

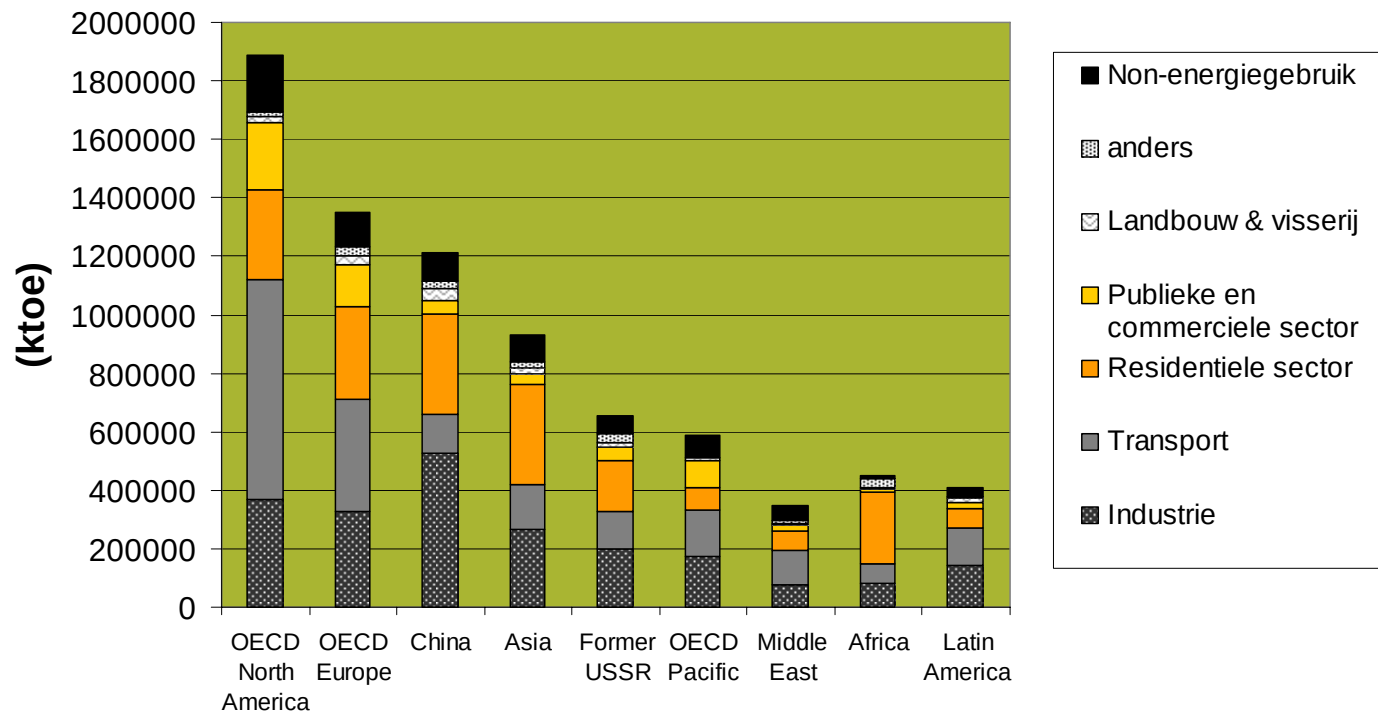


No-nonsense energieontwerp: Tussen creativiteit en degelijkheid

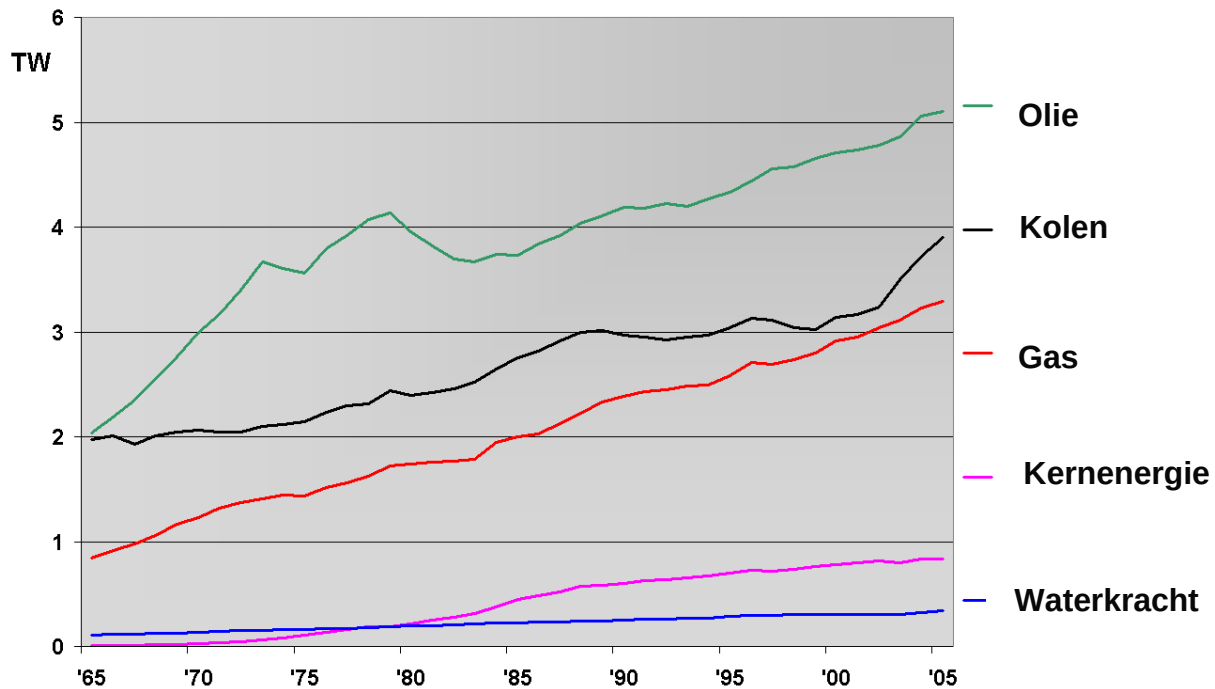
Laure Itard, lector Energie & de Gebouwde Omgeving
30 November 2010

