ASHRAE Hellenic Chapter

ΤΕΕ

ENERGY IN BUILDINGS

EMEA 2024

Europe, the Middle East & Africa

FRIDAY - SATURDAY

NOVEMBER 22-23, 2024

@ 9:00-18:00

@ GRAND HYATT ATHENS HOTEL

SESSIONS:

- SUSTAINABILITY
- HEALTH & SAFETY
- DECARBONIZATION
- TECHNICAL SOLUTIONS
- DIGITAL ENVIRONMENT
- POLICIES & LEGISLATION
- ENERGY EFFICIENCY FIRST
- RESILIENCE TO CLIMATE CRISIS

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Future of Sustainable Products between Regulations and Market Surveillance

- Ali NOUR EDDINE, DR-Eng.
- Technical Manager
- Eurovent Certita Certification

Investing in Energy Efficient HVAC

Renovation:

- Europe invests EUR 85-90 billion annually in building energy efficiency measures, around 40% of the world-wide market for energy efficiency retrofits
- Europe would need to invest EUR 275 billion of additional investments in buildings annually to meet its climate targets

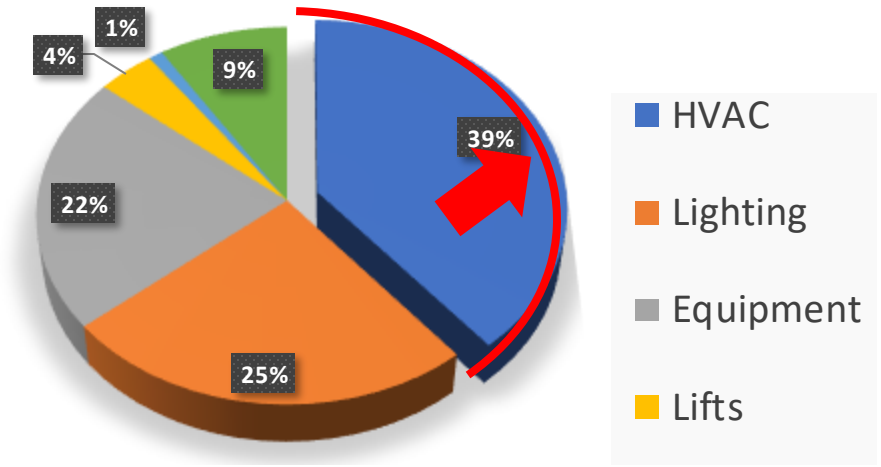
Construction:

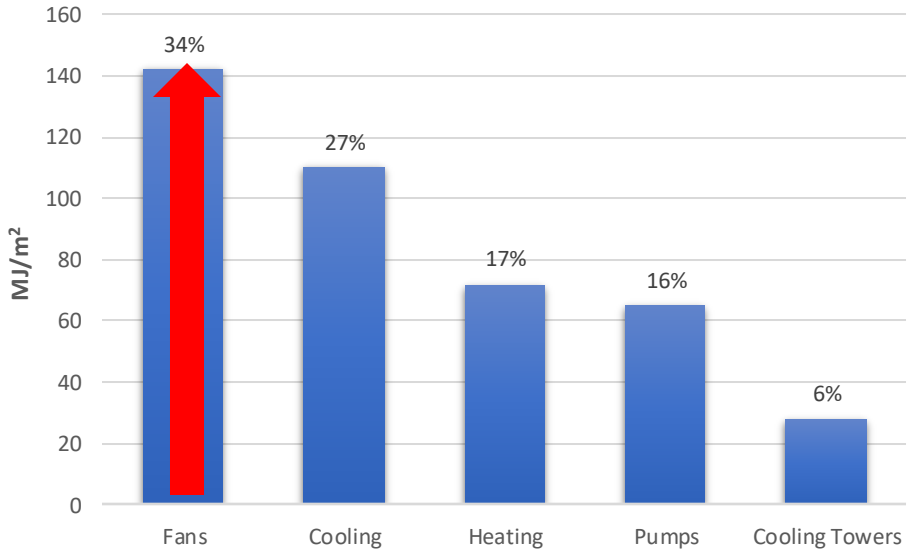
- EU27 invested EUR 700 billion in construction of buildings in 2019, 40% residential and 60% non-residential.

Climate Strategy & Partners (2021), European Commission (2019 & 2020), HSBC (2017), S1P Global Market Intelligence (2018), and Statista (2021)

Where should we invest?

- A typical HVAC account is generally responsible for approx. 40% (up to 70% in some regions) of total building energy consumption.
- Mechanical Ventilation is a considerable part of this consumption
- Indispensable in new and refurbished airtight buildings to ensure IAQ
- Air handling units have a major impact on energy consumption Air transport and heat recovery





Solution: Incentive and/or Regulation

International Framework

✓ **The 2021 International Energy Conservation Code**

The IECC also asks for new HVAC cooling performance standards. Equipment must now surpass the minimum cooling and heating rejection efficiency requirements by 5%-10%.

