCOP (Eurovent 2013 certified data for Air conditioning).

The objective of the Eco-design Directive is to improve the energy efficiency and to reduce the environmental impacts. The seasonal performance of air conditioning units represents better the energy efficiency of the unit than peak performance. A first draft of regulation based on Eco-design Directive, including the seasonal performance criteria was in consultation with stake holders already in 2013.

This document contains products in relation with:

- ENER[3] Lot[4] 21 (central air heating products)
- ENTR[5] Lot 6 (air conditioning products)
- ENTR Lot 1 (high temperature process chillers)

This future directive will impact:

- Heat Pumps air-to-air ≥ 12 kW
- Heat Pumps water-to-air up to 1 MW
- Chillers (reversible Heat Pumps in cooling mode) air-to-water and water-to-water up to 2 MW

and also:

- Air Conditioners air-to-air ≥ 12 kW
- Air Conditioners water-to-air up to 2 MW

The preparatory study identified the following significant environmental aspects to be regulated:

- Energy efficiency
- Carbon dioxide and nitrogen emissions,
- Sound power levels.

The energy performance requirements related to the seasonal performance SCOP/SEER with calculation methods very similar to those already existing in EN 14825.

Consequently, if the timeframe doesn't change, all Air Conditioners (below and above 12 kW) have to have Seasonal Performances Data from January 2017 and will have to respect the Directive requirements.

The Air Conditioners programme offered by Eurovent Certita Certification will integrate these parameters as soon as possible in order to /offer to our participants a programme in line with the future EU directives.

Data publication

Making the certified data easily available for end-users and consultants has always been a priority for Eurovent Certita Certification. Our directory of certified data, available since the creation of the company, and launched as an interactive website around 2001, brings reliable data to end-users. In addition to the certified data a dedicated description page for each certification programme containing the outline of the programme, definitions and rating conditions is made accessible and constantly updated to help visitors understand the value of certified data (http://www.eurovent-certification.com)

Conclusion

We are at the turning point concerning the Energy efficiencies for all thermodynamic systems (Air Conditioners, Rooftops, Liquid Chilling Packages …). The usual energy efficiencies achieved at full load are going to disappear gradually in order to be replaced by new performances which will better describe these units in terms of energy consumption. Soon, the new European Regulation will change also the current market by fixing higher requirements. With them, the verification of the published data by a third-party body, such as Eurovent Certita Certification for e.g., remains a useful added value to verify the announced performances as a complement to the market surveillance, and to help comparing the products thanks to the online database. ■

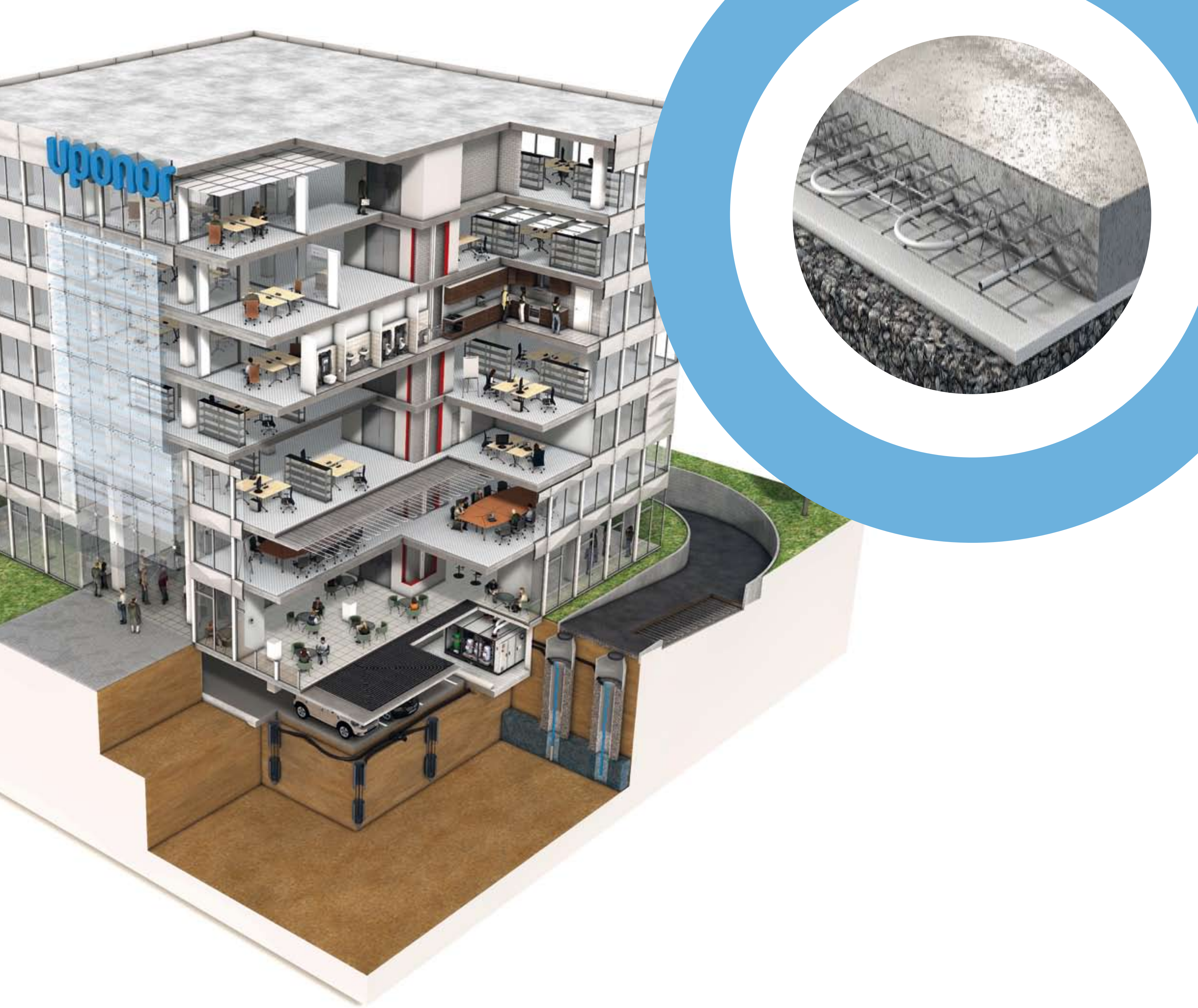
3 ENER= Directorate General of Energy
4 Lot= product group
5 ENTR= Directorate General of Enterprise and Industry

Terms used to describe the performance of chillers, air conditioners and heat pumps

COLLECTED BY DR SANDRINE MARINHAS, EUROVENT CERTITA CERTIFICATION

While chillers, air conditioners and heat pumps used to be rated at one standard condition, a process is on its way for the development and generalisation of figures for seasonal values, which goal is to come closer to the behaviour of the units over the year in order to better represent its efficiency. We expose here as simply as possible the main terms for these units and the key equations.

Terms	Cooling mode	Heating mode	unit
reference design conditions reference temperature conditions cooling mode: 35ºC dry bulb (24ºC wet bulb) outdoor and 27ºC dry bulb (19ºC wet bulb) indoor heating: for average: -10°C, colder : -22°C and warmer: +2°C climates	$T_{designc}$	$T_{designh}$	°C
load or demand load of the building at certain temperature conditions	P_c	P_h	kW
full load load at reference design conditions	$P_{designc}$	$P_{designh}$	kW
part load ratio load divided by the full load	PLR		%
capacity capacity a unit can deliver at certain conditions	DC		
capacity ratio load divided by the declared capacity	CR		
bin hours duration at a given temperature for a specific location	h_j		h
bivalent temperature (CR=100%) lowest outdoor temperature where capacity is equal to the load		$T_{bivalent}$	°C
operation limit temperature lowest outdoor temperature where the unit still delivers capacity		T_{OL}	°C
reference annual demand(s) representative annual demand(s)	Q_c	Q_h	kWh
efficiency (energy efficiency ratio and coefficient of performance) capacity divided by the effective power input at standard conditions: at conditions of EN 14511	EER	COP	kW/ kW
at part load: at conditions of EN 14825 (degraded for fixed stage units)	EER_j	COP_j	
electric back up heater (below Tbivalent) supplementary electric heater, with a COP of 1		elbu	kW
thermostat off corresponding to the hours with no load	TO		
standby unit partially switched off but reactivable by a control device or timer	sb		
off unit completely switched off	off		
crankcase heater (to limit refrigerant concentration in oil at compressor start) where a crankcase heater is activated	CK		
auxiliary power consumptions $\sum h_{aux}.P_{aux} = h_{TO}.P_{TO} + h_{sb}.P_{sb} + h_{CK}.P_{CK} + h_{off}.P_{off}$	TO, sb, off, ck		kWh
degradation coefficient for fixed stage units (same equations for COPj) efficiency loss due to the cycling of respectively chillers and ACs	Cc / Cd		%
$EER_j = EER.\frac{CR}{c_c.CR+(1-c_c)}$; $EER_j = EER.\left(1 - C_d.(1 - CR)\right)$ = *EER.(Part Load Factor)*			kW/ kW
reference seasonal efficiency [reference: EN 14825, 2013] seasonal efficiency calculated for the reference annual demand $SEER = \frac{Q_c}{\frac{Q_c}{\frac{\sum h_j.P_{c,j}}{\sum h_j.\left(\frac{P_{c,j}}{EER_j}\right)}}+\sum h_{aux}.P_{aux}}$; $SCOP = \frac{Q_h}{\frac{Q_h}{\frac{\sum h_j.P_{h,j}}{\sum h_j.\left(\frac{P_{h,j}-elbu_j}{COP_j}+elbu_j\right)}}+\sum h_{aux}.P_{aux}}$	SEER	SCOP	kWh/ kWh
active seasonal efficiency seasonal efficiency excluding auxiliary consumptions	$SEER_{on}$	$SCOP_{on}$	kWh/ kWh
European seasonal energy efficiency ratio [reference: Eurovent Certification, 2008] Antecedent term used for SEER before European standard was issued *ESEER =0.03.EER$_{100\%}$+0.33.EER$_{75\%}$+0.41.EER$_{50\%}$+0.23.EER$_{25\%}$*	ESEER	-	kWh/ kWh
integrated part load value [reference AHRI, 1998] (EER in kW/Ton) First equivalent to ESEER, with weighting coefficients related to the United States *IPLV = 0.01.EER$_{100\%}$+0.42.EER$_{75\%}$+0.45.EER$_{50\%}$+0.12.EER$_{25\%}$*	IPLV	-	kW/ Ton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Performance of Variable Refrigerant Flow (VRF) Systems

Keywords: variable refrigerant flow, VRF, testing, performance, air conditioning, testing conditions

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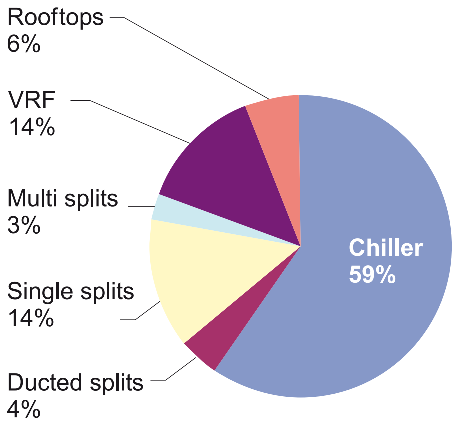

Figure 1. Estimated market share of cooling systems in Europe in 2008 (Final report of Task 2 – Air Conditioning products July 2012).

Summary

After two years of the work of the Launching Committee for the Eurovent certification programme for Variable Refrigerant Flow (VRF) systems, the Operational Manual and Rating standards for VRF have been validated in May 2013. This certification programme concerns air cooled and water cooled outdoor units cooling only, heating only and reversible.

The tests will be based on the European standard EN 14511 which has been recently updated in order to take into account systems with multiple indoor units. The tests will be performed in European accredited and independent laboratories.

The following performances will be certified:

- Cooling and heating capacities
- Efficiencies in cooling and heating (EER and COP resp.)
- A-weighted global sound power levels

Introduction

The Eurovent Certified Performance mark exists since 1994. From the beginning the Eurovent certified Performance mark for air conditioners has been one the flagship certification programmes. This scheme covers all air cooled and water cooled air conditioners up to 100 kW. It can be estimated that Eurovent certified air conditioners covers more than 80% of the European market. For many years it is well recognized on the European market but also in the Middle East and in Asia.

In 2007 a dedicated certification programme for Rooftop units has been created in order to differentiate this type of direct expansion cooling system from the other package, split and multisplit units.

Until recently VRF systems were the only type of direct expansion cooling systems not covered by a dedicated certification programme. As one can see in the below chart, VRF systems represent a significant market share among cooling systems in Europe.

Moreover, if we look at the evolution of the market for VRF systems in Europe, it can be seen that this market segment had the highest growth during the last decade among cooling systems and has the highest potential for the following decade (see **Figure 2**).

As a result the need for a certification programme for VRF systems was critical, that is why a Eurovent Launching Committee was set up in 2011 in order to work on the preparation of a certification programme for such systems.

Definition of VRF systems

Variable Refrigerant Flow (VRF) systems are direct expansion multi-split cooling and/or heating systems. It can integrates a large number of indoor units (up to several dozens), each indoor unit having its own regulation system. Outdoor units are typically combinations of single modules that can be connected with each other in order to increase the capacity of the system. These types of systems include in general variable speed compressors. As for classical multi-split systems, VRF systems can air cooled or water cooled, cooling only, heating only or reversible and can be able to generate simultaneously heating and cooling.

The typical characteristics of such systems are as follows:

- Refrigerant: R410A
- Scroll compressor
- Electronic expansion valve
- Indoor heat exchanger: coil with tubes and fins with different types of fans
- Outdoor heat exchanger: coil with tubes and fins with axial or centrifugal fans for air cooled systems and plate heat exchangers for water cooled systems.

Cooling capacities of VRF systems lie in general between 10 and 56 kW (4 to 20 HP) for single modules whereas complete systems can have capacities up to 150 kW.

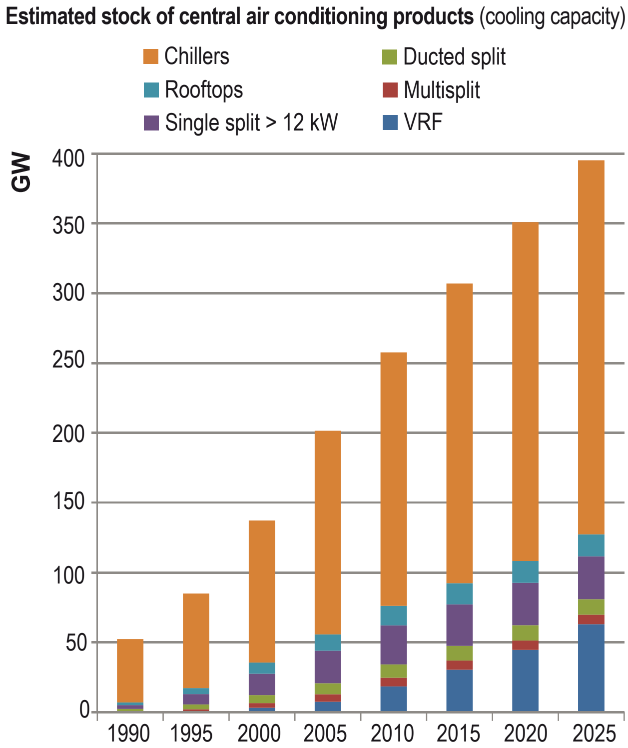

Figure 2. Evolution of market shares of the different cooling systems in Europe (Final report of Task 2 – Air Conditioning products July 2012).

