

Campus Dirk Martens

Older (main) building:
build in 1970

Younger building:
build in 2003



Energy saving investments:

1.Insulate.

We have invested in additional insulation of the rooftop of the main building (+18cm)

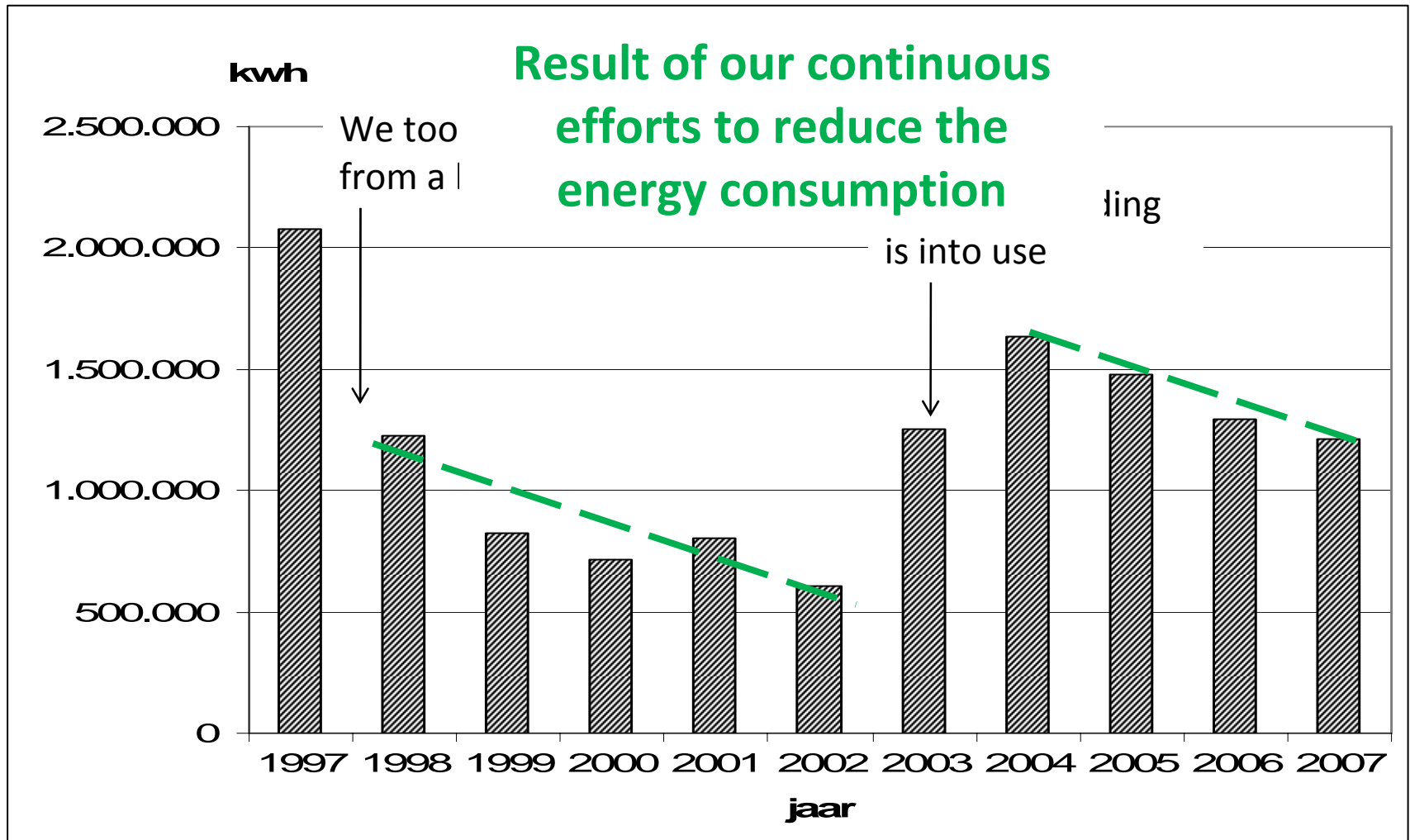
Energy saving investments:

1. Insulate;
2. Record energy consumption;



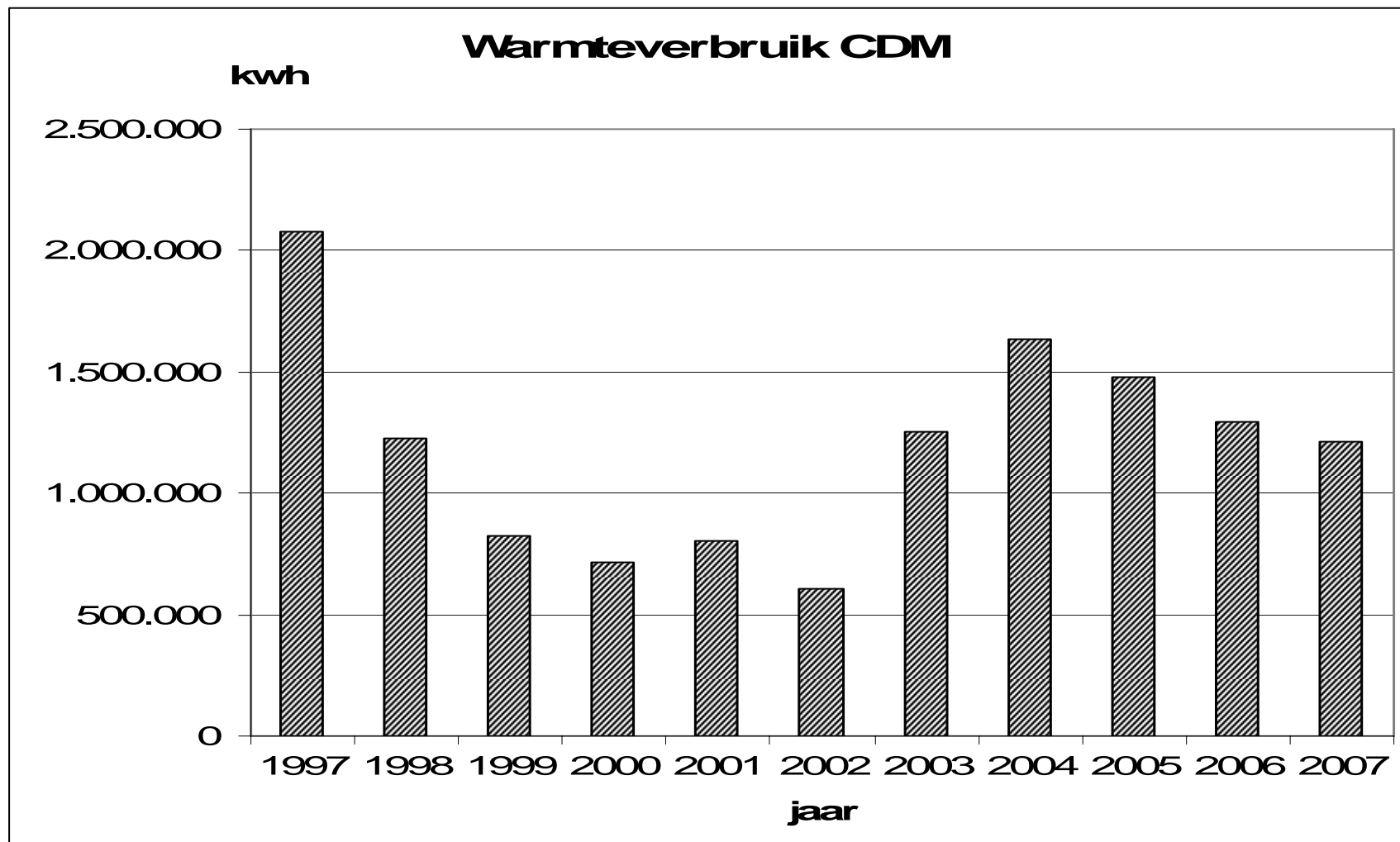
Evolution of energy consumption

(10 kWh = 1 l fuel; 11 kWh = 1 m³ gas)



Evolution of energy consumption

(10 kWh = 1 l fuel; 11 kWh = 1 m³ gas)



Energy saving investments:

1. Insulate;
2. Record energy consumption;
- 3. Compare your consumption to similar situations**

Surface of the oldest building:	12.250 m ²
Energy consumption in 2002:	600 000 kWh
	49 kWh/m ² .year
Surface of the new building:	6.275 m ²
Increase of energy:	600 000 kWh
	95 kWh/m ² .year

49 kWh/m².year, 95 kWh/m².year, compared to similar buildings?

Numbers published by our regional department of education:

Naam school	Bouwjaar	Opp.	Bezetting	Brandstof (b)	Elektriciteit (b)	Water (b)	Kost energie +water
		(m ²)	(ll/m ²)	(kWh/m ²)	(kWh/m ²)	(m ³ /m ²)	(EUR/m ²)
School A	1960	382	0,110	278	19	0,364	17
School B	1950	1.065	0,169	130	12	0,146	8
School C	1965	1.614	0,162	111	12	0,151	6
School D	1930	700	0,243	252	28	0,497	17
School E	1992	1.278	0,226	177	17	0,600	11
School F	1993	2.240	0,112	130	10	0,233	7
School G	1958	1.456	0,205	185	13	0,065	11
School H	(-)	1.714	0,173	149	17	0,283	11
School I	1929	1.690	0,269	230	21	0,523	13
School J	1958	1.042	0,185	(-)	13	0,358	(-)
Totaal		13.181	0,185	182	16	0,322	11

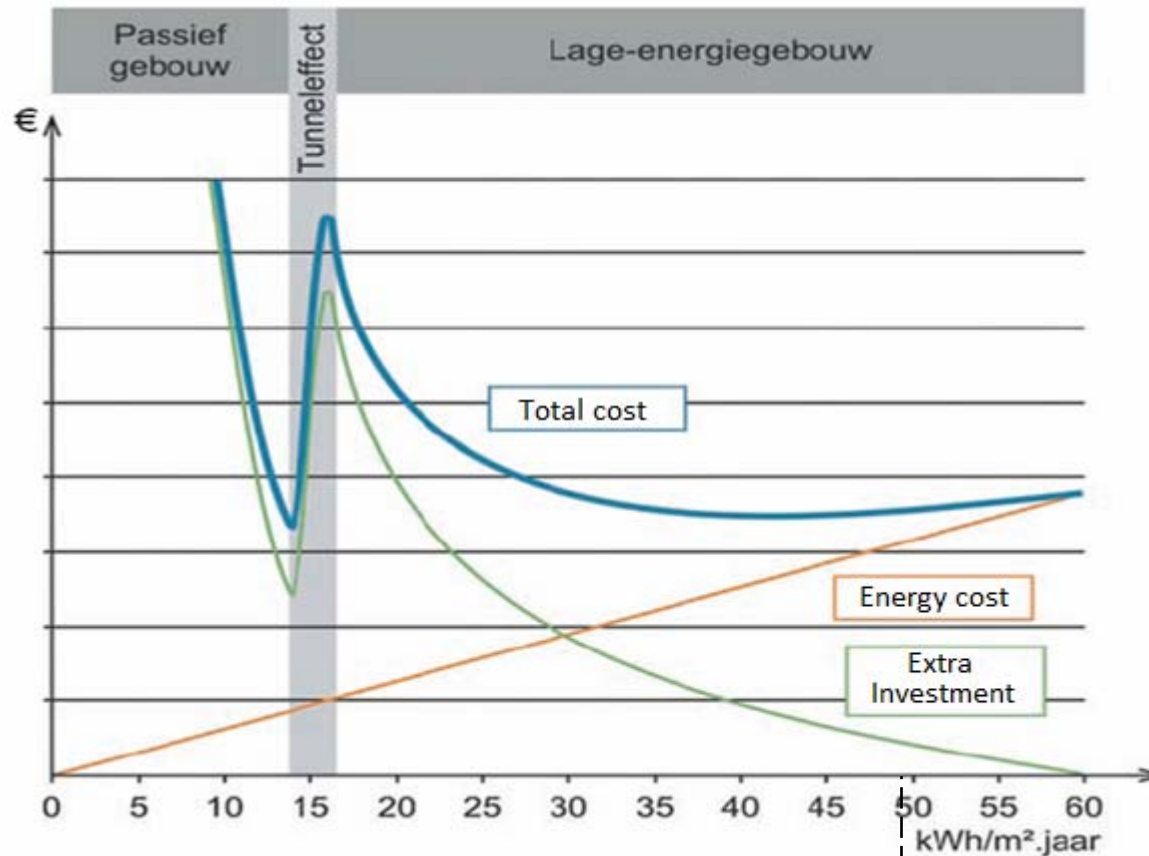
Tabel 2: karakteristieken en kengetallen basisscholen De Speling 2005

(a) Verbruiken 2005, brandstof klimaat gecorrigeerd in BWV (bovenste verbrandingswaarde)

(b) Betekenis codes: rood (hoog t.o.v. Vlaamse gemiddelde), oranje (midden) en groen (laag t.o.v. Vlaamse gemiddelde)

The saving of energy requires investments.