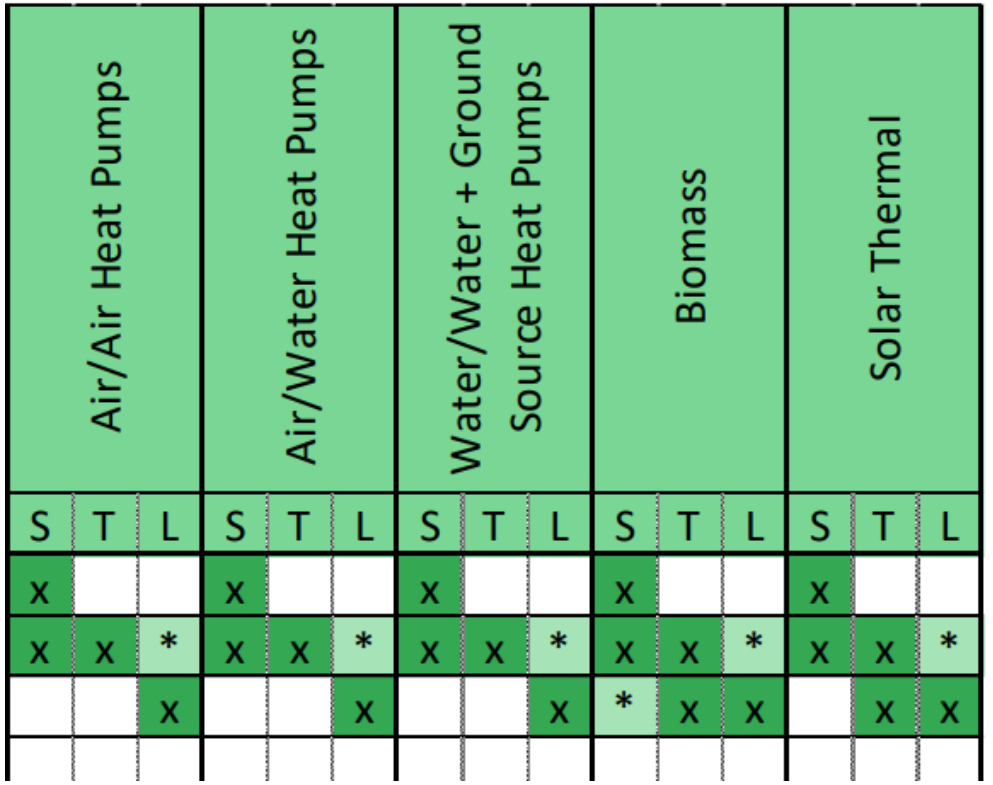
✓ **European Union Directive (EU) 2009/125/CE**

also commonly known as Ecodesign, defines minimal requirements for energy-related products. It's objective is the reduction of energy consumption and CO2- emission rates as well as an increase in the overall share of renewable energies

Solution: Incentive and/or Regulation

Number	Country	Coal boilers			Oil boilers, condensating			Gas boilers, condensating			Hybrid Heat Pumps			Air/Air Heat Pumps			Air/Water Heat Pumps			Water/Water + Ground Source Heat Pumps			Biomass			Solar Thermal		
		S	T	L	S	T	L	S	T	L	S	T	L	S	T	L	S	T	L	S	T	L	S	T	L	S	T	L
1	Austria							*		*				x			x			x			x			x		
2	Belgium		x			x	*	x	x	*	x	x		x	x	*	x	x	*	x	x	*	x	x	*	x	x	*
3	Bulgaria									x			x			x			x			x	*	x	x		x	x
4	Croatia																											
5	Cyprus							x			x			x			x			x			x			x		
6	Czechia							x						x			x			x			x			x		
7	Denmark								x			x			x		x	x		x	x						x	
8	Estonia																											
9	Finland								x			x			x		x	x		x	x		x	x			x	
10	France				x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
11	Germany							x			x			x		x	x		x	x		x	x		x	x		x
12	Greece				x			x			x			x	x		x	x		x	x		x	x		x	x	
13	Hungary	x			x			x		x	x		x	x		x	x		x	x		x	x			x		x
14	Ireland													x			x			x						x		
15	Italy				x				x		x	x		x	x		x	x		x	x		x	x		x	x	
16	Latvia					x				x			x			x			x			x			x			x
17	Lithuania														x			x			x			x			x	
18	Luxemburg															x			x			x			x			x
19	Malta																x									x		
20	Netherlands																x			x						x		
21	Norway																x			x			x			x		
22	Poland	x			x			x	x					x	x		x	x		x	x		x	x		x	x	
23	Portugal									x				x		x	x		x	x		x	x		x	x		x
24	Romania							x			x						x			x			x			x		
25	Slovakia							x						x			x			x			x			x		
26	Slovenia							x		x				x		x	x		x	x		x	x		x	x		x
27	Spain							*						x			x			x			x			x		
28	Sweden					x			x			x			x			x			x			x			x	
29	United Kingdom							x		*	x						x		*	x		*	x		*	x		*

Table 1. Summary of incentives (S = subsidy; T = tax reduction; L = loans; *only at local level – light colour)



Source: Analysis of the existing incentives in Europe for heating powered by fossil fuels and renewable sources. www.inforse.org/europe

Easier said than done?

Only For Air Handling Unit:

✓ 204,523 Units sold in EU in 2022

How To Verify Compliance?

