



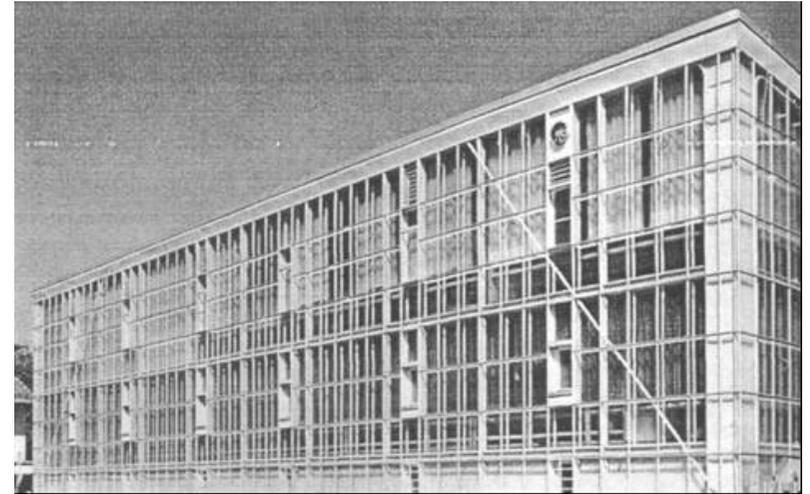
Best Facade

Best Practice for Double Skin Facades –WP 1 “State of the Art”

Definition

“A double skin façade (DSF) can be defined as a traditional single façade doubled inside or outside by a second, essentially glazed façade. Each of these two façades is commonly called a skin.

A ventilated cavity - having a width which can range from several centimetres to several metres - is located between these two skins.



Steiff Factory, Giengen / Brenz, Germany, 1903

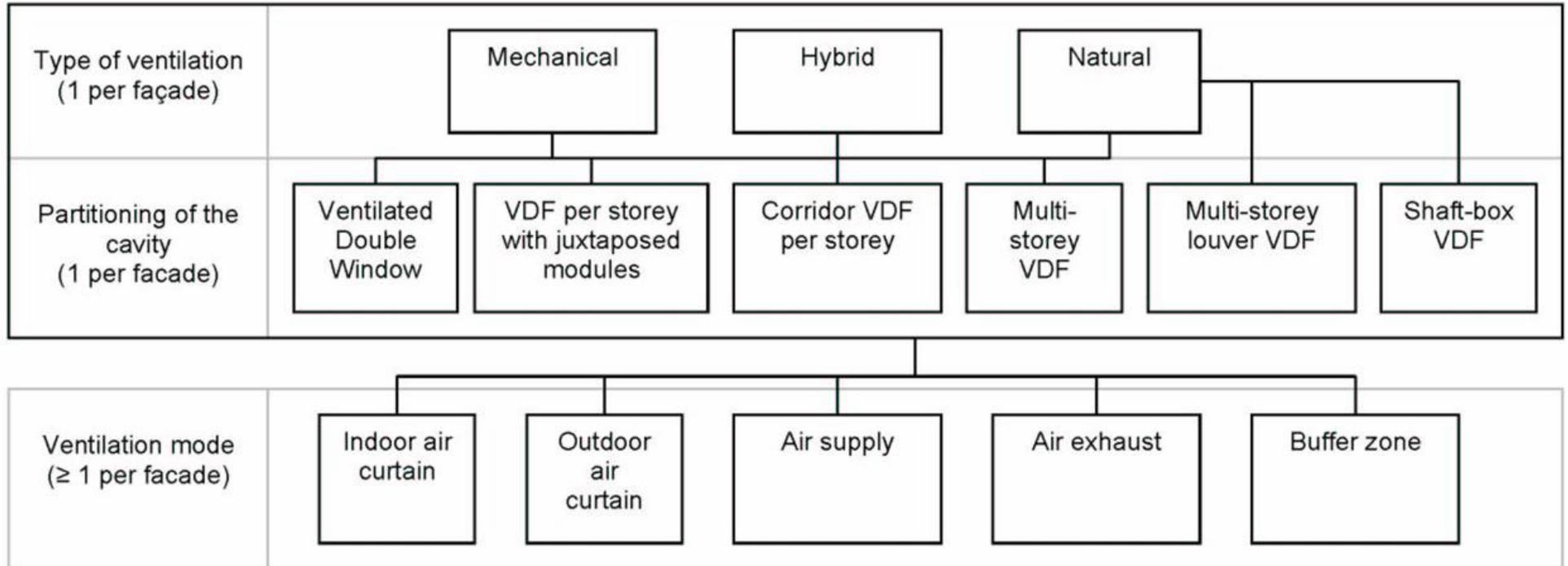
Characteristic parts

- Exterior and interior glazing
- Air cavity between the exterior and interior glazing
- Ventilation mode of the cavity
- Shading device
- Openings
- HVAC system



