Quake

Onbegrensd©

Oosterhoff

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Cool School
Den Haag, 27 maart 2026

Cool schools of onfrisse scholen

Symbiotic Architecture

Connecting nature, technology and culture

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20ste-eeuwse aanpak

- Eenvoudige berekeningen
- Ingewikkelde Installaties & bouwkundige details
- Hoe investeringen en desondanks toenemend energie gebruik
- Toenemend ‘comfort’ , afnemende gezondheid en concentratie vermogen

- ‘ Frisse’ school:
  - > 1.100 €/m² installaties, onderhoud en afschrijving > 75 €/m².j
  - Primair energie gebruik > 50% hoger dan in 1973
  - Obesitas een van de grootste gezondheidsproblemen

niet ondanks
maar dankzij
‘frisse’ scholen norm



Better spaces for learning

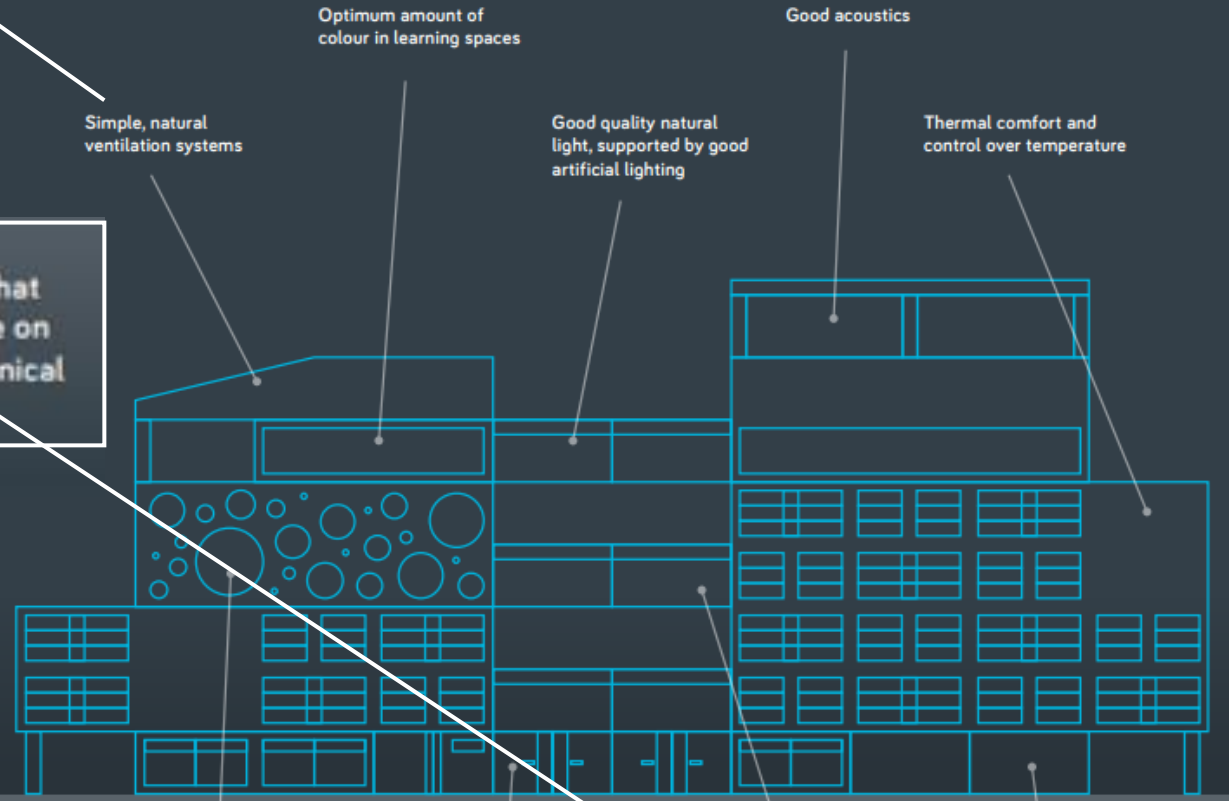
#TopMarkSchools

RIBA Architecture.com

How is good design defined?

Simple, natural ventilation systems

Simple design that reduces reliance on complex mechanical systems



How was good design defined?

- ✓ **Good quality natural light, supported by good artificial lighting**. To achieve this, the lighting strategy needs to be sensibly considered early in the design process to allow for proper coordination and a good understanding of the educational activities that the lighting needs to support.
- ✓ **Pupil sense of ownership. School design that creates dedicated social or self-directed learning spaces, incorporates child centred furniture, and allows for the display of work or imagery pupils can identify with on the walls**. End users from the school should help develop these elements rather than imposing something upon the school to represent their identity.
- ✓ **Simple, natural ventilation systems**. Flexible natural ventilation with variable levels of ventilation, and higher ceilings to absorb stale air. Or where that is not possible or appropriate, mechanical ventilation, which is simple to operate and quickly responsive to allow air quality to be easily maintained.
- ✓ **Thermal comfort and control over temperature**. Thermal controls should be easy to use and quick to adapt to changing uses of space.
- ✓ **Optimum amount of colour in learning spaces**. To create interest but not become a distraction. Opportunity for this should be incorporated into design strategies.
- ✓ **An optimum level of visual interest in terms of design**. Appropriate provision for the display of work and storage solutions which are developed with the school are integral to good design.
- ✓ **Flexible spaces**. That can be zoned for various activity areas to help facilitate learning.
- ✓ **Good acoustics**. For effective learning, pupil engagement, and wellbeing.
- ✓ **Simple design that reduces reliance on complex mechanical systems**. Early stage design decisions are crucial in minimising the complexity and related costs of systems that school facilities managers or caretakers will need to manage.

Good school design can reduce running and maintenance costs, in some cases by more than several times a teacher's average salary a year. It could have prevented the English school estate from spending upwards of £150m annually on unnecessary operation and maintenance costs

Simplicity is one of the most important qualities of good design, and critical to ensuring the building is good value. The easier buildings are to manage, repair, operate and maintain, the more likely they are to operate efficiently and effectively.