Solution

Software Check

Testing laboratories

Factory Audit

Data Check

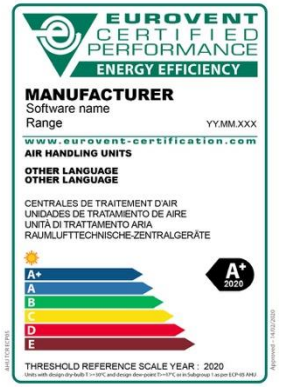
Market Surveillance

Third Party Certification

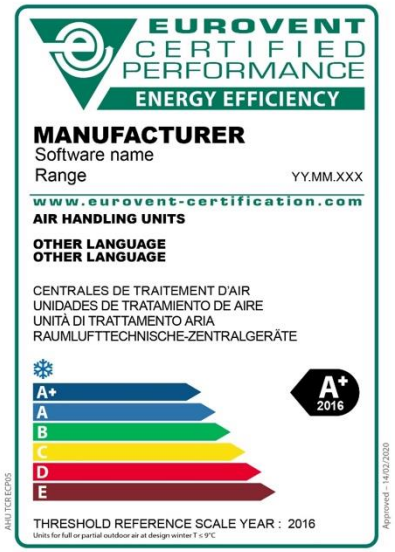
ANNUAL CERTIFICATION FISHNET

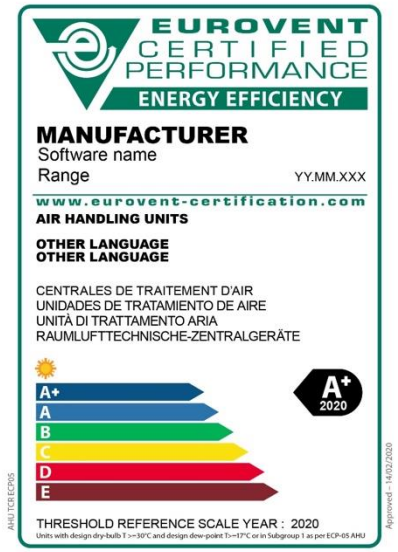
FREE AVAILABILITY ON-LINE

[Eurovent Certita Certification website]



Energy Label





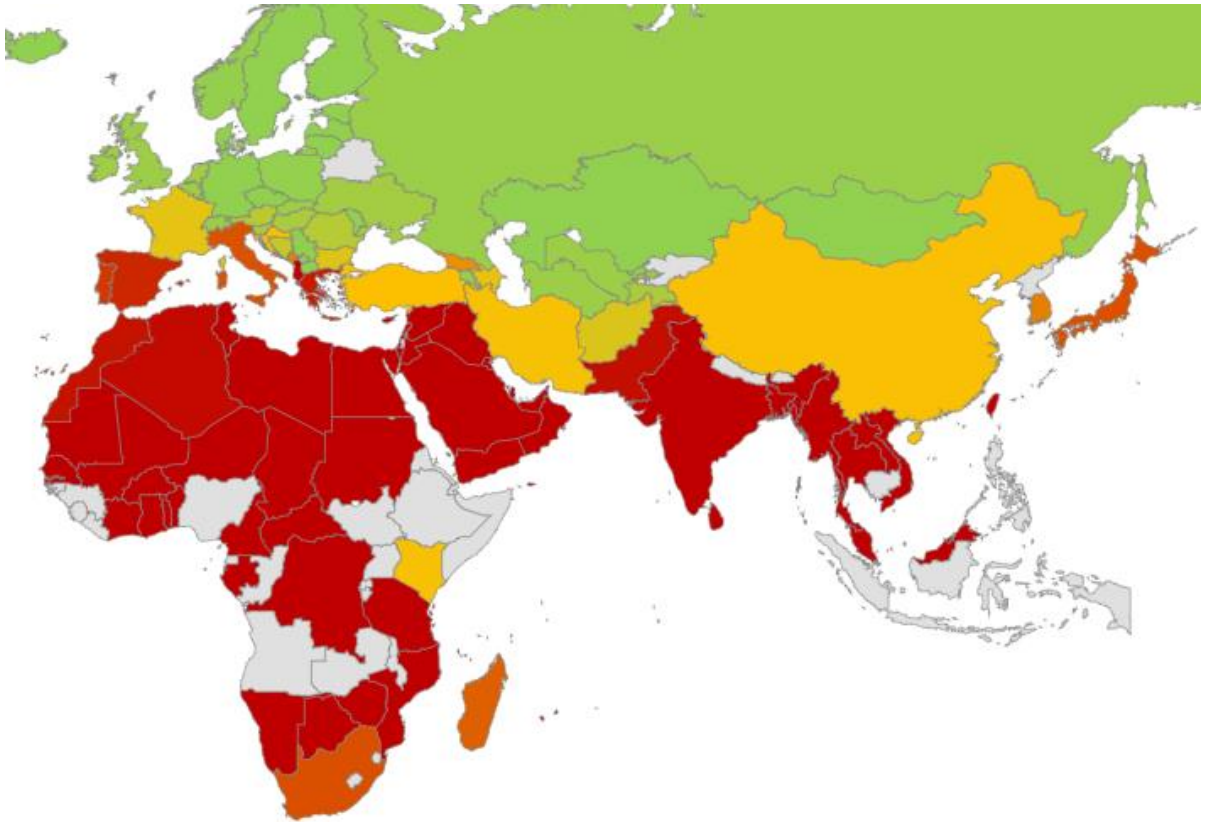
Reference parameters for energy classes

→ Air velocity

→ Heat recovery efficiency

→ Flow resistance (heat recovery)

→ Fan efficiency ratio



CLASS	All Units	Units for full or partial outdoor air at design winter temperature ≤ 9°C		
	Velocity	Heat recovery system		Fan Efficiency Grade
	v_{class} [m/s]	η_{class} [%]	Δp_{class} [Pa]	$NG_{ref\text{-}class}$ [-]
A+ / A+↬ / A+↑	1.4	83	250	64
A / A↬ / A↑	1.6	78	230	62
B / B↬ / B↑	1.8	73	210	60
C / C↬ / C↑	2.0	68	190	57
D / D↬ / D↑	2.2	63	170	52
E / E↬ / E↑	No calculation required			No requirement