Section showing constructive elements through the façade

Typology of DSF



Partitioning of the cavity



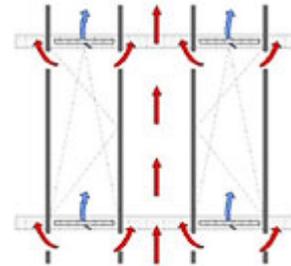
Ventilated double window



Juxtaped: delimited by storey and facade module



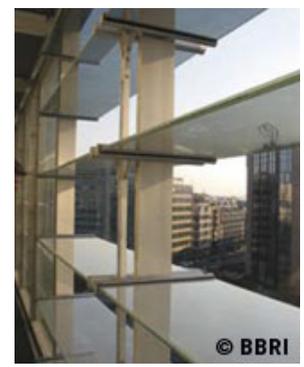
Corridor: delimited by storey



Shaft box: inlet per storey outlet shafts

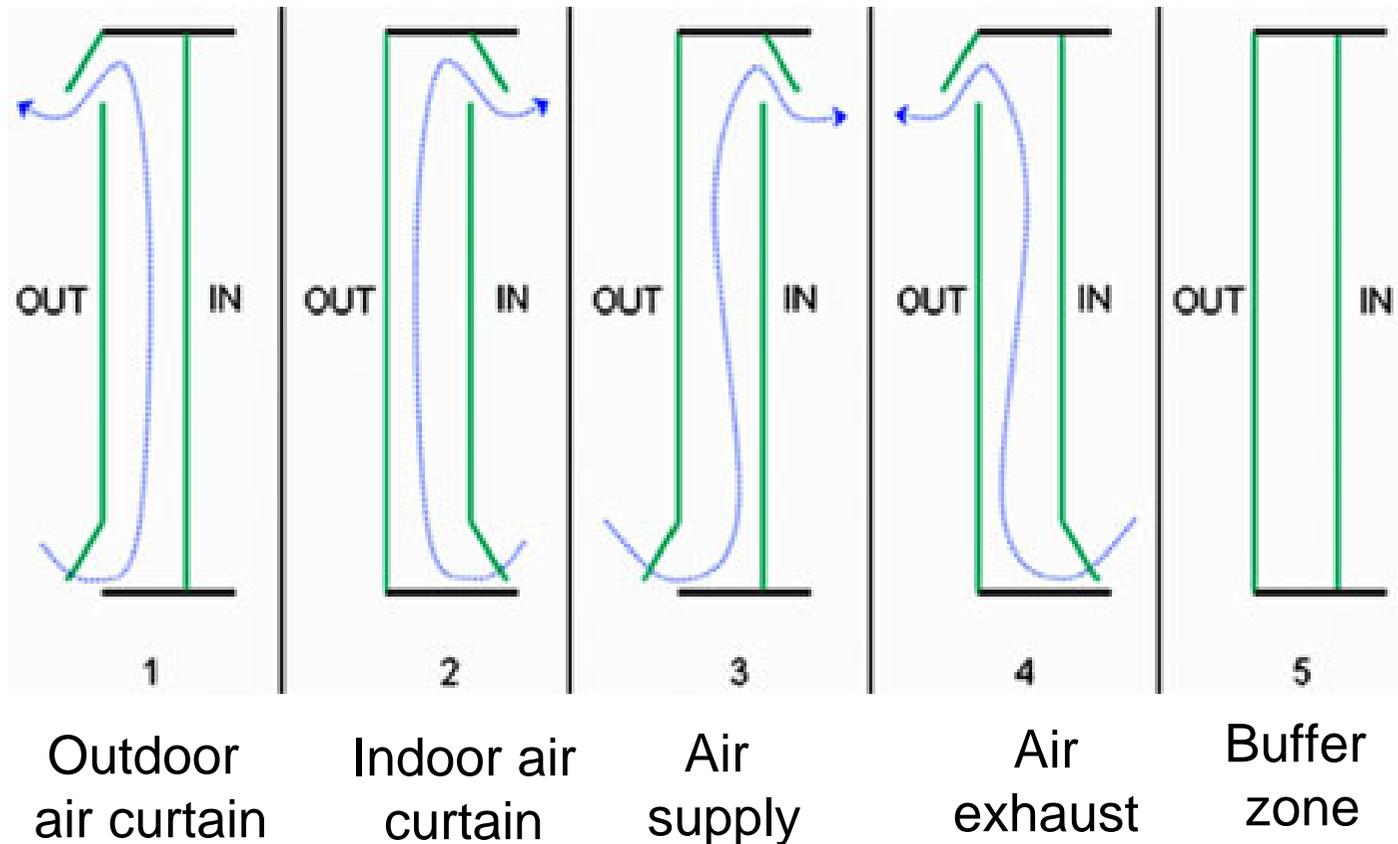


Multistorey



Multistorey louver

Ventilation mode of the cavity



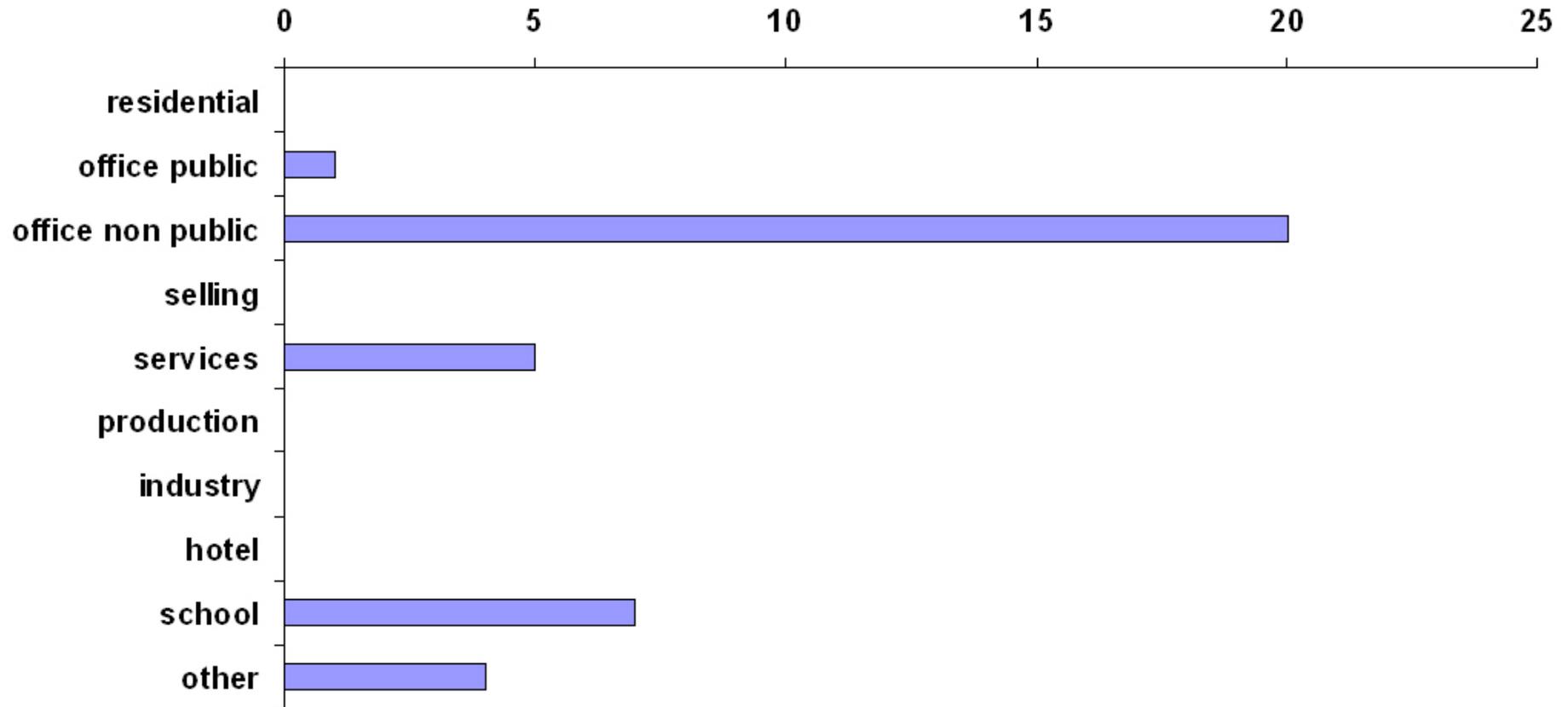
Analyzed Facades

Nr.	Country	Partner	Facade			
			name	city	orientation	utilisation
1	Austria	IWT	BiSoP	Baden	S / N	school
2			Felbermayr	Salzburg	S	office - n.p.
3			Fachhochschule	Kufstein	NW	school / office - n.p.
4			Justizzentrum	Leoben	SE	office - p.
5			Schubertstrasse	Graz	SE	office - n.p.
6	Belgium	BBRI	Aula Magna	Louvain-La-Neuve	SE	other
7			Sony	Zaventem	NE / SW	office - n.p.
8			UCB Center	Brussels	NE / SW	office - n.p.
9	France	LASH-DGCB	Cité	Lyon	NE	office - n.p.
10			EAL	Vaulx en Velin	NE	school
11			Thiers	Lyon	E	office - n.p.
12	Germany	IBP	Münchner Tor	Munich	N / S / E / W	office - n.p.
13			Geschäftsgeb. Süd 1+4	Munich	N / S / E / W	office - n.p.
14			Zentralbibliothek	Ulm	N / S / E / W	library
15	Greece	NKUA	A-A Holdings	Athens	E	office - n.p.
16			Alumil M5	Kilkis-Stavrochori	E	office - n.p.
17			AVAX	Athens	E	office - n.p.
18	Portugal	ISQ	CGD	Lisboa	S	office - n.p.
19			Atrium Saldanha	Lisboa	SW	office - n.p. / services
20			ES Viagens / expo 98	Lisboa	SE	office - n.p. / services
21			Palacio Sotto Mayor	Lisboa	SE	services
22			Torre Zen	Lisboa	S	office - n.p. / services
23	Sweden	WSP	ABB	Sollentuna/ Stockholm	W	office - n.p.
24			Arlanda	Stockholm	N / S / E / W	other (airport terminal)
25			Glashuset	Stockholm	S	office - p. / school
26			Kista	Kista / Sockholm	S / W	office - n.p.
27			Polishuset	Stockholm	S / W	office - n.p.
28	Germany	IBP	VERU	Holzkirchen	W	test facility