Wereldwijd gebruik van energie

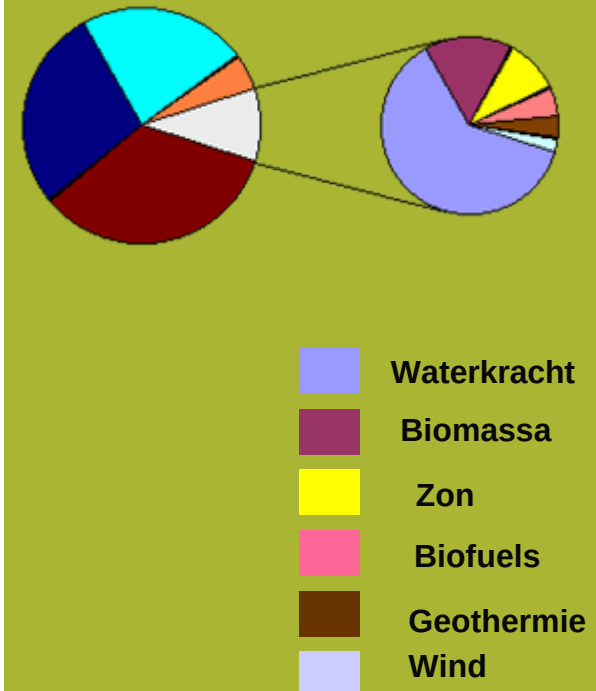
Totaal eind-energiegebruik per regio



Wereldwijd gebruik van energie

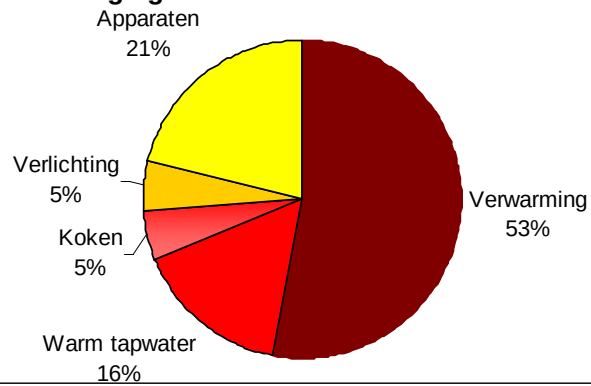


Totaal versus duurzaam

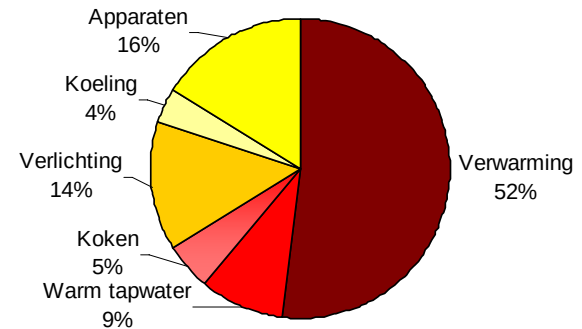


Verdeling energiegebruik ontwikkelde landen