Zukunftsfähiger Schulbau
12 Schulen im Vergleich

Deutsche Bundesstiftung Umwelt
Bauband 2

Edition DETAIL



Grundschule an der Haimhauserstraße, München, 1898



Erste Openluchtschool, Amsterdam, 1931



Schulanlage Wandermatte, Wabern, 1956



Hohenstaufen-Gymnasium, Göppingen, 1959



Gymnasium Sonthofen, 1976



Mittelschule Buchloe, 1976



Gymnasium Baesweiler, 1978



Schule im Park, Ostfilldern, 1999



Max-Born-Berufskolleg, Recklinghausen, 2008



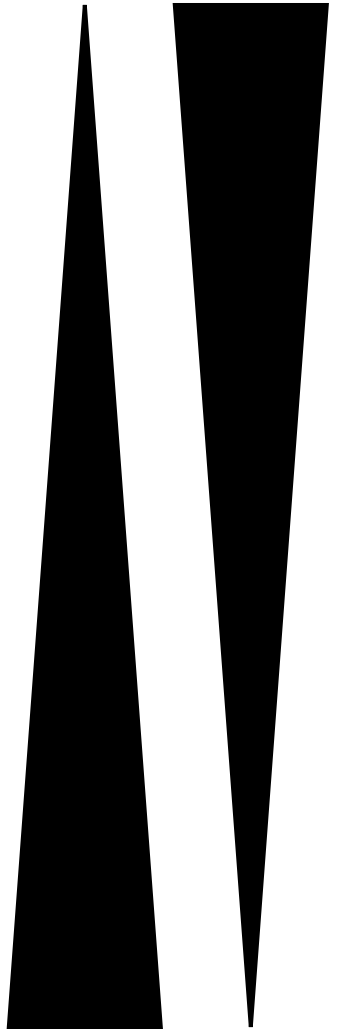
Berufliche Oberschule Erding, 2011



Gymnasium Buchloe, 2013



Schmuttertal Gymnasium, Diedorf, 2015



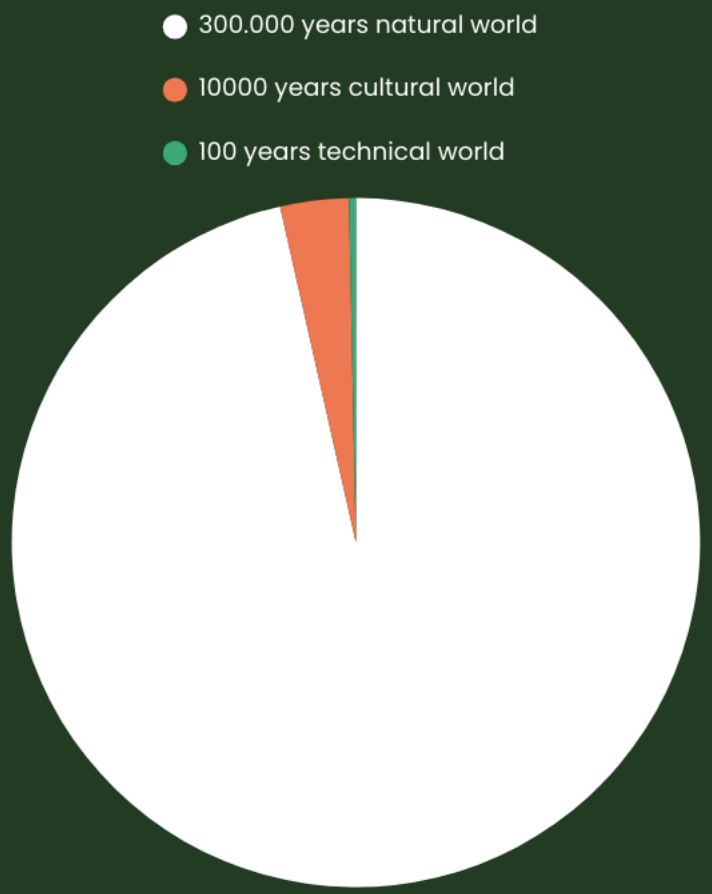




Increased complexity →
systems in more than 90% of the cases do not perform (as intended)
annual maintenance & reservation replacement over 5x higher
no or hardly any measured increased energy efficiency

Prof. Dipl.-Ing. Thomas Auer | Chair of Building Technology
and Climate Responsive Design | TUMunchen

Hoe komt dit
&
kan het beter
?


300.000 years natural world
10000 years cultural world
100 years technical world

Assumption 1:

A static highly controlled environment is productive

Then why do students fall asleep in lecture rooms?





because we’re telling
their body to go to sleep

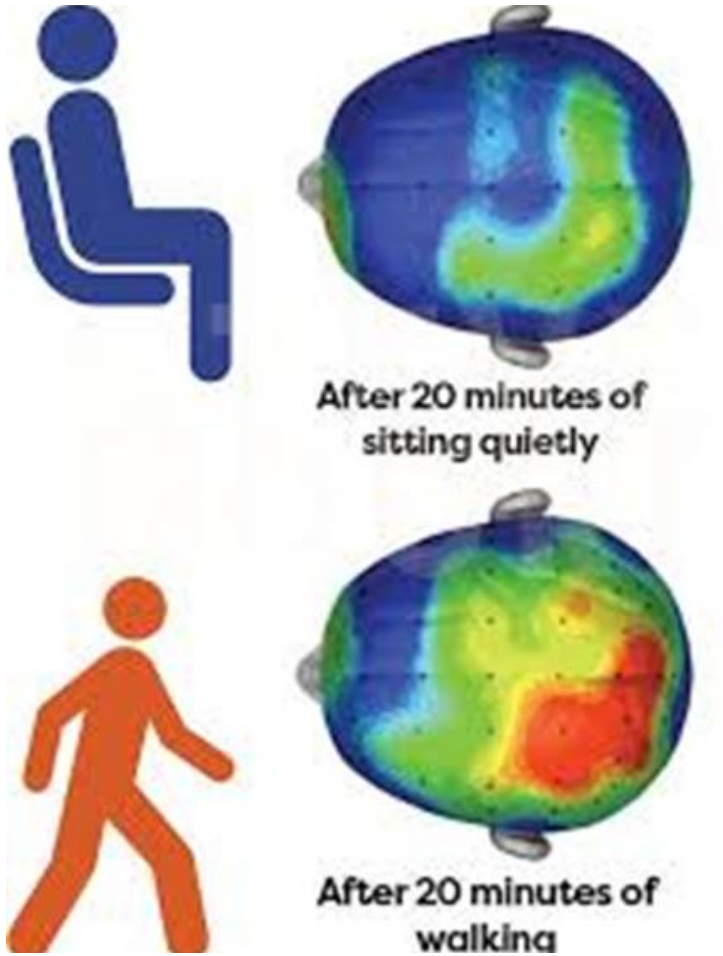




for nearly 300.000 years
this is when our body is
trained to be alert







A static highly controlled environment **isn't** productive

Assumption 2:

A strictly individually control indoor climate is healthy



=



+



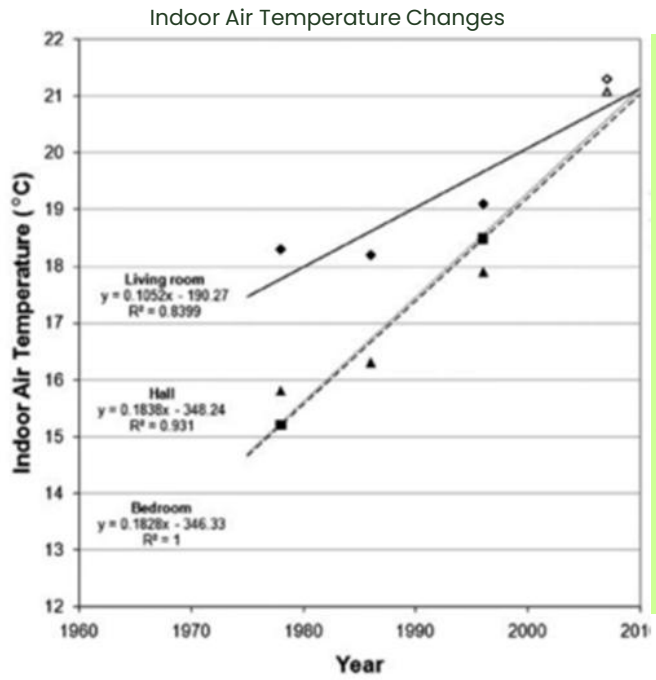
Energy Intake	=	Labour	x	Metabolism

Discussion

a thermoneutral indoor climate
is like going to this doctor

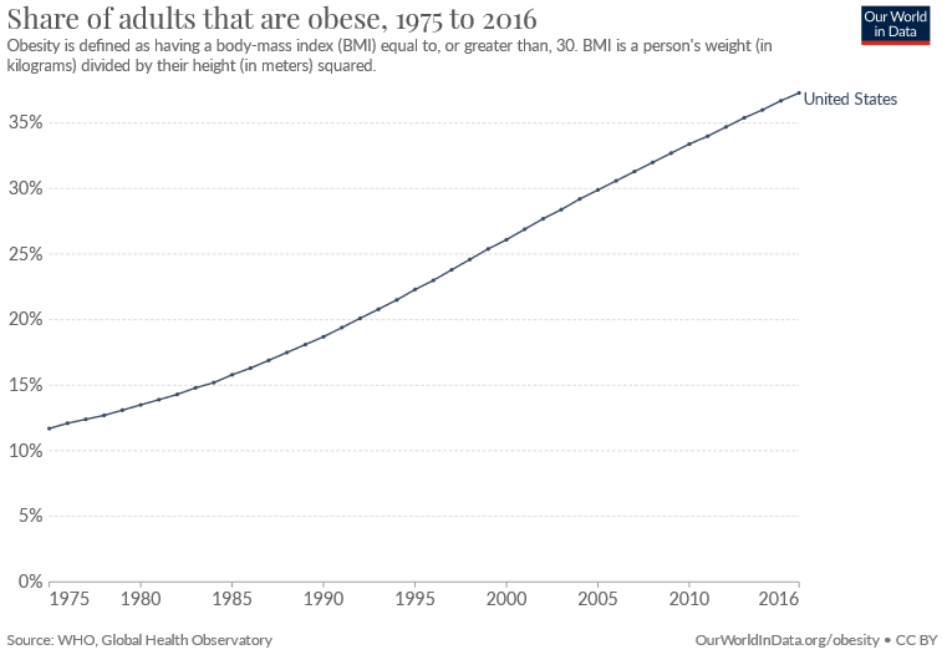


Reduced metabolism since 1970's
equals
average increase of 10 -15 kg of body mass



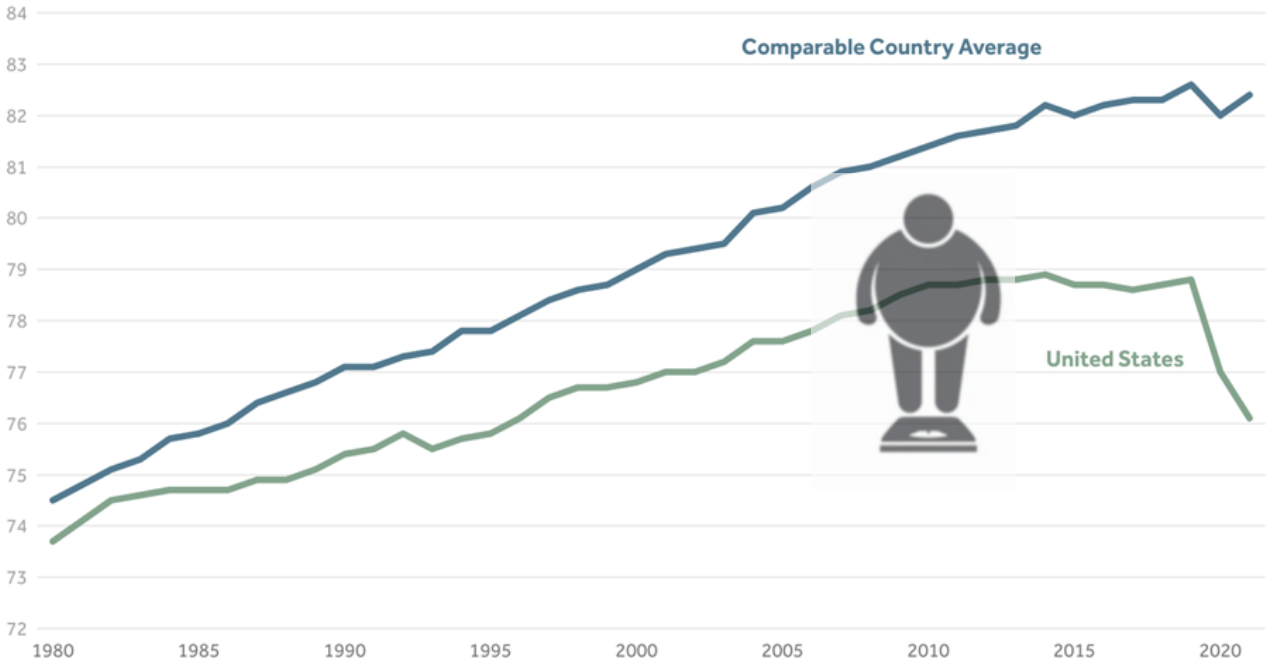
'simple' mathematics:

1 °C equates to ± 3 -5 kg
body mass
worth of metabolism



Average indoor temperature in winter
increased with over 3 ^{0}C

Obesity increased with > 300%
approximately 30-40% of the increase can be
contributed to reduced metabolism



