

Fresh schools? Healthy schools!

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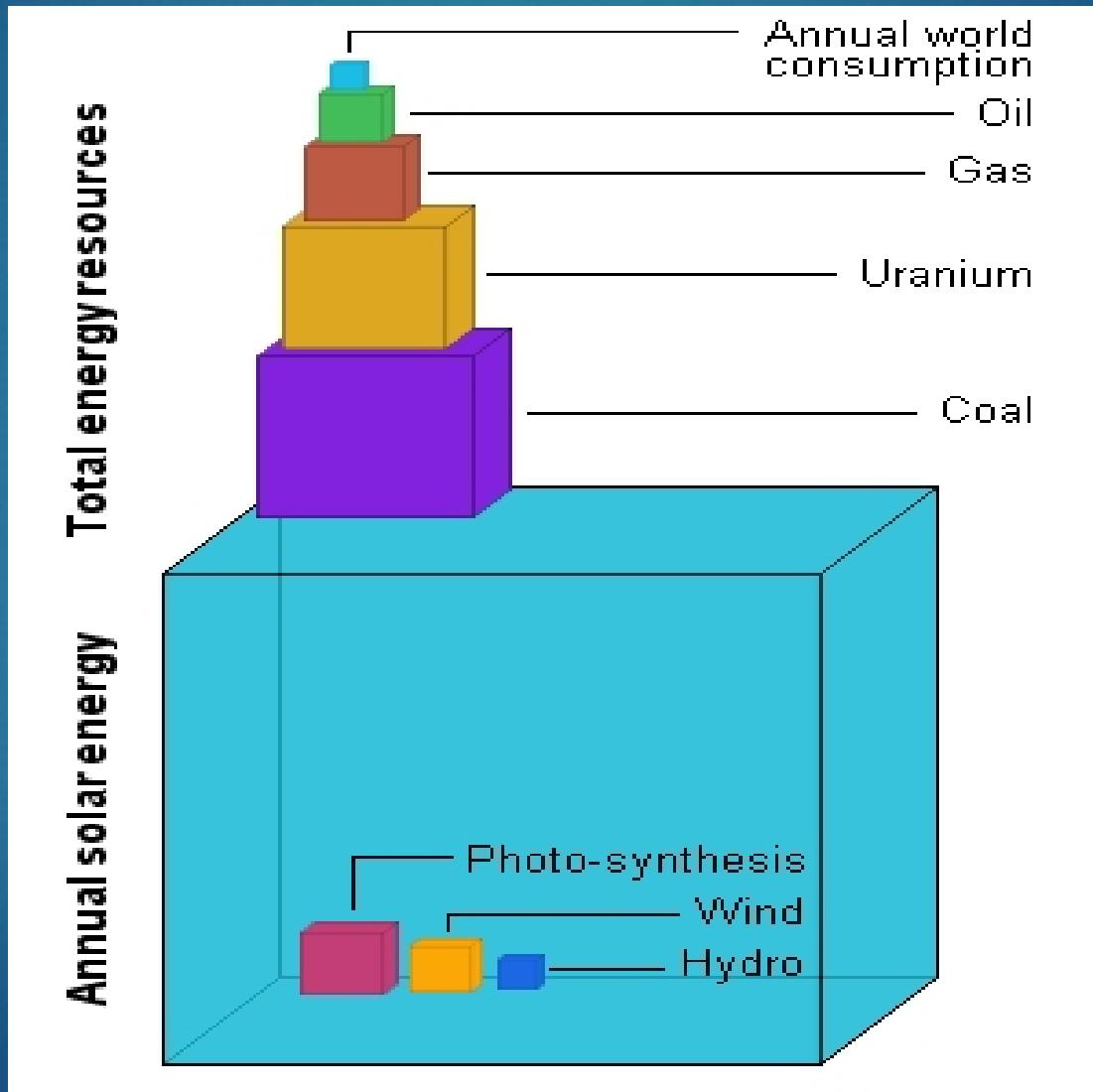
BREDA AVANS

21 DECEMBER 2016

Energy objectives

- ▶ 2020 20-20-20 CO2-sustainable-effective
- ▶ 2020 BENG 15 kWh/m² (newly built)
- ▶ 2050 Buildings E-neutral / Fossil Free