Energiegebruik in de residentiële sector

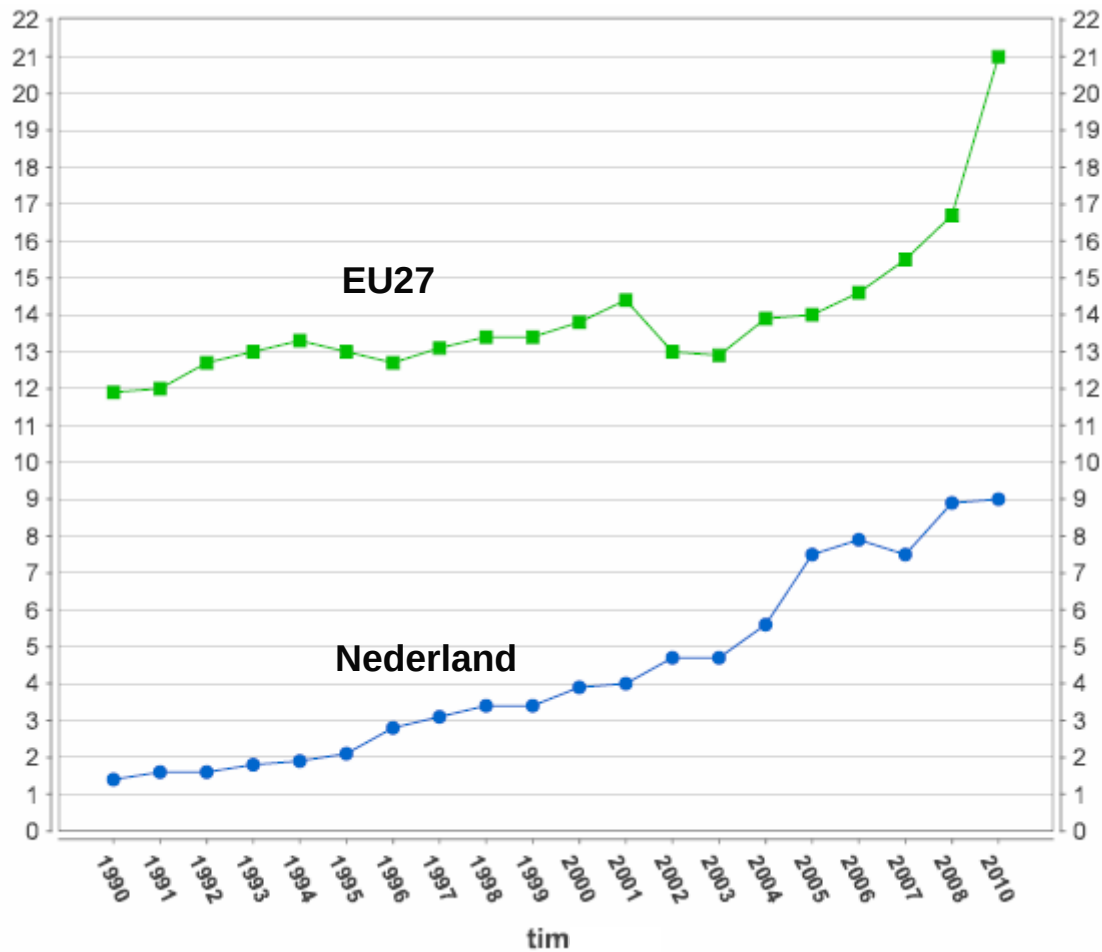


Energiegebruik in de commerciële en publieke sectoren



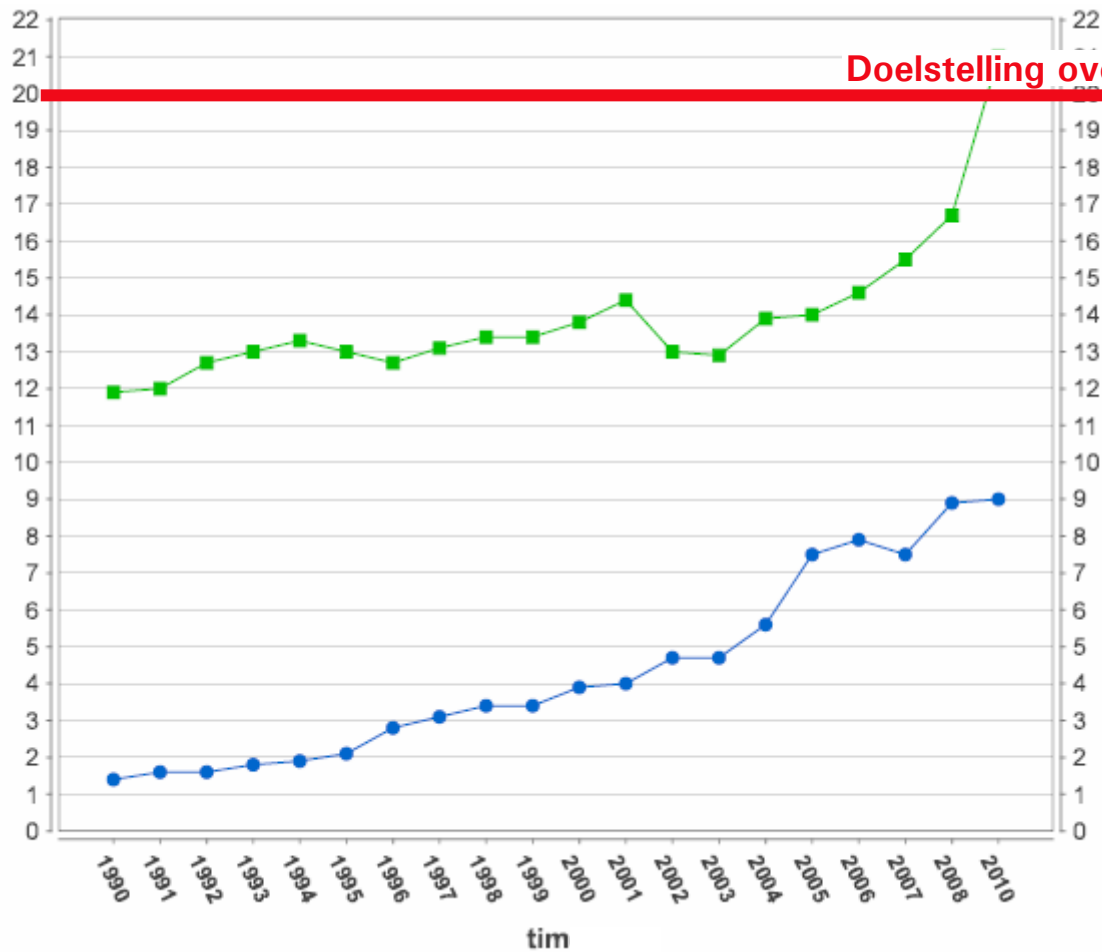
Aandeel duurzame elektriciteit

%



Aandeel duurzame elektriciteit

%

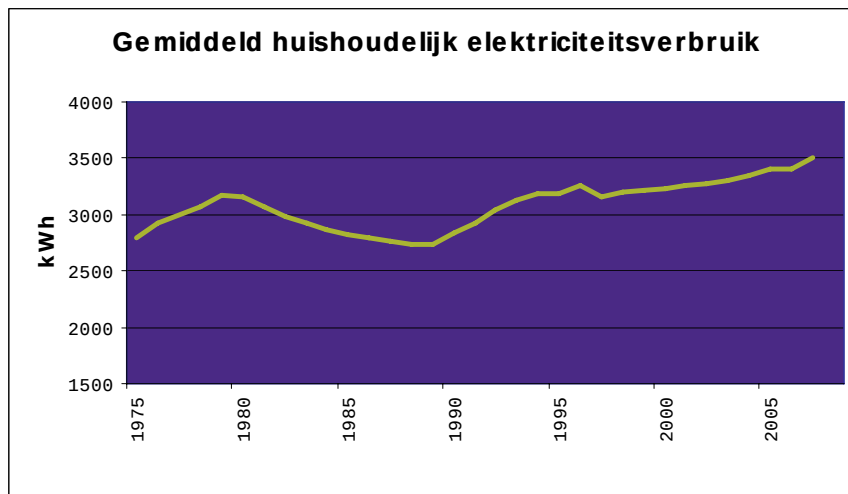
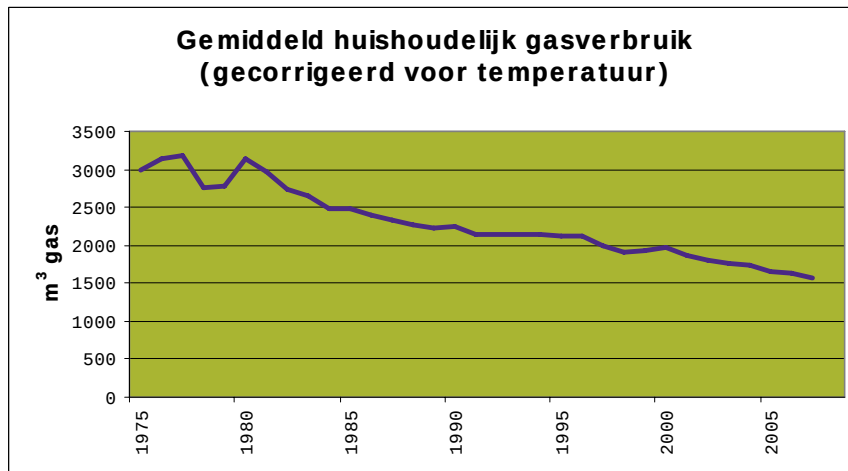