decrease in life expectancy in the US, mostly due to:
stress & obese

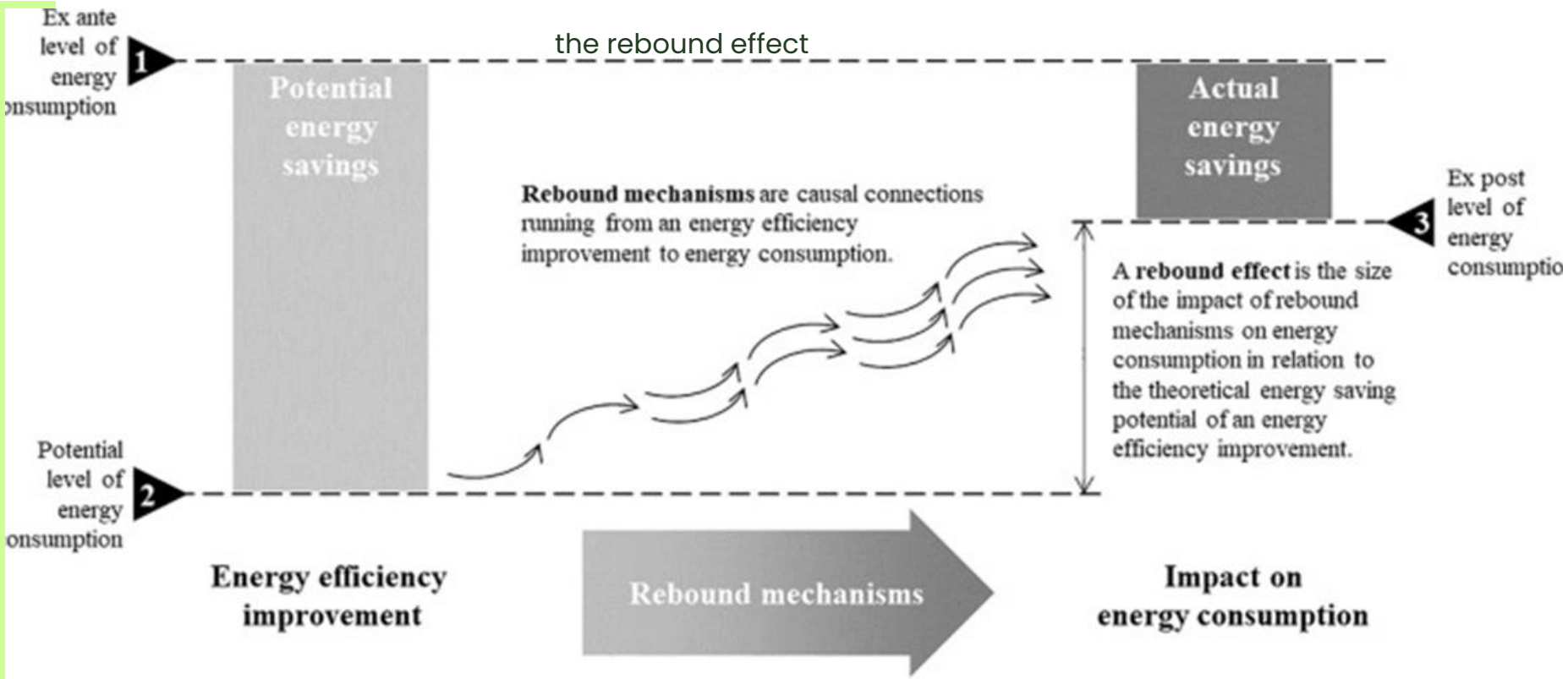
Short term comfort **isn't** healthy

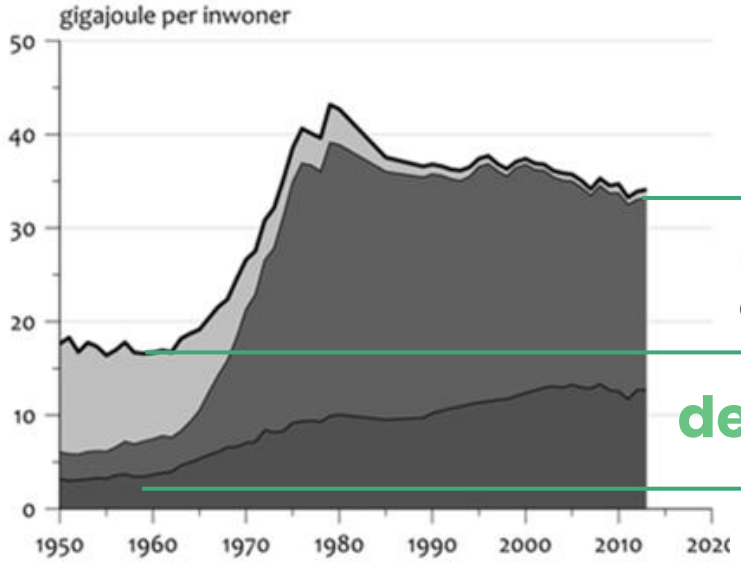
Assumption 3:

Increasing efficiency is the way to reduce environmental impact of the build environment?

Jevons Paradox

the rebound effect





Domestic heating energy per person
(Netherlands 1950 to 2014)

real life increase due to
decreased effectiveness

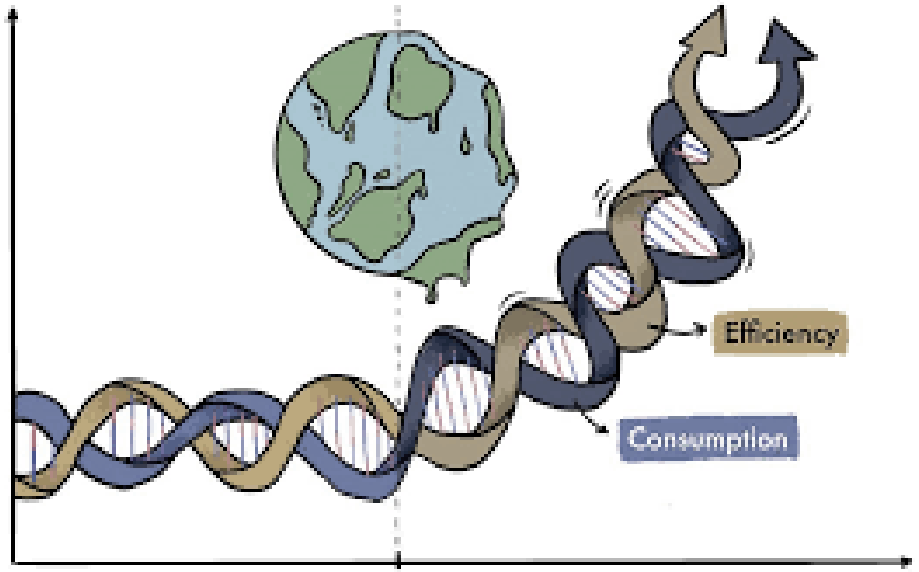
resulting increase > 75%

decrease > 90%

expected saving based on
increased efficiency

Source: cbs

90%	**increased efficiency**	**1600 %**	**decreased effectiveness**



FOSSILE INDUSTRIAL ERA

RENEWABLE INDUSTRIAL ERA

‘if you do what you did, you’ll get what you got ‘
Albert Einstein

efficiency ‘only’ **isn’t** sustainable

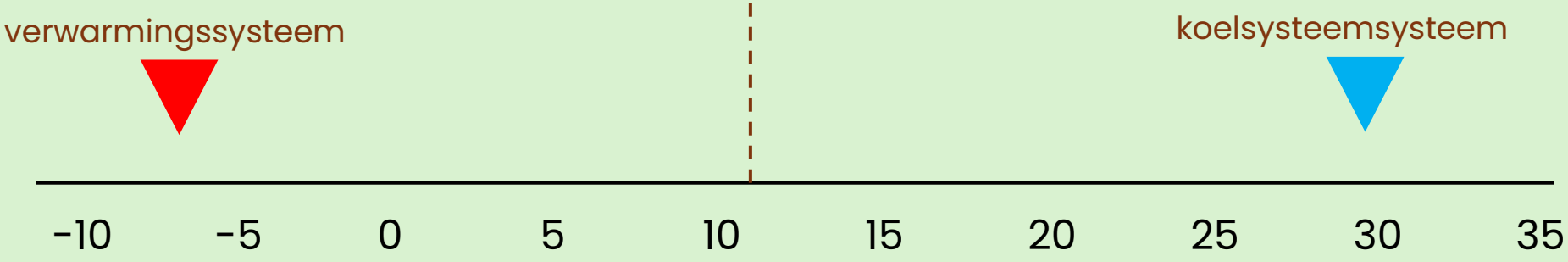
Assumption 4:

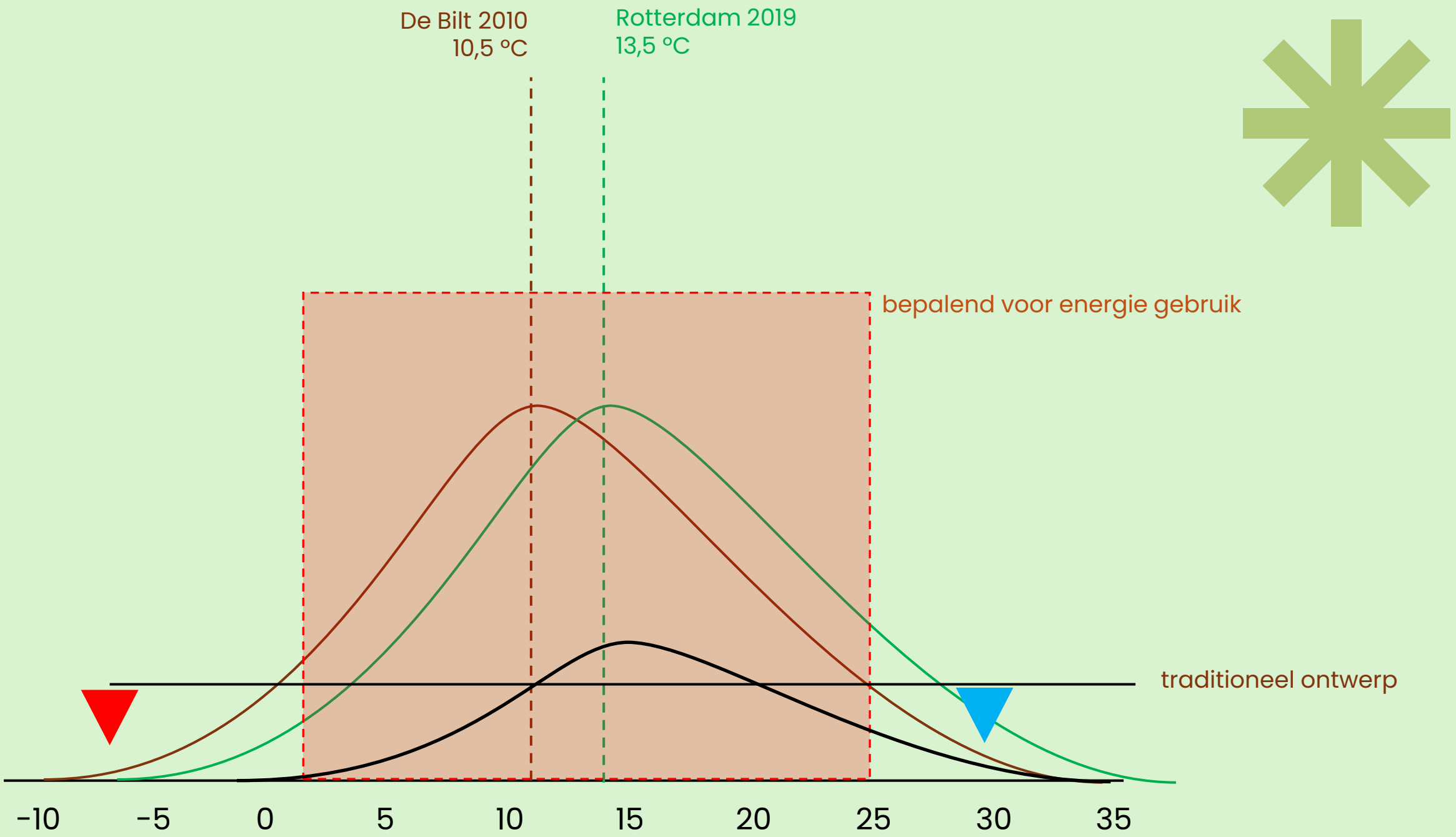
Simple standardized calculations are useful to design 21st century buildings