Fossil Free Energy



Requirements Fossil Free Buildings

- ▶ optimal insulation
- ▶ optimal sustainable energy production
- ▶ optimal ventilation
- ▶ minimum number of technical installations
- ▶ heat storage
- ▶ electricity storage

Prefab Insulating Exterior Facades



Industrial production

- ▶ prefabricated elements
- ▶ irrespective composition
 - ▶ finishing materials
 - ▶ colour combinations
- ▶ new insulating windows and doors
- ▶ triple glazing
- ▶ ventilation system incorporated
- ▶ PV - PVT roof

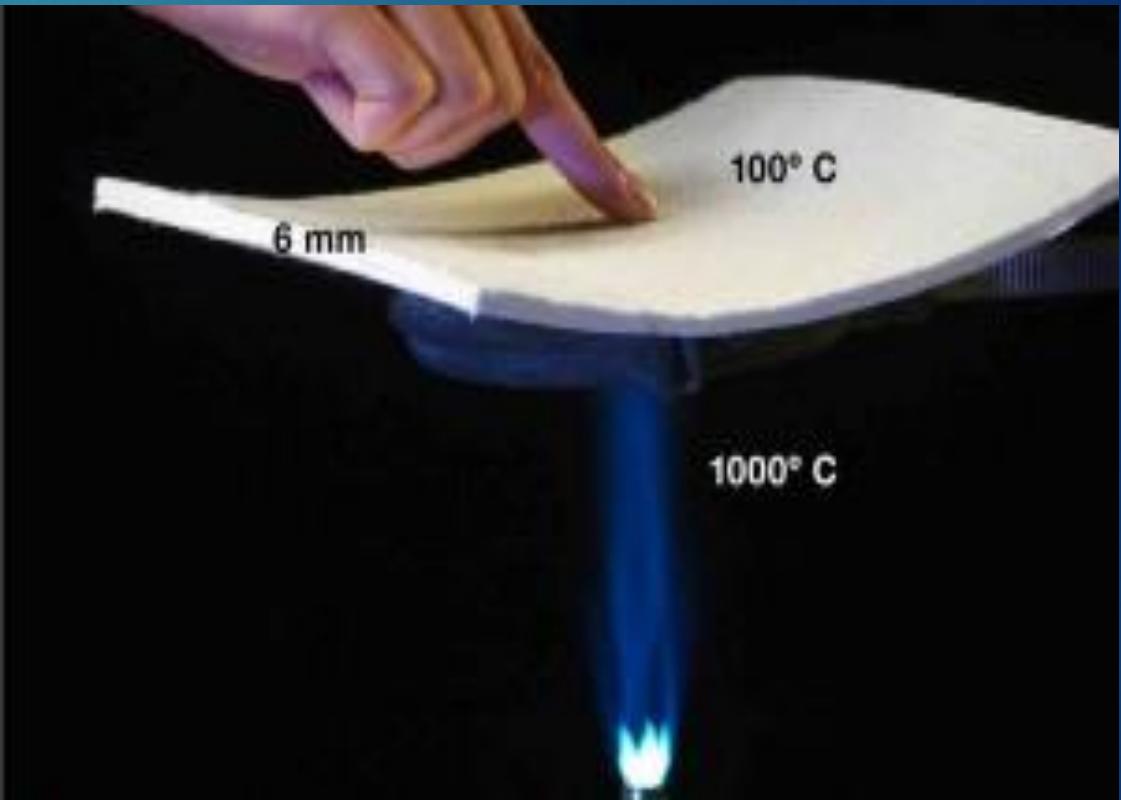
Fresh and Healthy





AEROGELS

- ▶ vapour open
- ▶ water repellent
- ▶ environmental friendly
- ▶ siliciumdioxide (Quartz)
- ▶ Insulating
- ▶ noise reducing
- ▶ flexible
- ▶ non flammable





Healthy school

- ▶ optimal indoor climate
 - ▶ concentration, distraction
- ▶ address health issues in lessons
 - ▶ (weight, bullying, movement)
- ▶ physical / social safe environment
 - ▶ results in healthy behaviour
- ▶ notice health problems
 - ▶ (physical and emotional development)

