Colder air without adequate ventilation can increase the risk of mold

Indemiljørådgiver Aps

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Colder indoor temperatures

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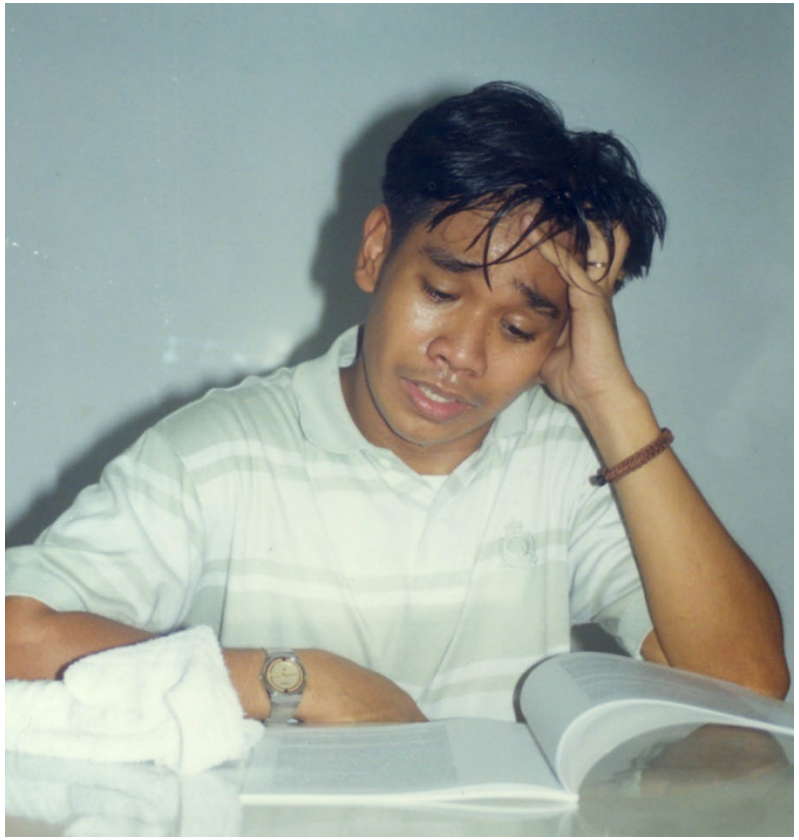
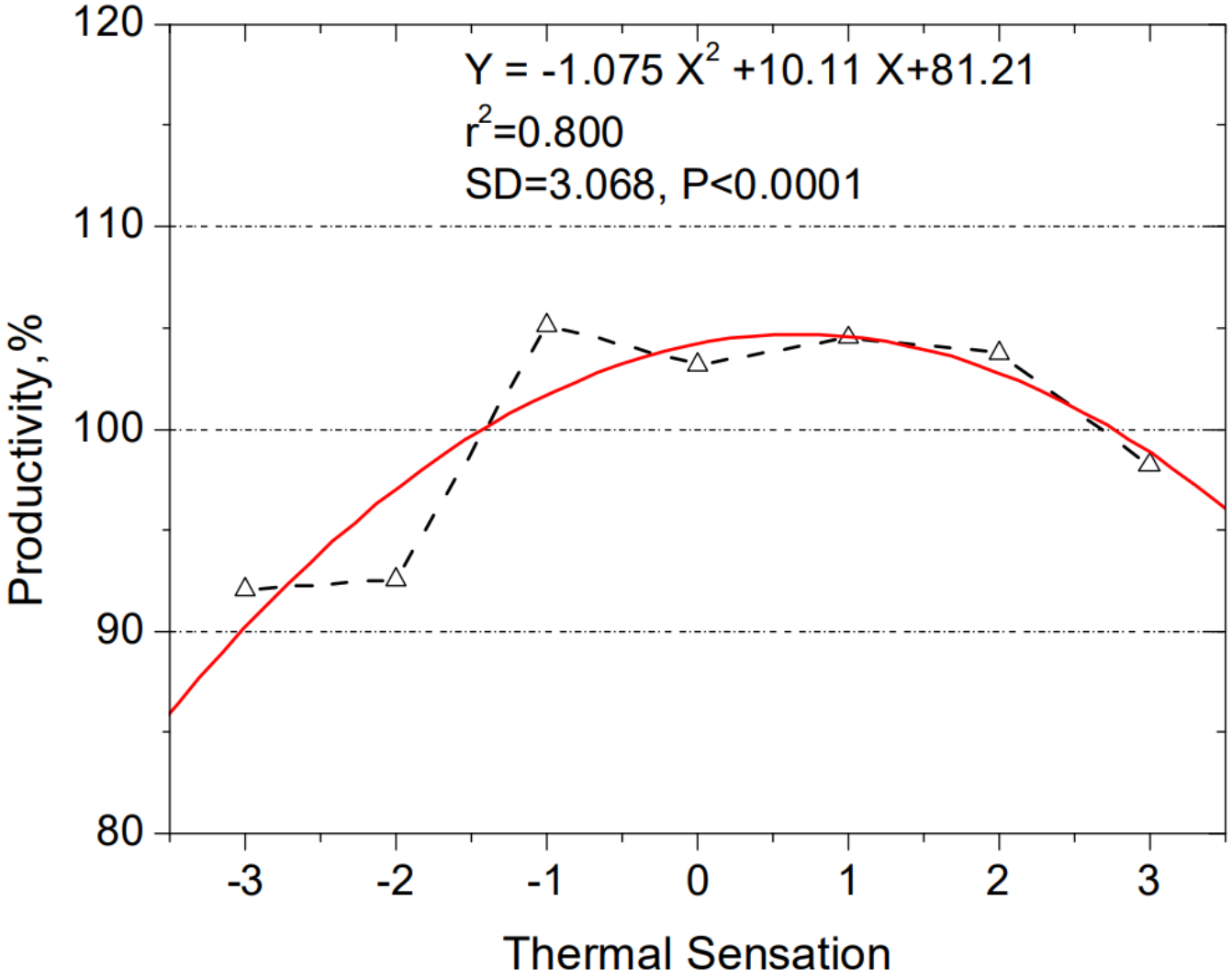
Headlines:

Productivity
Spread of infectious diseases
Thermal comfort
Moisture problems
The joint responsibility
Summary



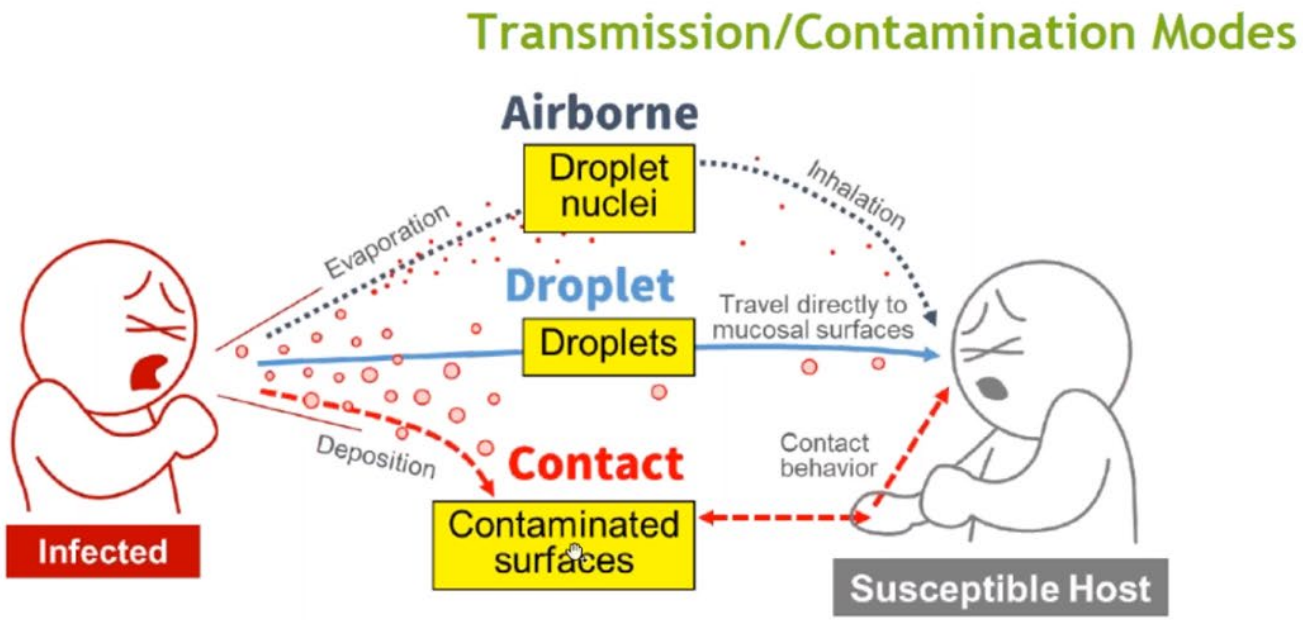
No… This is heat stress!



+ 3 hot
+ 2 warm
+ 1 slightly warm
0 neutral
- 1 slightly cool
- 2 cool
- 3 cold

X. Ye, Z. Lian, ZP Zhou, J. Feng, Cz Li, Ym Liu. (2005). INDOOR ENVIRONMENT, THERMAL COMFORT AND PRODUCTIVITY. Proc. Indoor Air 2005