The more economic the building is, the more investment is needed to obtain the same profit



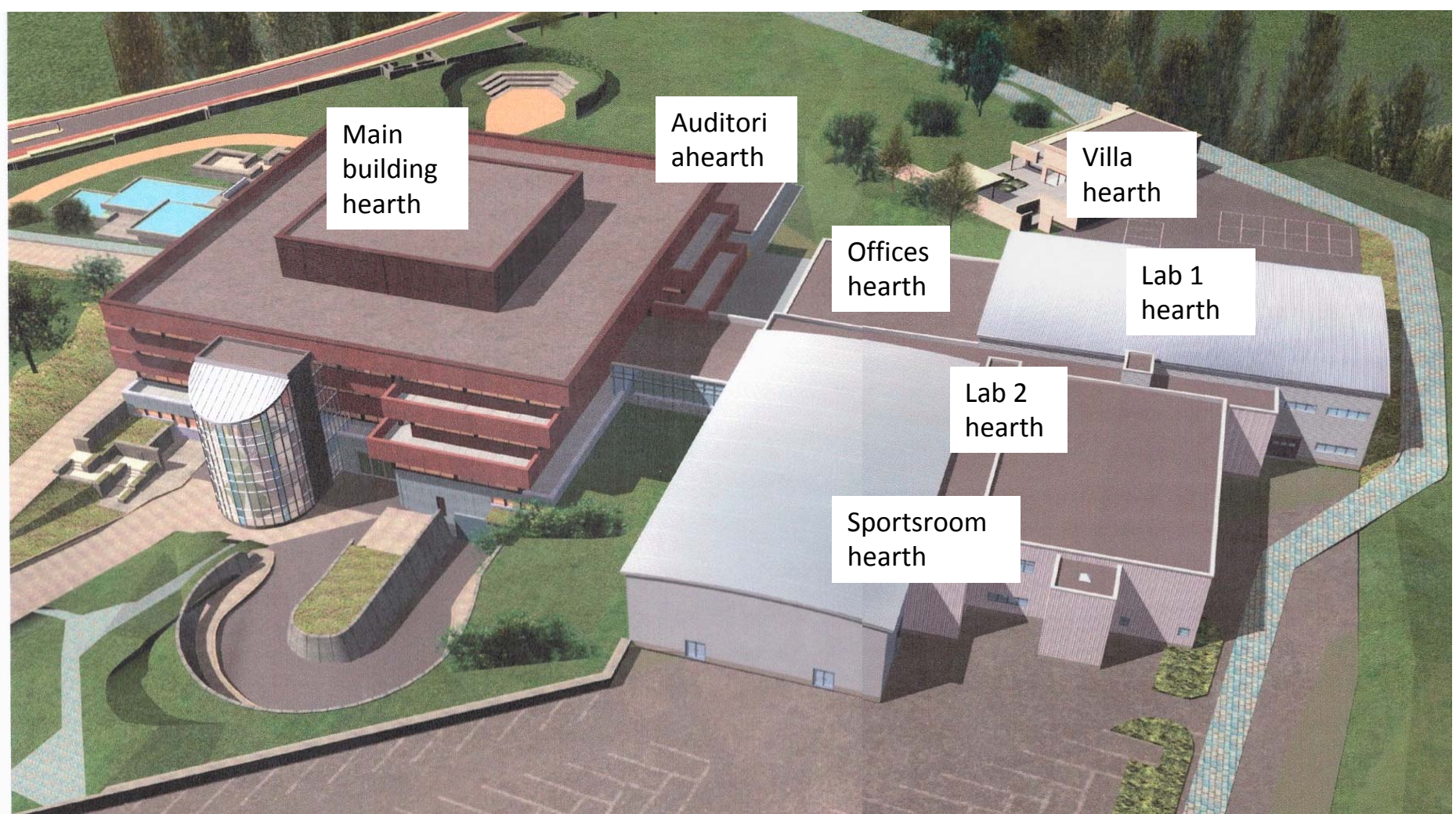
Tunnel effect: consumption $< 15 \text{ kWh/m}^2$;
heating system is no longer required

49 kWh/m².yea
r

Energy saving investments:

1. Insulate;
2. Record energy consumption;
3. Compare your consumption with similar situations;
- 4. Produce the heat near the point where it is needed**

Decentralized heat production (7 fireplaces)



Energy saving investments:

1. Insulate;
2. Record energy consumption;
3. Compare your consumption with similar situations;
4. Produce the heat near the point where it is needed;
- 5. Ventilation is a major cause of energy loss;**

Heating season in Belgium: october→april \approx 160 working days = **1280 hours**.

Average outdoor temperature over the heating season \approx **5°C**.

Necessary amount of air: $30\text{m}^3/\text{h}/\text{person} =$ **38 400 m³** over the heating season.

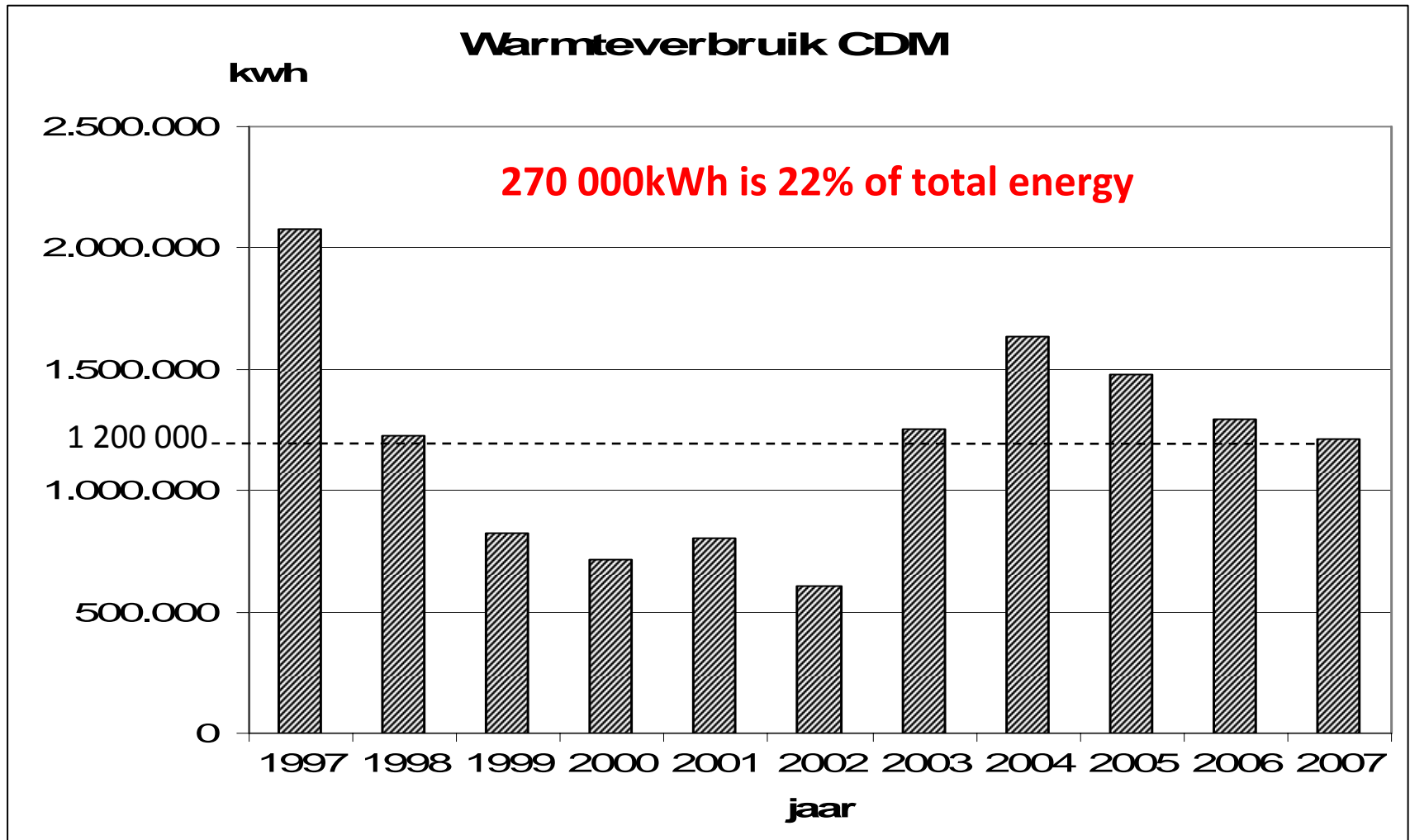
Energy needed to warm up air from 5°C outdoor temp. to 20°C indoor temp.: $1,2 \text{ kJ}/\text{m}^3 \text{ } ^\circ\text{C}$
• $15^\circ\text{C} =$ **18kJ/m³**