“Ambitions” for a healthy schoolbuilding

	Class C acceptable	Class B; Good		Class A: very good	
Energy	Label A++		Label +++		Label ++++
Air	CO2 1.200 ppm		CO2 950 ppm		CO2 800 ppm
Capacity ventilation	>6 dm3/s (21,6 m3/uur)		>8,5 dm3/s (30,6 m3/uur)		12 dm3/s<br (>43,2="" b="" m3="" uur)<=""/>
Class Filter	F5		F6		F7
Temperature Winter	19-25 C		20-24 C		21-23 C
Temperature Summer	22-27 C		23-26 C		23,5- 25,5 C
Airspeed summer /winter	0,23 m/s	0,19 m/s	0,20 m/s	0,16 m/s	0,16 m/s 0,13 m/s
Light	300 lux		500 lux		500 lux on worksheet
Daylight factor	3%		5%		7%
Noise installations	35 dB		33 dB		30 dB
Reverberation time T30	0,8 s		0,6 s		0,4
Airborne sound insulation	39 dB	34 dB	> 43 dB		31 dB

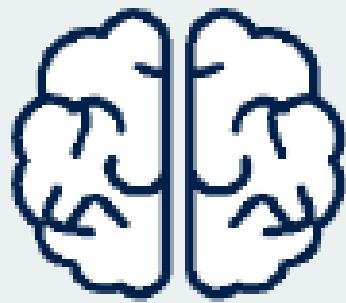
only very good is adequate



Best observed performance



Improved air quality = better performances



Prestaties stijgen
gemiddeld met
2,8% en soms zelfs
met 15%⁴



Hogere snelheid

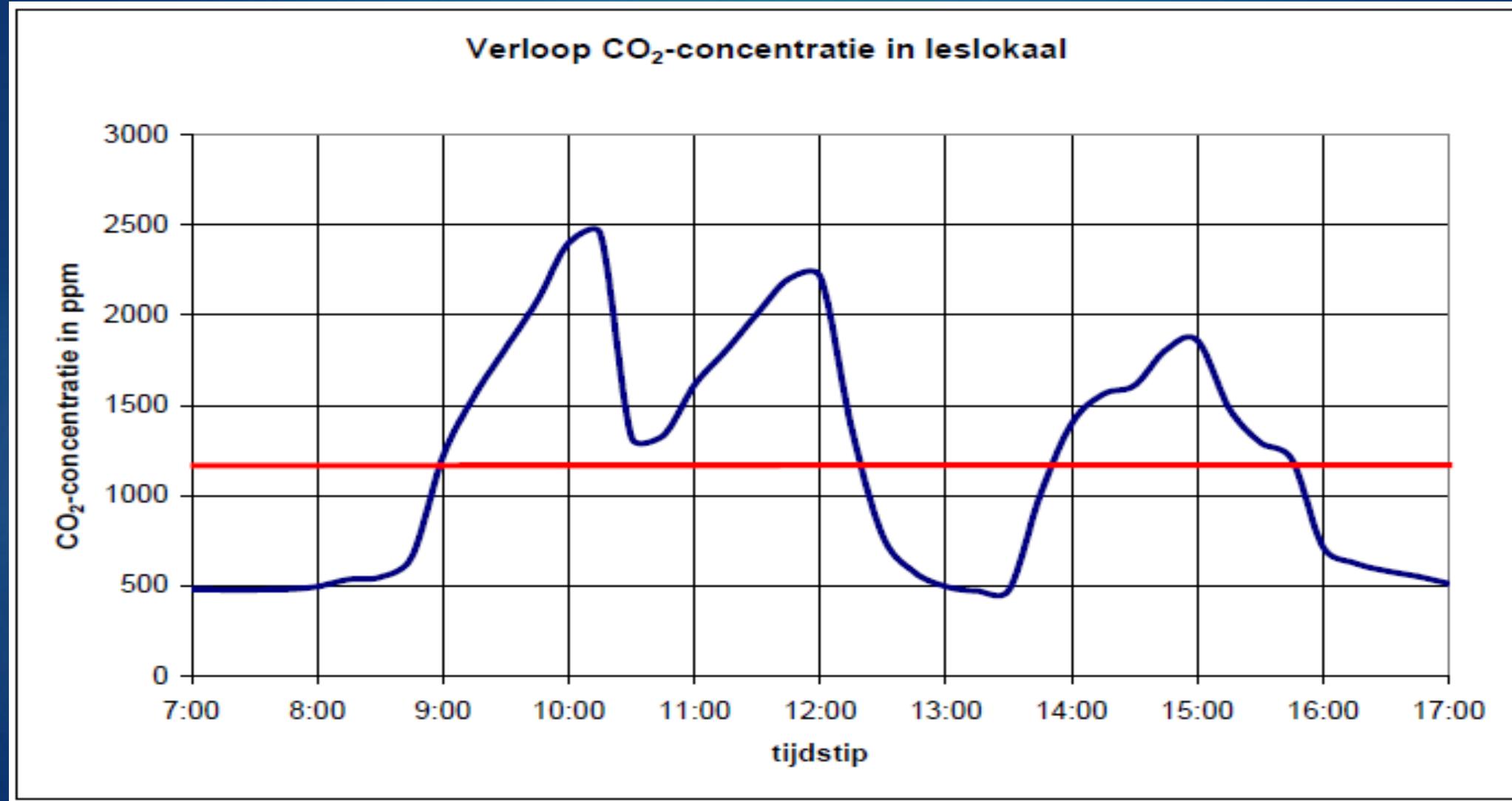


Meer aandacht