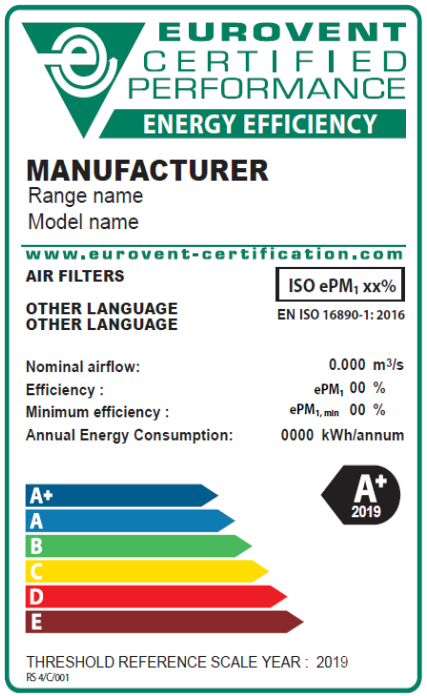
Table 6: Table for energy efficiency calculations

The lowest classes E, E↬ and E↑ have no requirements.

Energy Label

ISO 16890: a great milestone

A first step to give the decision power to End-Riskers



II.2.2. Energy Efficiency Classification and Labelling

Table 1: Energy efficiency class limits for each filter class according to EN ISO 16890:2016 measured at 0.944 m³/s.

M_X = 200 g (AC Fine)	AEC in kWh/y FOR ePM1 (ePM_1 and $ePM_{1,min} \geq 50\%$)					
	A+	A	B	C	D	E
50&55%	800	900	1050	1400	2000	>2000
60&65%	850	950	1100	1450	2050	>2050
70&75%	950	1100	1250	1550	2150	>2150
80&85%	1050	1250	1450	1800	2400	>2400
>90%	1200	1400	1550	1900	2500	>2500
M_X = 250 g (AC Fine)	AEC in kWh/y FOR ePM2.5 ($ePM_{2.5}$ and $ePM_{2.5,min} \geq 50\%$)					
	A+	A	B	C	D	E
50&55%	700	800	950	1300	1900	>1900
60&65%	750	850	1000	1350	1950	>1950
70&75%	800	900	1050	1400	2000	>2000
80&85%	900	1000	1200	1500	2100	>2100
>90%	1000	1100	1300	1600	2200	>2200
M_X = 400 g (AC Fine)	AEC in kWh/y FOR ePM10 ($ePM_{10} \geq 50\%$)					
	A+	A	B	C	D	E
50&55%	450	550	650	750	1100	>1100
60&65%	500	600	700	850	1200	>1200
70&75%	600	700	800	900	1300	>1300
80&85%	700	800	900	1000	1400	>1400
>90%	800	900	1050	1400	1500	>1500

Hygienic Unit

Environmental Challenges

Energy Performance

Comfort

Quality

Hygienic Unit

All the requirements are listed in the Appendix H of the AHU TCR, they are related to the following topics:

General	Unit Housing	Air Treatment
• Planning • Manufacture • Shipment	• Metallic Materials • Non-Metallic Materials • General AHU Arrangement • Inner Casing Surface • Inspection, Maintenance and Cleaning • Filter Maintenance	• Filter • Cooling and Heating Coil • Humidifier • Dehumidifier • Heat Recovery System • Fans • Silencer

Hygienic Unit

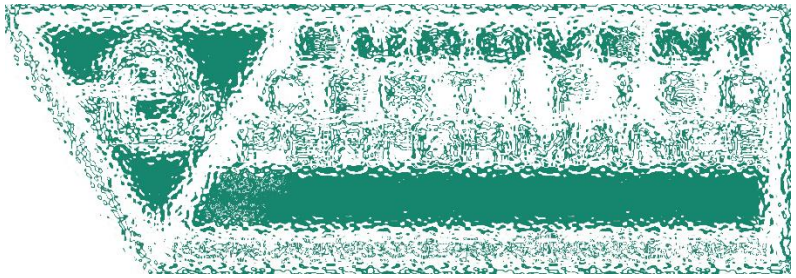
	Offices, schools, hotels, retail … Level 1 ★☆☆	Hospitals Level 2 ★★☆	Pharmaceutical, food processes, white rooms Level 3 ★★★
Corrosivity class for metallic materials	At least C3		At least C4
Thermal Bridging class	At least TB3		At least TB2
Casing Air leakage Class	At least L2 (M)* & L2(R)*		At least L1 (M) & L1(R)
Water Drainage from pans, condense trays and water tanks	95%		
Filters class (supply side)	Epm1 50%		Epm1 85%
Number of filter on supply side	1	2	
Fin thickness	0.10 mm	0.12 mm	
Minimum distance between fins (cooler)	2.5 mm		3.0 mm
Minimum distance between fins (heating)	2.0 mm		2.5 mm

Specifications are subject to change without notice.