Spread of infectious diseases

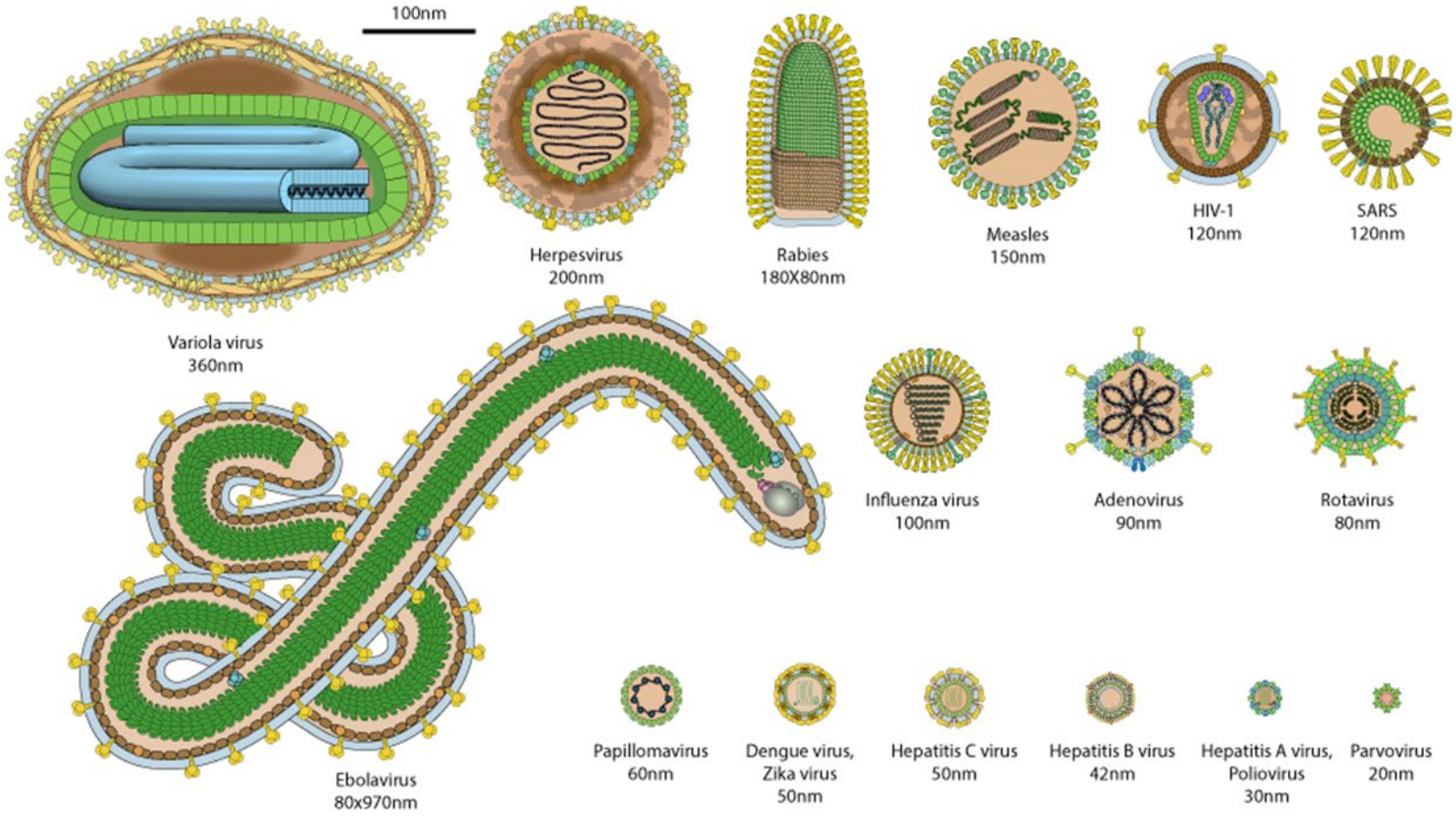


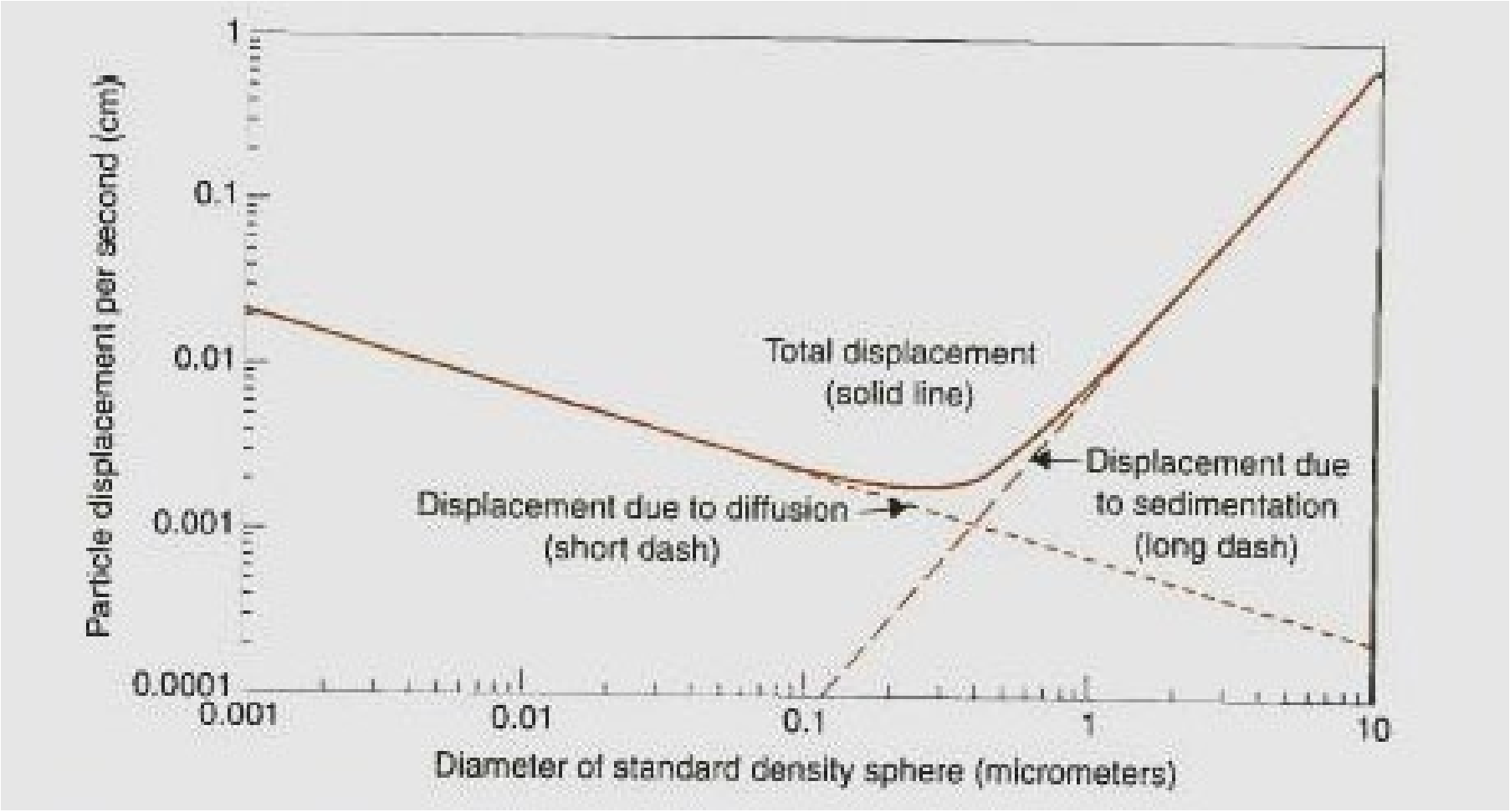
Role of ventilation in the control of the COVID-19 infection: Emergency presidential discourse SHASE, March 23, 2020.