Doelstelling overheid 2020

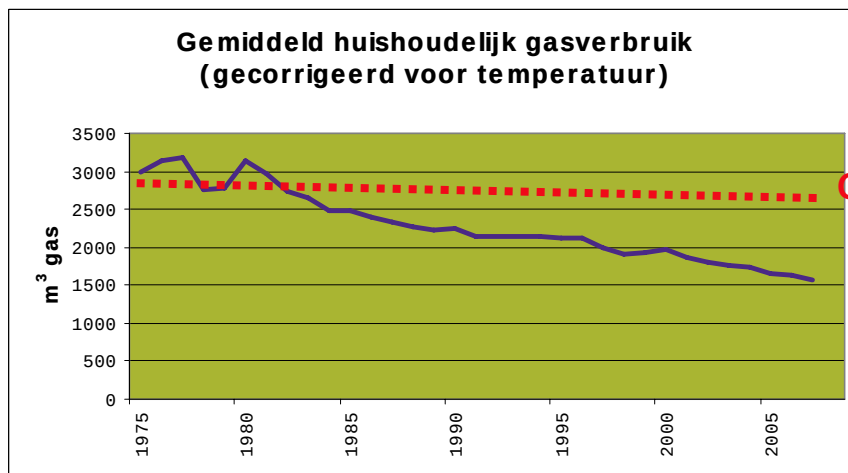


DE PROBLEMATIEK ANNO 2010

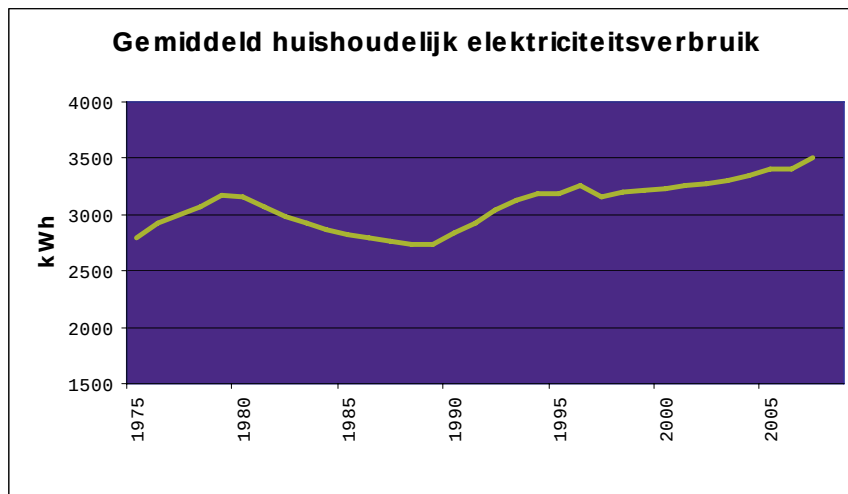
Woningen



Woningen



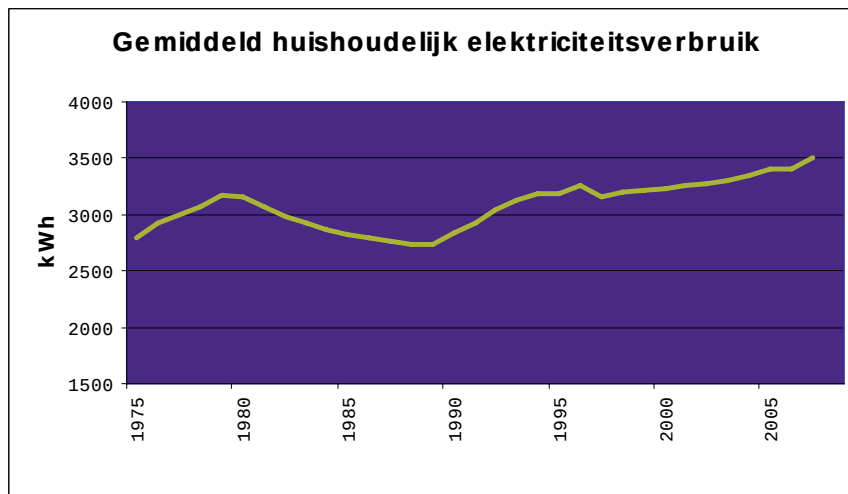
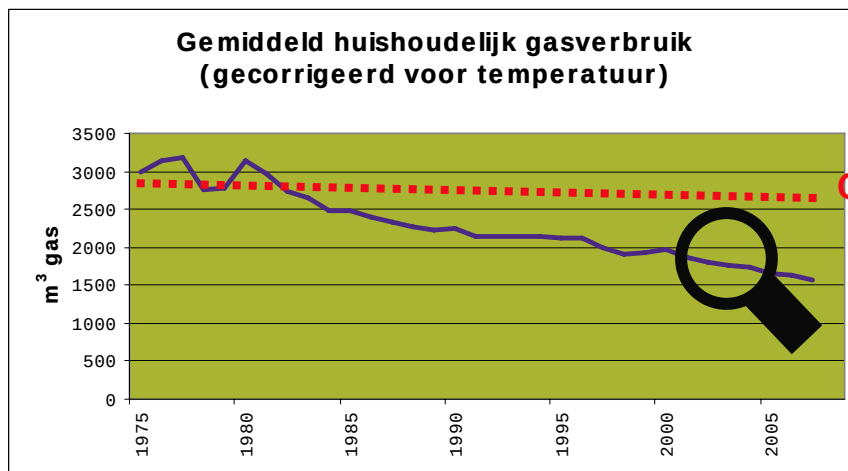
Gehele voorraad



Doelstelling overheid:

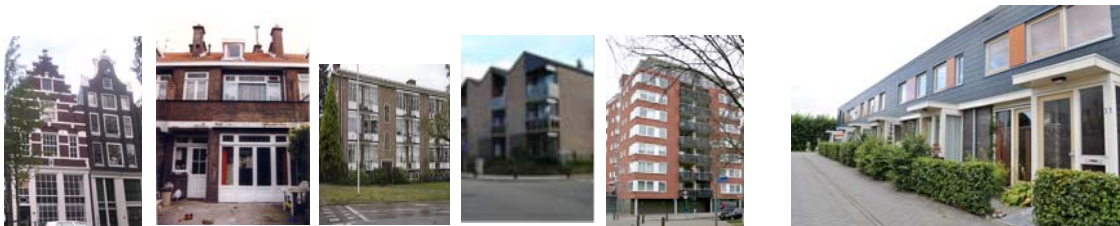
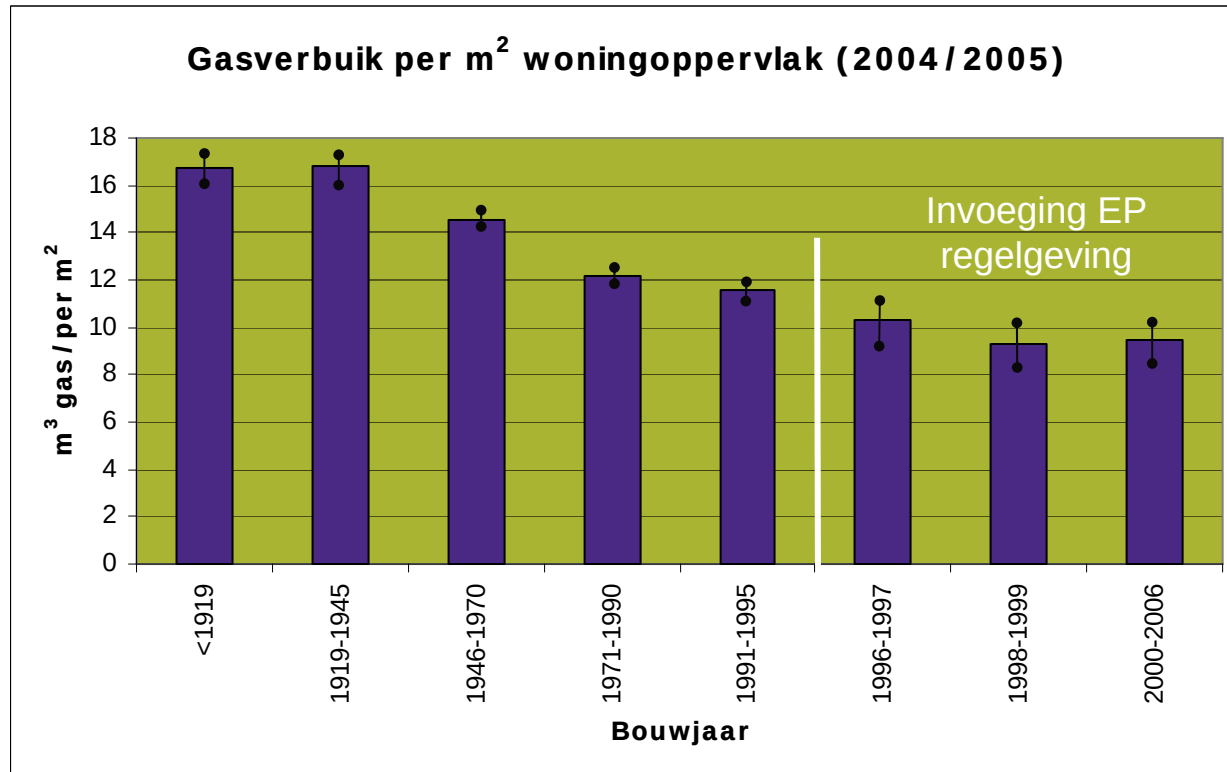
2% besparing per jaar

Woningen



**Doelstelling overheid:
2% besparing per jaar**

Woningen



Waarom stagneert energiebesparing?

1. Bewoners gedragen zich anders dan verwacht:

- gedrag beïnvloedt de (energie) prestaties van techniek
- techniek beïnvloedt gedrag



•Meer uren verwarming aan

•Meer radiatoren aan

•Meer ventilatie

MINDER

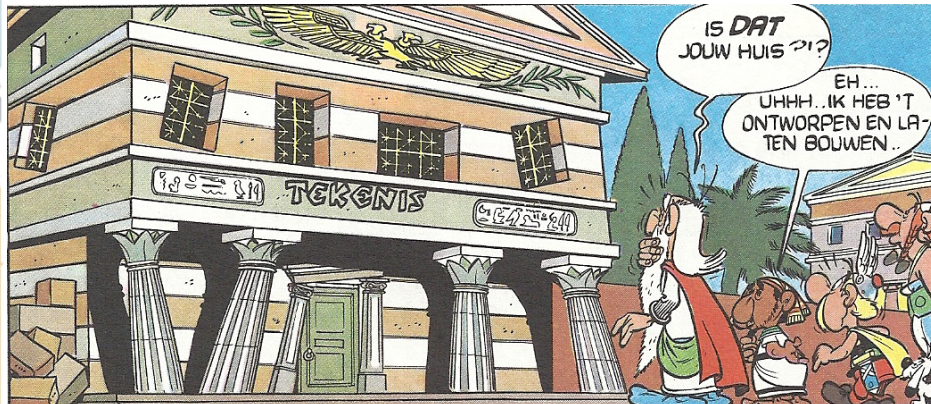
Waarom stagneert energiebesparing?

1. Bewoners gedragen zich anders dan verwacht:

- gedrag beïnvloedt de (energie) prestaties van techniek
- techniek beïnvloedt gedrag

2. 50% nieuwbouwwoningen anders gebouwd dan in bouwvergunning

TU VOIS, JULES.
COMME ÇA, NOS PETITS AN
À PLUMES, N'AURONT PLUS
FROID : C'EST EN DIRECT
SUR LE CIRCUIT DU
CHAUFFAGE CENTRAL
...



- Meer uren verwarming aan

- Meer radiatoren aan

- Meer ventilatie

MINDER

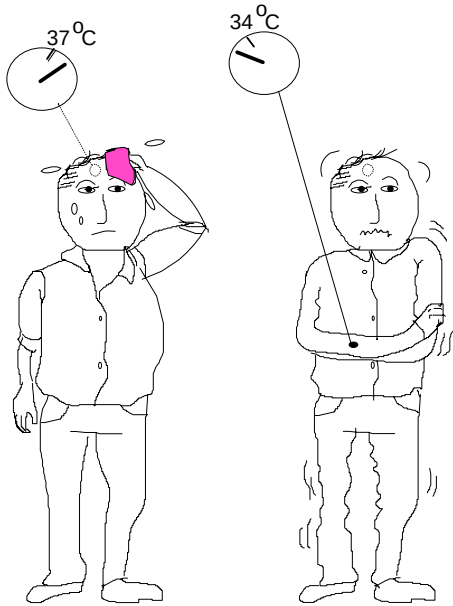
Waarom stagneert energiebesparing?