* M= model box, R= real unit

Hygienic Unit

The Hygienic option is a certification by range proposing 3 levels of certification representing by stars

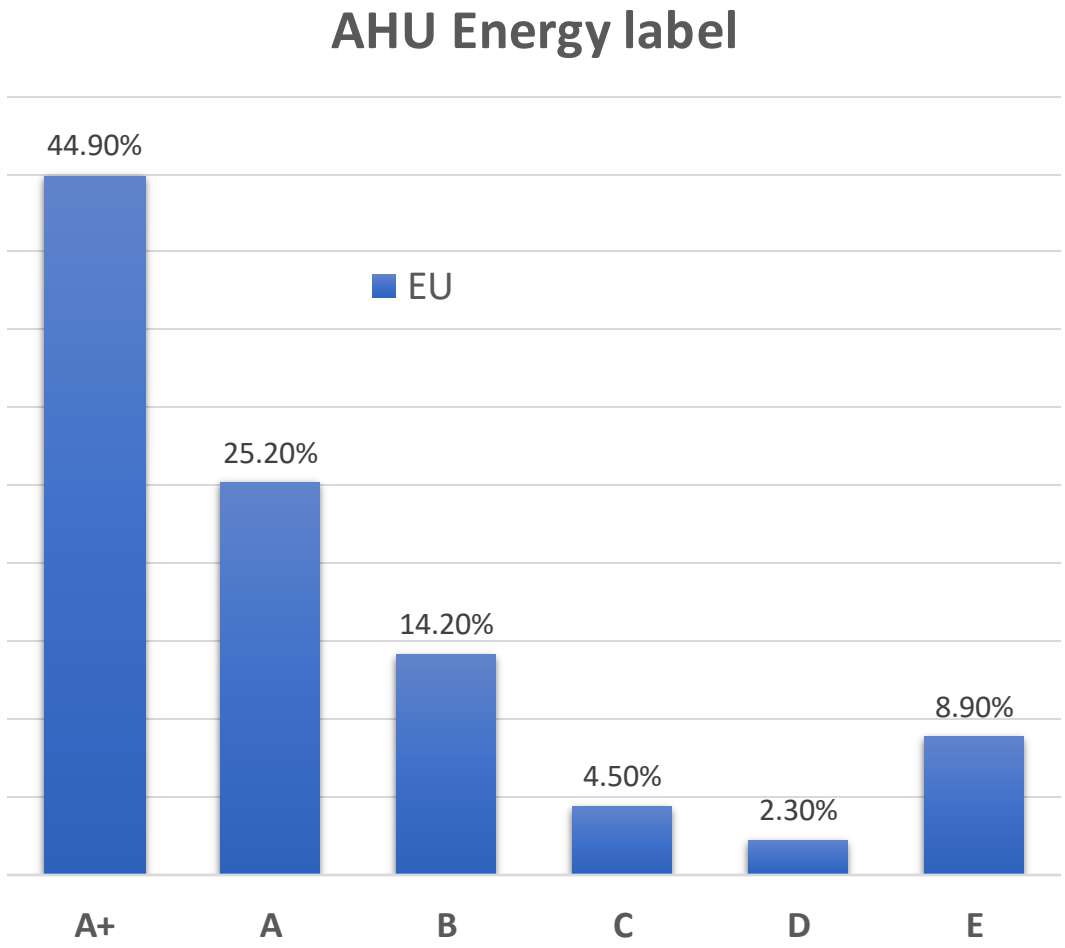


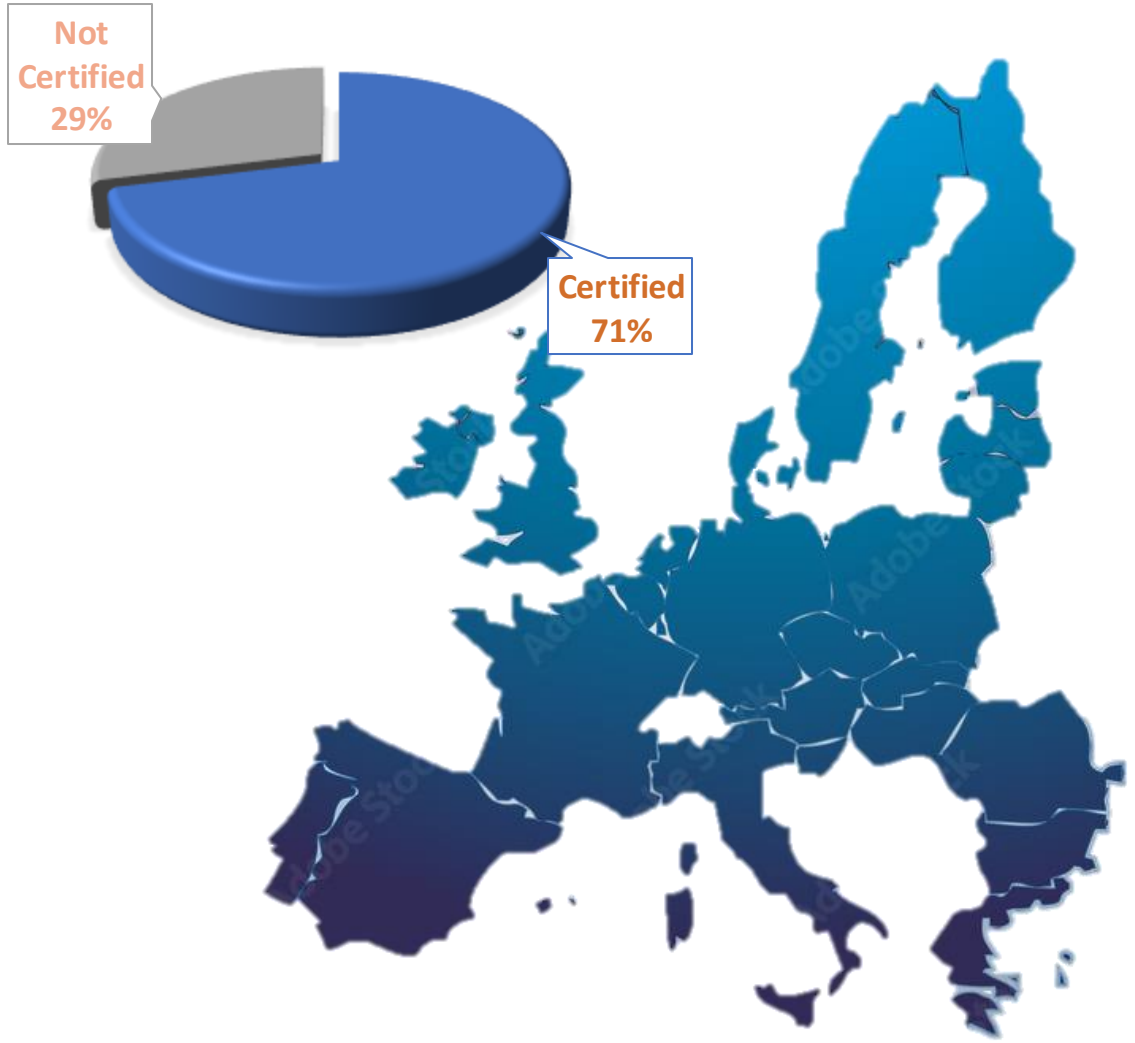
Level 3 — **Compliant with VDI 6022-1 DIN 1946-4**