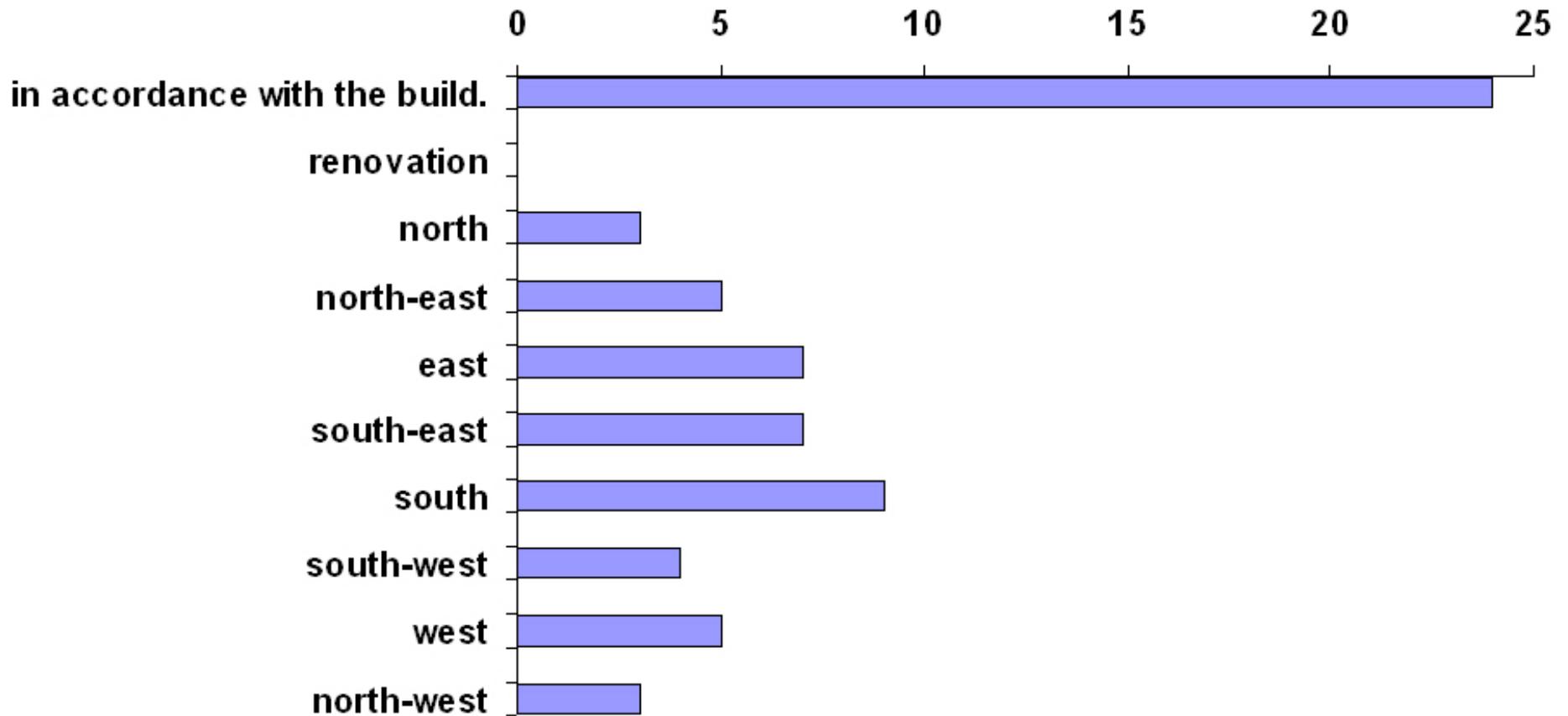
Analyzed Facades



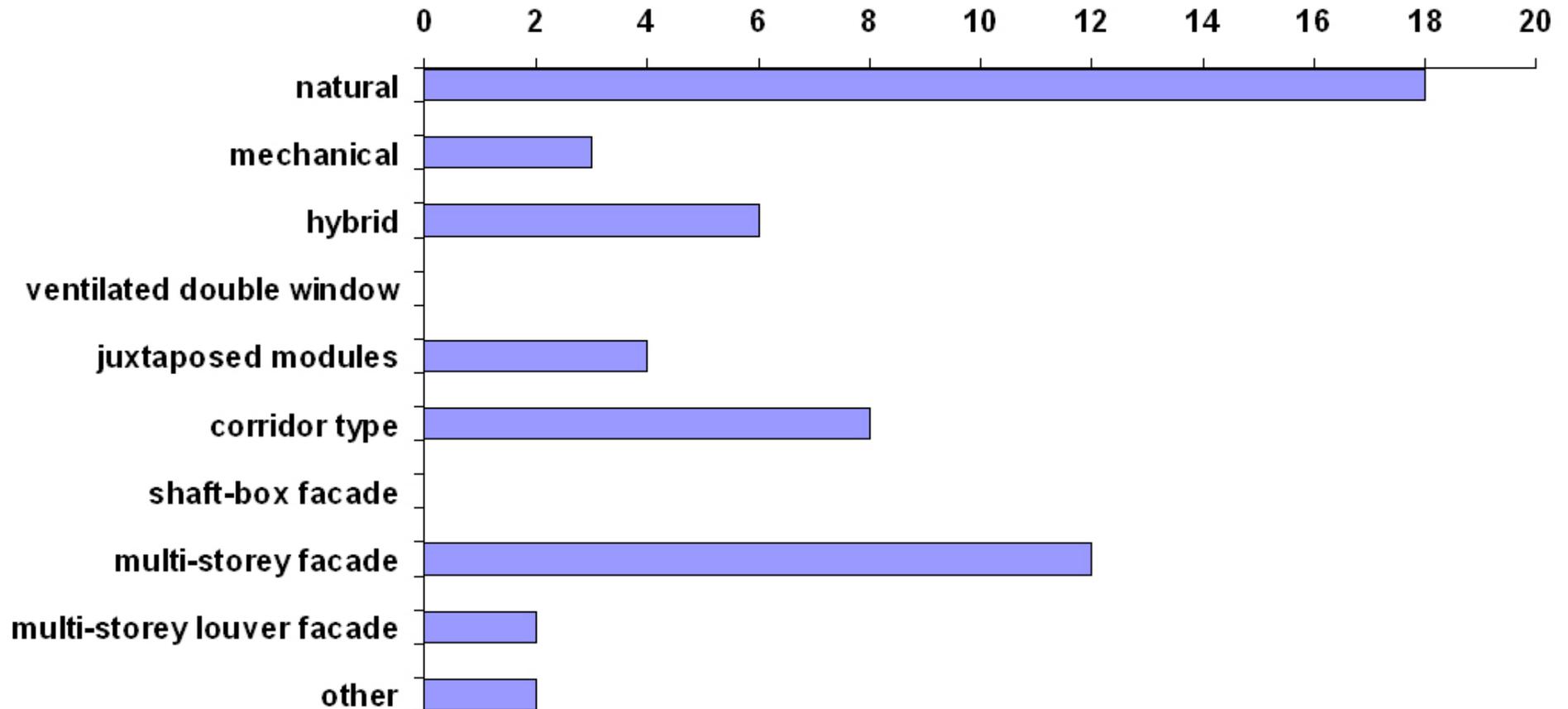
Utilisation of BESTFAÇADE buildings



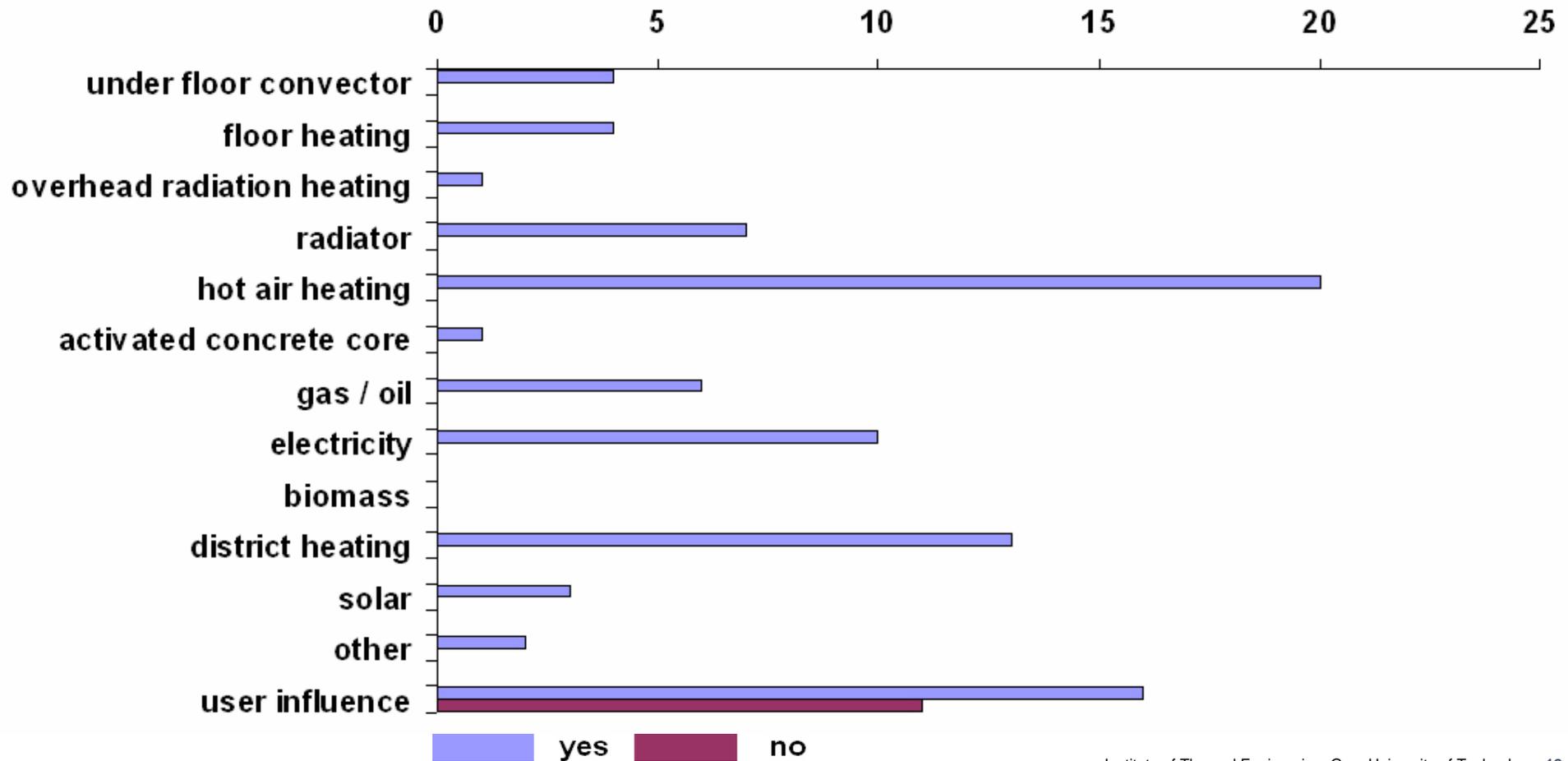