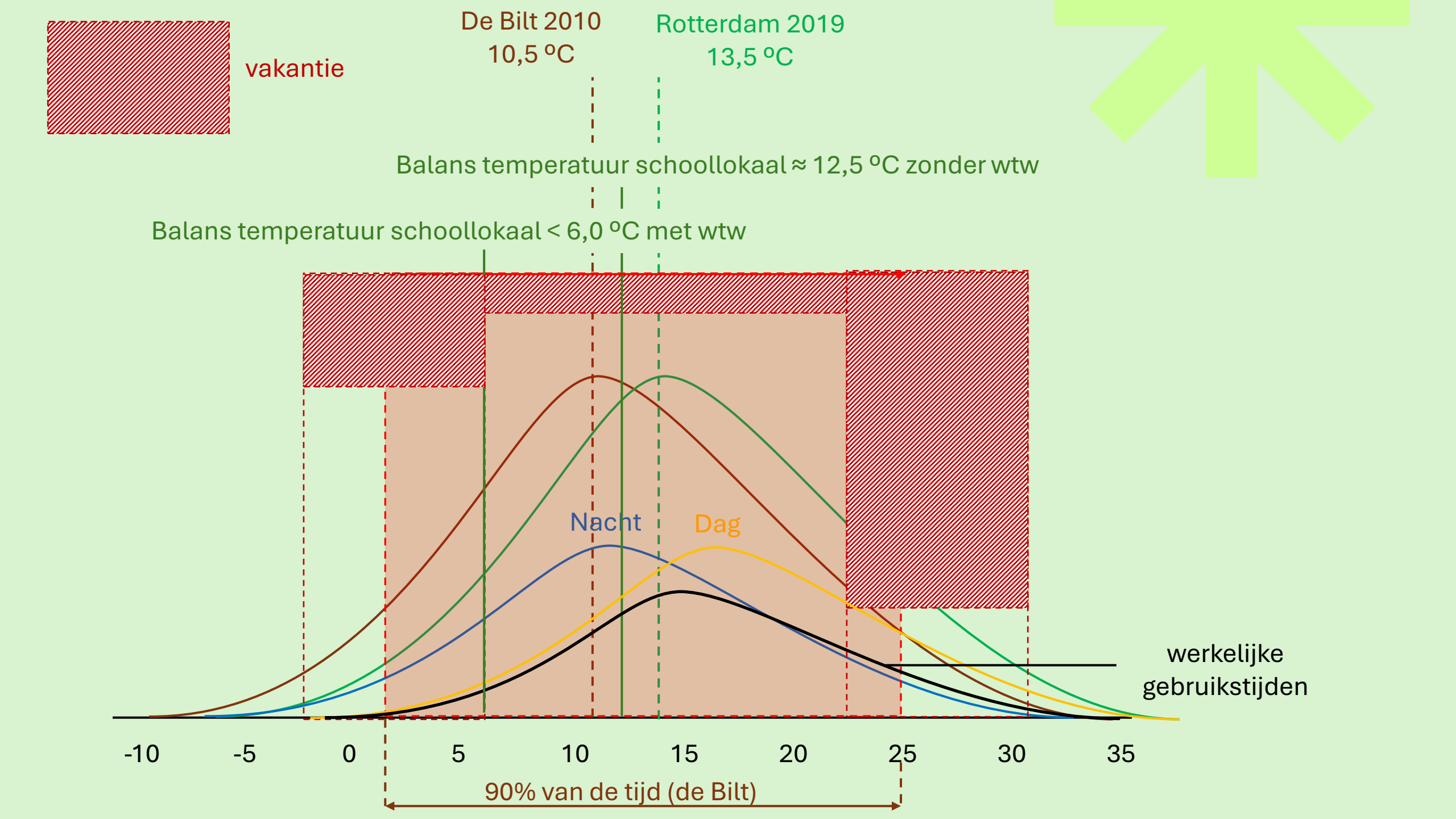
De Bilt 2010
10,5 °C

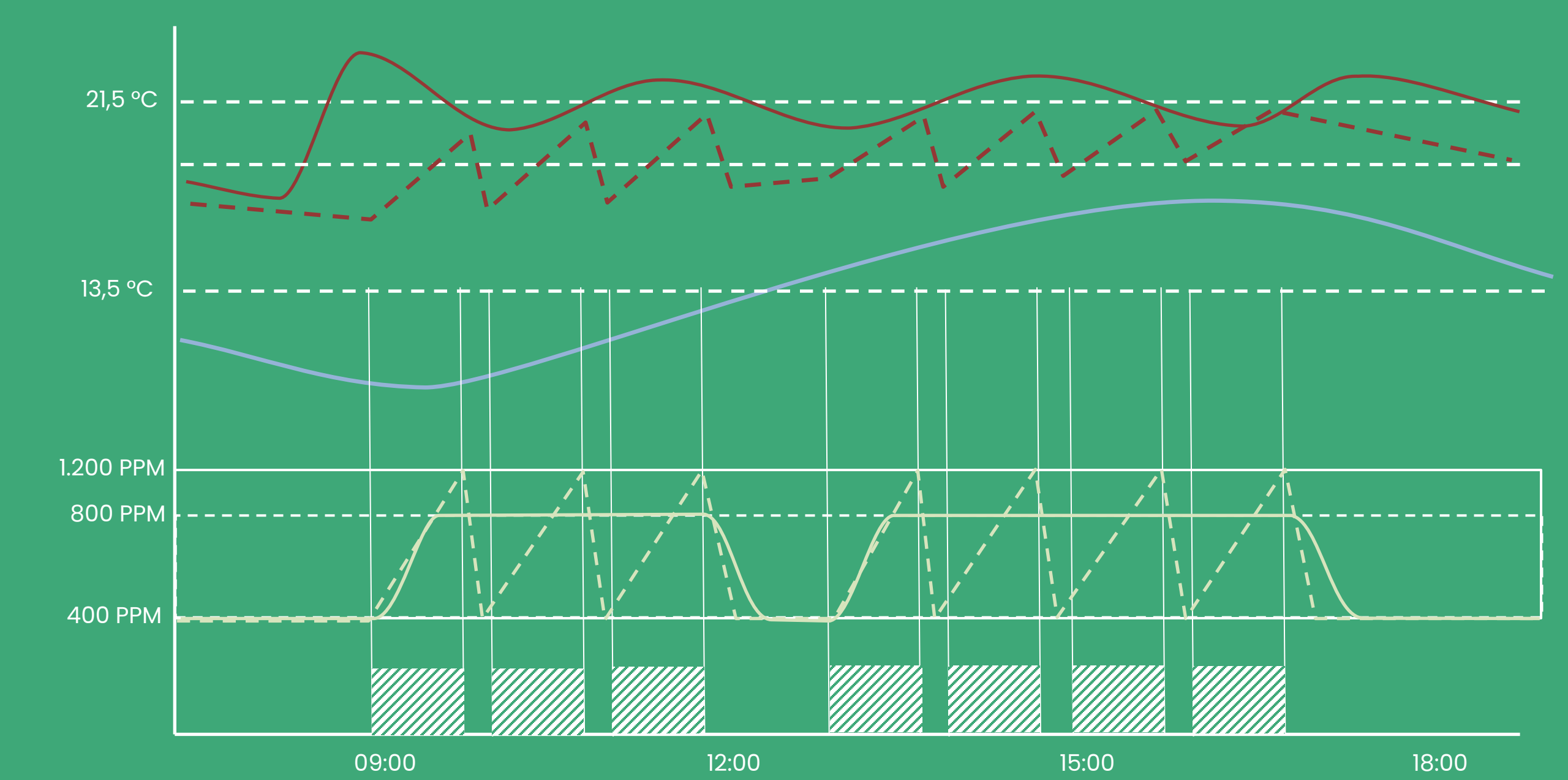
gemiddelde temperatuur conform NEN 660

Met een gemiddeld bezettingsgraad
Met een gemiddelde windsnelheid (In het weiland)




De Bilt 2010
10,5 °C
Rotterdam 2019
13,5 °C
bepalend voor energie gebruik
traditioneel ontwerp
-10
-5
0
5
10
15
20
25
30
35