Level 2 — **Compliant with VDI 6022-1**

Level 1

Value of Certification and Market Surveillance





Seek the Value and not the price !!!

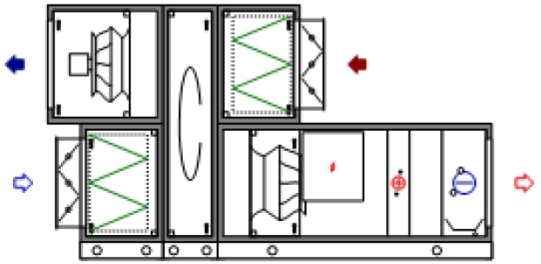
Position	I.M.	Energy class of the air handling unit		
		A+	A	C
Electric Energy (fans)	kWh/yr.	33,285	36,368	39,778
Heating Energy (heating coil)	kWh/yr.	168	1,931	8,098
Cooling Energy (cooling coil)	kWh/yr.	9,826	10,138	10,690
Total energy cost	€ / yr.	8978	10138	10690
Unit Cost difference to class A+	€ / yr.	-	900	2161
Difference after 15* years to A+ class	€	-	13,508	32,428

Prices per kWh. Electricity 0.2517 €/kWh, Gas 0,06 €/kWh (based on a SEER chiller efficiency)

HRS effic. adopted 85.5% for A+ class, 80.2% for A class & 73% for C class, respectively.

* Present values over 15 years with a rate of return @3%.

LCC calculations courtesy of FläktGroup



Airflow rate (SUP/EHA): 10,000 m^3/h

Ext. Static Pres. (S/E): 400/300 Pa

Supply (S/W): 20°C

Exhaust (W): 22°C

Exhaust (S): 24°C

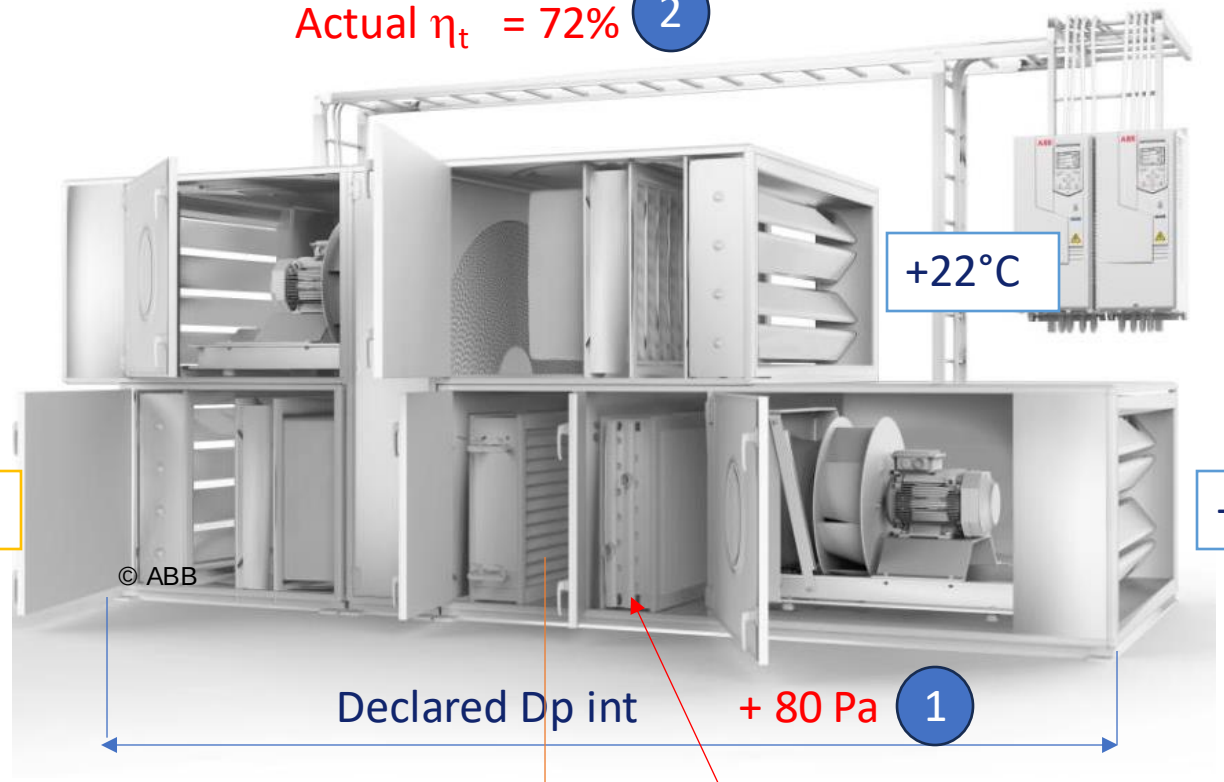
Rotary Heat Recovery Wheel, Water heater & cooling coils, Filter ePM1 70% (SUP), ePM10 50% (ETA) + Fans (SUP+ETA)