Implementation and orientation of façades within BESTFAÇADE



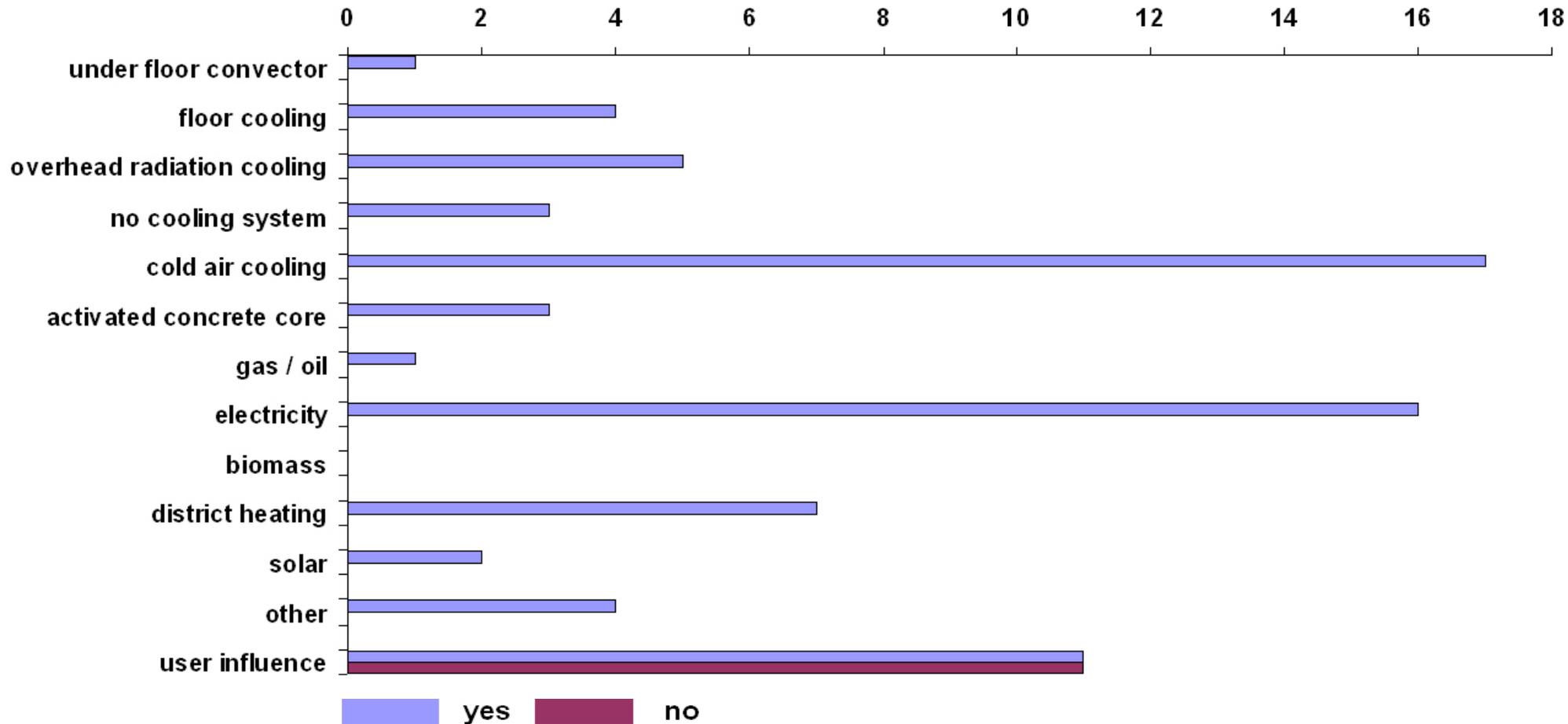
Type of ventilation and partitioning of the gap