Average energy consumption per person over the heating season: $18\text{kJ}/\text{m}^3 \bullet 38\,400 \text{ m}^3 =$
 $691 \text{ MJ} =$ **192 kWh/person**.

At peak times there are **1500 people** on this campus. A well tuned invariable ventilation would cost **270 000 kWh/year**

Evolution of energy consumption

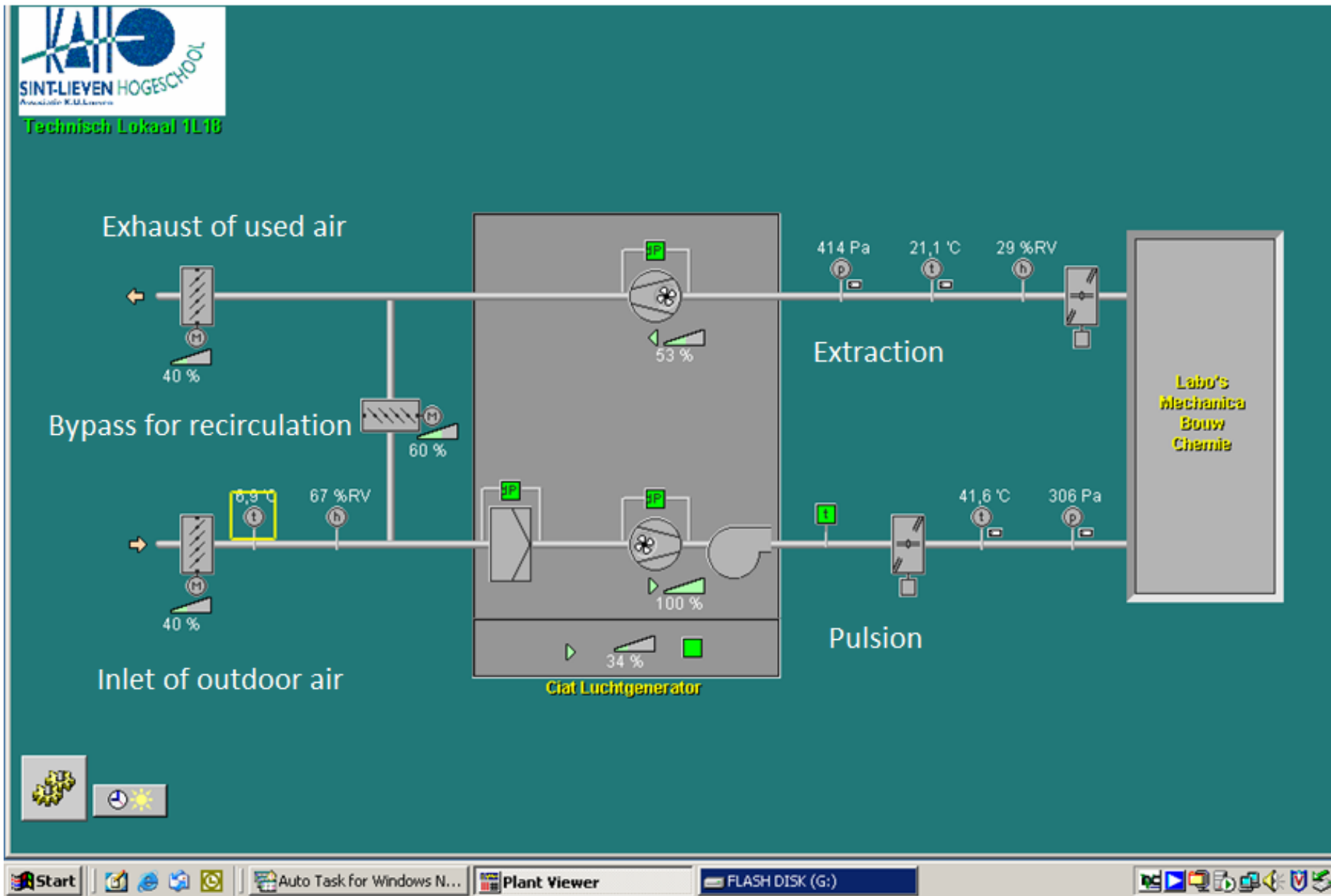
(10 kWh = 1 l fuel; 11 kWh = 1 m³ gas)



Possible energy savings on ventilation:

- Tune the amount of fresh outdoor air

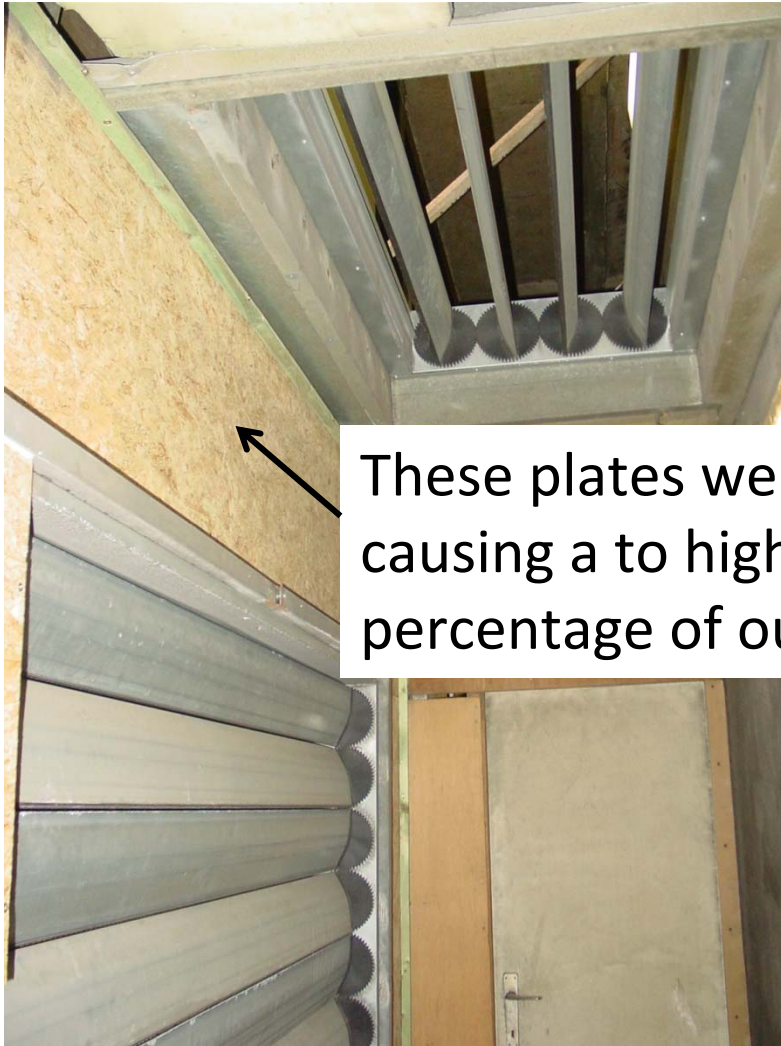
Displayed settings: the pulsed air is a mixture of 40% fresh outdoor air and 60% recycled air.