Cooling capacities of indoor units lie in general between 2 and 7 kW. This means that typical systems can include up to 50 indoor units connected.

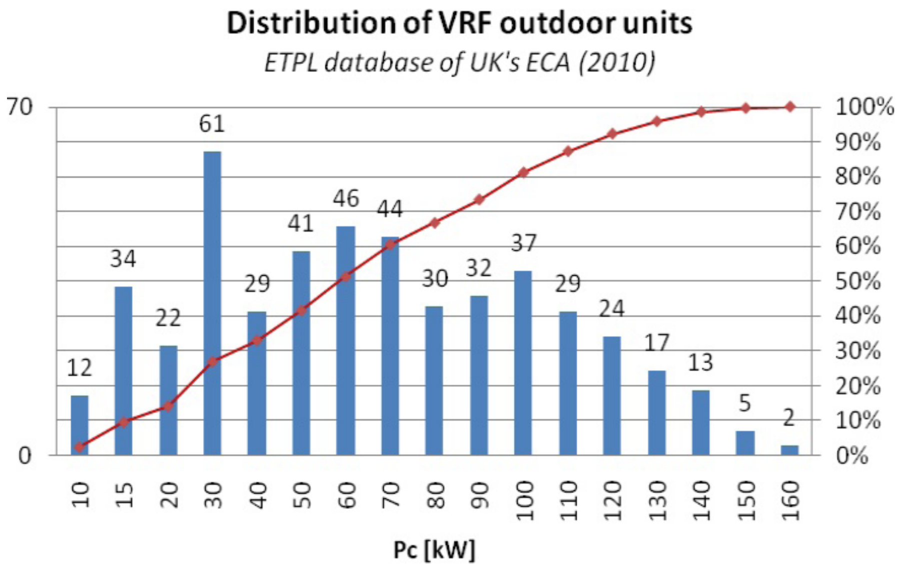

Figure 3. Distribution of capacities of VRF outdoor units (Final report of Task 2 – Air Conditioning products July 2012).

Eurovent Certification programme for VRF systems

Scope

The scope of the programme covers all single modules and combinations of modules with the following characteristics:

- air cooled or water cooled
- with cooling or heating capacities up to 50 kW (18 HP)
- for systems with cooling capacities higher than 50 kW the certification is possible as an option. In this case tests are performed in manufacturer's laboratory by independent and accredited test agencies

Certified Performances

The following performances are certified:

- Cooling capacity of the outdoor unit at standard condition (kW)
- Heating capacity of the outdoor unit at standard conditions (kW)
- Energy efficiency of the outdoor unit in cooling mode (EER) at standard conditions (kW/kW)
- Energy efficiency of the outdoor unit in heating mode (COP) at standard conditions (kW/kW)
- A-weighted global sound power level (dB(A))

Tolerances

The tolerances for the different certified performances are given in **Table 1**.

Testing requirements

Tests are performed with 2 to 4 indoor units (ducted or cassette). The connection ratio shall be 100% +/-5%.

Thermal tests are performed according to the European standard EN 14511-3. In particular the Appendix I of this standard defines the method for multi split units with a large number of indoor units. Indeed, for such systems it is impossible to assess the performance of every possible combination of outdoor and indoor units as the number of combinations is potentially infinite. Therefore the standard defines a method to assess the performance of the outdoor unit only as it is presented in the catalogue of all VRF manufacturers.

The following requirements shall be met during the tests:

- Electrical consumption of each indoor units shall not exceed 110% of the declared nominal consumption
- For ducted units the airflow rate of each ducted unit shall not exceed 110% of the declared nominal airflow.
- The length of the refrigerant piping shall be between 5 and 7.5 m, however the length can be higher if the installation of the system requires it.
- The testing method can be the calorimeter method (for units with capacity up to 20 kW) or the enthalpy method (from 20 to 50 kW).

Acoustical tests are performed according to the European standard EN 12102:2013 with the same conditions as for the thermal tests. The tests can be performed in reverberant chambers or in anechoic chambers.

The testing conditions according to EN 14511-3:2013 are given in **tables 2 and 3**.

Table 1. Tolerances of the certified performances.

	2013–2014	2015
Cooling and heating capacities	−8%	−5%
Energy efficiency EER and COP	−10%	−8%
A-weighted global sound power levels	+2 dB(A)	0 dB(A)

Table 2. Testing conditions for air to air VRF systems.

Air / Air	Outdoor unit		Indoor unit	
	Dry Temp	Wet Temp	Dry Temp	Wet Temp
Cooling mode	35°C	24°C	27°C	19°C
Heating mode	7°C	6°C	20°C	15°C max
Acoustic tests	35°C	–	27°C	19°C

Table 3. Testing conditions for water to air VRF systems.

Water / Air	Outdoor unit		Indoor unit	
	Dry Temp	Wet Temp	Dry Temp	Wet Temp
Cooling mode	30°C	35°C	27°C	19°C
Heating mode	10°C	7°C	20°C	15°C max
Acoustic tests	30°C	35°C	27°C	19°C

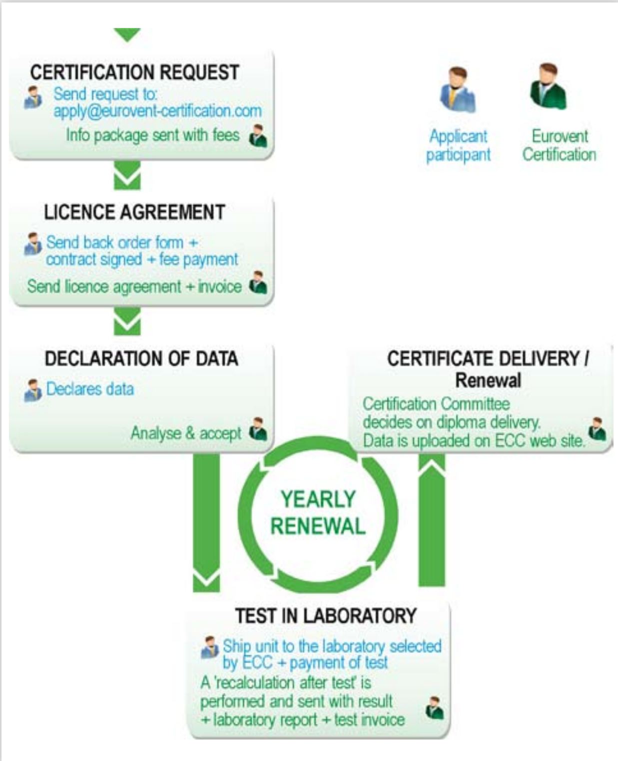

Figure 4. Illustration of the certification process.

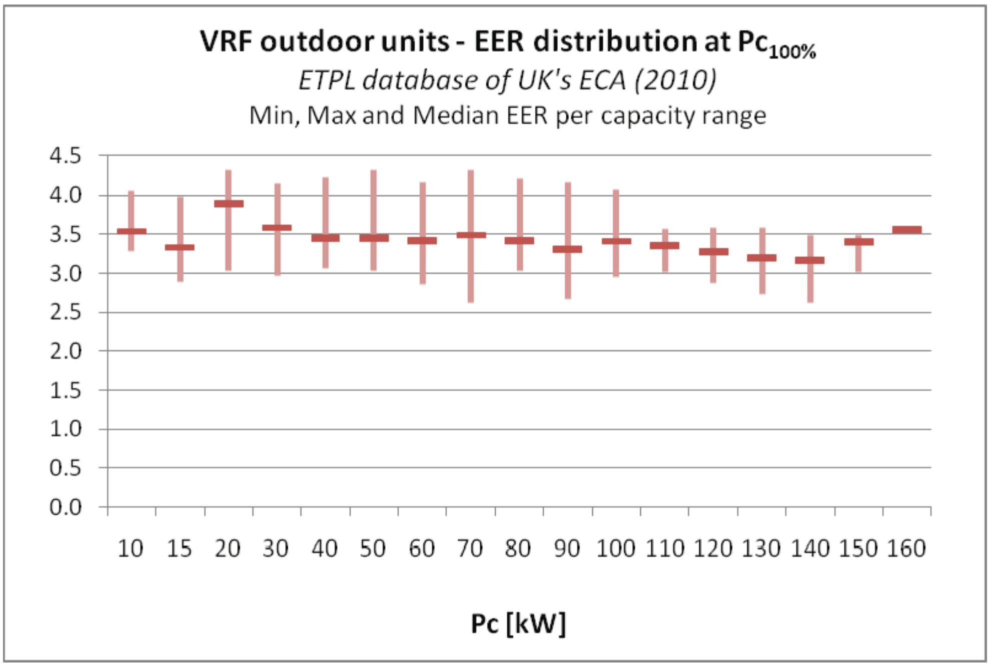

Figure 5. Distribution of efficiencies of VRF outdoor units according to the cooling capacity (Final report of Task 4 – Air Conditioning products July 2012).

Certification process

Eurovent Certification programmes are based on continuous monitoring of manufacturers production. For the VRF certification programme, each year 8% of the certified outdoor units are tested in an independent and accredited laboratory. If the performances of the tests are not according to the claimed performances within the above defined tolerances the performances of the manufacturer are rerated according to the measured values.

Future steps of the certification programme for VRF systems

End of 2013

The first VRF certified manufacturers will be published on the Eurovent certified Performance website (www.eurovent-certification.com) and on the Certiflash website (www.certiflash.com).

2014-2015

The scope will be extended to outdoor units with capacity higher than 50 kW thanks to tests performed in manufacturer's laboratories by independent and accredited test agencies.

As it can be seen in the charts below the efficiencies of systems composed of combinations of single outdoor modules (>50 kW) are similar to the efficiencies of systems with single outdoor modules (<50 kW). Therefore the certification of the performances of single modules (up to 50 kW) provides already a quite good understanding of the performances of all combinations. However the certification of combinations with cooling capacity higher than 50 kW will bring more transparency to the market.

2017

An Eco-design regulation on air conditioning systems will be published in the following months by the European Commission and will come into force likely by the 1st of January 2017. This regulation will cover all types of air conditioning systems including VRF. The regulation will define Eco-design requirements and in particular minimum efficiency requirements. These minimum efficiencies will be based on seasonal efficiency which takes into account of the difference of efficiency of such system according to outdoor conditions (see **Figure 6**).

Taking into account the seasonal efficiency of VRF systems will allow to get efficiency data closer to the reality than efficiency at standard conditions. Nevertheless it can be seen from **Figure 7** that efficiency at standard conditions are still a good parameter for comparing VRF systems with each other as the efficiency at standard condition EER is highly correlated with the seasonal efficiency.

The Eurovent Certification programme for VRF systems will take into account the seasonal efficiency as soon as it will be implemented in the European regulation.

Conclusion

The Eurovent certification programme for Variable Refrigerant Flow (VRF) systems is now available. The setting up of this programme required to update the European standard dedicated to this type of products. As for other Eurovent certification programmes this scheme is based on real units testing in independent and accredited European laboratories. The certification

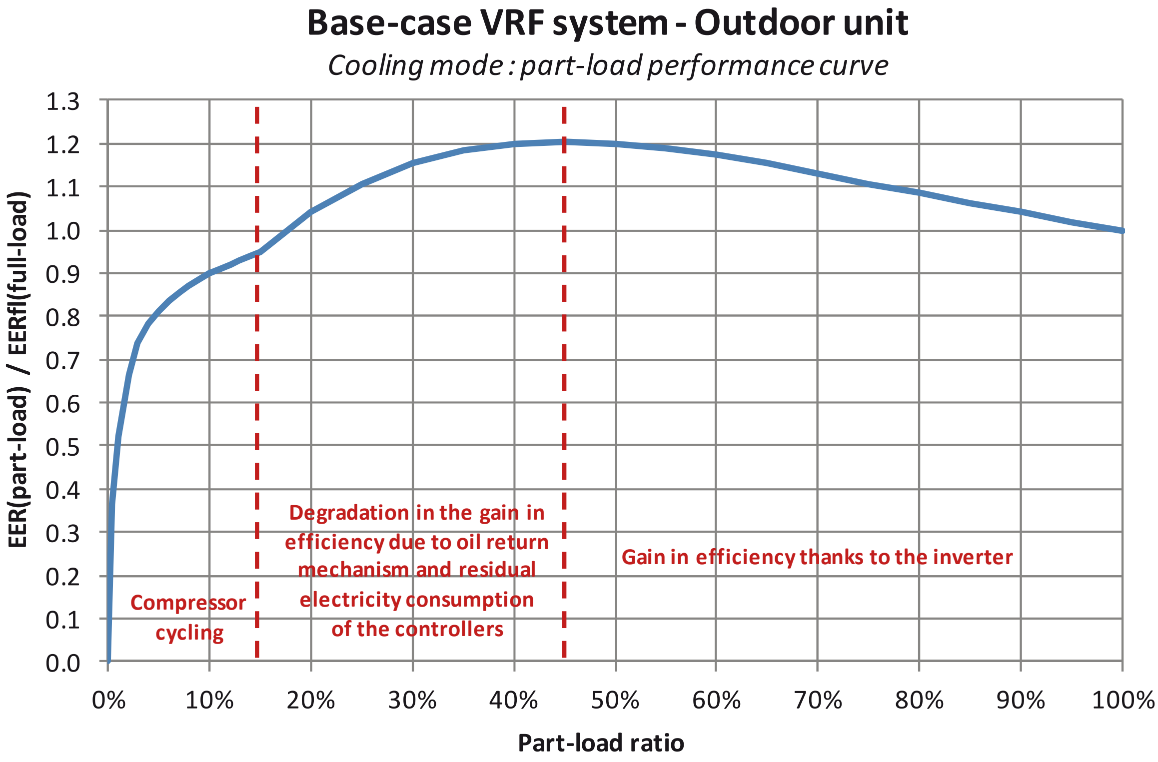

Figure 6. Estimation of the cooling efficiency of VRF system at different part-load conditions (Final report of Task 4 – Air Conditioning products July 2012).

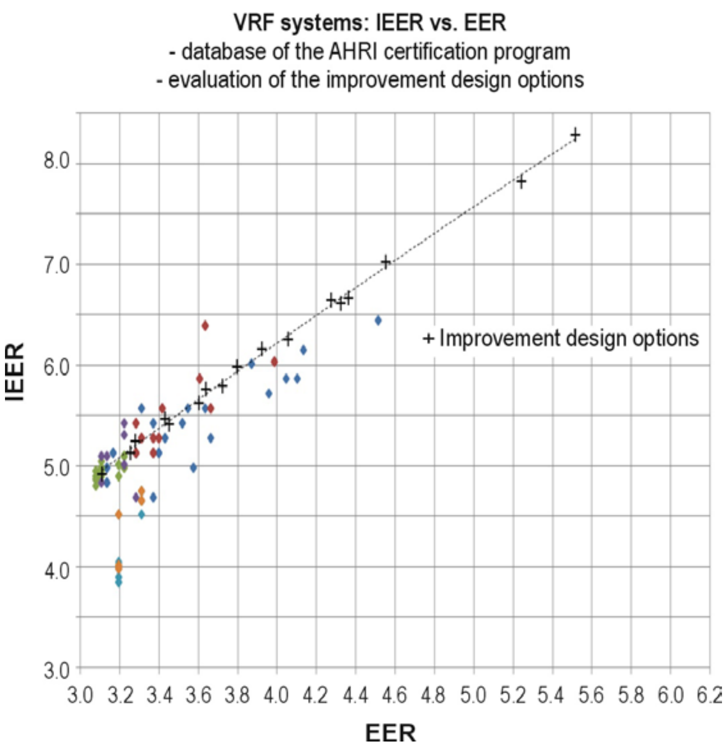

Figure 7. Correlation between efficiency at standard conditions EER and seasonal efficiency (Final report of Task 6 – Air Conditioning products July 2012).

process is based on continuous monitoring of manufacturers production with yearly selections and testing campaigns.