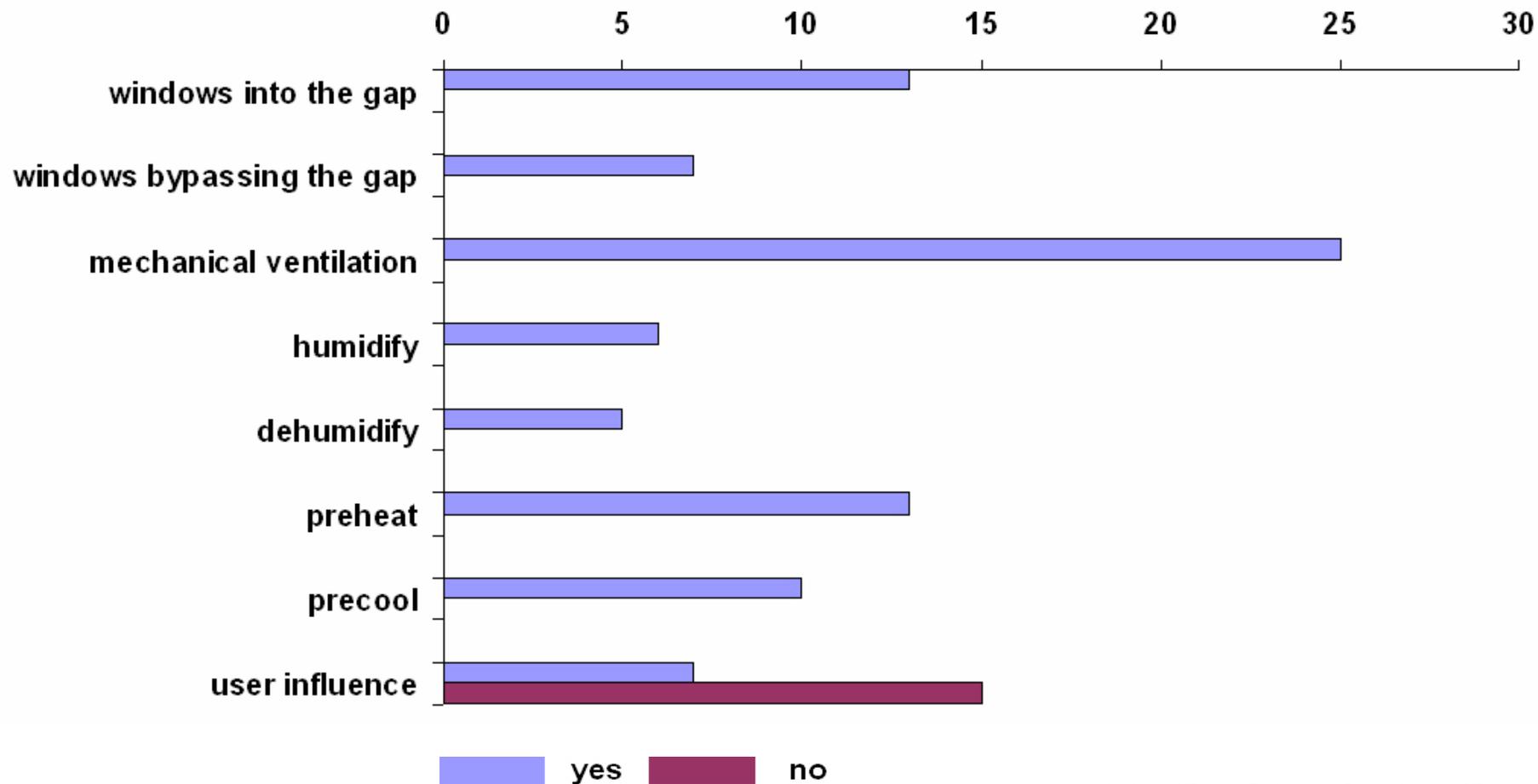
Types of room *heating* devices and used energy source of BESTFAÇADE buildings



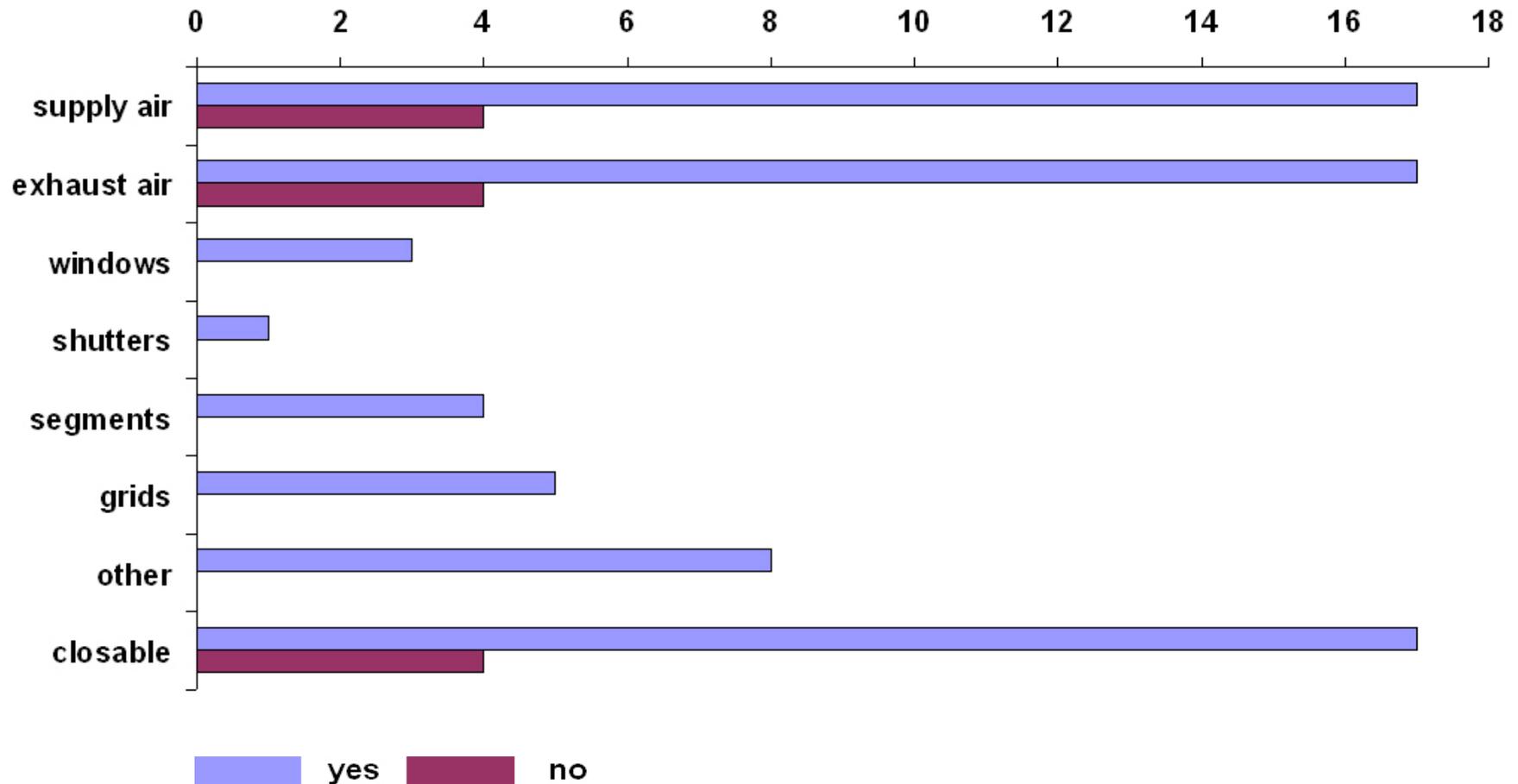
Types of room *cooling* devices and used energy source of BESTFAÇADE buildings