Mode	PM Size	Measures
Airborne	< 10	Mask, Face Shield, Ventilation
Droplets	10<D<50	Confinement, Social Distancing
Contact	> 50	Hygiene, Disinfection, Behavior

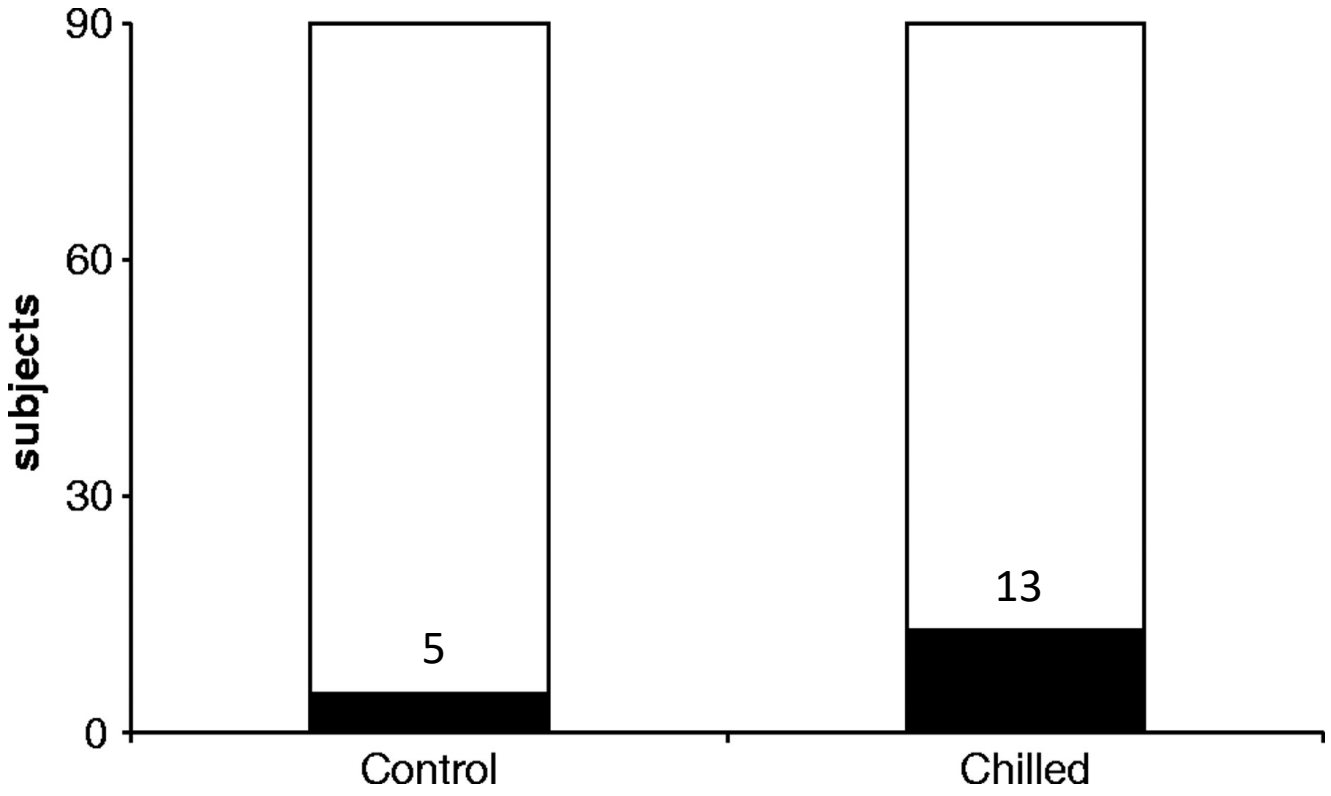
Human virus relative size

This picture displays most common human viruses with their relative size. The nucleic acids are not to scale.




Particle displacement per second (cm)
1
0.1
0.01
0.001
0.0001
0.001
0.01
0.1
1
10
Diameter of standard density sphere (micrometers)
Total displacement
(solid line)
Displacement due to diffusion
(short dash)
Displacement due
to sedimentation
(long dash)

Number of test persons who reported to have a common cold after a controlled procedure of being cold after a follow-up period of 4-5 days.



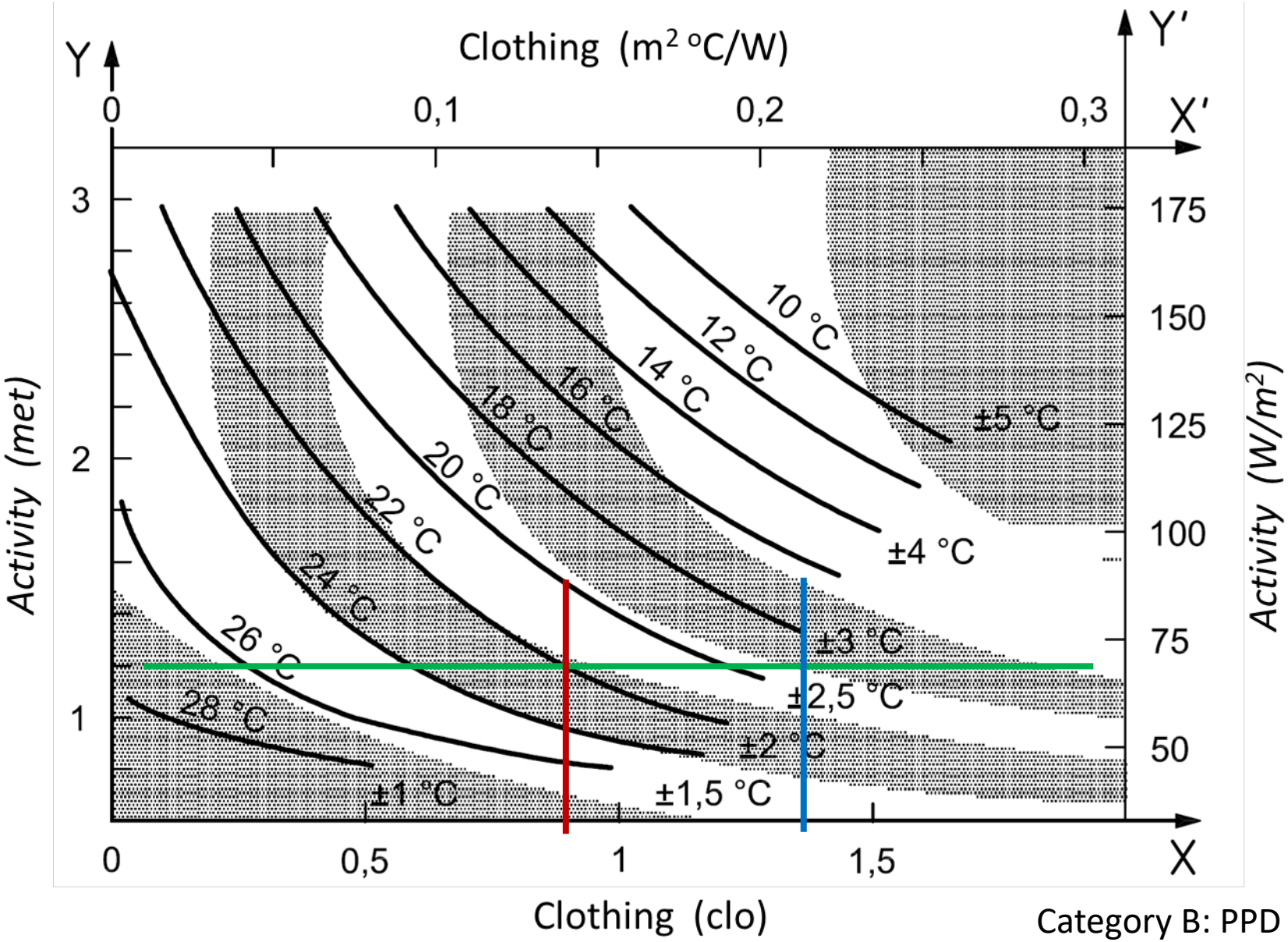
Half the test persons were asked to take off shoes and socks and sit for 20 minutes with their feet in buckets with cold water at 10 °C. The other half - the control group - sat with their feet in empty buckets without their shoes and socks off also for 20 minutes.