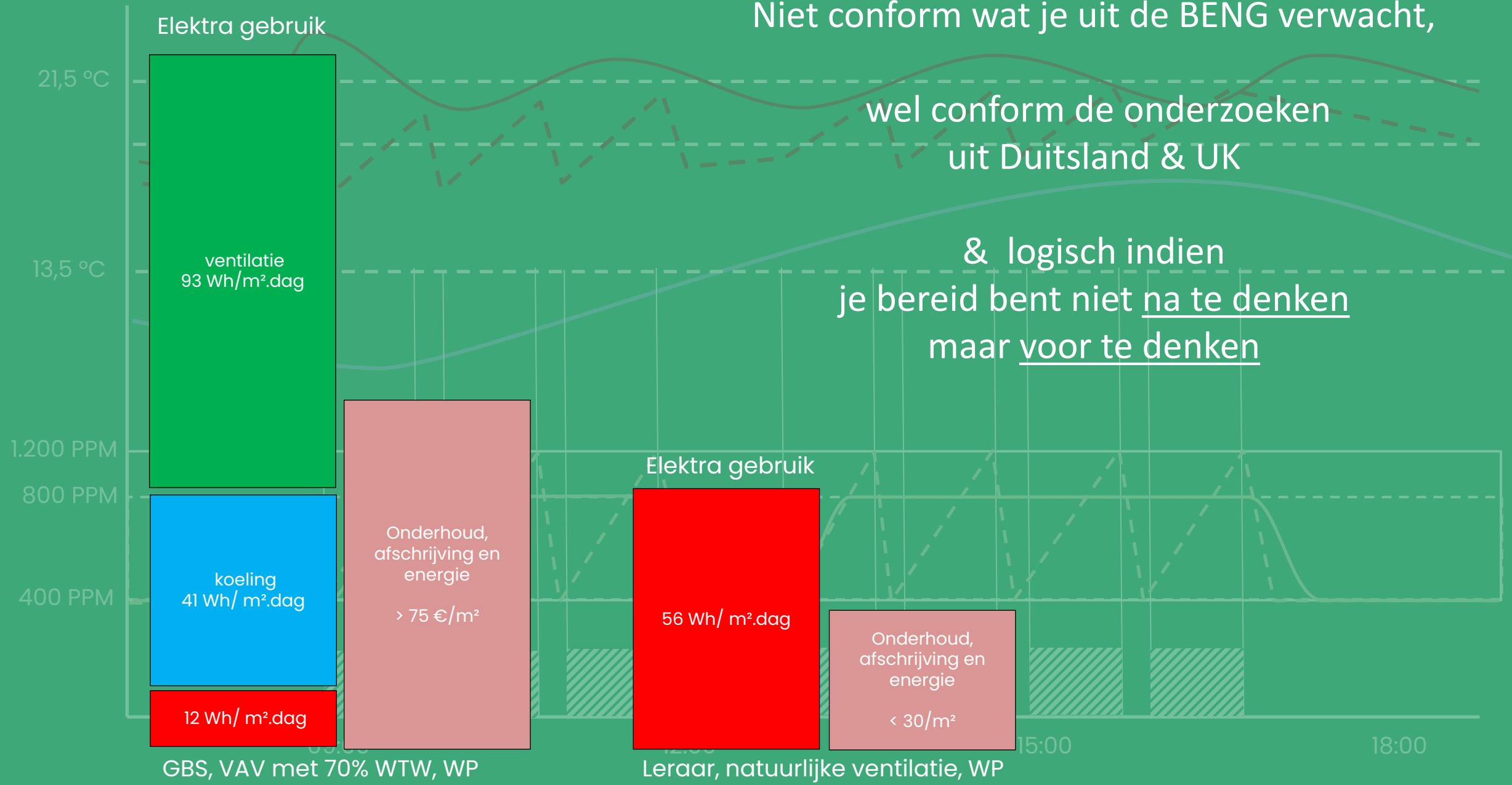

vakantie
De Bilt 2010
10,5 ºC
Rotterdam 2019
13,5 ºC
Balans temperatuur schoollokaal ≈ 12,5 ºC zonder wtw
Balans temperatuur schoollokaal < 6,0 ºC met wtw
Nacht
Dag
werkelijke
gebruikstijden
-10
-5
0
5
10
15
20
25
30
35
90% van de tijd (de Bilt)


21,5 °C
13,5 °C
1.200 PPM
800 PPM
400 PPM
09:00
12:00
15:00
18:00
GBS, VAV met 70% WTW, WP
Leraar, natuurlijke ventilatie, WP

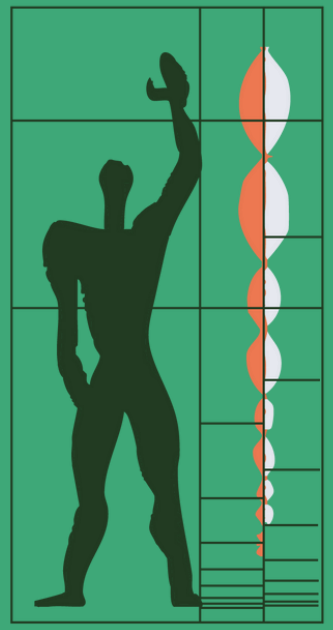
Niet conform wat je uit de BENG verwacht,

wel conform de onderzoeken
uit Duitsland & UK

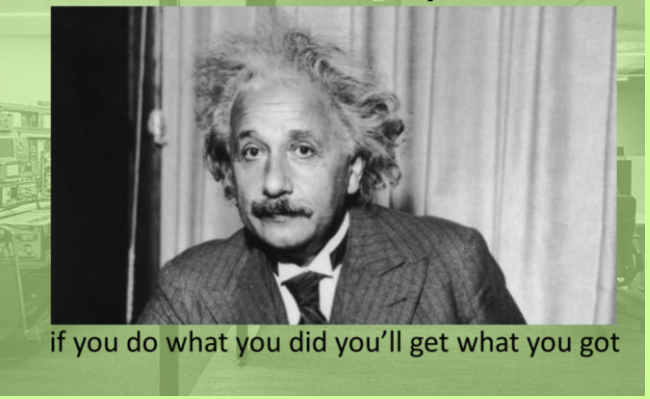
& logisch indien
je bereid bent niet <u>na te denken</u>
maar <u>voor te denken</u>



Effort = **Effect** x **Effectiveness** x **Efficiency**



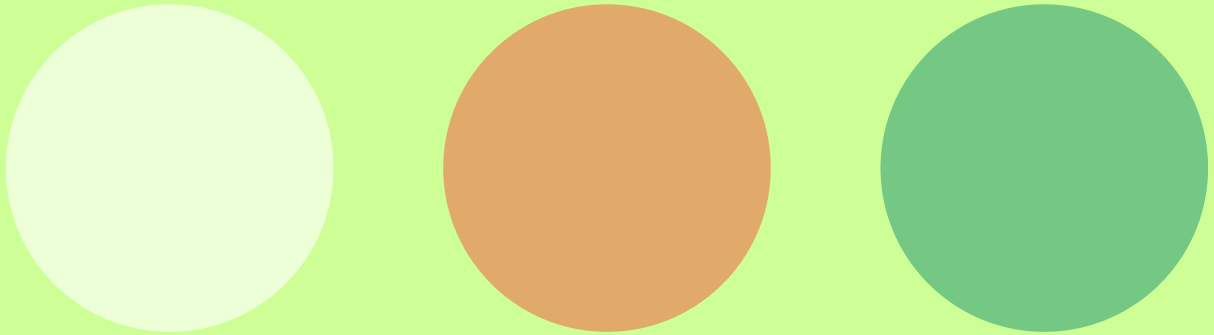
The 20ste-eeuw gin alleen maar over (financiële) efficiëntie



Om Andere resultaten te krijgen zullen we op een Andere manier naar de wereld moeten kijken