By setting up this certification progamme the Eurovent Certified Performance mark covers now all main types of cooling systems from packaged, split and multi-split air conditioners to rooftops and chillers. The Eurovent Certified Performance mark thus allows the European air conditioning industry to level up the playing field and to ensure to the end users real performance data based on proven certification processes. ■

Acknowledgements

All charts and figures given in this article are based on the remarkable work done by Armines for the European Commission during the preparatory study on Air Conditioning and Ventilation systems in the context of the Ecodesign directive. The study and all related documents can be found in the project website at www.ecohvac.eu.

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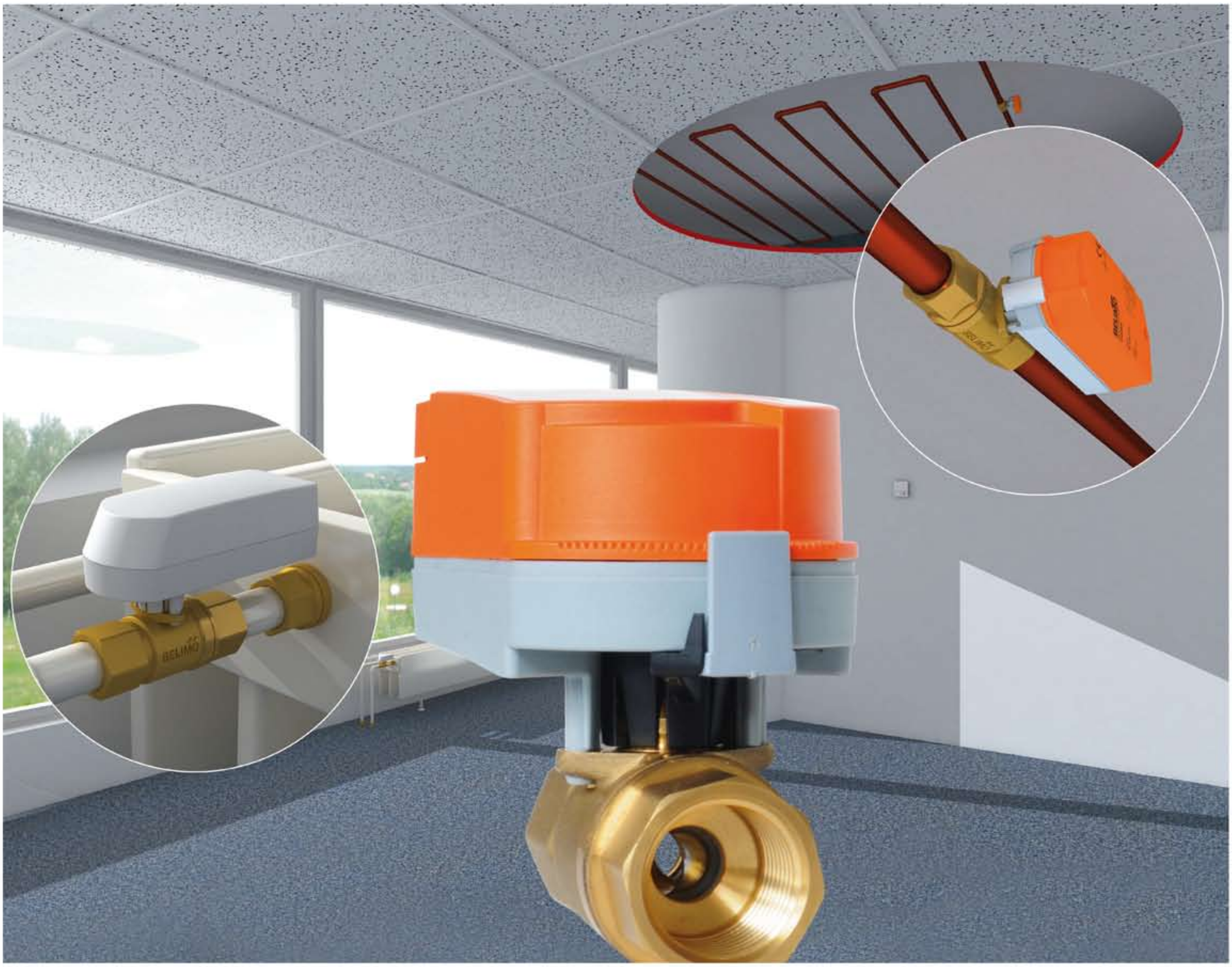

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Quick Compact Valve QCV.
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nZEB headquarters of Skanska

The Entré Lindhagen Building which is the new headquarters of Skanska and the Nordic bank giant Nordea is a very low energy office building. The building is designed to be one of the greenest office buildings in the Nordic countries without compromising on indoor climate and functions for the tenants. The office building, located in the central part of Stockholm, has 57,500 m² rentable floor area and consists of three parts in 9 office floors and a common basement floor including garage in 3 levels. Skanska leases half of the building and Nordea Bank leases the other half. The building was finalized in January 2014. The expected delivered energy use is 49 kWh/m².

Keywords: office building, ground source heating and cooling, nZEB, energy efficient design, low energy building, seasonal heat storage.

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The systems

Under the garage there is an energy storage which consists of 144 bore holes with double U-tubes 32 mm PE in active depth of 220 m. The system is called Skanska Deep Green Cooling (DGC) which has a patent in Sweden, is approved for a patent in US and has patent pending in Europe.

Summer time the building is cooled by the energy storage system. In winter time the system partly heats the building by preheating the supply air for ventilation and at the same time restoring the energy storage to normal temperature.

The system solution does not include compressors and the expected COP is therefore high, between 20 – 30 (!). A smaller building consisting of 3000 m² rentable area and 12 boreholes is already in use with DGC. A validation of the performance of the system after one year of operation has resulted in COP=15 with lower annual cooling demand than expected. The system is robust, consisting only of circulation pumps, heat exchangers and a self-regulating chilled beam system in office floors.

Figure 1. The façade with external sun shading.

The ground temperature is used in the same level as the undisturbed ground temperature at the same depth which makes the system independent of geometry due to heat losses. The temperature level above freezing makes it possible to use normal city water in the ground loop instead of ethanol mixture.

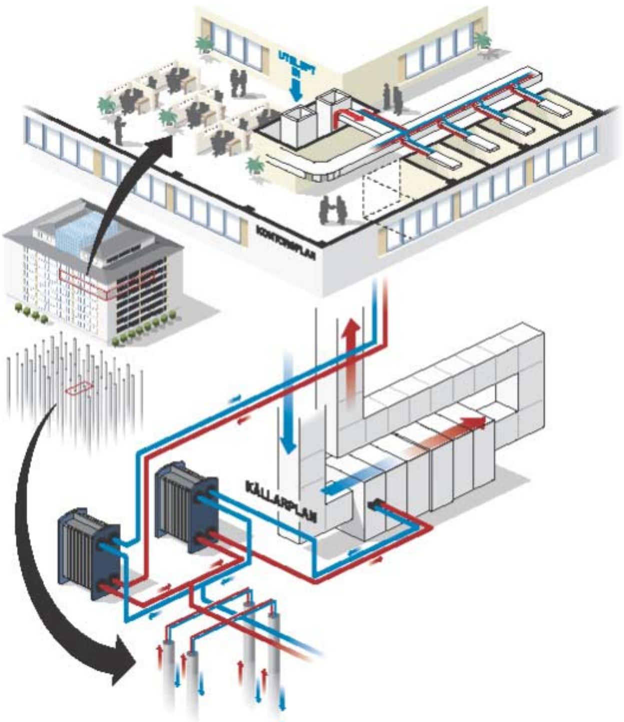


Figure 2. Illustration of Skanska Deep Green Cooling and a simplified technical connection scheme of the system.

The system is designed to match the entire cooling demand of the building, both indoor climate demand and process cooling of server rooms, etc. Winter time the ground temperature level is reset after a hot summer by preheating the outdoor supply air to the air handling units in an additional coil in the AHUs. The two nearby multi-family buildings are also connected to the DGC system and preheat outdoor air for ventilation with additional coils and the DGC gets rid of summer heat to achieve normal ground temperature level for next summer. Delivered Energy for heating and power including elevators, fans, pumps, heat losses from pipes and freezing protection of storm water system, but excluding lighting electricity outlets for PC, etc is expected to be 49 kWh/m² heated area (65,265 m²) where heating demand is 33 kWh/m² and power for building services 16 kWh/m². Cooling demand totally covered by the DGC system is calculated to be 26 kWh/m² including process cooling. Power to pumps and pressure drop over coils for DGC is expected to be less than 1 kWh/m² and is included in the building use above.

Air handling units are made for low face velocity around 1.0 m/s through the coils and filters and the ducting systems are made for max 5 m/s in the shafts and max 3 m/s on the office floors according to Skanska Commercial Development Standard, see REHVA Journal 3/2011. Heat recovery is made

Figure 3. The main circulation pumps for the Skanska Deep Green Cooling in the front and the ground heat exchanger in the rear.

with double run around coils and a temperature heat recovery efficiency of over 80% which enables using all exhaust air for heat recovery, even air from toilets. The lighting on the office floors is equipped with daylight control and presence control to further reduce the energy demand.

The Skanska roadmap for Deep Green

By these measures described above the building is very energy efficient. But to reach what we in Skanska call "deep green" we have to reach net zero primary energy. As we now have gone from picking the low hanging fruits to the high hanging fruits, the next step is to

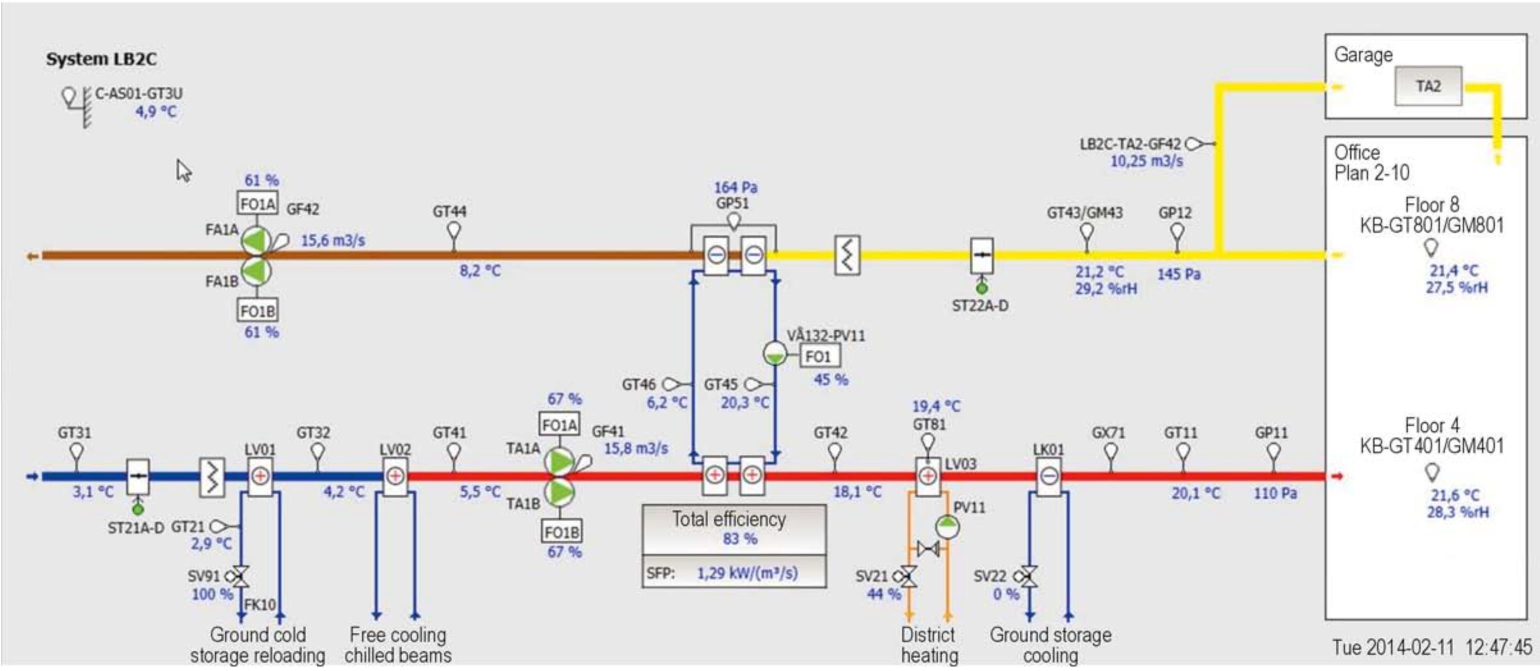


Figure 4. Office air handling unit in operation. Screen dump from BMS.

Figure 5. One of the office Air Handling Units.

include renewable energy. But when we have examined this we realized that by, for example, balancing the annual heat demand which will occur during winter with solar heating which will occur during summer, the environmental usefulness of this will be none or it could even increase the environmental impact!

How is then the nZEB building possible?

Grid interaction and load matching

Now we enter into investigations and studies of the infrastructure of the local district heating and its connection to the north European power grid. If we should export heating from the solar heating panels to the district heating grid during summer, the garbage incineration fueled Combined Heat and Power plant in the district heating grid has to reduce its production, while there is less demand for/place for waste heat and that will lead to less production of power in the CHP plant which will lead to more power production in the existing coal fired power plants in the north European power grid with more carbon dioxide emissions. In winter we need the same amount of heat that we produced by solar collectors in the summer, but now it is produced not only by CHP but also by bio-fueled boilers or/and even by fossil-fueled boilers. In this case, the load matching is bad even if we use grid interaction.

How to make the solar heating to have a positive impact in an advanced district heating system?

In a northern location like Stockholm we need a seasonal heat storage in order to get a better load matching between the renewable energy production and the building heat demand using solar heating. This is not a new technology. Skanska was the constructor of a 100,000 m³ uninsulated rock cavern filled with hot ground water used for seasonal storage and heated by solar collectors and an electric boiler for a local district heating system in Lyckebo, 80 km north of Stockholm in the 1980s. For the seasonal storage the geometry is of great importance to avoid too high annual heat losses. To use this technology in cities, you need large outdoor areas in remote places near railways, motorways, etc to mount solar collector fields and large seasonal storages to reduce the losses (heat losses per m³ will decrease by increasing the volume of the storage). So this has to be made as business development with many stakeholders. One single building owners do not have the possibility to build such a system. The district heating company that owns the network has to be involved, a number of building owners has to agree to invest or to go into long-term energy agreements with a solar heating seasonal storage system owner. The LCC cost is also higher than traditional district heating and that has to be financed somehow, as a part of a green offer to the tenants. We are doing potential studies, thesis about customer opinions, legal matters, planning case studies together with the universities, energy companies and the customers.