Claire Johnson, Ronald Eccles. (2005). Acute cooling of the feet and the onset of common cold symptoms, Family Practice, Volume 22 (6), Pages 608–613. https://doi.org/10.1093/fampra/cmi072

Human Metabolic Rate

Activity	*(W/m²)*	*(Met)*
Laying down	46	0.8
Sitting, relaxed	58	1.0
Standing, relaxed	70	1.2
Sitting activity (office work, school etc.)	70	1.2
Standing activity (shop, laboratory etc.)	93	1.6
Moving activity (house work, working at machines etc.)	116	2.0
Harder activity (hard work at machines, work shops etc.)	165	2.8

Thermal comfort



Category B: PPD < 10 %, DS/ISO 7730

Clo values of clothing ensamples

	I_{cl} (clo)
Walking shorts, short-sleeved shirt	0.36
Trousers, short-sleeved shirt	0.57
Trousers, long-sleeved shirt	0.61
Same as above, plus suit jacket	0.96
Same as above, plus vest and T-shirt	0.96
Trousers, long-sleeved shirt, long-sleeved sweater, T-shirt	1.01
Same as above, plus suit jacket and long underwear bottoms	1.30
Sweat pants, sweat shirt	0.74
Long-sleeved pajama top, long pajama trousers, short 3/4 sleeved robe, slippers (no socks)	0.96
Knee-length skirt, short-sleeved shirt, panty hose, sandals	0.54
Knee-length skirt, long-sleeved shirt, full slip, panty hose	0.67
Knee-length skirt, long-sleeved shirt, half slip, panty hose, long-sleeved sweater	1.10
Knee-length skirt, long-sleeved shirt, half slip, panty hose, suit jacket	1.04
Ankle-length skirt, long-sleeved shirt, suit jacket, panty hose	1.10
Long-sleeved coveralls, T-shirt	0.72
Overalls, long-sleeved shirt, T-shirt	0.89
Insulated coveralls, long-sleeved thermal underwear, long underwear bottoms	1.37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The other problem with 19 degree…