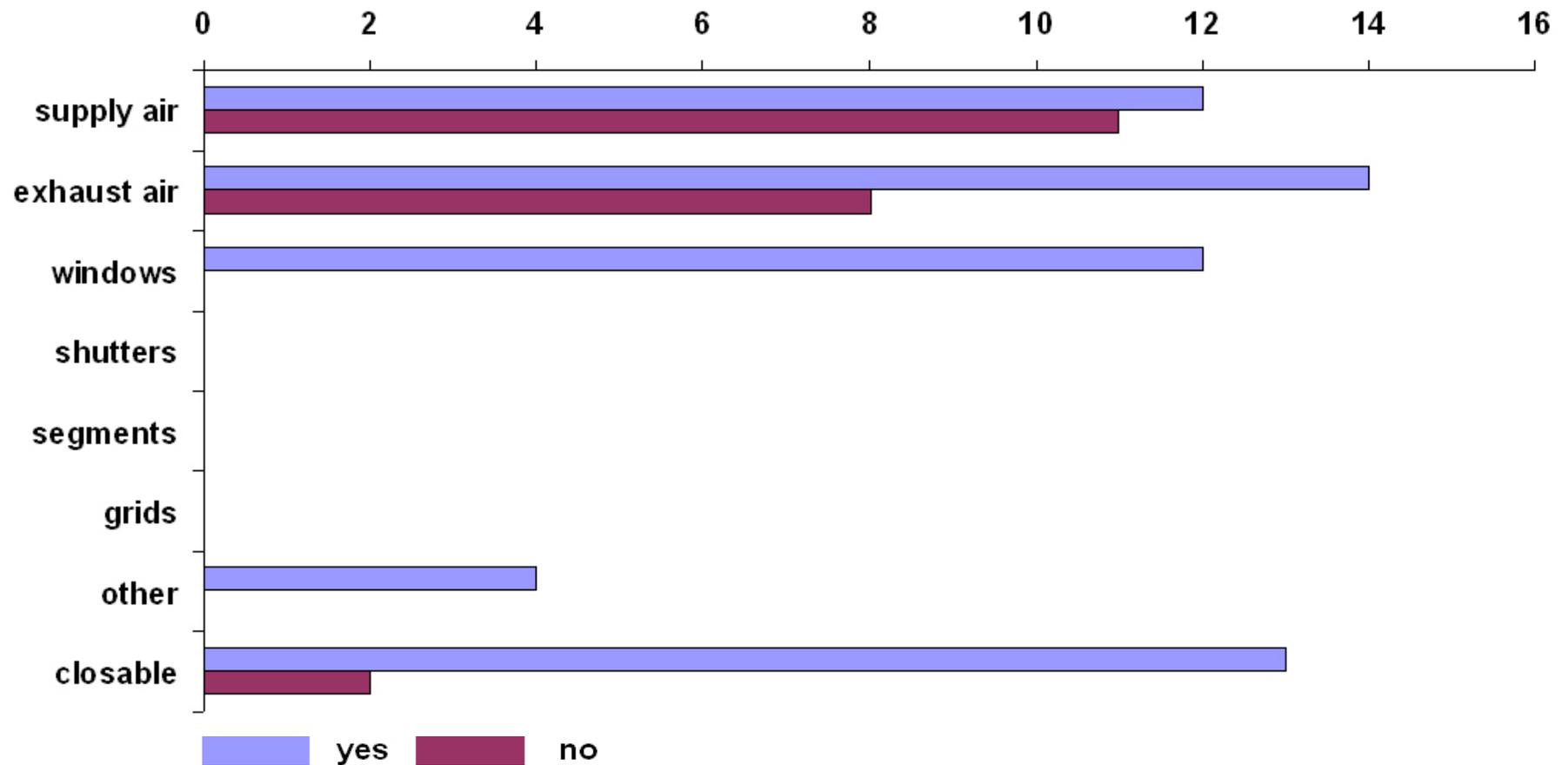
Ventilation and air conditioning of BESTFAÇADE buildings



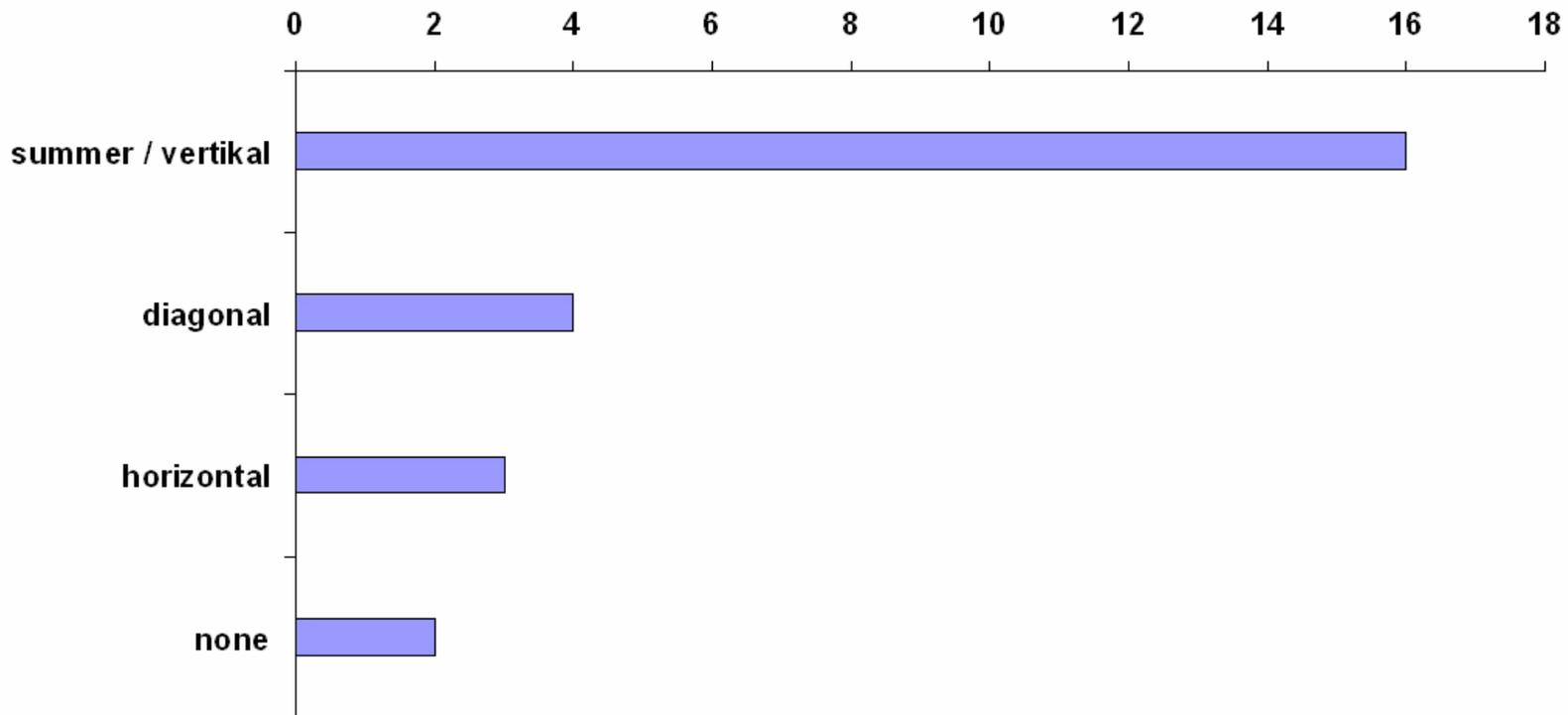
Ventilation openings in *outer* shell of analysed façades