Skanska is also developing similar business cases with wind mill organizations on how to keep out of the certification systems to assure a real addition of green – not only greenwashing - to have an alternative to put renewable installations on the buildings if and when that seems wise.

nZEB and RES

Our efforts in these projects are aimed at finding reasonable solutions which will increase the use of renewable energy sources and replace fossil fuels. At the same time the solutions have to be robust and allow the use of different solutions in cooperation with the grid when that seems as a good opportunity, instead of doing it only on the building level and calculating energy meter figures without taking into consideration the consequences out in the grid, such as load matching. This implicates the demand for a wider definition of nZEB in order to make it possible to include initiatives for renewable energy made out in the grid to be part of the nZEB definition, given that it is a proven real addition that is equal with initiatives for renewable energy made on the building. During February 2014, REHVA is starting up a production of a guidebook lead by **Jarek Kurnitski** that will show the implications of on-site and nearby renewable energy systems (RES). IEA annex 52 and task force 40 are working with monthly time steps of load matching and grid interaction. In Sweden, the consulting company IVL in February 2014 started a project funded by three different organizations to define methods and different time steps to show energy performance and carbon dioxide emissions where load matching and grid interaction are taken into consideration when using RES.

Summary

These initiatives and business development steps are parts of a long-term process that will hopefully result in real solutions and products that will be accepted by the market players, the building codes and the classification systems to make rational decisions possible, and not just sub-optimizing when adding renewable energy to the buildings in the near future. The result will be a very low energy building with RES added to the infrastructure grid to reduce the energy demand down to zero. ■

REHVA

Federation of European Heating, Ventilation and Air Conditioning Associations

REHVA position paper on the European Commission 2030 climate and energy policy

Brussels, 04 February 2014

The Commission's new proposal for 2030 EU climate and energy policy framework sets a target to reduce greenhouse gas (GHC) emissions by 40% below the 1990 level but has abandon binding targets for energy efficiency and renewables which have guided the R&D work in the building sector for more than 10 years. **Abandoning the energy efficiency target could stop the progress and destroy the leadership in the industry.**

REHVA is deeply concerned about the lack of binding targets for energy efficiency and strongly believes that only with three balanced, ambitious targets for GHG, renewables and energy efficiency it is possible to ensure a successful overall climate and energy framework for Europe for 2030 and beyond.

Experience shows that only binding targets can lead the way towards continuous development in energy efficiency, especially in the building sector which represents nearly a half of the energy end-use. The building sector has always needed strong regulatory boost before any major progress has happened. Voluntary efforts by a few forerunners have resulted in success stories which lead the way, but the vast majority has just followed the minimum requirements set by the building codes. Systematic improvement of energy performance of buildings can be done without drawbacks only through national binding requirements, together with voluntary efforts which are not alone sufficient.

REHVA can agree that the GHG target 40% is important as such, and will to some extent contribute towards a greater share of renewables, but it may stop a progress in energy efficiency and create unstable situation for industry. Without binding targets, Member States may expect that progress will happen through the GHG target by itself or through the existing regulations and measures, and through voluntary efforts. Only binding national long term targets will ensure an active boost in the industry and end users towards better efficiency and encourage innovations, too.

GHG targets alone will put the main focus to energy production oriented policies instead of systematic improvements throughout the whole energy chain, including end-use, distribution and production. Holistic and balanced energy policies are evidently needed to maintain the achieved progress and to keep the leadership role. Thus energy efficiency targets are equally or even more important as the GHG target, as they have a direct influence in the consumers and the industry.

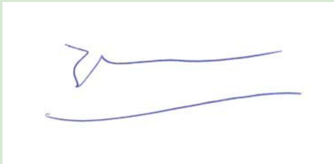
REHVA also believes that three binding targets policy is not only the key to achieving any of those targets, but to reach a sustainable way to strengthen Europe's position as a global leader in energy efficiency, especially in the building sector, and to overcome the still existing weaknesses in this way. By now, several successful innovations have entered the market, with the quality has increased through success stories by forerunners in European industry, for example in eco-design and energy labelling, resulting in win-win situation to both end-users and manufacturers.

"Only the saved energy is free". Success stories of energy savings are available, and the best of these have also improved the citizens' well-being. Energy efficiency improvements have been cost effective and positive impact on the economy (unemployment reduction, export increase, etc.). To put the highest priority in the energy efficiency target could actually be the most effective way, to lead to an increase in renewables, and also a major reduction in GHG.

The EU has through systematic legislatory efforts like the EPBD, EED and ErP and binding country specific targets, reached a development which can by the year 2020 result in reaching the 20-20-20 target, or at least close to the targets. In the situation where European industry has experienced benefits from ambitious targets as a tool towards global leadership in energy efficiency, the lack of binding energy efficiency target looks a drastic step backwards. The fact that the 20% target for energy efficiency still looks very difficult to meet should stress the importance of a binding and ambitious target to energy efficiency.

As a conclusion, **energy efficiency improvements are so directly linked to GHG reductions that the discussion of GHG reduction target without a binding energy efficiency target will become speculative**. Therefore it would be **essential to fix ambitious and cost-effective energy efficiency targets together with GHG targets**. Also **binding target for renewables is essential** for a holistic and balanced policy framework. ■

Karel Kabele
REHVA President



Jan Aufderheijde
REHVA Secretary General

Jorma Railio
Chair of the REHVA Technical and Research Committee

REHVA joins CEN as a Liaison Organisation

Report by Ioan Silviu Dobosi

One constant concern of REHVA, with the development of the activity in the Technical and Research Committee (TRC), has been to be involved in making CEN standards. Since 2007 REHVA has had the status of a Liaison Organization, specifically in two committees CEN TC 156, Ventilation for buildings and CEN TC 228, Heating systems in buildings. For each CEN TC, REHVA has appointed a Liaison Person. Given the status of CEN, by which the activity is mostly carried through affiliated National Societies of Standardization from European countries, the involvement of the Liaison Persons from REHVA in the effective activity of elaborating the standards was limited only to the participation as an observer in the Plenary Meetings of the two technical committees. The discussions carried in the REHVA TRC Meeting, concerning a more direct involvement of the REHVA representatives in the standardization process have created the possibility of negotiating a new agreement for the cooperation between REHVA and CEN. An agreement between CEN and REHVA was signed on 14 January 2014. This new agreement allows REHVA to take part directly in the working groups for specific work items and standards.

In the liaison agreement both parties have agreed upon the following:

Art 1.Scope of this Agreement

This Agreement, by defining the rights and obligations of the Parties, aims at facilitating the contribution of the Liaison Organization to the relevant CEN activities at technical level to ensure high quality and consensus-based technical deliverables.

Art 2. Status of Liaison Organization and indication of Technical Committee(s)/body(ies)

2.1 CEN grants the status of Liaison Organization to the Organization indicated in the "Agreement Specific Terms" herein, who accepts it.

2.2 The status of Liaison Organization is granted for the Technical Committee(s)/body(ies) listed in Annex 1 at the time of the signature of this Agreement.

2.3 The Liaison Organization may request at any time to CEN to be allowed to participate in additional Technical Committee(s)/body(ies) or to withdraw from them . Any participation in new Technical Committee(s)/body(ies) shall be granted by CEN in accordance with the provisions of the CEN CENELEC Internal Regulations - Part 2 and CEN-CENELEC Guide 25.

2.4 Any modification to the list of Technical Committee(s)/body(ies) in Annex 1 of this Agreement shall not require an amendment to the present Agreement , but shall be timely registered in the relevant CEN database by the CEN-CENELEC Management Centre and the amount of the annual financial fees shall be adapted accordingly, as defined in Art. 5.

2.5 The list indicating the Technical Committee(s)/body(ies) to which the Liaison Organization has access is renewed automatically for the following year unless otherwise communicated to the CEN-CENELEC Management Centre by the Liaison Organization at the following email address partners@cencenelec.eu, and this by 30 November of the current year at the latest.

Art. 3. Modalities of cooperation

3.1 The Liaison Organization, with regard to the identified Technical Committee(s)/technical body(ies) for which liaison status has been -or will be- granted , is entitled:

a) to receive access, through the appropriate electronic tools, to the working documents associated with these Technical Committee(s)/other technical body(ies);

b) to appoint representative(s) to these Technical Committee(s)/other technical body(ies). Participation of Liaison Organization representative(s) implies:

- no voting rights;
- the possibility to propose technical documents with a view of their possible conversion into CEN deliverables , through the regular consensus and approval process;
- the possibility to introduce preparatory work as a support to ongoing standardization activities;
- the possibility to submit technical contributions to the body's meetings;
- the possibility to formulate advice on current and future standards programmes.

3.2 The Liaison Organization ensures that the technical input provided by its representative(s) in the Technical Committees and other technical bodies express the consensus view of the majority of the members of the Liaison Organization.

3.3 The Liaison Organization shall contribute to the relevant CEN technical activities defined in this Agreement in full respect of the rules of the CEN-CENELEC Internal Regulations - Part 2, of other relevant guidelines, including CEN-CENELEC Guide 25, and CEN established practices.

After the signing of the new agreement, REHVA has nominated with help of TRC representatives in three committee and six working groups. The nominated experts have an access to the material of that specific committee and can participate in the work. They are also requested to report regularly to REHVA the progress in the activities. The REHVA liaisons in 2014 are:

CEN/TC 371 Project Committee - Energy Performance of Building project group:

TC level liaison: Livio Mazzarella - Italy

WG 1: Overarching EPBD standards:
Jarek Kurnitski – Estonia

CEN/TC 156 Ventilation for buildings:

TC level liaison: Ioan Silviu Dobosi - Romania

WG 19: Revision of EN 15251: Olli Seppänen – Finland

WG 20: Revision of EN 13779: Olli Seppänen – Finland

WG 21: Revision of EN 15241, 15242 and 15243:
Jarek Kurnitski – Estonia

WG 23: Inspection of ventilation and AC systems:
Jorma Railio – Finland

CEN/TC 228 Heating systems in buildings:

REHVA TC level liaison: Christian Feldman - France

WG 4: Calculation methods and system performance and evaluation: Jarek Kurnitski - Estonia ■

REHVA Annual Meeting and Seminar 2014

VDI-Technical Division Building services is delighted to invite you to Dusseldorf, Germany for the REHVA-Annual Meeting from 28-30 April 2014.

This Annual Meeting will bring together practitioners, researchers and educators from the international building services community. REHVA's internal meetings and the REHVA General Assembly will be held on the April 28th and 29th.

The REHVA Annual conference will focus on "***Energy efficient, smart and healthy buildings***". This technical conference will take place on **April 30th** at the Maritim Hotel Dusseldorf Airport. The main topics of the conference are ventilation and indoor-air quality, cooling load and building automation. VDI-GBG is planning an excellent programme, which will offer researchers, industry, building owners, end-users, consultants, engineers, architects, policy makers, etc., a platform for the exchange of knowledge and innovative technical solutions.

Düsseldorf was again voted city with one of the best quality of life indexes worldwide, and for good reason! The state capital of North Rhine-Westphalia holds many highlights for all tastes and interests in store. We hope you will take up the many opportunities for you to find out what Düsseldorf has to offer!

We look forward to greeting you at the **REHVA Conference 2014**!

More information: Please visit the conference website to register www.vdi.de/rehva-am-2014. **The Registration is now open!**

April 30, 2014 Maritim Hotel Düsseldorf Airport, Düsseldorf, Germany "Energy efficient, smart and healthy buildings"

Conference Programme:

09:00	**Opening**. Prof. Dr.-Ing. Birgit Müller VDI
09:05	**Welcome Introduction**. Prof. Karel Kabele, REHVA President
Section 1: Energy Efficiency	
09:10	**Energy efficient and green buildings in Germany**. Dipl.-Ing. Thomas Kleist VDI, GREYDOT, Germany
09:30	**REHVA Definition on nZEB**. Prof. Jarek Kurnitski, Tallinn University of Technology, Estonia
09:50	**Influence of Building Automation and Control Systems on energy standards**. Prof. Dr.-Ing. Martin Becker VDI, University of Applied Sciences Biberach, Germany
10:10	**Building services in listed or historic buildings – VDI-Standard 3817**. Dipl.-Ing., Dipl.-Chem. Rainer Kryschi VDI, Kryschi Wasserhygiene, Germany
10:30	**Coffee**
Section 2: Ventilation	
11:00	**Hygiene in air-conditioning systems – new development of VDI-standard 6022**. Dr. Andreas Winkens VDI, Ingenieurbüro Winkens, Wegberg, Germany
11:20	**Cooling Loads – the new standard VDI 2078**. Prof. Dr.-Ing. Uwe Franzke VDI, ILK-Dresden, Germany
11:40	**Weather Data for building services** . Prof. Dr. Livio Mazzarella, Polytechnic University of Milan, Italy
12:00	**Mixed Ventilation – the new REHVA-Guidebook No. 19**. Prof. Dr.-Ing. Dirk Müller VDI, E.ON Energy Research Center RWTH Aachen, Germany
12:20	**Lunch**
Section 3: European good practices and frontrunners - EU projects of REHVA	
13:30	**REHVA Cooperation in EU projects, Efficient energy for EU cultural heritage**. Anita Derjanecz, REHVA Project Officer
13:45	**Nearly Zero Energy Hotels - case studies and the definition of a NZEH**. Stefano Corgnati PhD., REHVA vice-president
14:00	**BUILD UP portal: achievements and new priorities**. Peter Wouters PhD., INIVE EEIG, Belgium
14:15	**Monitoring and benchmarking of HVAC system efficiency** Ian Knight PhD., Cardiff University, iSERV project coordinator
14:30	**REHVA Student Competition Awards Ceremony**. Prof. Dr. Manuel Gameiro da Silva, REHVA vice president
14:45	**REHVA Student Competition Winner Presentation**
15:00	**Summary**. Prof. Dr.-Ing. Birgit Müller VDI
15:15	**End of the conference**

Report of CEN TC 156 activities in 2013

IOAN SILVIU DOBOSI
Dr. eng. Romania
Vice-president of REHVA and AIIR
REHVA liaison for CEN TC 156

Scope of CEN/TC 156 – Ventilation for buildings

The scope of the CEN Technical committee 156 is "Standardization of terminology, testing and rating methods, dimensioning and fitness for purpose of natural and mechanical ventilation systems and components for buildings subject to human occupancy".

The committee deals with all aspects of ventilation for buildings. The scope includes both residential and non-residential buildings.

The active Working Groups and the current work items in CEN TC 156 are:

Working Group 1 – Terminology

Convenor: Mr. Eric Curd, UK

Work item – Revision of the EN 12792. Definitions and Symbols.

Working Group 2 – Natural and mechanical powered residential ventilation

Convenor: Mr. Marc Jardinie, France

Scope of WG 2 – The standardization of design and dimensioning of mechanical and natural powered residential ventilation systems and requirements for component characteristics including methods of performance testing of components/products.

Work item 1 – prEN 13141-6 Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 6: Exhaust ventilation system packages used in a single dwelling.

Work item 2 – prEN 13141-8 Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 8: Performance testing of un-ducted mechanical supply and exhaust ventilation units (including heat recovery) for mechanical ventilation systems intended for a single room.

Work item 3 -prEN 13141-11 Ventilation for buildings – Performance testing of components/products for residential ventilation – Part 11: Supply ventilation systems.

Working Group 3 – Ductwork

Convenor: Mr. Lars-Åke Mattsson, Sweden

Work item – Decision to try to unify all duct standard with an umbrella standard that stipulates all common technical features.

Working Group 4 – Terminal Units

Convenor: Mr. Alan Green, UK

Work Item 1 – EN 16445 Air Terminal Devices – Aerodynamic Testing and Rating for Mixed Flow Applications for Non Isothermal Testing Cold Jets.

Work Item 2 – Basic data used to prepare EN14240 EN14518 and EN15116.

Work Item 3 – prEN16211 Measurement of air flows on site-methods.

Work Item 4 – Review of EN 1751 Aerodynamic Testing Dampers and Valves.

Work Item 5 – Decentralised air handling terminals.