3. Installaties werken niet naar behoren



DE COMPLEXITEIT VAN ENERGIEONTWERP

De Mens: comfort & gezondheid



Luchttemperatuur

Wand, plafond en vloer
temperatuur

Luchtbewegingen

Vochtigheid

Kleren

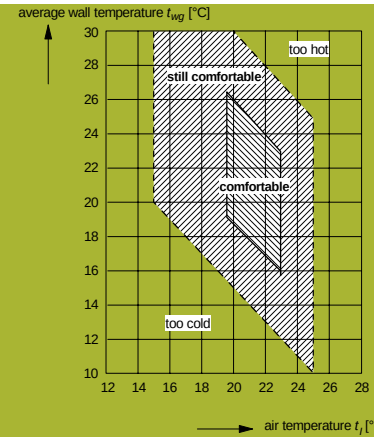
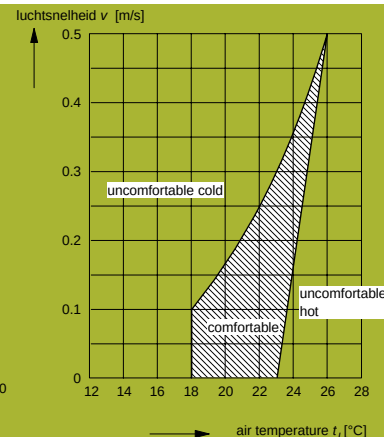
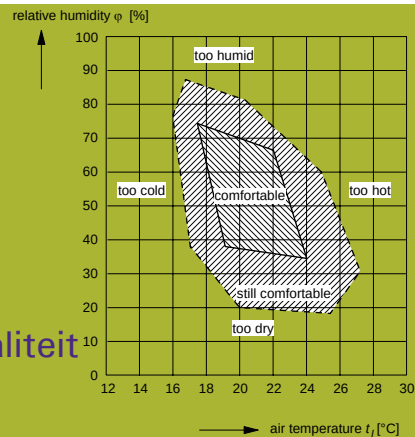
Activiteit

Geur

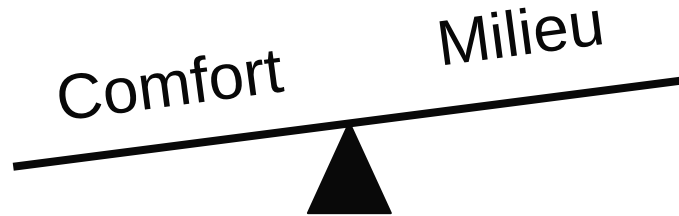
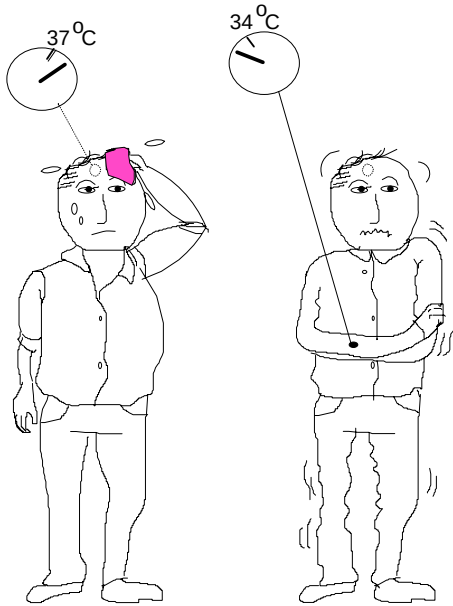
Geluid

Licht

Luchtkwaliteit



Het Milieu



Luchttemperatuur

Wand, plafond en vloer
temperatuur

Luchtbewegingen

Vochtigheid

Kleren

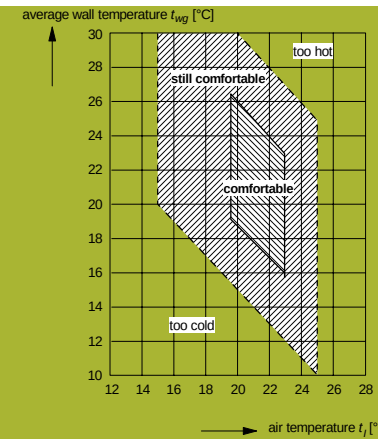
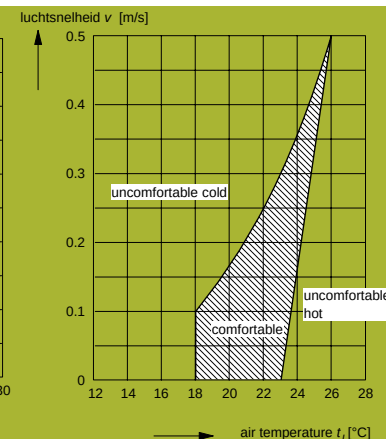
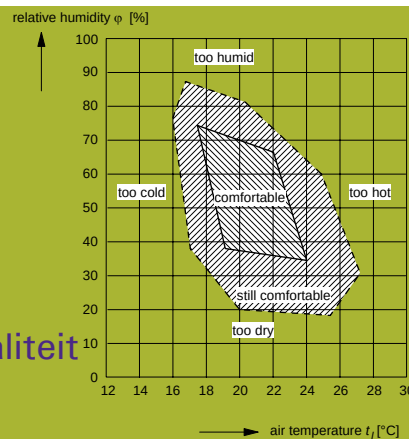
Activiteit

Geur

Geluid

Licht

Luchtkwaliteit



Uitputting grondstoffen

Broeikaseffect (CO₂)