Air mixing centre (plenum) : mixes outdoor air with recycled air.
The percentage of fresh air is controlled by a motor driven valves.



Air mixing centre (plenum) : mixes outdoor air with recycled air



These plates were missing,
causing a to high
percentage of outdoor air

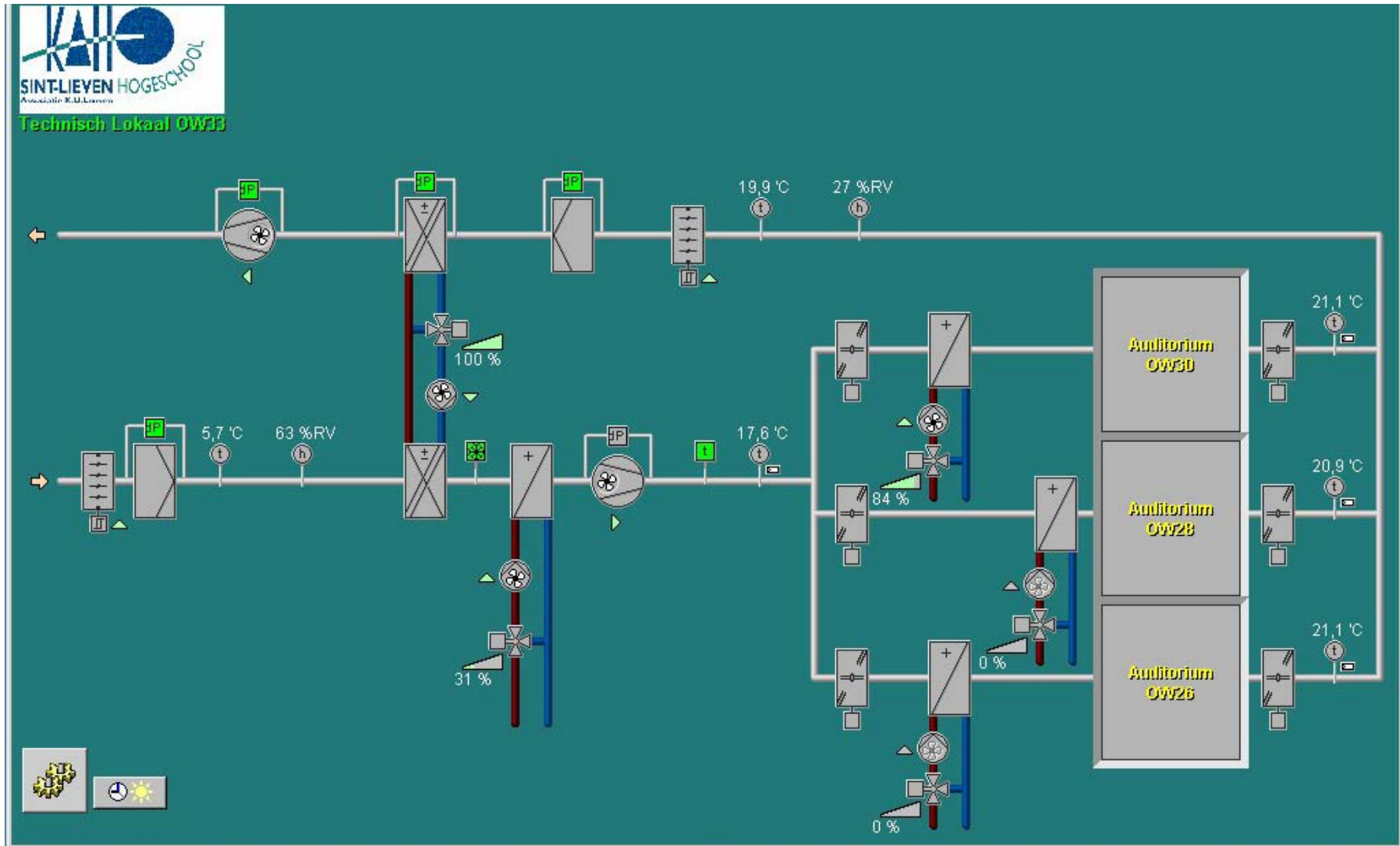


Possible energy savings on ventilation:

- Tune the amount of fresh outdoor air
- **Recover energy by heat exchange between inlet and exhaust.**

Auditorium: always 100% outdoor air. Is this worth?

Air-water heat exchange unit in the exhaust airduct and in the inlet airduct. Heat transfer by circulating water.