Working Group 9 – Fire and smoke protection of ventilation systems in buildings

Convenor: Mr. Michel Rouyer, France

Scope of WG 9 – To standardize guidance on fire precautions for ventilation and air conditioning systems.

Work Item 1 – prEN 15650 Ventilation for buildings – Fire dampers.

Work Item 2 – prEN 15871 Ventilation for buildings – Fire resisting duct sections.

Working Group 14 – Ventilation of Commercial Kitchens

Convenor: Mr. Peter Wimbök, Germany

Work item 1 – prEN 16282-1 General and method for calculation.

Work item 2 -prEN16282 -Kitchen ventilation hoods; Design and safety requirements.

Work item 3 – prEN 16282-3: Kitchen ventilation ceilings; Design and safety requirements.

Work item 4 – prEN 16282-4: Outlets; Design and safety requirements.

Work item 5 – prEN 16282-5: Air duct; Design and safety requirements.

Work item 6 – prEN 16282-6: Aerosol separators; Design and safety requirements.

Work item 7 -prEN 16282-7: Installation and use of fixed fire suppression systems.

Work item 8 – prEN 16282-8: Kitchen ventilation Installation for treatment of cooking fumes; Design and safety requirements.

Work item 9 -prEN 16282-9: Capture and containment performance ofextraction systems – test methods.

Working Group 16 (JWG TC 113/156) – Multi-function ventilation units, including heat pumps for heating, cooling and domestic hot water

Convenor: Mr. Claus Händel, Germany

Work item – prEN 16573 Ventilation for Buildings – Performance testing of components for residential buildings – Multifunctional balanced ventilation units for single family dwellings, including heat pumps.

Working Group 17 – Fans

Convenor: Mr. Anthony Breen, UK

Scope of WG 17 – Standardisation in the field of fans used for all purposes. All purposes mean standards also applicable to other applications than building ventilation.

Excluded are fans exclusively designed and used for smoke control and in potential explosive atmospheres (ATEX). There are other CEN Technical Committees in charge of these applications.

Work item 1 – Adoption of ISO 12759 as non harmonised EN standard.

Work item 2 – Harmonised standard to meet requirements of regulation 327/2011.

Work item 3 – prEN 14461 – Relocation from CEN/TC 356 to CEN/TC 156/WG 17 and NWIP.

Working Group 19 – JWG between CEN/TC 156 and CEN/371

Convenor: Dr. Bjarne Olesen, Denmark

Work item – Revision of EN 15251- Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.

Working Group 20

Convenor: Mr. Claus Händel, Germany

Work item – Revision of EN 13779 – Ventilation for non-residential buildings – Performance requirements for ventilation and room-conditioning systems.

Working Group 21 – Revision of calculation standards

Convenor: Gerhard Zweifel – Switzerland

Work item 1 – EN 15241 – (Ventilation for buildings) Energy performance of buildings – Modules M5-6, M5-8, M6-5, M6-8, M7-5, M7-8 – Calculation methods for energy losses due to ventilation and infiltration in commercial buildings.

Work item 2 – EN 15242 – (Ventilation for buildings) Energy performance of buildings – Modules M5-1, M5-5, M5-6, M5-8 – Calculation methods for the determination of air flow rates in buildings including infiltration.

Work item 3 – EN 15243 – Energy performance of buildings – Modules M3-3, M3-5, M3-6, M4-3, M4-5, M4-6, M6-2, M6-3, M7-2, M7-3 – Calculation of room temperatures and of load and energy for buildings with room conditioning systems.

Working Group 22 – Environmental Performance of Buildings

Convenor: Mr. Bruno Ziegler, France

Working Group 23 – Guidelines for inspection of ventilation systems and air conditioning systems

Convenor: Mrs. Anne-Marie Bernard, France
Twined **Convenor:** Mr. Remi Carrie, France

Work item 1 – (revision of EN 15239) Ventilation for buildings (Energy performance of buildings) – Module M5-11 – Guidelines for inspection of ventilation systems.

Work item 2 – (revision of EN 15240) Ventilation for buildings (Energy performance of buildings) – Modules M4-11, M6-11, M7-11 – Guidelines for inspection of air conditioning systems.

This article is an invitation to all members of the TRC and specialists of the National Societies affiliated REHVA, wishing to perform a voluntary activity in the European standardization process.

For additional information please contact the REHVA liaison persons:

REHVA TC 156 (Committee level liaison): Ioan Silviu Dobosi – Romania

WG 19: Olli Seppänen

WG 20: Olli Seppänen

WG 21: Jarek Kurnitski

WG 23: Jorma Railio ■

All presentations of REHVA-iSERV seminar are available at www.rehva.eu > Publications & Resources > Event presentations.

REHVA-iSERV Seminar in Brussels

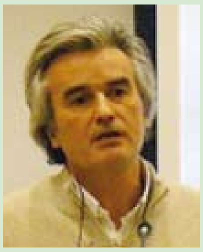
REHVA organised its 2014 Seminar together with the iSERV project consortium around the topic of "***Energy Effective Operation of HVAC Systems***" on February 13th 2014 at the Thon Hotel EU. The seminar included a mix of keynote presentations, case studies and small group discussions. The audience, professionals in the field of building services were delighted with the presentations.

The seminar focused on how the energy use of buildings can be saved and made more effective. As iSERV is approaching to its end, so it was also time to discuss the projects results and their further use.

In the first section Energy effective buildings - EU policies and implementation were discussed.

The Policy Instrument to constrain the growth in Air Conditioning Energy Consumption was presented by **Roger Hitchin**, Building Research Establishment. **Paula Rey-Garcia**, Team leader-Buildings, DG Energy presented European policies of buildings energy efficiency – challenges and policy updates.

Vincent Berrutto, Head of Unit of the Executive Agency for Small and Medium-sized Enterprises (EASME) presented the new policy for energy efficiency related



Stevens Beckers
CEO
Lateral Thinking Factory

Roger Hitchin
Building Research Establishment

Paula Rey-Garcia
Team leader-Buildings
DG Energy

Vincent Berrutto
Head of Unit, Executive Agency for Small and Medium-sized Enterprises (EASME)

Ian Knight
Project coordinator, Welsh School of Architecture, Cardiff University

John Woollett
Swegon

Peter Dyment
Camfil

Pau Garcia-Audi Executive Agency for Small and Medium-sized Enterprises (EASME)

Figure 1. The seminar started with a key note from Mr Stevens Beckers, CEO of Lateral Thinking Factory on how to build building while having a holistic approach to sustainability.

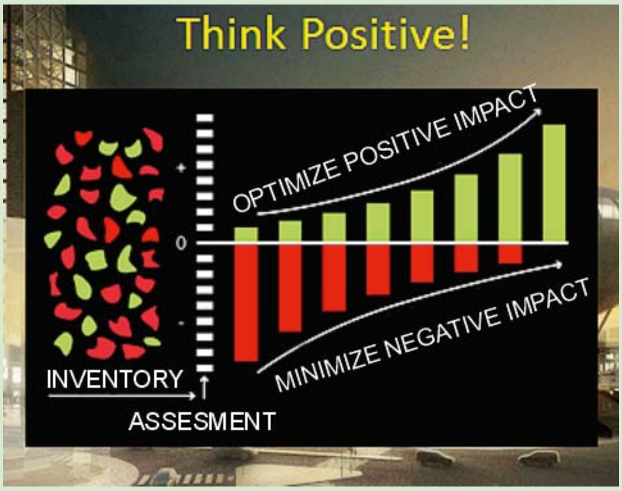


Figure 2. The keynote speaker Stevens Beckers, CEO of Lateral Thinking Factory, stressed in his opening speech the importance to increase the positive properties of buildings and decrease the negative impact.

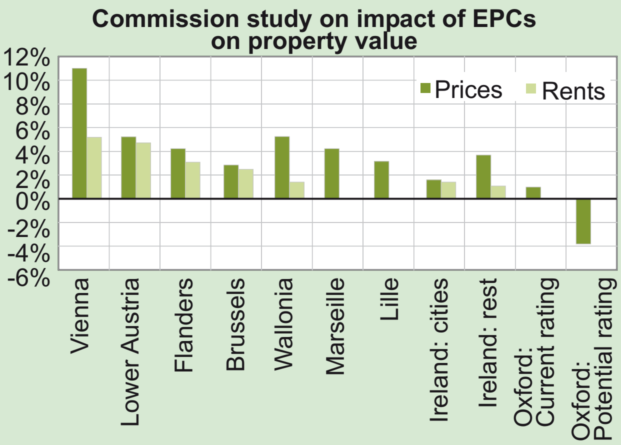


Figure 3. Paula Rey-Garcia, Team leader-Buildings, DG Energy showed the effect of one letter or equivalent improvement in EPC rating on the value of properties.

research and demonstration of 2014-2020 financial period. The financial support activities are from the tear 2014 integrated with the Horizon 2010 programme in future. The Intelligent Energy Europe programme dos not continue as an independent programme. The Executive Agency of Competitiveness and Innovation (EACI) has broadened its area of activities and changed its name to Executive Agency for Small and Medium-sized Enterprises (EASME). Both research and demonstration project programmes related to energy efficiency of buildings will be evaluated and administrated by EASME. Berrutto described is his presentation what king of project proposal they like receive (**Figure 4**).

In the second section, Energy effective operation of HVAC systems – the iSERVcmb project were discussed. The Inspection of HVAC Systems through continuous monitoring and benchmarking – outcomes of the iSERVcmb project were reported by Ian Knight, project coordinator, Welsh School of Architecture, Cardiff University. John Woollett from Swegon and Peter Dyment from Camfil informed the audience on all the Lessons learnt from iSERV. The Energy efficient operation of buildings - good practices from IEE projects were presented by Pau Garcia-Audi, the project officer of iSERV project from Executive Agency for Small and Medium-sized Enterprises (EASME).

The seminar ended in a fruitful discussions about the deployment of iSERV results – policy and industry perspective. The first discussion was on Legislation and policy recommendations from iSERV; it was moderated by Ian Knight, Cardiff University. In the second discussion, the question "What can producers and system operators gain from iSERV?" was debated amongst the participants. ■

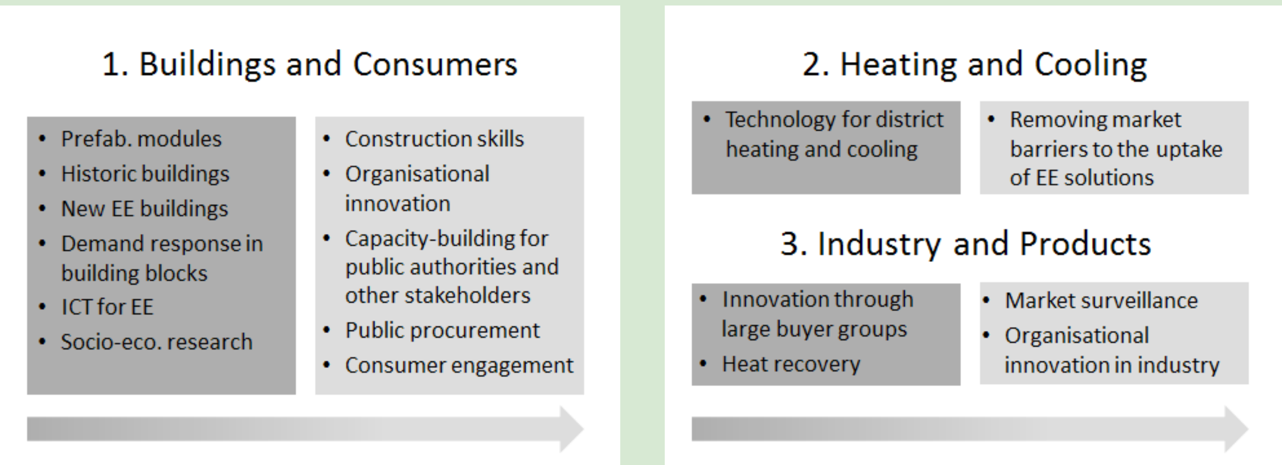
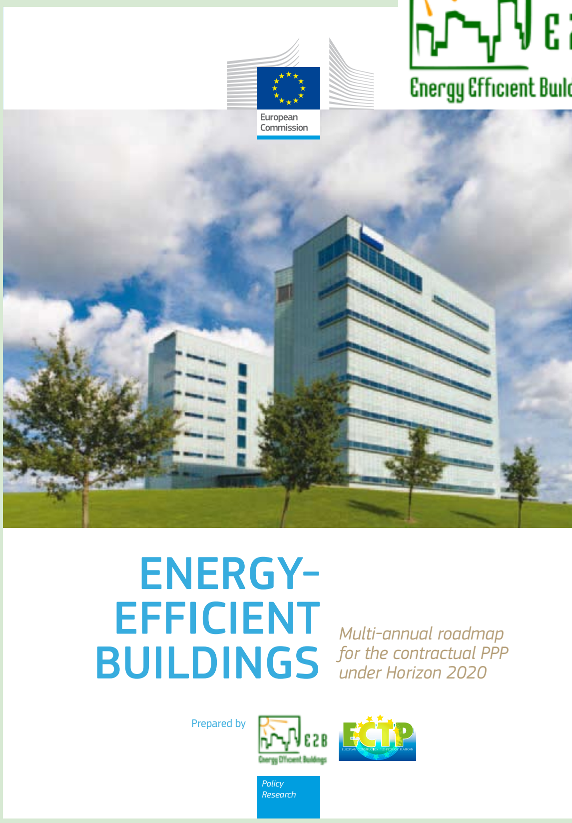


Figure 4. Vincent Berrutto, Head of Unit of the Executive Agency for Small and Medium-sized Enterprises (EASME) described is his presentation what kind of project proposal they like receive, topics on dark back ground for research and on light for demonstration and dissemination.

REHVA joins E2BA– following the EU Research Roadmap for energy efficient buildings

REHVA joined on the Energy Efficient Building Association (E2BA) steering the Energy Efficient Buildings Initiative (E2B EI). The overall vision of E2B EI is to deliver, implement and optimise building and district concepts that have the technical, economic and societal potential to drastically decrease energy consumption and reduce CO_2 emissions in both new and existing buildings across the EU.

E2BA brings together research associations, universities and industry active in the field of buildings energy efficiency and is influencing the EU research agenda within the HORIZON2020 programme. E2BA recently signed the new contract with the European Commission on the Energy Efficient Buildings Public-Private Partnership (EeB) providing € 1 Billion funding within H2020 for EeB PPP research in the period 2014-2020.



Research and Innovation Roadmap for energy efficient buildings in Europe

The Roadmap aims at ultimately contributing on health and safety, both at work site as well as for occupants, due to enhanced indoor environmental conditions. The roadmap prioritizes EU research and defines targets and indicators. The objectives are to develop, integrate and demonstrate **at least 40 new technologies by 2020** in the fields:

- **Innovative construction** e.g. building envelope, multi-target design, prefabrication methods, approaches adapted to public buildings or commercial/ private-housing ones;
- Systemic, cost-effective, mass-customised, high-performing, and minimally invasive **building-retrofitting solutions** integrating innovative energy equipment and storage, to multiply at least by 2.5 the yearly energy efficient and high quality renovation rate with tangible benefits for users;
- **Interactive sustainable buildings** for energy neutrality/positivity in a block of buildings, for a further 15% reduction at district and city scale in energy and emissions by 2020;
- **Performance monitoring tools** to ensure energy efficiency during the service life, by providing the full performance predicted at the design phase and long-lasting quality to the end-user, in combination with durable components.