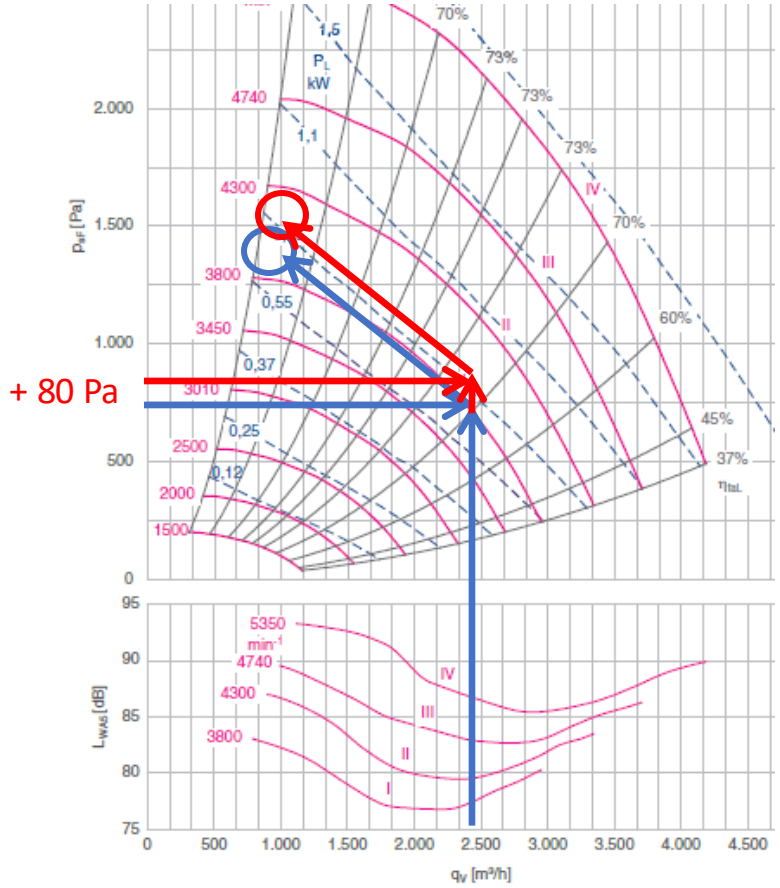
Location: London, 24/7 operation

Case study

Declared η_t = 78%

Actual η_t = 72% (2)





Declared temperature 15°C

Actual temperature 13°C

Excessive heat consumption to heating up by an extra 2K

Case Study

1

Excess fan power consumption (80 Pa deviation):

$$P = \frac{\Delta P_t \times q}{\eta} \times 10^{-3} kW = \frac{2.78 \times 80}{0.6} \times 10^{-3} = 0.37\ kW$$

Excess annual electricity consumption (supply+exhaust)

$$E = 2 \times 0.37\ kW \times 8{,}760\ h\ \approx 6{,}480\ kWh$$

- Hotel (350 beds)
- The air handling unit supplies (hygienic) air to the hotel rooms
- Supply/exhaust temperature: 20°C (winter)
- Air flow rate: 10,000 m3/h (2.78 m3/s)
- Constant flow system (without DCV)
- 24/7 operation (8760 h/year)

Case Study

2

Seasonal Heat Consumption of the heater:

$$Q = q_m \times \{t_{ex} - [t_{ph} + \eta_t \times (t_{ex} - t_{ph})]\} \times h_{year}$$