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Moisture problems

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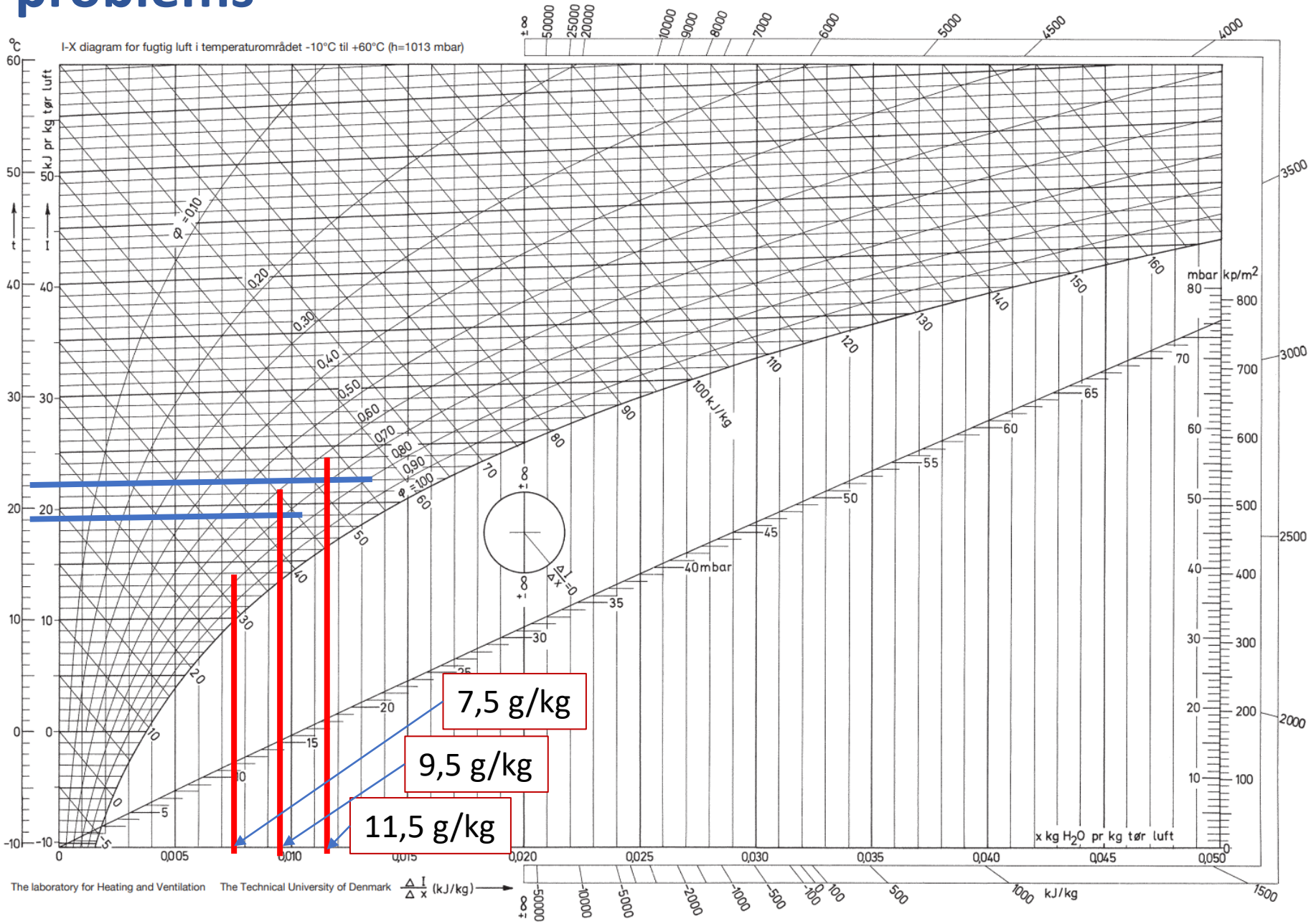
22 °C
19 °C



How much more water can indoor air contain at 70 %RH and 22 °C - than at 19 °C and same relative humidity?

11,5 g/kg mod 9,5 g/kg : (11,5 – 9,5) g/kg * 100 % / 9,5 g/kg = 21 %

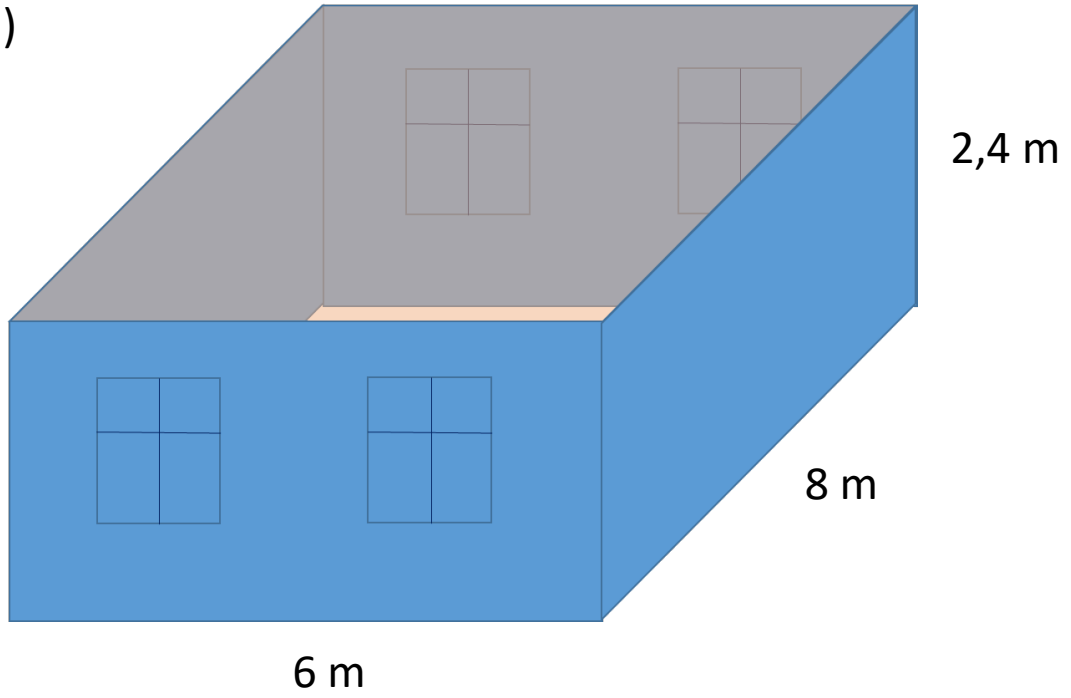
How much higher air change rate is required at 19 °C than at 22 °C to have the same assurance not to exceede 70 % RH?

(11,5 – 7,5) g/kg / (9,5 -7,5) g/kg = 2

Twice as high an air exchange. This is a number we need to remember!

How about a modern small dwelling simulated with BSIM?