Ozonlaagaantasting

Smogvorming

Humane toxiciteit

Ecotoxiciteit water

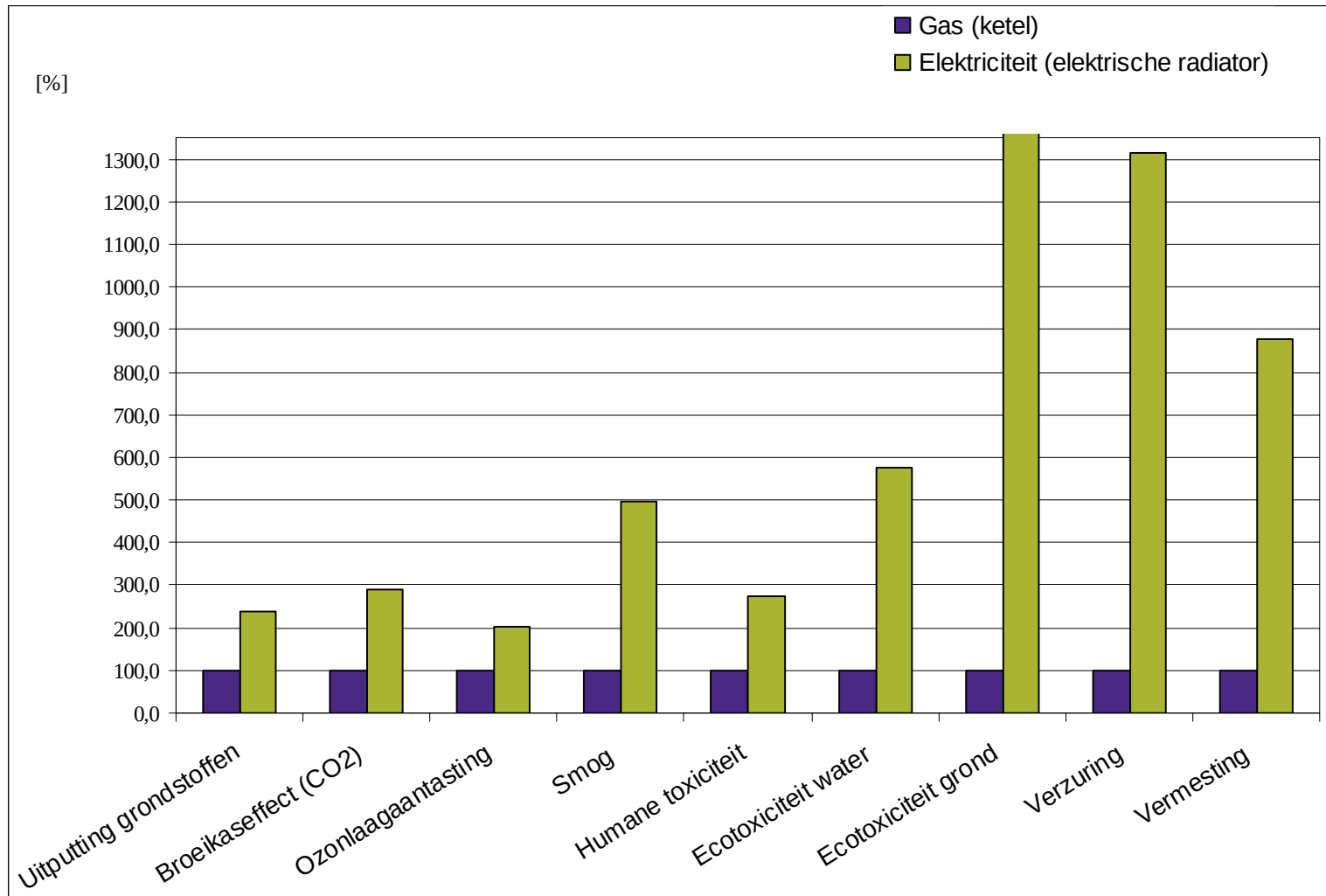
Ecotoxiciteit grond

Verzuring

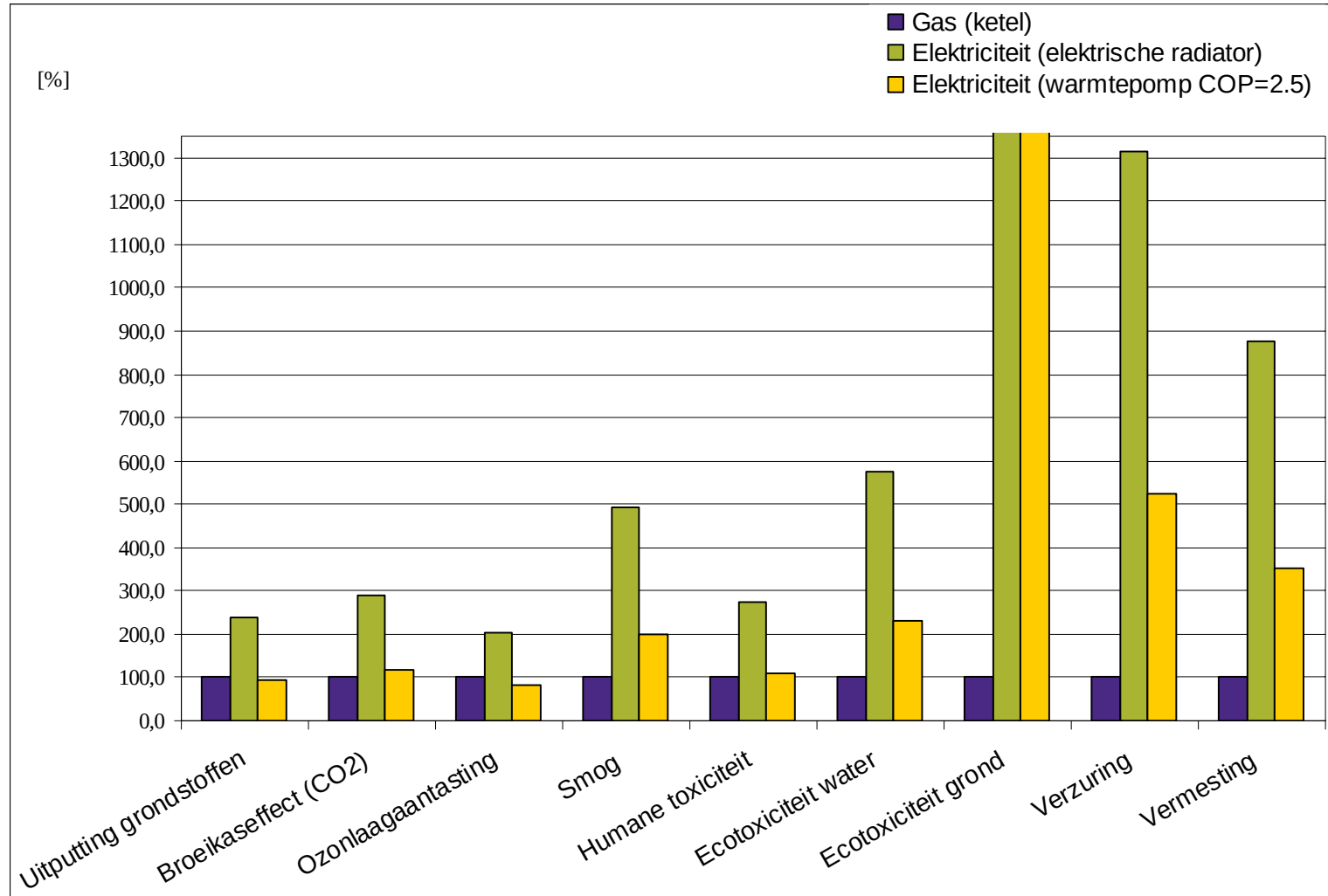
Vernesting



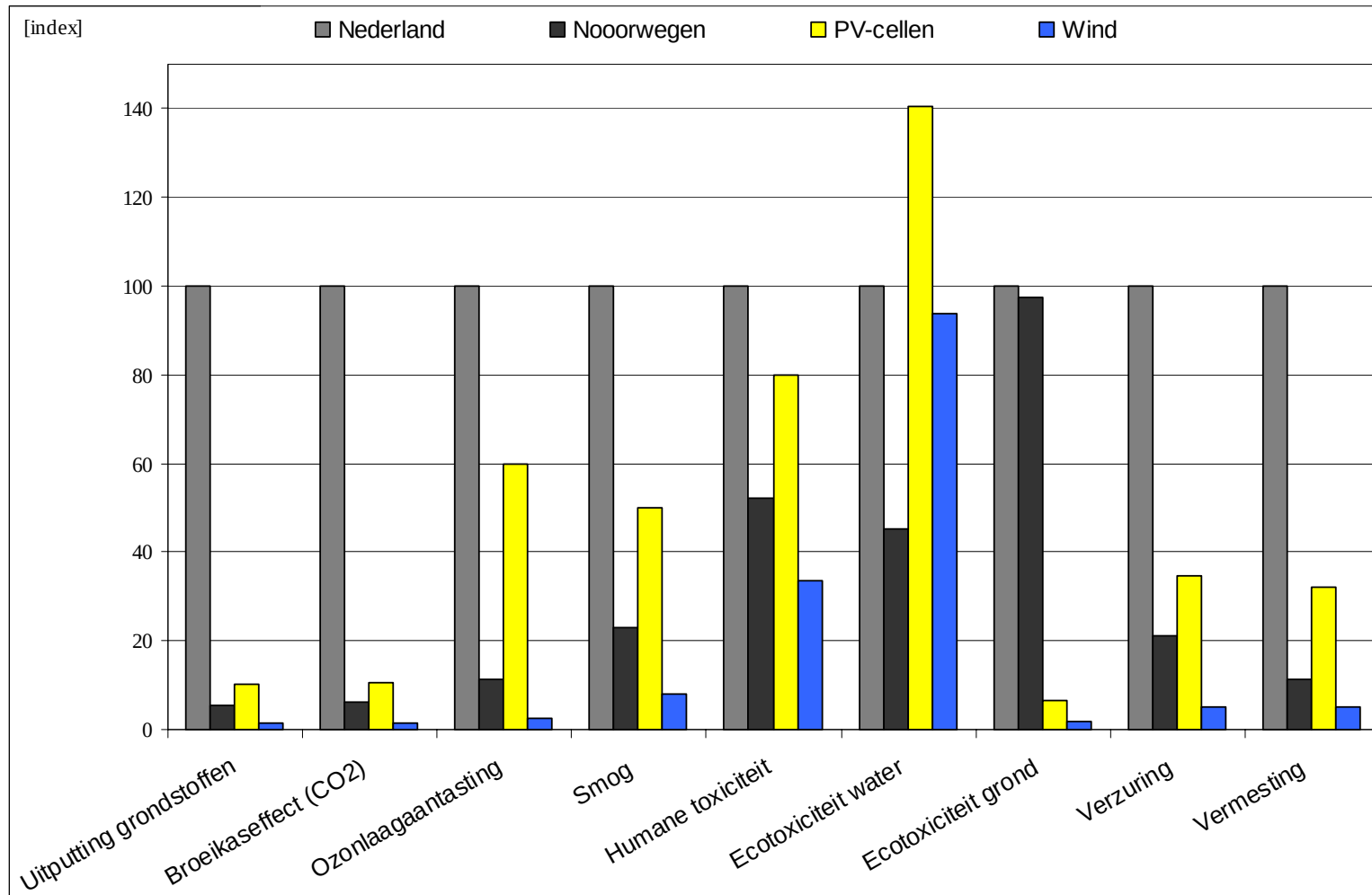