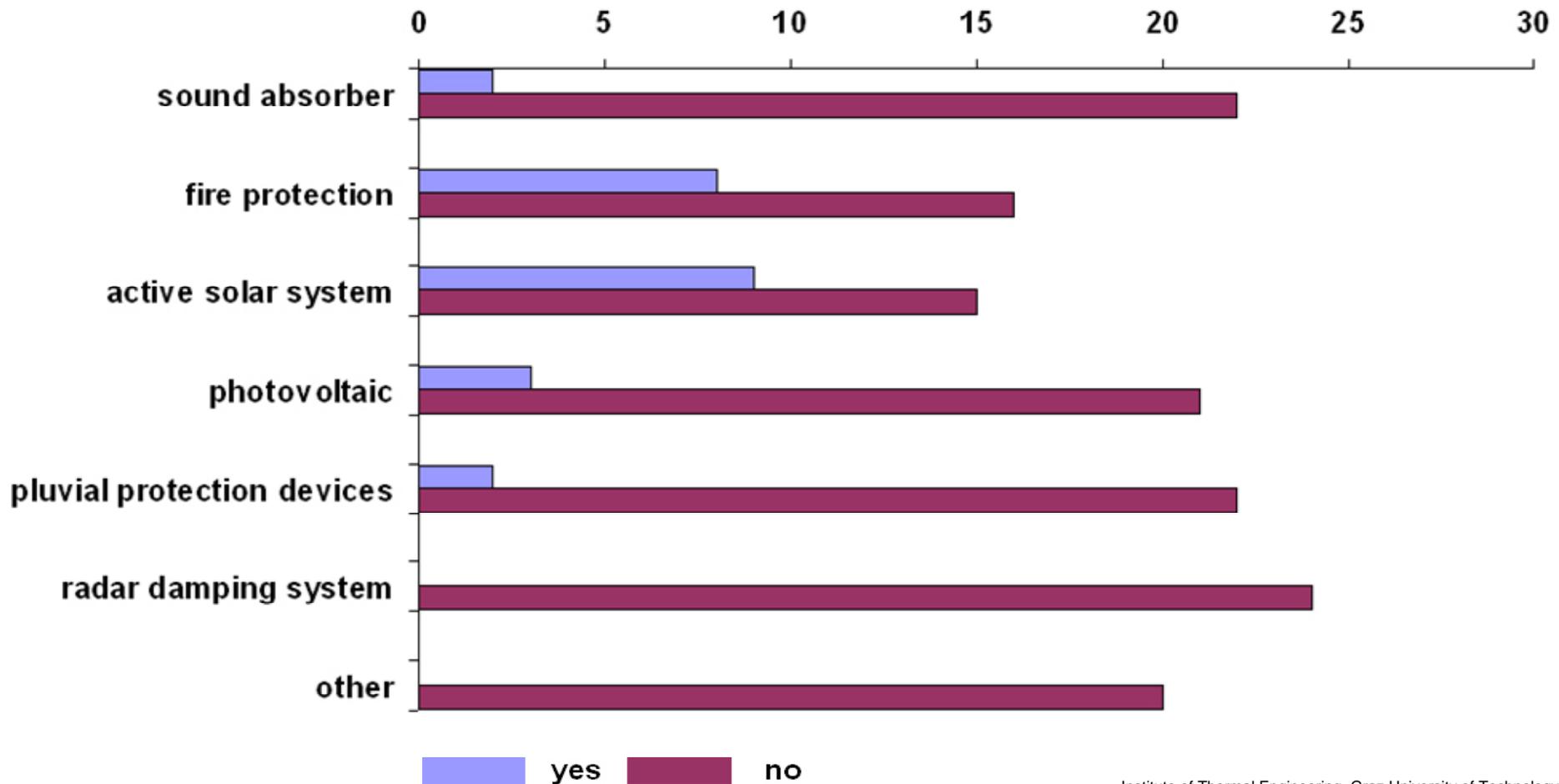
Ventilation openings in *inner shell*



Air flow in the gap in summer

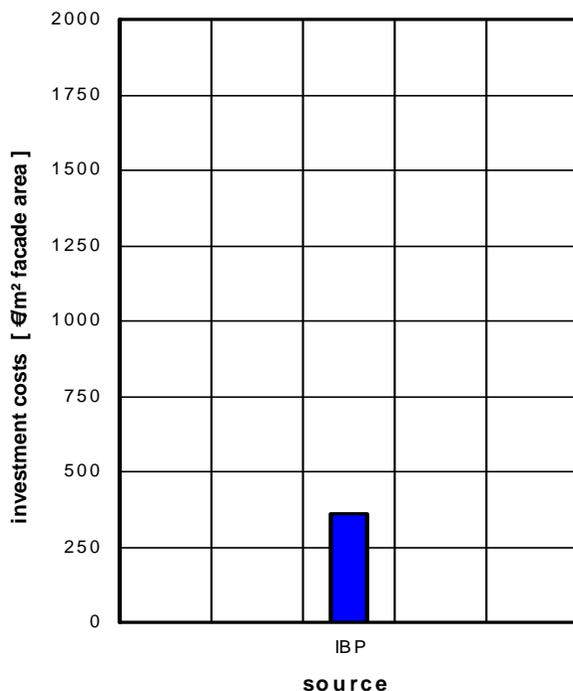


Integration of different devices into the façades (besides shading systems)

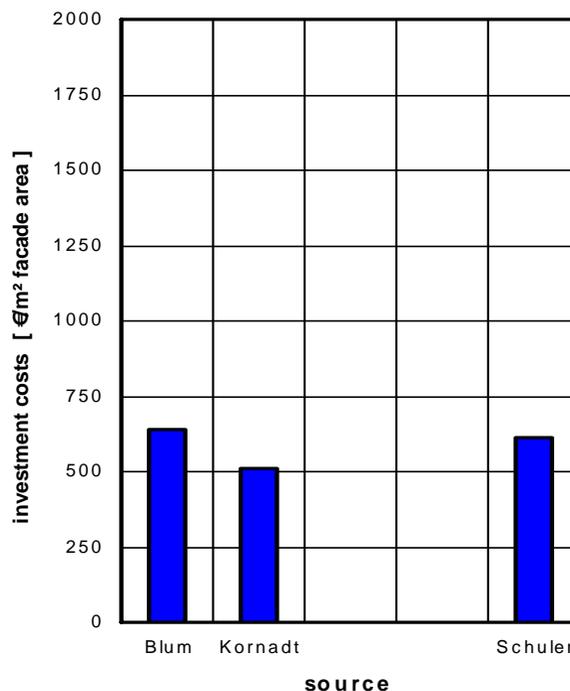


Cost of DSF compared to conventional façades.