en betere
concentratie



Minder verzuim

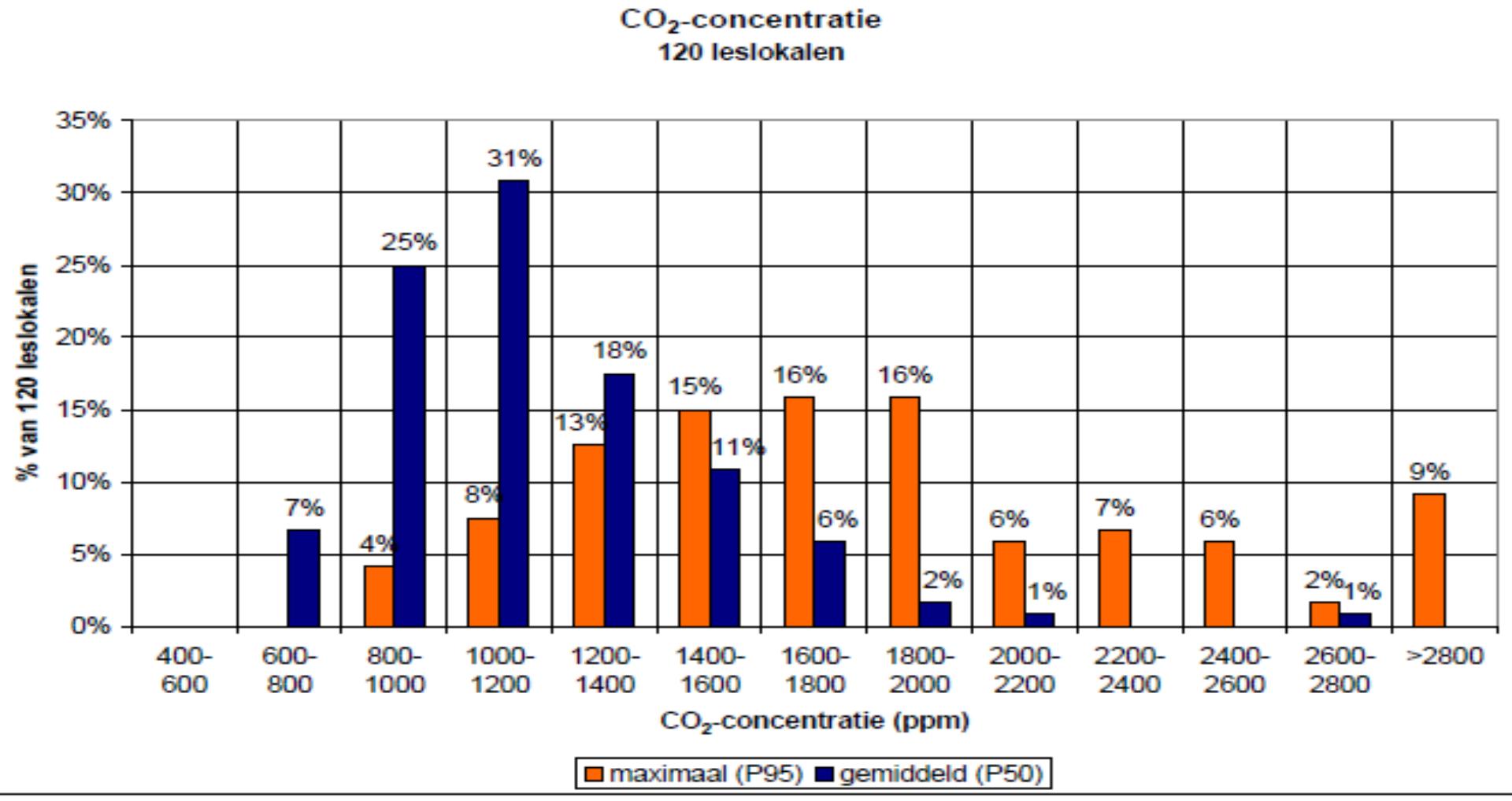
Effective ventilation needed



88% classrooms
maximum value
 $\text{CO}_2 > 1200 \text{ ppm}$

38% classrooms
average value
 $\text{CO}_2 > 1200 \text{ ppm}$

on average over
all 120 classrooms
during 39% of the
teachingtime the
value $\text{CO}_2 > 1200$
ppm



Insulation = Ventilation



Ventilation systems



Mechanische ventilatiesystemen kunnen in koudere maanden zorgen voor een optimale luchtkwaliteit zonder dat warmtecomfort afneemt.

Hybride oplossingen kunnen de voordelen van natuurlijke en mechanische ventilatie combineren.

Conditions Ventilation

- ▶ amount and quality of supply air
- ▶ clean filter system
- ▶ exhaust air and air supply on several spots
- ▶ air distribution pipes (cleanable)
- ▶ heat recovery system (100% separation exhaust / supply air)
- ▶ prevention policy contamination (softeners, toners, carpets)
- ▶ service contract required
- ▶ frequent inspections