Auditorium: heat recovery by air/water heat exchange.
Recovery < 38%

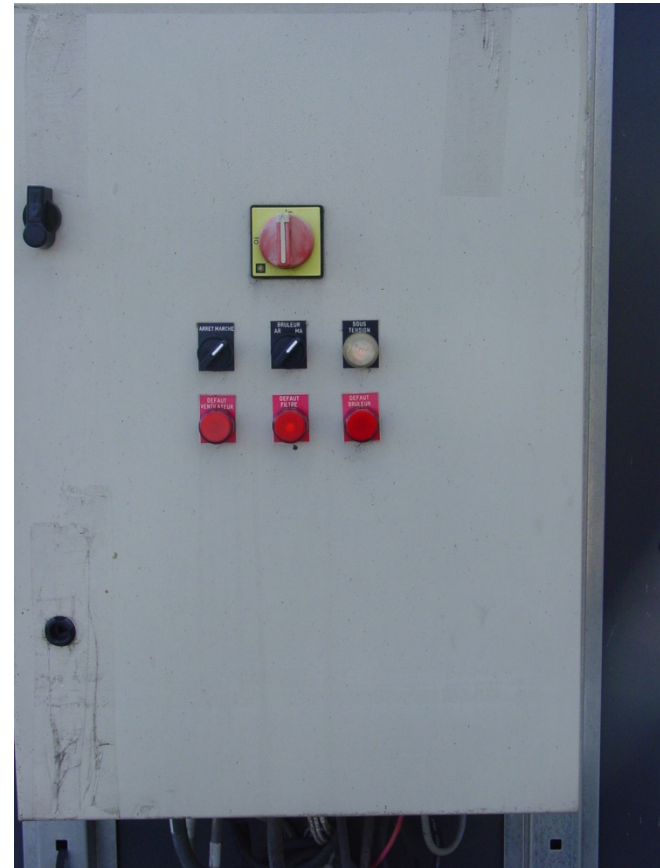
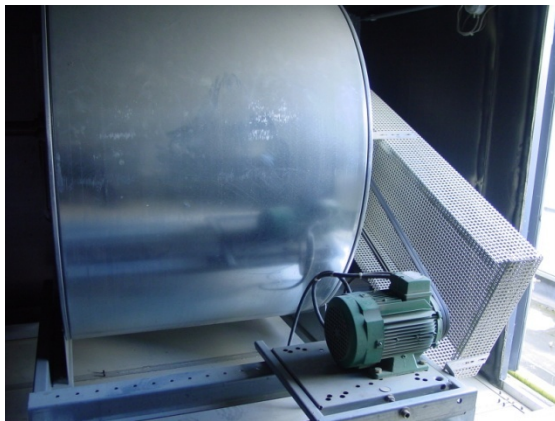


Possible energy savings on ventilation:

- Tune the amount of fresh outdoor air;
- Recover energy by heat exchange between inlet and exhaust;
- **Control the speed of fans.**

Electronic speed control of airfans. Speed is automatically adjusted to the load.

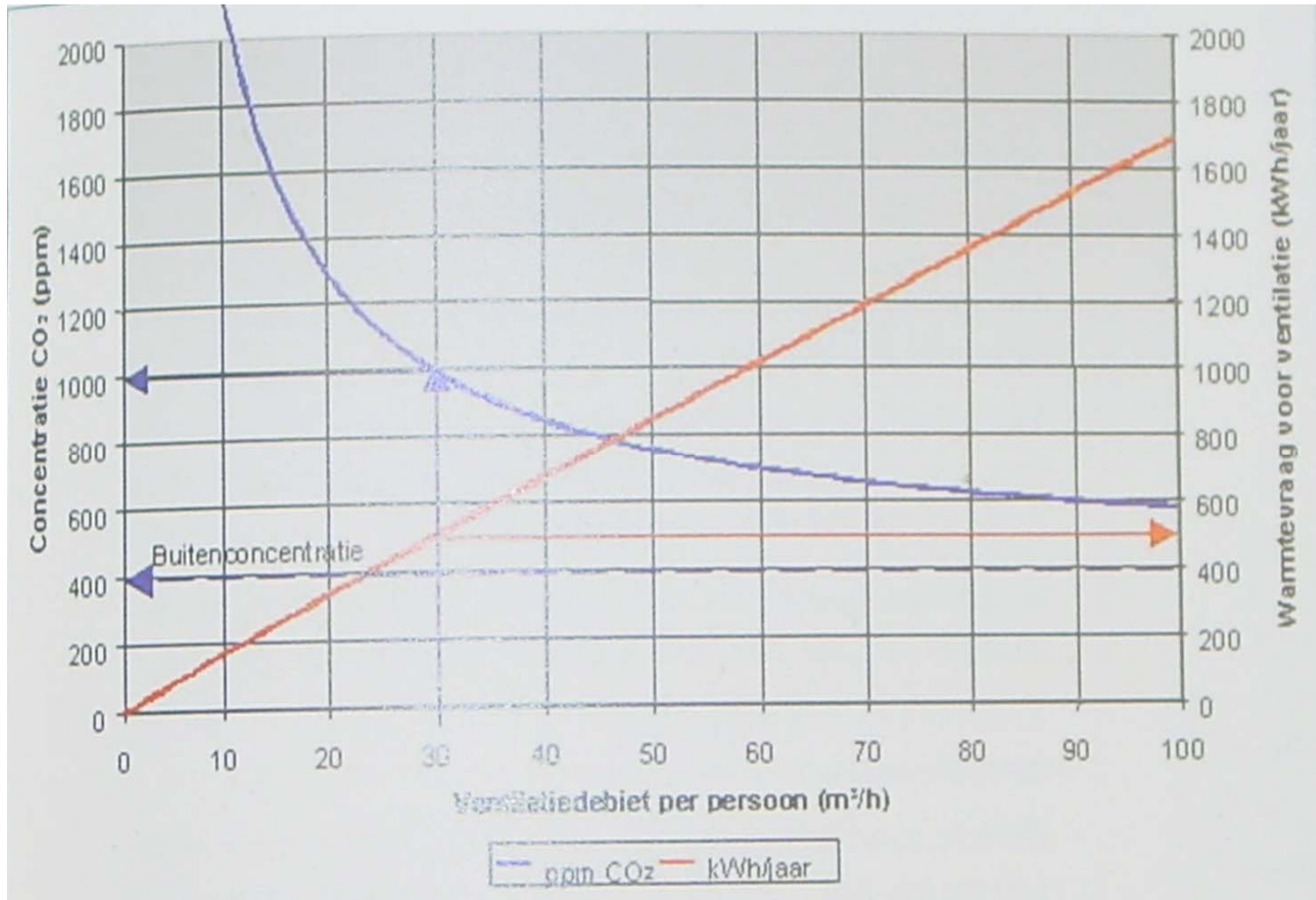
Reducing speed to 50% reduces electric energy to 12,5%!



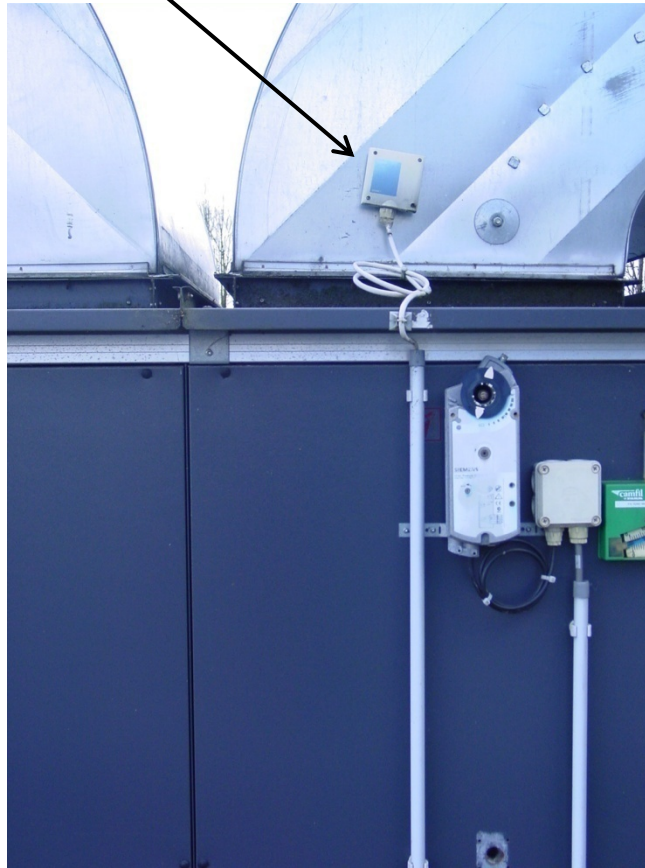
Possible energy savings on ventilation:

- Tune the amount of fresh outdoor air;
- Recover energy by heat exchange between inlet and exhaust;
- Control the speed of fans;
- **Automatic adjustment of ventilation amount by measurement of CO₂ content of extracted air.**

E.g.: a ventilation of $30\text{m}^3/\text{hour}\cdot\text{person}$ results in a CO_2 -concentration of 1000 ppm inside the building. In the diagram the energy need of doing this is estimated on $500\text{kWh}/\text{year}\cdot\text{person}$ (we calculated 192 kWh)

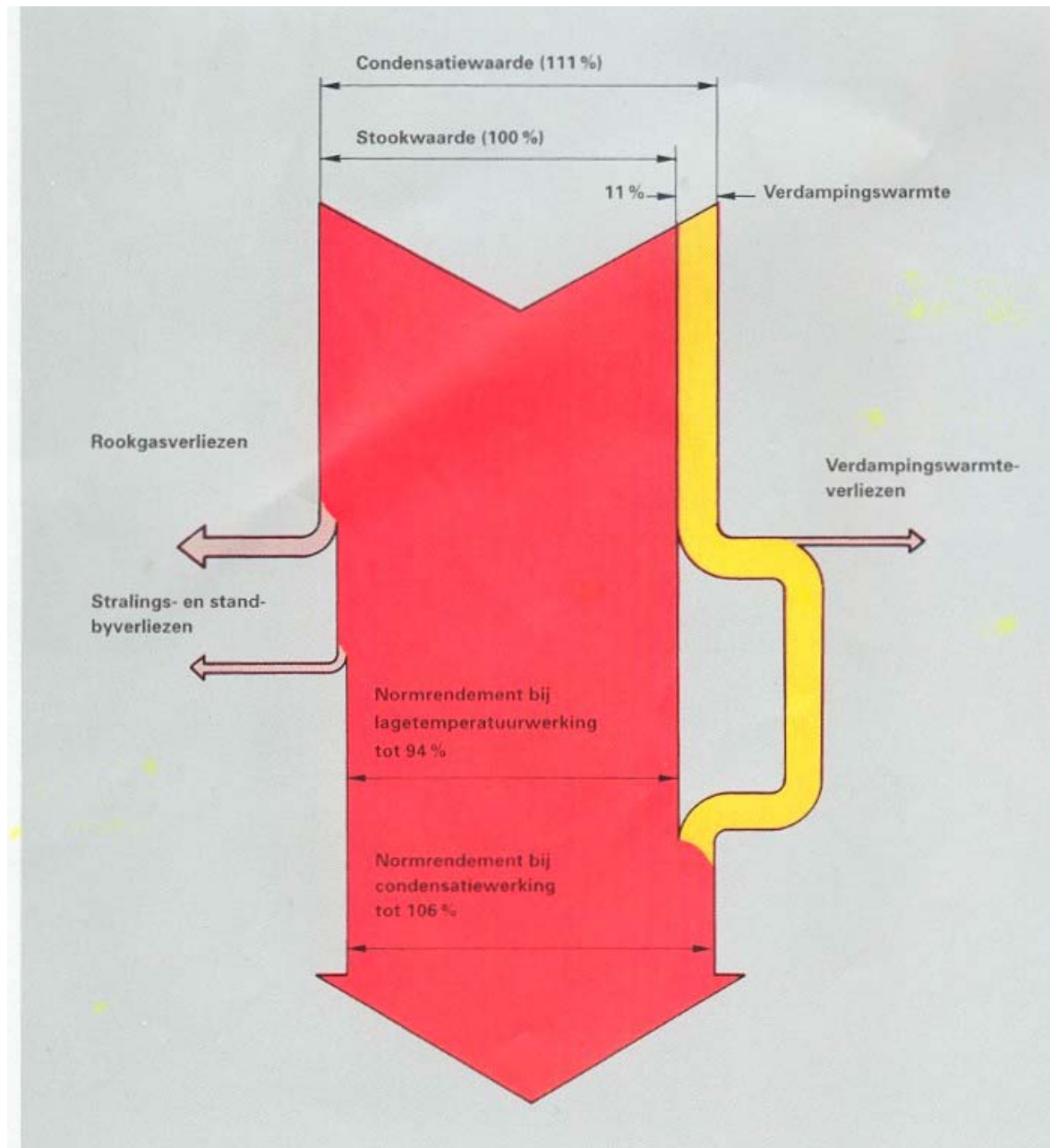


CO2 concentration
sensor in exhaust duct



Energy saving investments:

1. Insulate;
2. Record energy consumption;
3. Compare your consumption with similar situations;
4. Produce the heat near the point where it is needed;
5. Ventilation is a major cause of energy loss;
- 6. Install High efficiency boilers,
and make sure that condensing boilers do condens!**




Auditorium: Boiler Renova Bulex (modulerend 180 kW)