Transforming energy efficiency into a sustainable business

By 2020 the PPP plans contribute to the EU Energy targets by the large scale research actions ensuring also the sustainability of buildings energy efficiency developments:

- Increase private investment in research & innovation up to 3% of turnover associated with high quality and energy efficient building retrofitting;
- 10 new types of high-skilled jobs through knowledge transfer and training;
- Reduce energy and CO_2 respectively by 50% and by 80% compared to 2010 levels;
- At least 100 demonstration buildings and districts would be retrofitted with ICT-based solutions and monitored to reduce up to 75% in energy use and help standardisation and interoperability, and at least 10 000 dwellings would be engaged by 2020 through the project activities. ■

Touch screen controller for full monitoring of dust collection equipment from Camfil

A new Touch Screen Controller from Camfil Air Pollution Control (APC) provides full monitoring and control of all functions of an industrial dust collector and associated equipment. The easy-to-use controller is equipped with a touch screen interface that allows ready access to all of its functions. It is designed for use with Farr Gold Series® dust collectors, or other types of collectors if integrated with a motor starter or variable frequency drive (VFD) package.

A built-in differential pressure sensor monitors the primary filter pressure drop. Four analog inputs can be used to monitor the secondary filter as well as other devices such as leak detectors, flow meters and compressed air pressure monitors. Six digital inputs are also included to monitor hopper level, smoke detection, remote cleaning and other functions. The controller can also monitor fan power consumption, and can provide data logging of system performance with multi-language capability.

More information: www.camfilapc.com/touch-screen-controller and www.camfilapc.com/videos/touch-screen

REHVA Guidebook on Legionellosis prevention

Legionellosis Prevention in Building Water and HVAC Systems

A Practical Guide for Design, Operation and Maintenance to Minimize the Risk

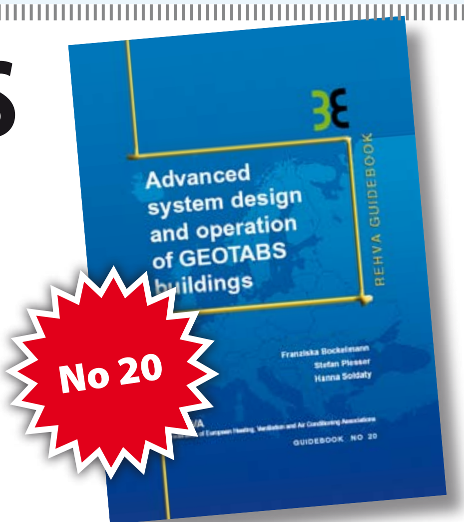
REHVA Guidebook on Mixing ventilation

Mixing ventilation is the most common ventilation strategy in commercial and residential buildings. Introduced will be the new design guide that gives overview of nature of mixing ventilation, design methods and evaluation of the indoor conditions. The Guidebook shows practical examples of the case-studies.

Reversible hybrid heat pump in one package from CIAT

Aquaciat 2 HYBRID is the first range of packaged, outdoor, reversible hybrid heat pumps that house an integrated natural-gas-powered condensation boiler module. This new range combines the benefits of both technologies in a single package that is compact and particularly easy to install. With a total of eight possible combinations available and three 45 to 80 kW boilers, Aquaciat 2 HYBRID meets the heating and air-conditioning needs of new and existing tertiary-sector buildings ranging from 500 m² to 1500 m². Engineered using eco-design principles, the entire range is at least 85% recyclable. Aquaciat 2 HYBRID won the Silver Trophy in the HVAC category at the Innovation Awards held during the Interclima trade show in Paris from 4th to 8th November.

Aquaciat 2 HYBRID heat pumps are particularly compact and easy to operate. Their all-outdoor design means that they are simple to install, do not require the building to be equipped with a machine room or a gas boiler room or gas-fired boiler rooms, and do not entail extensive alterations. A small outdoor space and a connection to a natural-gas supply are all that are needed. Aquaciat 2 HYBRID heat pumps provide heat either thermodynamically or with their gas-fired boiler depending on the scenario chosen by the system user. Aquaciat 2 HYBRID controls the automatic operation of the system all year round. An outdoor temperature sensor enables the CONNECT2 controller to switch between cooling and heating modes. In heating mode, it ensures that the heat pump's minimum COP remains higher than the primary energy conversion factor for electricity (2.58 in France) and automatically switches between gas or electricity, depending on which is the most economical source of energy. Aquaciat 2 HYBRID ensures efficient use of electricity. It can automatically switch over to the gas-fired boiler when the electrical power reaches a threshold value or upon receiving an external signal from a BMS. The advantage for smart grids is that it can supply exactly the same heat output regardless of the energy source (gas or electricity). It also instantaneously lowers the electricity usage during wintertime peak-load periods without compromising on comfort for users. Aquaciat 2 HYBRID is also particularly well-adapted to harsh winters. Unlike a basic air-to-water heat pump, it can deliver a maximum amount of heat during extremely cold weather. Because the capacity of the gas-fired boiler is independent of the outdoor temperature, indoor environments remain comfortable and peak heating needs are met in full. The '4-pipe/DHW' option also allows hotel owners to use the gas-fired boiler to provide high-temperature domestic hot water whilst continuing to heat economically with the air-to-water heat pump.



Next generation simulation tools for solar shading

The Swedish Solar Shading Organization (SSF) has signed an agreement with Swedish software manufacturer EQUA Simulation Ltd. The ambition is for EQUA, which is now developing the building simulation program IDA Indoor Climate and Energy (IDA ICE), to deliver a new generation of specialized energy simulation tools for SSF members and their clients in 2014. The new tool, IDA ESBO (Early Stage Building Optimization), will be based on the IDA ICE package and will comprise an entirely new solar shading module.

Virtually everyone involved in delivering products and services to the construction industry constantly faces new challenges. The regulations for energy efficiency and indoor climate are constantly tightened while demands for environmental responsibility increase. This puts us all in new and challenging situations. One of these is how energy consumption depends on the choice of the various technical solutions that will be installed in a building. The building owner wants to have full information on his or her investment, needs confirmation that the facilities being built will be attractive to future tenants and wants the building to achieve a high score in the chosen environmental certification system, like BREEAM, LEED or local versions. Consultants and planners need better information from material and system suppliers and then face the next problem: how to optimally combine the different technical systems and produce reliable calculations on the overall result in terms of energy consumption and comfort.

In the late 90's the Swedish Solar Shading Organization SSF took the initiative to develop a calculation tool named Parasol, in close cooperation with Lund University. Parasol is still an excellent tool for the calculation of the effects of solar shading and glass combined, but has its limitations when it comes to the interaction with other technical systems and functions, such as indoor climate or lighting systems. This is where IDA ESBO comes into the picture and gives consultants and designers the tools they will need.

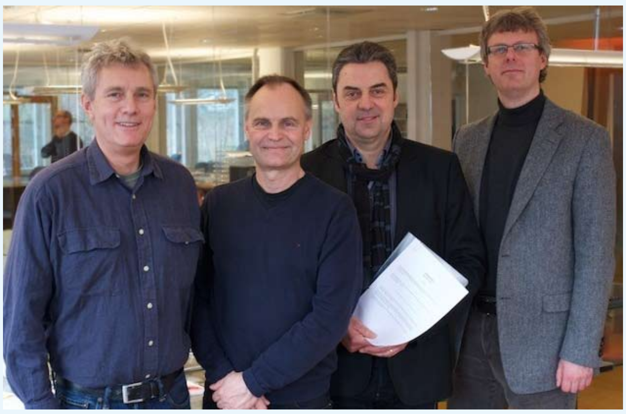
A working group from the SSF, representing both the solar shading and the control technology, and a technical HVAC consultant from Bengt Dahlgren Ltd, representing the user, will take responsibility for providing EQUA with the input and feedback needed to develop a simulation tool that will fulfill the requirements of the standards of today.

Per Sahlin from EQUA Simulation Ltd promises a free web version "IDA ESBO" for users:

"Our goal and ambition with the product series IDA ESBO is that different types of climate and energy related functions and products will be evaluated in combination, as a holistic system, without any drastic simplifications, yet simple enough for users who are not simulation professionals. The free version of IDA ESBO is expected to replace the previous IDA Room, which today is a popular web tool with thousands of users globally. IDA ESBO will offer radically improved functionalities, including energy calculations. A paid version of IDA ESBO is intended to constitute an adequate but simple alternative to calculate a complete building."

SVENSKA SOLSKYDDS FÖRBUNDET

EQUA.



The project group includes Marcus Selin and Per Sahlin (on left) from EQUA Simulation Ltd, Anders Hall representing SSF and Somfy and Max Tillberg (on right) from consulting company Bengt Dahlgrens Ltd.

Scientific HVAC&R journals

Collected and edited by Olli Seppänen

Research papers and reports are important for the advancement of all technology. The industry has to have reliable information to be able to make sustainable and feasible decisions on product development and strategic planning. For scientists and research organisations it is important to have the results of their work published in the reliable peer-reviewed journals. Peer reviewing meaning that all published papers are reviewed and accepted for publication by 2-4 internationally known experts of the specific topic area of the article.

As many readers of the REHVA Journal are also interested either to read or publish the scientific papers REHVA Journal publishes here the key information of some most important scientific journals relevant to HVAC&R industry. The list is by no means exhaustive, many other scientific journals exist which deal also HVAC relevant issues but the main focus is on some other topic.

The REHVA European HVAC Journal (REHVA journal) is not a scientific journal, instead it offers the readers articles on the advancements of HVAC&R technology in products, building systems, and related regulations.

The journals below are listed in alphabetical order. The introduction of HVAC&R journals will continue in the next issue of the REHVA Journal.

Advances in Building Energy Research (ABER) aims to provide expert and authoritative reviews and analyses of the most important developments across the rapidly expanding fields of energy efficiency and environmental performance of buildings. It also provides a unique forum by bringing together invited contributions from the foremost international experts, to examine new technologies and methodologies with the latest research on systems, simulations and standards.

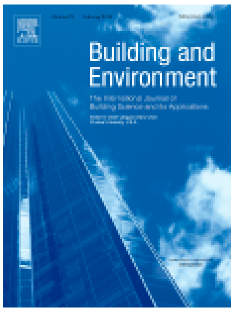
Published bi-annually and peer-reviewed, ABER delivers an invaluable resource for architects, building engineers, environmental engineers, industry professionals, students, teachers and researchers in building science.

Topics covered by ABER include:

- invaluable thermal comfort in the built environment
- advanced materials to improve energy efficiency of buildings
- indoor air quality
- energy efficient lighting and daylight
- visual comfort in the built environment
- thermal and air flow studies in the urban environment
- passive solar heating of buildings and passive cooling in buildings
- energy efficient HVAC systems for buildings
- urban energy systems
- design and retrofitting of energy efficient buildings
- use of renewable energies in the built environment
- natural, mechanical and hybrid ventilation
- monitoring and measurement techniques in buildings
- energy rating and classification of buildings
- intelligent control of buildings
- building physics
- environmental impact and sustainability in the building sector
- legislative and educational aspects for energy efficient buildings

Editor-in-Chief and founder of the journal: Professor Mat Santamouris, National and Kapodistrian University of Athens, Greece, msantam@phys.uoa.gr, http://mat.santamouris.dinstudio.com/

Publications



Building and Environment, the International Journal of Building Science and its Applications, is published by Elsevier since 1965. The journal website is http://www.journals.elsevier.com/building-and-environment. Its current impact factor is 2.430 and its 5-year impact factor is 2.699. The journal is one of many journals published by Elsevier without any background organization. Prior to 2012, the journal published one volume per year. In early years, the journal published four issues per year with 5 to 6 articles per issue. The number was gradually increased to 12 issue per year and more than 20 articles per issue. From 2013, the journal publishes one volume per month and each volume has more than 20 articles. There is no more issue number in each volume. The journal is now publishing volume 74 for April 2014.

Building and Environment is an international journal that publishes original research papers and review articles related to building science and human interaction with the built environment. The Journal is focused on new knowledge, rigorously verified with measurement and analysis, related to the environmental performance of buildings in different scales, ranging from cities, communities, buildings, to building systems and assemblies.

The Journal invites research articles conveying robust, tested knowledge on:

- technologies and integrated systems for high performance buildings and cities
- thermal, acoustic, visual, air quality building science and human impacts
- tools for the design and decision-making community, including tested computational, economic, educational and policy tools
- solutions for mitigating environmental impacts and achieving low carbon, sustainable built environments

The journal accepts only online submissions through http://ees.elsevier.com/bae/default.asp, an Elsevier Electronic Submissions system. Through http://www.elsevier.com/journals/building-and-environment/0360-1323/order-journal, one can subscribe to the journal as an individual or an institution.

Editor-in-Chief: Dr. Qingyan "Yan" Chen, the Vincent P. Reilly Professor of Mechanical Engineering, Purdue University, USA, yanchen@purdue.edu

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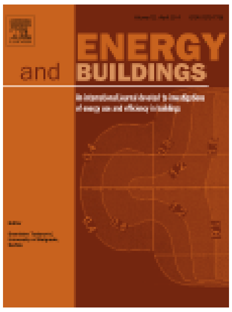


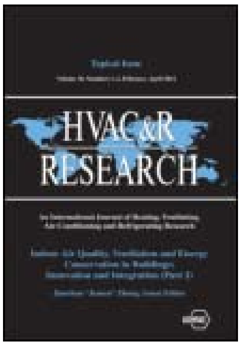
Energy and Buildings (ENB) an international journal, published by Elsevier, is devoted to investigations of energy use and efficiency in buildings publishing articles **with explicit links to energy use in buildings**. The aim is to present new research results, and new proven practice aimed at reducing the energy needs of a building and improving indoor environment quality. Papers with results based on simulations are welcome but those with clear links to laboratory or field measurements are preferred. These links may include calibration, benchmarking, or comparisons of results.

The journal operates an article based publishing model – all papers are assigned to an issue with page numbers as soon as possible after acceptance (usually within 6 weeks). There are no restrictions on the number of articles published per year. Typically 12-14 issues per year. Its 2-Year Impact Factor is 2.679.

Topics covered include:

- Energy demands and consumption in existing and future buildings - prediction and validation
- Indoor environment quality, including health and thermal comfort vis-à-vis energy
- Natural, mechanical and mixed ventilation
- Air distribution in buildings
- Application of solar and other renewable energy sources in buildings
- Energy balances in building complexes (residential, commercial, industrial, public and other buildings)
- Energy efficiency improvement measures of HVAC&R and other technical systems in residential, commercial, public and industrial buildings, and semi open built spaces
- Heat recovery systems in buildings
- Buildings and district heating and cooling
- Energy conservation in built environment
- Energy efficient buildings

Editor-in-Chief: Professor Branislav Todorovic, University Belgrade, Serbia, todorob@eunet.rs



HVAC&R Research is published by Taylor & Francis Group on behalf of ASHRAE, the world's leading organization for the advancement of HVAC&R technology. ASHRAE and Taylor & Francis aim to expand the global reach and readership, to achieve the highest possible levels of accessibility through rapid review and publication process, and to improve access to past articles. HVAC&R Research offers comprehensive reporting of research in the fields of environmental control for the built environment and cooling technologies for a wide range of applications and related processes and concepts, including underlying thermodynamics, fluid dynamics, and heat transfer. Only works reporting on research that is original and of lasting value are accepted for publication. Included in the ISI Web of Science and Current Contents databases, the journal is ASHRAE's archival research publication. Currently 20 th volume. Impact Factor: 0.585 in 2012, and 5-Year Impact Factor: 1.103. Ranking: 35/57 in Construction & Building Technology; 81/125 in Mechanical Engineering; 39/54 in Thermodynamics.