Basic ventilation: 0,3 l/s m^2
Moisture production: 2 persons (120 g/h) og others (135 g/h)
Windows: 4 m^2 facing South
Airing out: 3 h^{-1} at temperatures exceeding 25 ^oC
Facade insolation: 0,3 W/m^2 K



Thank you Kim Wittchen, BUILD - AAU

2010

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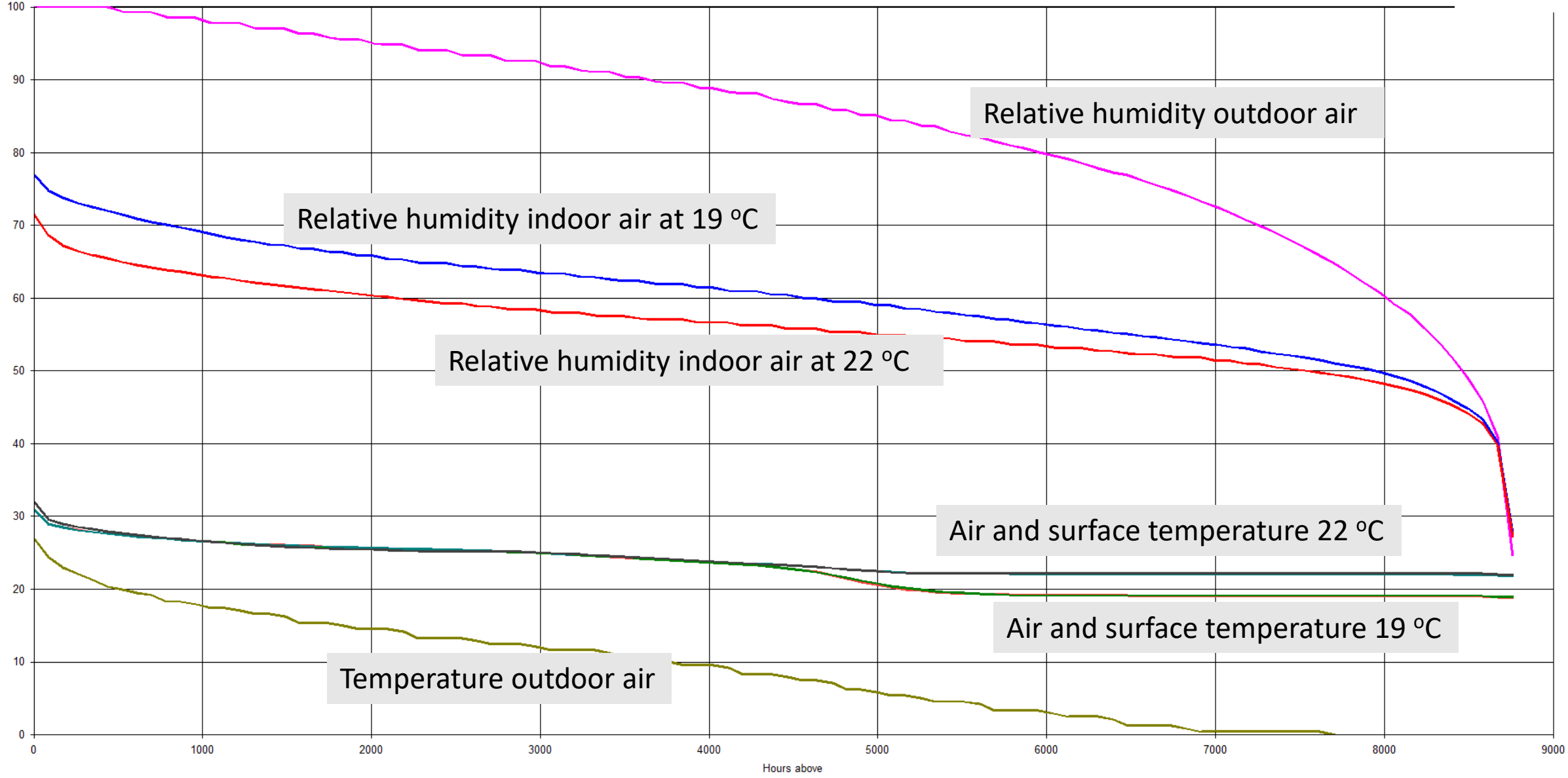