Natural World
that what happens naturally

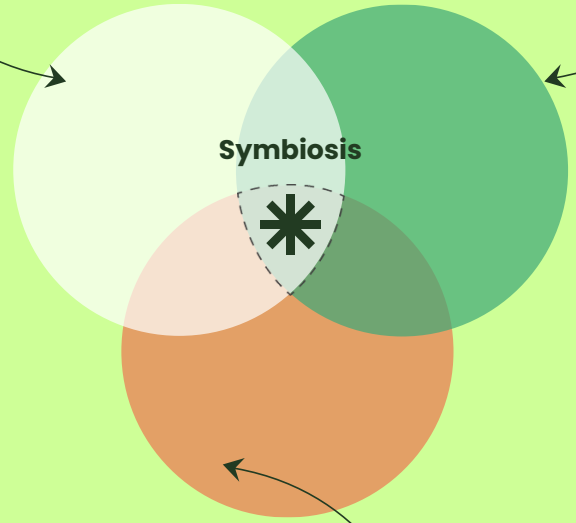
Technical World
uses effort to change the outcome



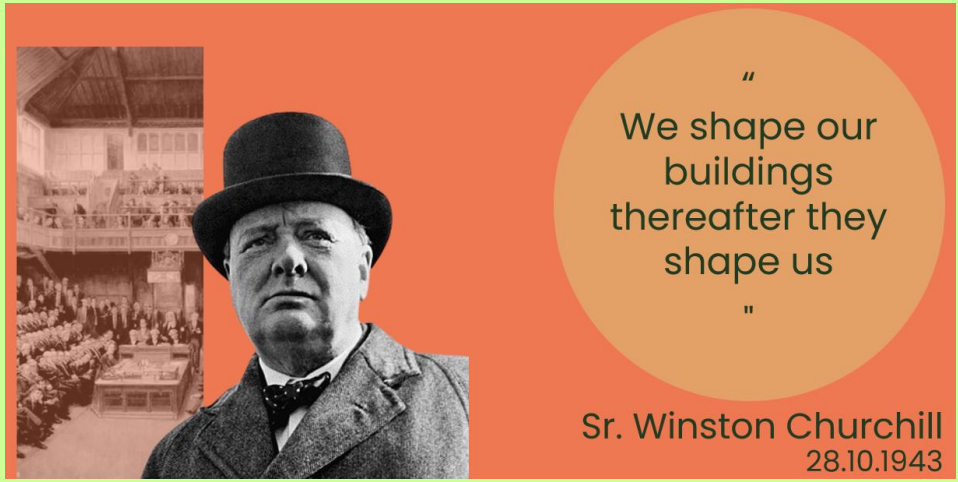
Cultural World
defines the objective

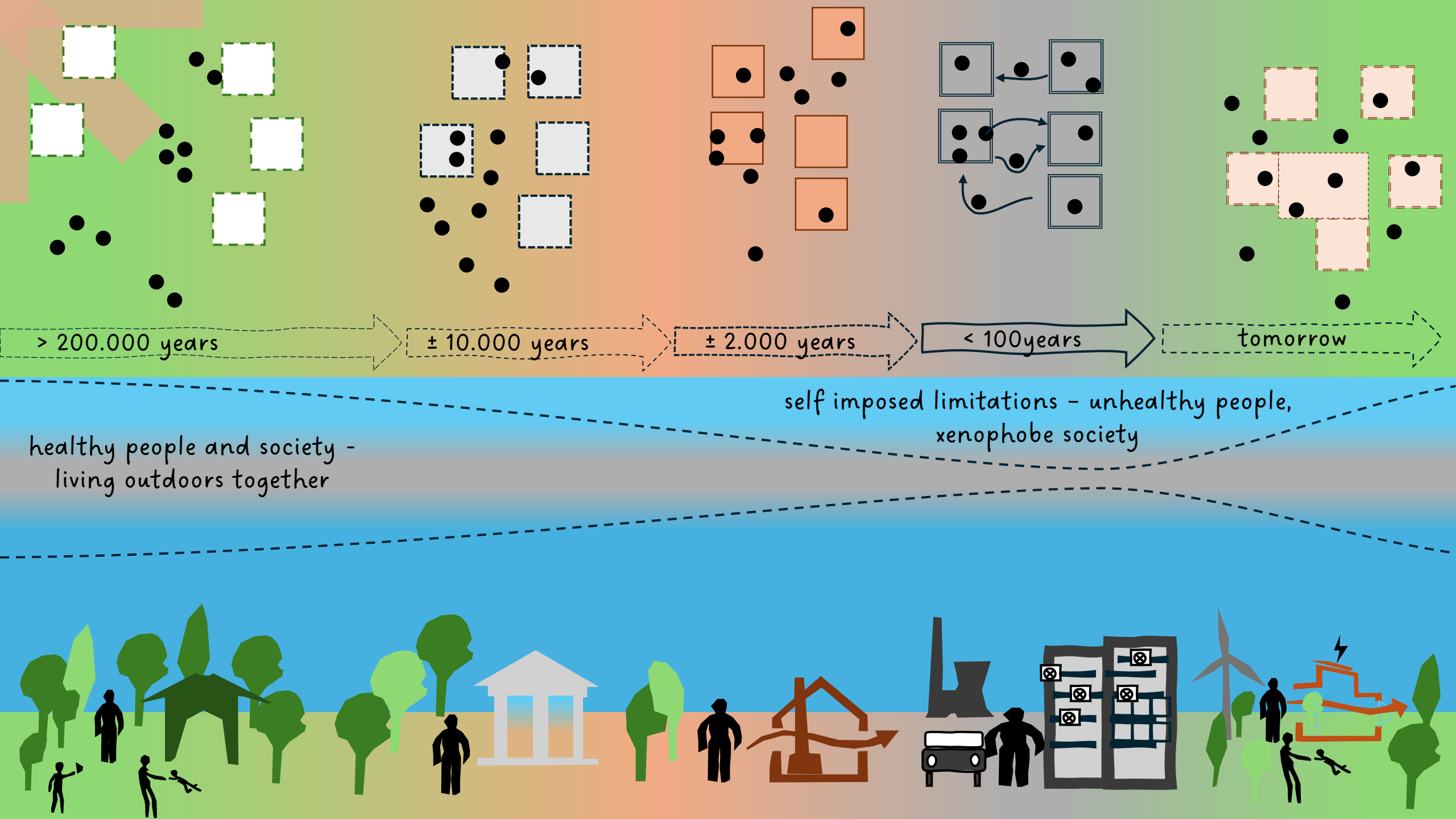
Natural World
that what happens without human interference

Technical World
human interference to alter the natural world



Cultural World
how we want to alter what naturally happens




> 200.000 years
± 10.000 years
± 2.000 years
< 100years
tomorrow
healthy people and society -
living outdoors together
self imposed limitations - unhealthy people,
xenophobe society





















De 21ste eeuw gaat over robuustheid