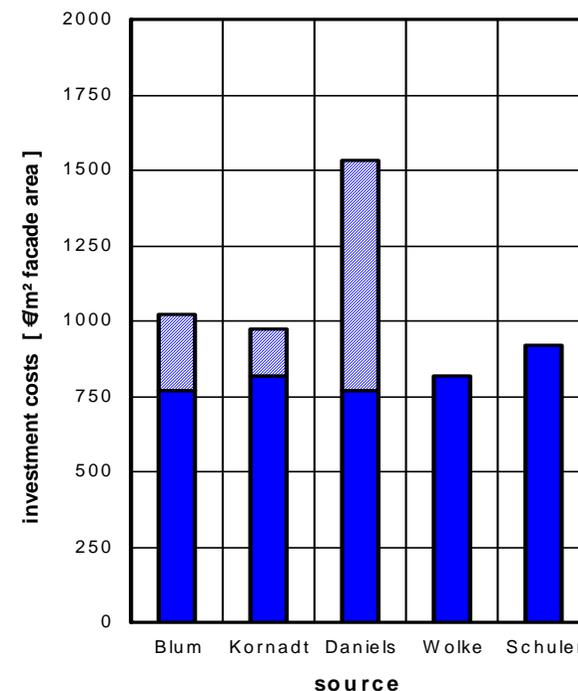
opaque facade with windows



glazed facade

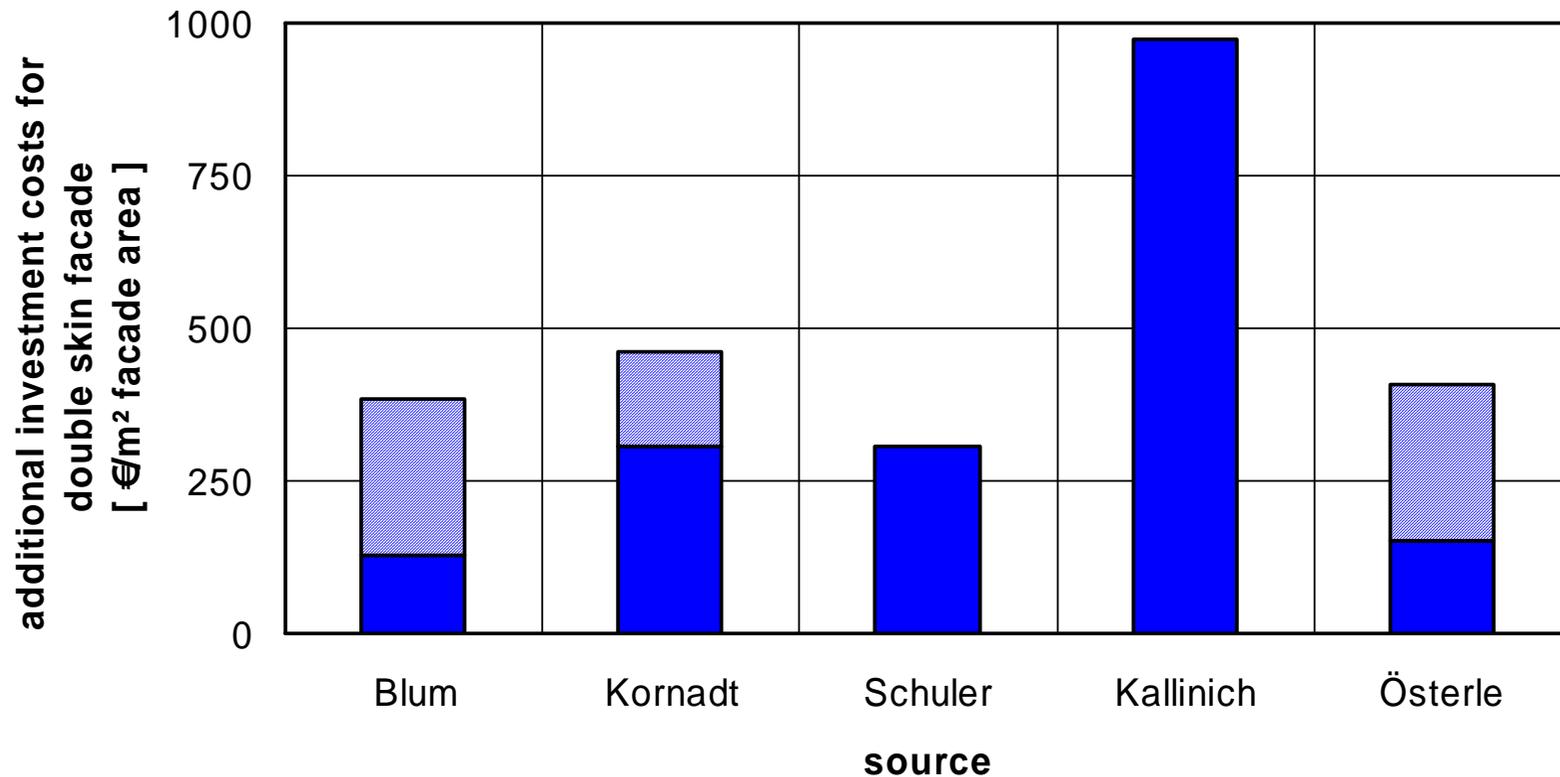


double skin facade



The blue and white fields show the range of cost mentioned in Blum (1998), Daniels (1997), Kornadt (1999), Schuler (2003) and own data.

Additional cost of DSF according to different authors. The blue and white fields show the range of cost



Potential advances of DSF



- Individual window ventilation is almost independent of wind and weather conditions, mainly during sunny winter days and the intermediate season (spring and autumn)
- Reduced heating demand thanks to preheating of outdoor air
- Night cooling of the building by opening the inner windows is possible if the façade is well ventilated
- Improved security thanks to the two glazed skins
- Better sound proofing from external noise sources e.g. at locations with heavy traffic, mainly during window ventilation
- More efficient exterior (intermediate) solar shading, as the shading can be used also during windy days

Potential disadvantages of DSF

- Poorer cross ventilation and insufficient removal of heat from the offices rooms during windless periods, when ventilation is mainly provided for by natural ventilation
- Hot summer/spring/autumn days can lead to high temperatures in office rooms as a result of window ventilation
- Higher investment cost
- The office floor area can be reduced
- Risk of sound transmission via the façade cavity from one office to another with open windows
- Cleaning can result in additional cost
- The energy saving potential has often been overestimated
- Fire protection can be more difficult depending on the type of façade.

Conclusion



- 28 façades of different buildings have been studied by means of a standardized questionnaire.
- Most of the buildings are office buildings followed by schools and service buildings.
- Nearly all of the buildings have mechanical ventilation systems and both heating and cooling are performed mostly by air heating/cooling systems.
- The types of façades are mainly multi-storey and corridor types, in Belgium juxtaposed modules are frequently used.
- The façade gaps are mostly naturally ventilated (except for Belgium, where the indoor air is led by mechanical ventilation via the gap to the centralized air handling unit).
- The shading is performed mainly with Venetian blinds located in the gap.
- The cleaning of the outer shell is done via a cradle or a lifting platform, the glazing of the gap is mainly cleaned from the gap or from the interior.

Conclusion



- The cost of DSF are about 20 – 80 % higher compared to single glazed facades and about 100 to 150 % higher compared to opaque façades with windows.
- Therefore there have to be significant benefits in the HVAC system cost or the operating cost of DSF to make them more attractive compared to conventional façades.