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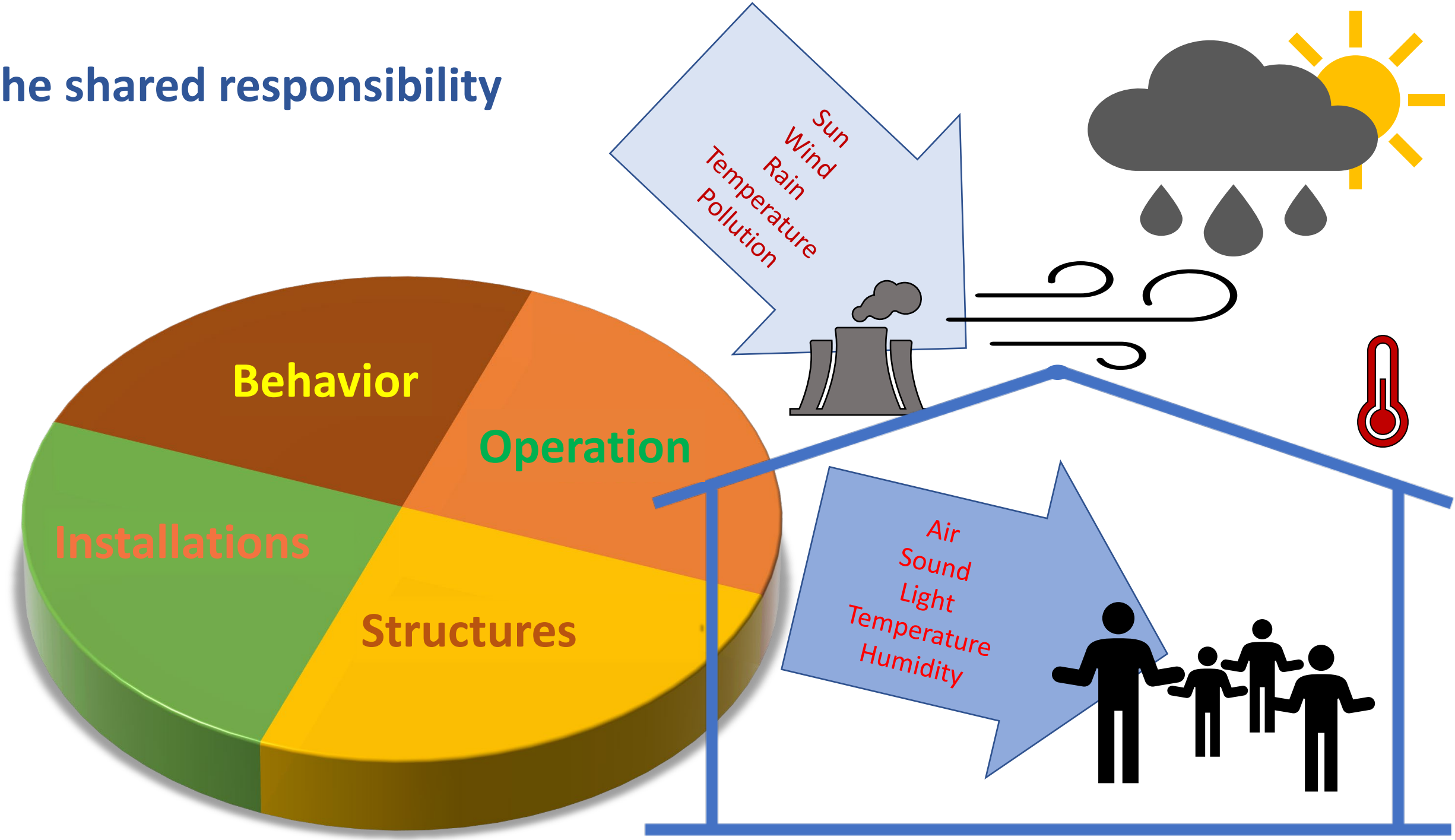
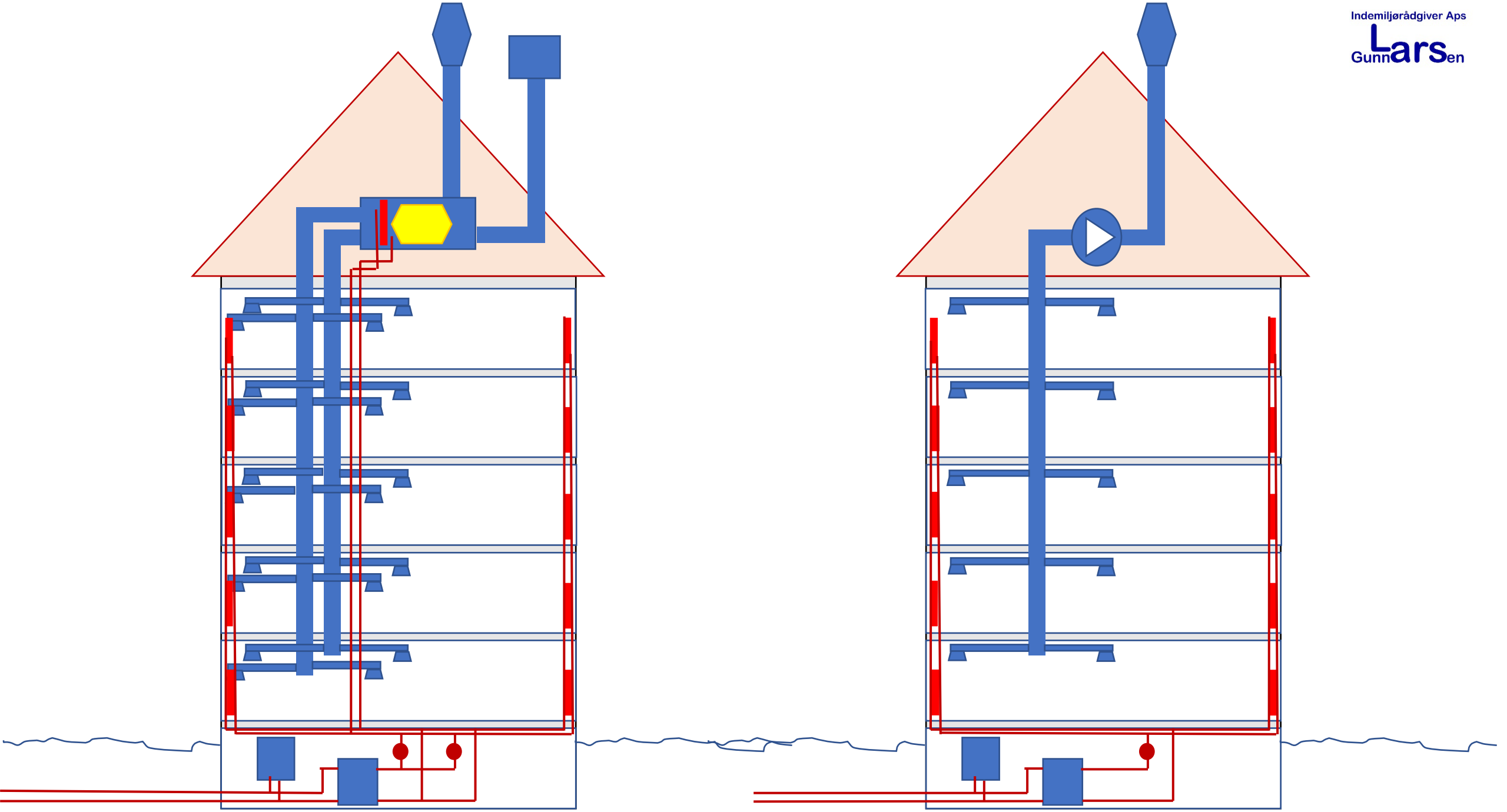
The shared responsibility





Summary

Produktivitet
We perform and learn less when we are not in thermal comfort.

Spread of infection
Maybe we infect each other more in dry air. We are more susceptible to infection when we are cold.

Thermal comfort
Being an office worker and working at 19 °C requires a lot of clothing - but with enough clothing, thermal comfort can be maintained.

Moisture problems
19 degree require much more ventilation and/or airing out.

The shared responsibility
The responsibility for maintaining a healthily satisfactory indoor climate is shared between the building user and the building owner/operating staff. Changes in the operation of buildings particularly require good cooperation.

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