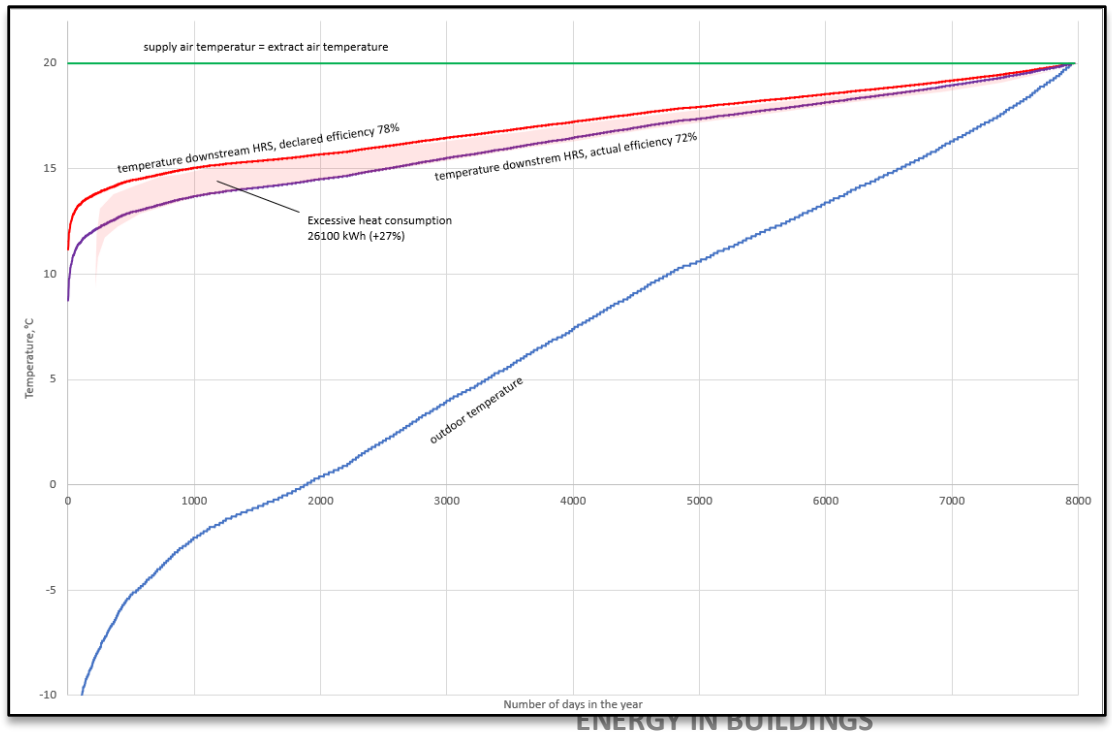
- **For 78% efficiency**

$$Q = 72{,}200\ kWh/y$$

- **For 72% efficiency**

$$Q = 98{,}300\ kWh/y$$

Excessive Heat Consumption ≈26,100 kWh (+27%)



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- Air flow rate: 10,000 m3/h (2.78 m3/s)
- Constant flow system (without DCV)
- 24/7 operation (8760 h/year)

Case Study

1

Excessive cost of electricity:

$$6{,}480\ kWh \times {}^{0.2173€}/_{kWh} = 1408\ €$$

2

Excessive cost of heat (natural gas):

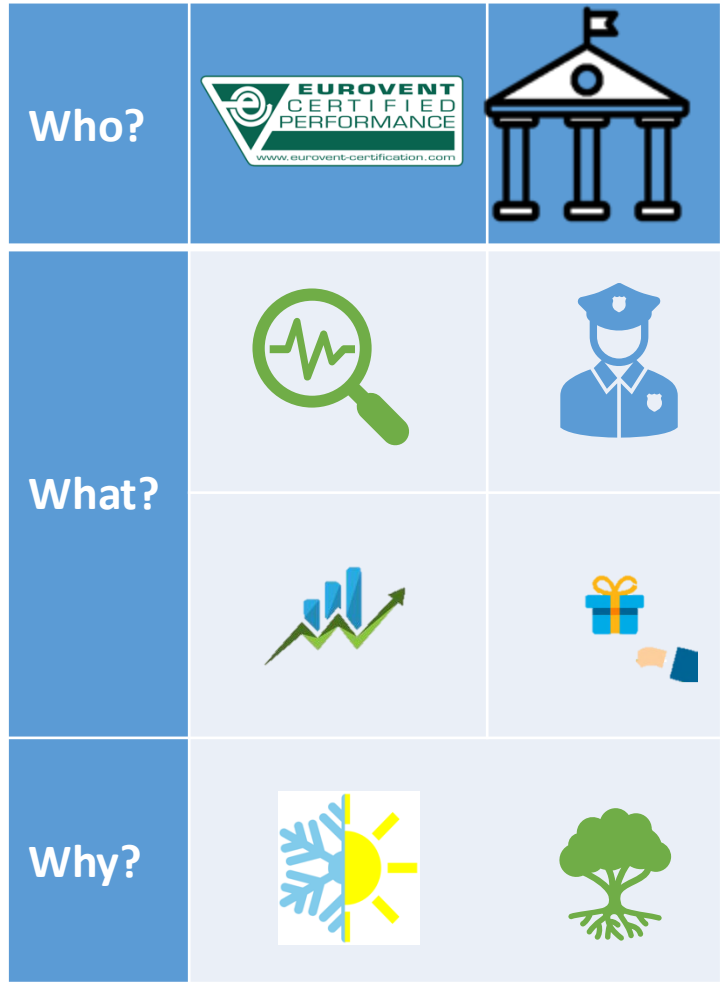
$$26{,}100 kWh \times 0{,}06€/kWh = 1566\ €$$

Excessive Cost 2,974 €/ year

- Hotel (350 beds)
- The air handling unit supplies (hygienic) air to the hotel rooms
- Supply/exhaust temperature: 20°C (winter)
- Air flow rate: 10,000 m3/h (2.78 m3/s)
- Constant flow system (without DCV)
- 24/7 operation (8760 h/year)

Summary

- Improving the efficiency of HVAC-R products is crucial for a more sustainable future
- Incentives and Regulations are necessary to influence the market
- Third-party certification is a valuable tool for market surveillance and product performance control
- Product certification is an effective solution for incentivization
- Certified products tend to increase the percentage of high-performance products in the market and unburden governments



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THANK YOU!

Q & A

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