Subjects covered in the journal:

- Building and Construction
- Built Environment; Control Engineering
- Engineering & Technology
- Fluid Mechanics; Heat Transfer
- Heating Ventilation & Air Conditioning
- Mechanical Engineering
- Power & Energy
- Systems & Control Engineering
- Thermodynamics

ASHRAE offers reduced subscription rates to ASHRAE members and the convenience of subscribing online at ashrae.org or through ASHRAE Customer Service. Institutional and non-member subscriptions can be obtained through Taylor & Francis. Subscribe Online at www.ashrae.org/hvacrr. Subscriptions are available in print and online formats.

Editor: Professor Reinhard Radermacher, PhD, University of Maryland, USA, raderm@umd.edu

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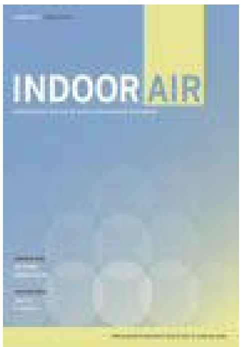


Indoor Air. International Journal of Indoor Air Environment and Health, is the official journal of the International Society of Indoor Air Quality and Climate (ISIAQ -see http://www.isiaq.org/) published by Wiley. Articles published in the journal report original research in the broad area defined by the indoor environment of non-industrial buildings. Specific topics include indoor air pollutant exposure and health effects, thermal comfort, ventilation and other controls, pollutant sources and dynamic behavior, and building factors that influence well-being of occupants.

The research results present the basic information to allow designers, building owners, and operators to provide a healthy and comfortable environment for building occupants, as well as giving medical practitioners information on how to deal with illnesses related to the indoor environment. Its impact factor is 3.302. Published in six issues per year, currently publishing volume 24 (first issue published in 1991). As an international journal with multidisciplinary content, Indoor Air publishes papers reflecting the broad categories of interest in this field:

- health effects
- thermal comfort
- monitoring and modelling
- source characterization
- ventilation and other environmental control techniques.

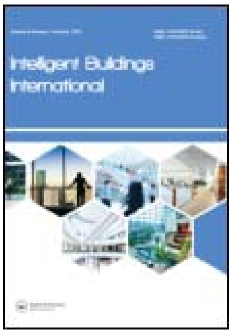
Website address: http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291600-0668

Submit papers at http://mc.manuscriptcentral.com/ina

Individual subscriptions are provided as a benefit of membership in ISIAQ.

Editor-in-chief: William W Nazaroff, University of California, Berkeley, USA, nazaroff@ce.berkeley.edu

Publications



Intelligent Buildings International (IBI), published by Taylor & Francis, examines developments in the design, construction and operating processes for intelligent buildings, and explores the wider context, including practical solutions which take into account sociological and economic considerations. Lessons from nature and vernacular architecture also feature in the journal. Intelligent buildings are ones in which the building fabric, space, services and information systems can respond in an effective manner to the demands of the owner, the occupier and the environment. Going beyond traditional engineering and architectural solutions, and in an effort to overcome fragmentation at educational and professional levels, peer-reviewed research is complemented by contributions from industry specialists that critically evaluate technological developments. Four issues per year now volume 6.

The principal areas covered include:

- understanding how the built environment affects people's well-being
- sustainable design and management
- automation and innovative systems
- approaches to design.

Topics covered by Intelligent Buildings International include:

- Integration of design, management and operation processes
- Assessment of rating methods
- Smart materials for intelligent facades
- Healthy indoor environments
- Whole life performance and value
- Regulations and standards
- Biomimetic architecture
- The impact of intelligent buildings on people and organizations
- Development of IT and communication systems
- Technological forecasting, social change and innovation
- Application of control and sensor technologies

Website: http://www.tandfonline.com/toc/tibi20/current

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Editor-in-Chief: Prof Derek Clements-Croome, University of Reading, UK, d.j.clements-croome@reading.ac.uk

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International Journal of Refrigeration (IJR) is published for the International Institute of Refrigeration (IIR) by Elsevier. It covers the theory and practice of refrigeration, including heat pumps, air conditioning, and food storage and transport. It is essential reading for all those wishing to keep abreast of research and industrial news in refrigeration, air conditioning and associated fields. The journal has published special issues on alternative refrigerants and novel topics in the field of boiling, condensation, heat pumps, food refrigeration, carbon dioxide, ammonia, hydrocarbons, magnetic refrigeration at room temperature, sorptive cooling, and phase change materials and slurries.

As well as original research papers the journal also includes review articles, papers presented at IIR conferences, short reports and letters describing preliminary results and experimental details, and letters to the Editor on recent areas of discussion and controversy. Other features include forthcoming events, conference reports and book reviews. Impact factor was 1.793 in 2012, 5-Year Impact Factor: 2.116.

Papers are published in either English or French with the IIR news section in both languages. 12 issues per year, in 2014 volume no 37.

Website address: http://www.journals.elsevier.com/international-journal-of-refrigeration

Submit papers to: http://ees.elsevier.com/jijr/

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Editor-in-chief: H. Auracher, Technische Universität Berlin (TUB), Berlin, Germany

International Journal of Ventilation (IJV) is devoted to the ventilation of occupied buildings and other enclosed spaces. Inaugurated in June 2002 it has rapidly become established and has attracted subscribers from major institutions, companies and universities in over 40 countries. The focus is on ventilation of buildings and building complexes. The journal includes related issues (e.g. energy and air quality) but only in association with ventilation. It is published by VEETECH Ltd, University of Warwick Science Park, UK.

Four issues per year, 12^{th} volume. The impact factor for IJV in 2012 was 0.224.

Call for papers can be found on website www.ijovent.org.uk. Submission direct to the editor at mliddament@ijovent.org.uk

Subscription: £284 online for access to all papers. Printed edition is also available to order.

Editor-in-chief: Dr Martin Liddament, mliddament@veetech.co.uk

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The Journal of Building Performance Simulation (JBPS) is the official journal of the International Building Performance Simulation Association (IBPSA), published by Taylor & Francis. IBPSA is a non-profit international society of computational building performance simulation researchers, developers, practitioners and users, dedicated to improving the design, construction, operation and maintenance of new and existing buildings. The JBPS is an international refereed journal, publishing only articles of the highest quality that are original, cutting-edge, well-researched and of significance to the international community. The journal also publishes original review papers and researched case studies of international significance.

The scope of topics includes:

- Theoretical aspects of building performance modelling and simulation.
- Methodology and application of building performance simulation for any stage of design, construction process
- Uncertainty, sensitivity analysis, calibration, and optimization.
- Methods and algorithms for performance optimization of building and the systems
- Methods and algorithms for software design, validation, verification.

Launched in 2008, the JBPS has already achieved an Impact Factor of 1.524 and ranks 12th out of the 57 journals listed in the Journal Citation Report's Construction and Building Technology subject category. One volume with four issues per year. 2014 will see Volume 7.

Website address: www.informaworld.com/jbps

Papers can be submitted to http://mc.manuscriptcentral.com/tbps.

Author and submission instructions at www.informaworld.com/jbps

Subscriptions at http://www.tandfonline.com/pricing/journal/tbps

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Founding co-editors: Jan Hensen, Eindhoven University of Technology, the Netherlands and Ian Beausoleil-Morrison, Carleton University, Ottawa, Canada ■

New book on nearly zero energy buildings (nZEB)

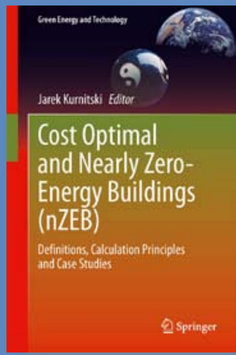
by Jarek Kurnitski, editor

Springer has published nZEB book dealing on 176 pages with definitions, calculation principles, early stage design considerations and case studies of nZEB office buildings across the Europe. Latest information available on nZEB buildings has been collected, including REHVA nZEB definition. To help authorities and experts working with energy performance regulation and defining nZEBs in national energy frames, energy calculation methodology and input data needed to set primary energy based minimum/cost optimal and nZEB requirements is discussed.

Worked examples are provided to illustrate the calculation of delivered, exported and primary energy, and renewable energy contribution. Five case studies of high performance nZEB office buildings across the Europe are reported to show alternative technical solutions and to draw some general design rules based on completed nZEB buildings. Specific features of nZEB design process especially in early stages and architectural competitions are included. These describe important design issues in scoping and conceptual design phase allowing to control design streams so that specified targets can be met.

Contents:

- *nZEB definitions and assessment boundaries*
- *present energy performance requirements and nZEB targets in some selected countries*
- *cost optimal energy performance*
- *target values for indoor environment in energy-efficient design*
- *energy efficiency measures in different climates*
- *how to include nZEB and low carbon targets in architectural competitions*
- *basic design principles of nZEB buildings in scoping and conceptual design*
- *nZEB case studies of five high performance office buildings*



The book is intended for all persons needing to be aware or working with energy performance of buildings – for decision makers in public and private sector, architects, engineers, construction clients, consultants, contractors, manufacturers, students etc.

Heating in spotlight

– a new technical brochure from European Heating Industry (EHI)

This technical brochure gives an overview of the great variety of available modern heating solutions for thermal comfort in buildings, demonstrating their specific benefits and potential for energy savings that can already now be achieved with highly efficient heating products and renewable energies.

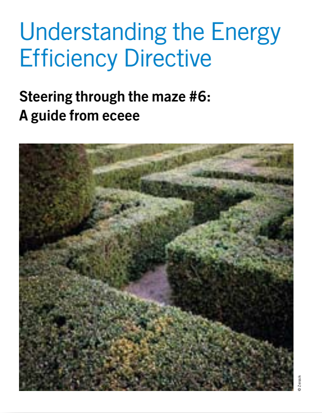
The brochure gives an overview of the state-of-the-art, energy efficient central heating solutions available on the European market. It demonstrates that there are many opportunities to unleash the potential for energy efficiency in European buildings.

The brochure has 44 pages with excellent illustrations. It is a helpful tool for a designer or professional when explaining the properties of various heating systems to customers. It can be also used in the educational institutes when teaching the principles of heating.

The Association of the European Heating Industry (EHI) represents and promotes the common interests of 40 market leading companies and 14 associations in the European thermal comfort sector, which produce advanced technologies for heating in buildings, including: space heaters (boilers, electric and fuel driven heat pumps, micro-cogeneration), heating controls and components, heat storage and heat emitters (radiators, surface heating and cooling systems), renewable energy systems (solar thermal, geothermal, biomass). The industry has total sales of more than 20 billion euro and employs 120.000 people.

Brochure download: http://www.ehi.eu/page/what-is-ehi

The Energy Efficiency Directive



eceee published a new guide – Understanding the Energy Efficiency Directive. The guide provides a simple summary of the Directive's contents. The guide is complemented by a new FAQ section on the Directive on eceee's web site.

The Energy Efficiency Directive, approved in 2012, was the legislative result of the EEP that was published in March 2011. The new directive repeals the Cogeneration Directive (2004/8/EC) and the Energy End-Use Efficiency and Energy Services Directive (2006/32/EC. The EED is ambitious. It is meant to fill the gap between existing framework Directives and national/international measures on energy efficiency and the 2020 EU target for energy savings. It covers all sectors except transport, and includes, for the first time in an "energy efficiency" directive, measures for supply side efficiency.

The Energy Efficiency Directive also puts a major focus on targets. The first target concerns the indicative 20% target mentioned above. The target calls for energy consumption for the entire EU of no more than 1 474 Mtoe of primary energy and/or no more than 1 078 Mtoe of final energy in 2020. The second target concerns the public sector. Article 5 states: "each Member State shall ensure that, as from 1 January 2014, 3% of the total floor area of heated and/or cooled buildings owned and occupied by its central government is renovated each year." The third target concerns specific energy savings from an energy efficiency obligation. According to Article 7: "That target shall be at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1.5% of the annual energy sales to final customers of all energy distributors or all retail energy sales companies by volume, averaged over the most recent three-year period prior to 1 January 2013."

Importantly, by June 30, 2014 the Commission will review progress towards the 2020 target and if it decides that the EU is not on a path to meet the target, it will submit further proposals to the European Council and the European Parliament. The guide is available at: http://www.eceee.org/all-news/press/2013/maze-guide-6.

__eceee__, the European Council for an Energy Efficient Economy, is a membership-based non-profit association. It generates and provides evidence-based knowledge and analysis of policies, and we facilitate co-operation and networking through Summer Studies, workshops, and social media.

european council for an energy efficient economy

REHVA REPORT 5 – Workshops at CLIMA 2013

CLIMA 2013 Congress, was organised by REHVA Czech member STP in Prague under leadership of Prof. Karel Kabele, president. Theme of the congress was: "**Energy Efficient, Smart and Healthy Buildings**".

As a part of the conference, REHVA organised 25 Technical Workshops. The objective of the workshops was to provide an opportunity for two-way communication between the speakers and their audiences on the selected subjects. REHVA gave the floor to its supporters: **AHRI**, **Belimo**, **Camfil**, **Caisse des Dépots**, **ES-SO**, **Eurovent Certification**, **Grundfos**, **Icade**, **Rhoss**, **Swegon** and **Uponor**; sister organizations **CCHVAC**, **SHASE**, **ICIEE**; related EU-projects **IDES-EDU**, **iSERV**, **3Encult**; and different REHVA taskforces from REHVA's technical and research committee. The REHVA Task Forces will further use the workshop results to develop European guidelines for improving the energy efficiency and indoor environment of buildings.

The report include the workshops presentation and a summary of the discussions. An accompanying CD-ROM includes PDF versions of the book and full WS-presentations.

REHVA REPORT 5 is available on REHVA Guidebooks' Shop at **www.rehva.eu**.

VDI Guidelines published January 2014

D VDI 2047/2 "Open recooler systems; Securing hygienically sound operation of evaporative cooling systems (VDI Cooling Tower Code of Practice)"

Recooling systems can become sources of airborne pathogens. The owner is obligated to minimise the risk ensuing from such installations. This guideline provides guidance for hygienically sound operation of recooling systems. The standard applies to existing and new evaporative cooling installations and apparatus where water is trickled or sprayed or can in any other way come into contact with the atmosphere with the exception of natural-draugth cooling towers with power dissipations of more than 200 MW.

VDI/VDE 6008/3 "Barrier-free buildings; Aspects of electrical installation and building automation"

The standard gives a summary overview of the main needs of persons and the requirements they place on electrical installations and building automation. This standard deals with requirements and solution approaches in real estate properties regarding electrical installations and building automation. The supplements also deal with broader, user-specific needs of people of all ages with and without mobility limitations or disabilities.

D VDI 6012/1.4 "Integration of decentralised and regenerative energy systems in buildings; Fundamentals; Fixing of solar modules and solar collectors on buildings"

The use of solar energy is increasingly an integral part of energy generation. Both for photovoltaics and solar heating many systems are available that in part greatly differ in appearance and design. A viable and reliable mounting of modules and panels on buildings is indispensable required and creates inter alia, the preconditions for a desired long period of operation of these systems. Different connection and fastening systems are used for this purpose in practice. The standard provides help on a professional and proper construction and gives advice for a proper selection of available mounting systems and mounting means.