White smoke = condensation



Auditorium: balancing bottle makes condensing almost impossible





Rook-
kanaal

rook-
kanaal

Condensor

Niet-conden-
serende ketel

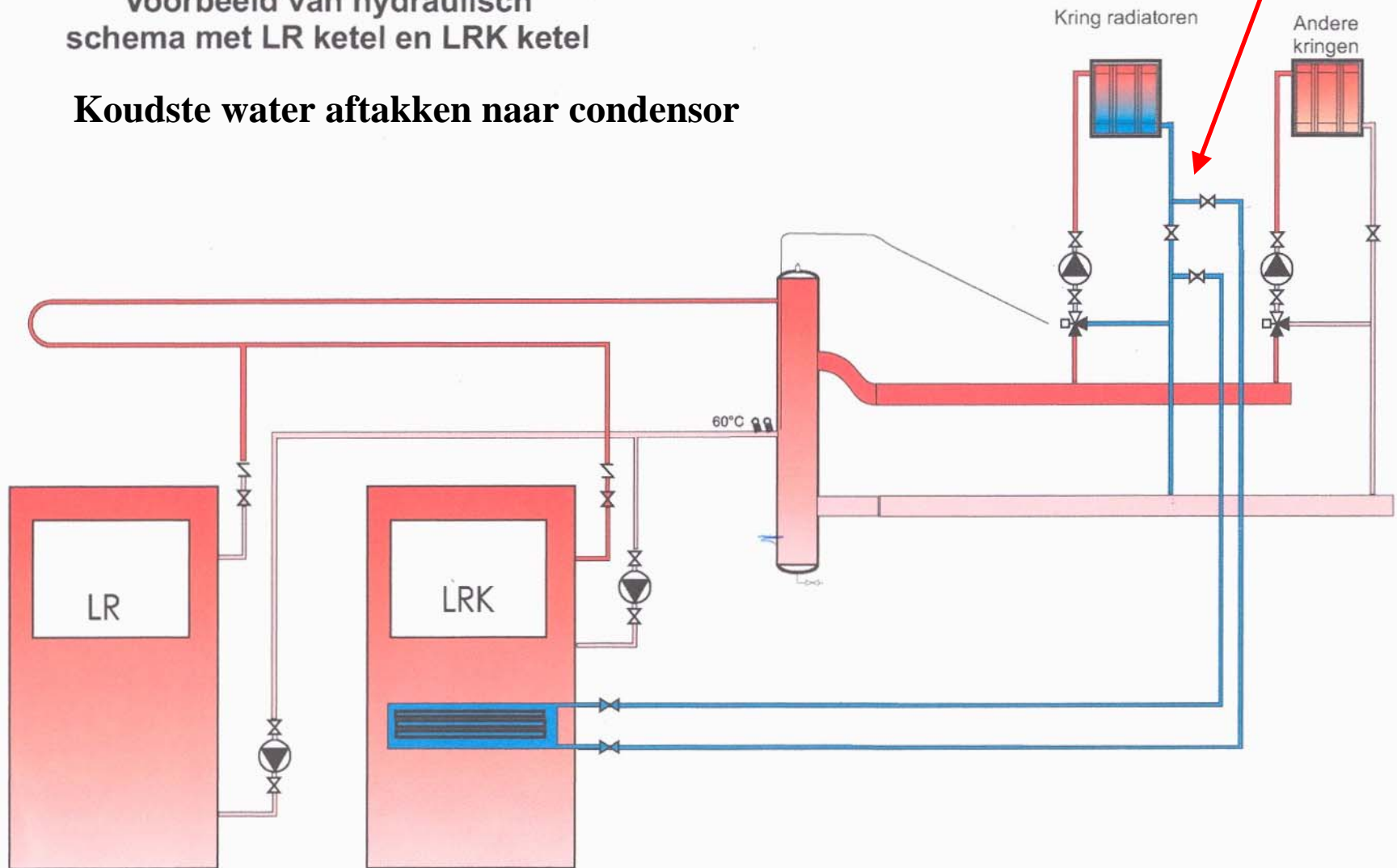
afvoer nacon-
densatie in de
schoorsteen

hoofdafvoer
condensaat



Voorbeeld van hydraulisch
schema met LR ketel en LRK ketel

Koudste water aftakken naar condensor



Fout geplaatste condensor !



Technisch Lokaal +4

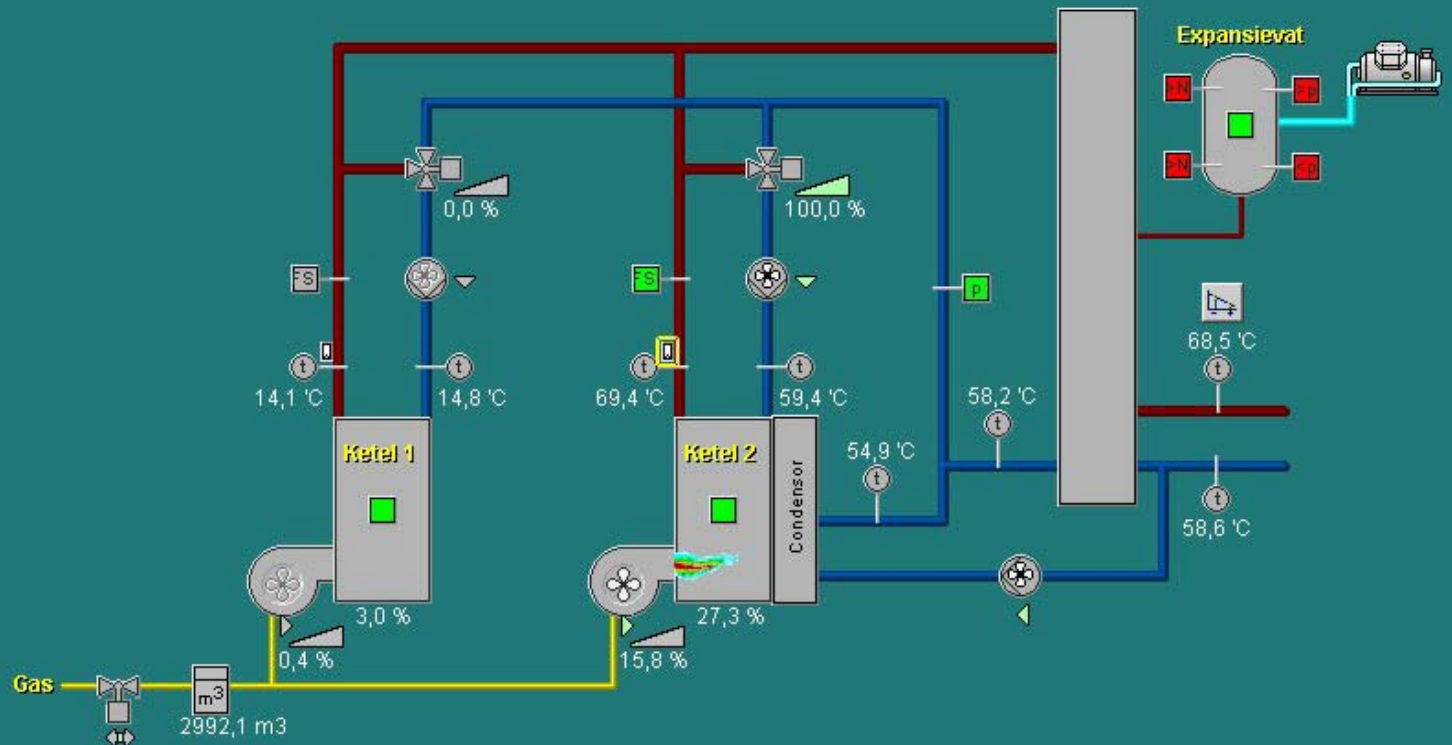
6,7 °C

Alarm Noodstop Stookplaats	NORMAAL
Alarm Gasdetectie Niv.1 Gascentrale	NORMAAL
Alarm Gasdetectie Niv.2 Gascentrale	NORMAAL
Alarm Gasdetectie Niv.3 Gascentrale	NORMAAL

Wh 0,0 kWh

m³ 0,0 m³

m³ 0,0 m³



Energy saving investments:

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4. Produce the heat near the point where it is needed;
5. Ventilation is a major cause of energy loss;
6. Instal High efficiency boilers,
and make sure that condensing boilers do condens!
- 7. Use programmable clocks**