Pre-Filter



Stof
Resten van
Haren

Medium Filters

A3™ Medium Filter



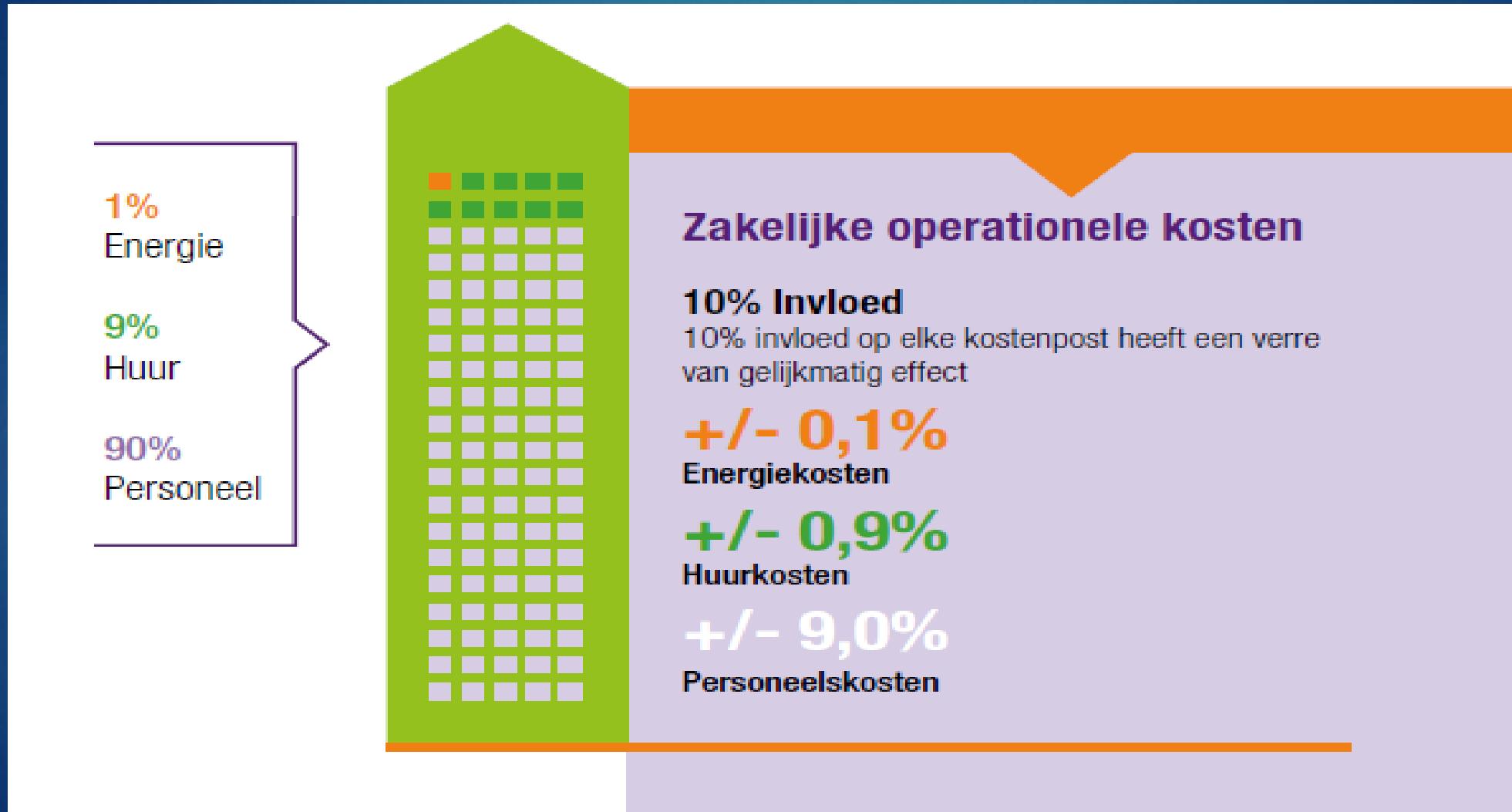
Giftige gassen
Slechte geuren

HEPA Filter



Bactiën
Kiemen
Pollen

Health and productivity of teachers



Conditions Thermal Comfort

- ▶ Temperature
- ▶ winter 19-25 and 21-23 C
- ▶ summer 22-27 and 23,5-25,5 C
- ▶ adjustable
- ▶ no downdraughts at windows

- ▶ solar shading
- ▶ active natural ventilation summernights
- ▶ thermische buffering in steenachtige materialen /binnenwanden
- ▶ air speed summer < 0,16m/s
- ▶ air speed winter < 0,13 m/s
- ▶ vertical temperature gradient < 2 K/m
- ▶ temperature floor 19-26 C ; children sitting:22C

Glasfilm



**Tot 40% meer isolatie
Reflecteert 92% van de binnenwarmte
Tot 73% meer zonwering in de zomer**

**Blokkeert meer dan 99% UV-straling
Verminderen schitteringen en reflecties
Scherfbindend & inbraakvertragend
Gaat condensvorming op ruit tegen
Terugverdientijd vanaf 3 jaar
8 jaar garantie, 15 jaar effectief
Getest & gecertificeerd**

Glasfilm



ROC Midden Nederland

**Raamfolie speciaal voor HR glas
Tot 85% warmtewering**

**Vuilafstotend, bestand tegen zuren
Blokkeert meer dan 99% UV-straling
Reduceert schitteringen en
reflecties
Scherfbindend
Inbraakvertragend
Getest en gecertificeerd
Garantie 8 jaar, 15 jaar effectief**

Noise barriers, sound insulation

- ▶ Building envelope
- ▶ noise levels on the building envelope minus 28dB
- ▶ Installations (well encapsulated)
- ▶ classrooms and aereas max 30dB
- ▶ reverberation time 0,4s (noise absorbing materials)
- ▶ speech intelligibility required
- ▶ airborne sound insulation between rooms > 43 dB

Light Conditions

- ▶ > 500 lux on work surface
- ▶ homogeneity > 0,7
- ▶ glare-free value <16 (UGR waarde)
- ▶ daylight factor average > 7%
- ▶ windows and skylights with thermal comfort
- ▶ backlight and reflections 1:10:30 or 1:3:10
 - ▶ taak: omgeving: periferie
- ▶ light dimmable and in parts switched off

Daylight every where in classrooms



8000 lumen 5x 5 m max 10 m1 verlengen

‘Biophilic design’; Into Green

Healthy play ground