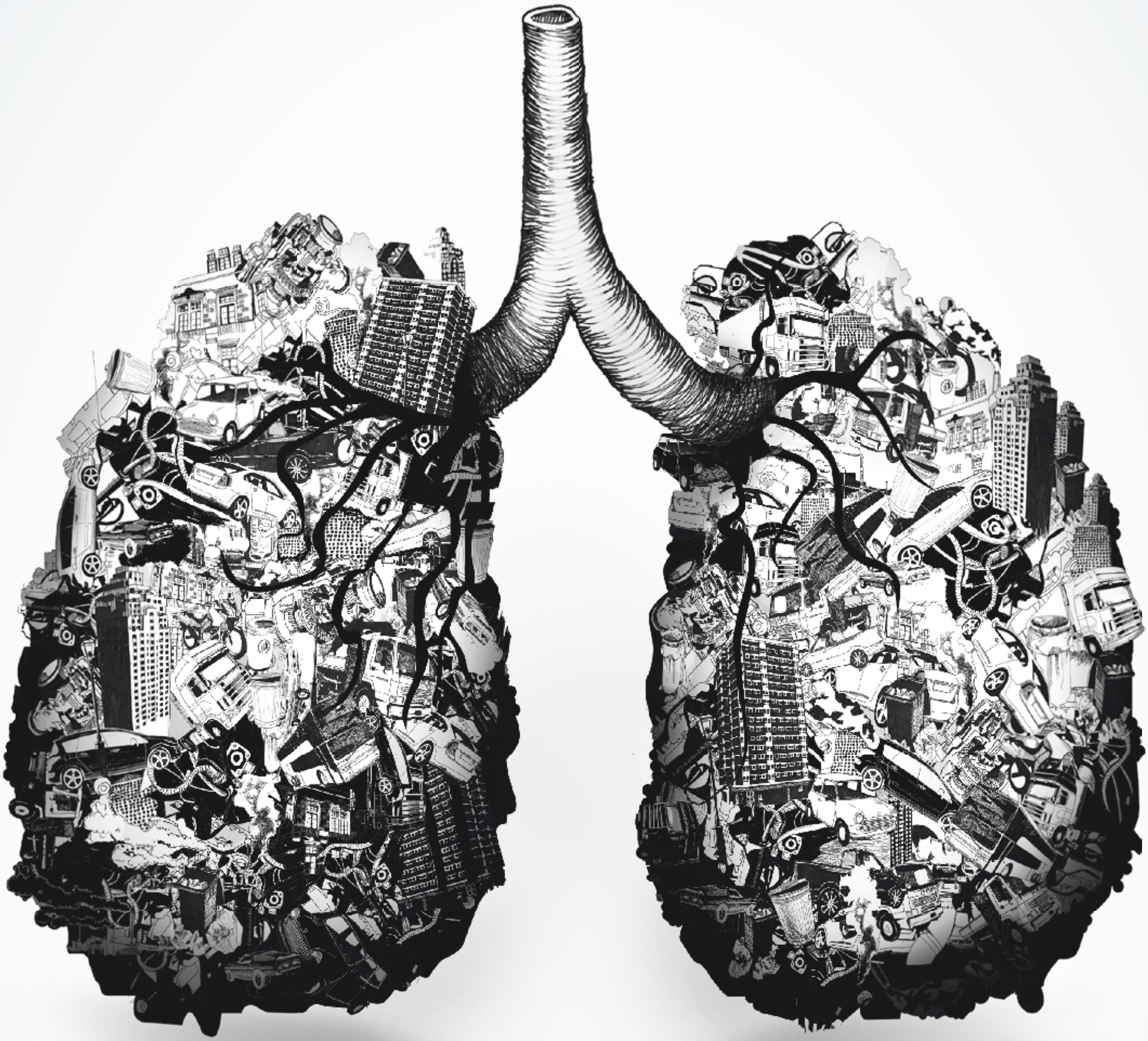
D VDI 6012/2.1 "Integration of distributed and renewables-based energy systems in buildings; Thermic systems; Biomass firing systems"

This standard covers the use of renewable, thermal energy systems in buildings, including the delivery and storage of fuels and the disposal of combustion residues. Systems are considered, which serve both the heat generation in close proximity to consumers in residential and non-residential buildings where the following wooden fuels are used: (a) solid pieces of wood, including attached bark, especially in the form of logs and wood chips, and twigs and cones; (b) compacts made of untreated wood in the form of briquettes according to DIN EN 14961-3 or in the form of pellets according to DIN EN 14961-2 as well as other wood briquettes or wood pellets made of natural wood with equivalent quality. The maximum rated output of the considered fuels in this standard is limited to 500 kW.

D VDI 6026/1. "Documentation in the building services; Contents and format of planning, execution and review documents; Requirements to be met by the documentation to satisfy the needs of the FM"

The requirements to be met by a building during all stages of its lifecycle (development and planning, execution, use, liquidation/demolition) must be taken into account during the development and planning stage. To this end, this standard details the demands of the facility management to be satisfied by the documentation as per VDI 6026 Part 1. The standard stipulates requirements to be met by the contents of that documentation required, during the lifecycle of the building, in order to implement a facility management. It does not define FM-minded planning as such.

D = Draft Guideline



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Events in 2014 - 2015

Conferences and seminars 2014

March 4-6	Ecobuild 2014	London, United Kingdom	www.ecobuild.co.uk/
March 18-19	International Workshop Quality of Methods for Measuring Ventilation and Air Infiltration in Buildings	Brussels, Belgium	www.aivc.org/News/Newsflash_20131009.html
March 19	REHVA - AiCARR Seminar - Towards nearly zero retrofitted buildings	Milan, Italy	www.rehva.eu
March 31	REHVA Seminar - Building Management Systems and Energy Efficiency	Frankfurt, Germany	http://goo.gl/RrGydw
April 2-3	8th International Conference Improving Energy Efficiency in Commercial Buildings (IEECB'14)	Frankfurt, Germany	http://goo.gl/H3Eyyi
April 3-4	COGEN Europe Annual Conference & Dinner 2014	Brussels, Belgium	http://goo.gl/8eT0nH
April 3-4	4th CIBSE ASHRAE Technical Symposium 2014 - "Moving to a New World of Building Systems Performance"	Dublin, Ireland	www.cibse.org/symposium2014
April 7-8	ASHRAE High Performance Buildings Conference	San Francisco, California	www.hpbmagazine.org/hpb2014
April 10-13	2014 Windsor conference-Counting the Cost of Comfort in a Changing World	Windsor, United Kingdom	http://nceub.org.uk
April 25-26	18th International Passive House Conference	Aachen, Germany	www.passivhaustagung.de
April 28-29	2014 Euroheat & Power Annual Conference and 60th anniversary	Brussels, Belgium	www.euroheat.org/2014EHPac
April 30	REHVA Annual Conference	Dusseldorf, Germany	www.rehva.eu
May 8-10	TTMD XI. International HVAC+R Technology Symposium 2014	İstanbul, Turkey	www.ttmd.org.tr/sempozyum2014
May 13-15	11th IEA Heat Pump Conference 2014	Montreal, Canada	http://goo.gl/lkn2kz
May 20	7th EHPA European Heat Pump Forum	Berlin, Germany	http://forum.ehpa.org/
June 5-6	International Conference "Energy Performance of Buildings"	Bucharest, Romania	www.rcepb.ro
June 23-24	Building Simulation and Optimization BSO14	London, United Kingdom	www.bso14.org
June 23-27	Sustainable Energy Week EU Sustainable Energy Week	Brussels, Belgium	www.eusew.eu
June 28-July 2	ASHRAE 2014 Annual Conference	Seattle, WA, USA	http://ashraem.confex.com/ashraem/s14/cfp.cgi
July 7-12	Indoor Air 2014	University of Hong Kong, Hong Kong	www.indoorair2014.org
August 31-Sep 2	11th IIR-Gustav Lorentzen Conference on Natural Refrigerants - GL2014	Hangzhou, China	
September 7-9	14th International Symposium on District Heating and Cooling	Stockholm, Sweden	http://svenskfjarrvarme.se/dhc14
September 10-12	ASHRAE/IBPSA-USA Building Simulation Conference	Atlanta, GA, USA	http://ashraem.confex.com/ashraem/emc14/cfp.cgi
September 21-24	Licht 2014 - Den Haag Holland	Den Haag, The Netherlands	www.licht2014.nl
September 24–25	35th AIVC Conference - 4th TightVent Conference - 2nd venticool Conference	Poznań, Poland	www.aivc.org
October 18-19	CCHVAC Congress	China	http://www.chinahvac.com.cn/cn/index.html
October 19-22	Roomvent 2014	Sao Paulo, Brazil	www.roomvent2014.com.br
October 28-29	9th International ENERGY FORUM on Advanced Building Skins	Bressanone, Italy	www.energy-forum.com/fr.html
December 10-12	9th International Conference on System Simulation in Buildings - SSB2014	Liege, Belgium	www.ssb2014.ulg.ac.be

Exhibitions 2014

March 4-7	Aqua-Therm Prague	Prague, Czech Republic	www.aquatherm-praha.com/en/
March 18-21	MCE - Mostra Convegno Expocomfort 2014	Fiera Milano, Italy	www.mcexpocomfort.it
March 30-Apr 4	Light + Building	Frankfurt, Germany	www.light-building.messefrankfurt.com
April 1-4	NORDBYGG 2014	Stockholm, Sweden	www.nordbygg.se
May 7-10	ISK - SODEX 2014	Istanbul, Turkey	www.hmsf.com
May 13-15	ISH China & CIHE	Beijing, China	www.ishc-cihe.com
October 1-3	Finnbuild 2014	Helsinki, Finland	www.finnbuild.fi
October 14-16	Chillventa 2014	Nuremberg, Germany	www.chillventa.de/en/

Conferences and seminars 2015

February 25-27	World Sustainable Energy Days	Wels Austria	www.wsed.at
April 16-18	International Conference Ammonia and CO2 Refrigeration Technologies	Ohrid, Republic of Macedonia	
May 6-8	Advanced HVAC and Natural Gas Technologies	Riga, Latvia	www.hvacriga2015.eu
May 7-9	REHVA Annual Conference	Riga, Latvia	www.hvacriga2015.eu
October 20-23	Cold Climate HVAC	Dalian, China	www.coldclimate2015.org

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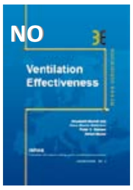
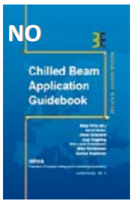
REHVA GUIDEBOOKS

REHVA
Federation of European Heating, Ventilation and Air-conditioning Associations

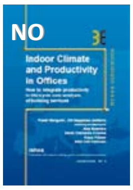
REHVA Guidebooks are written by teams of European experts



Improving the ventilation effectiveness allows the indoor air quality to be significantly enhanced without the need for higher air changes in the building, thereby avoiding the higher costs and energy consumption associated with increasing the ventilation rates. This Guidebook provides easy-to-understand descriptions of the indices used to mesure the performance of a ventilation system and which indices to use in different cases.

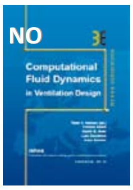


Chilled beam systems are primarily used for cooling and ventilation in spaces, which appreciate good indoor environmental quality and individual space control. Active chilled beams are connected to the ventilation ductwork, high temperature cold water, and when desired, low temperature hot water system. Primary air supply induces room air to be recirculated through the heat exchanger of the chilled beam. In order to cool or heat the room either cold or warm water is cycled through the heat exchanger.

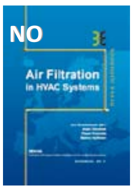


Indoor Climate and Productivity in Offices Guidebook shows how to quantify the effects of indoor environment on office work and also how to include these effects in the calculation of building costs. Such calculations have not been performed previously, because very little data has been available. The quantitative relationships presented in this Guidebook can be used to calculate the costs and benefits of running and operating the building.

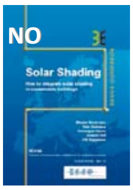
This Guidebook describes the systems that use water as heat-carrier and when the heat exchange within the conditioned space is more than 50% radiant. Embedded systems insulated from the main building structure (floor, wall and ceiling) are used in all types of buildings and work with heat carriers at low temperatures for heating and relatively high temperature for cooling.



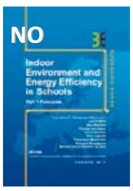
CFD-calculations have been rapidly developed to a powerful tool for the analysis of air pollution distribution in various spaces. However, the user of CFD-calculation should be aware of the basic principles of calculations and specifically the boundary conditions. Computational Fluid Dynamics (CFD) – in Ventilation Design models is written by a working group of highly qualified international experts representing research, consulting and design.



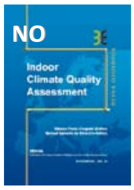
Air filtration Guidebook will help the designer and user to understand the background and criteria for air filtration, how to select air filters and avoid problems associated with hygienic and other conditions at operation of air filters. The selection of air filters is based on external conditions such as levels of existing pollutants, indoor air quality and energy efficiency requirements.



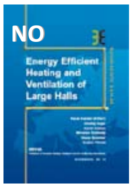
Solar Shading Guidebook gives a solid background on the physics of solar radiation and its behaviour in window with solar shading systems. Major focus of the Guidebook is on the effect of solar shading in the use of energy for cooling, heating and lighting. The book gives also practical guidance for selection, installation and operation of solar shading as well as future trends in integration of HVAC-systems with solar control.



School buildings represent a significant part of the building stock and also a noteworthy part of the total energy use. Indoor and Energy Efficiency in Schools Guidebook describes the optimal design and operation of schools with respect to low energy cost and performance of the students. It focuses particularly on energy efficient systems for a healthy indoor environment.

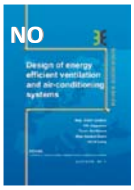


This new REHVA Guidebook gives building professionals a useful support in the practical measurements and monitoring of the indoor climate in buildings. Wireless technologies for measurement and monitoring has allowed enlarging significantly number of possible applications, especially in existing buildings. The Guidebook illustrates with several cases the instrumentation

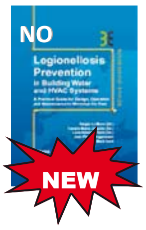


This guidebook is focused on modern methods for design, control and operation of energy efficient heating systems in large spaces and industrial halls. The book deals with thermal comfort, light and dark gas radiant heaters, panel radiant heating, floor heating and industrial air heating systems. Various heating systems are illustrated with case studies. Design principles, methods and modeling tools are presented for various systems.

This guidebook talks about the interaction of sustainability and heating, ventilation and air–conditioning. HVAC technologies used in sustainable buildings are described. This book also provides a list of questions to be asked in various phrases of building's life time. Different case studies of sustainable office buildings are presented.



This guidebook covers numerous system components of ventilation and air-conditioning systems and shows how they can be improved by applying the latest technology products. Special attention is paid to details, which are often overlooked in the daily design practice, resulting in poor performance of high quality products once they are installed in the building system.



This Guidebook is a practical guide for design, operation and maintenance to minimize the risk of legionellosis in building water and HVAC systmes. It is devided into several themes such as: Air conditioning of the air (by water – humidification), Production of hot water for washing (fundamentally but not only hot water for washing) and Evaporative cooling tower.

In this guidebook most of the known and used in practice methods for achieving mixing air distribution are discussed. Mixing ventilation has been applied to many different spaces providing fresh air and thermal comfort to the occupants. Today, a design engineer can choose from large selection of air diffusers and exhaust openings.

This guidebook provides comprehensive information on GEOTABS systems. It is intended to support building owners, architects and engineers in an early design stage showing how GEOTABS can be integrated into their building concepts. It also gives many helpful advices from experienced engineers that have designed, built and run GEOTABS systems.

In this REHVA Report in cooperation with CEN, technical definitions and energy calculation principles for nearly zero energy buildings required in the implementation of the Energy performance of buildings directive recast are presented. This 2013 revision replaces 2011 version. These technical definitions and specifications were prepared in the level of detail to be suitable for the implementation in national building codes.