Milieubelasting bij de productie van 1 MJ warmte

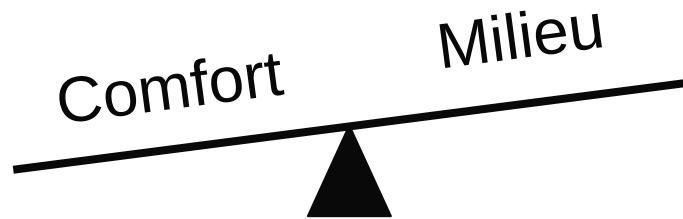
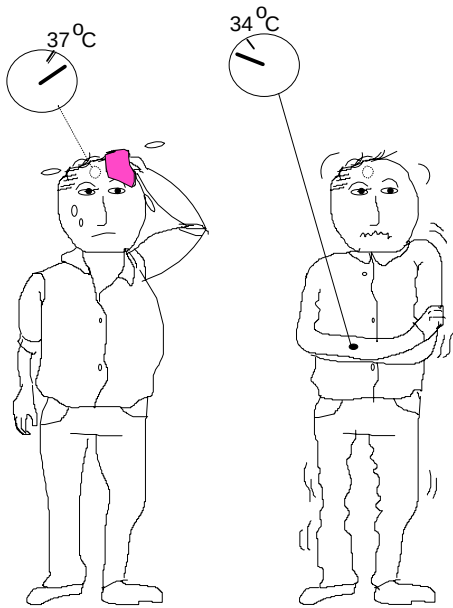


Milieubelasting bij de productie van 1 MJ warmte



Milieubelasting van elektriciteit

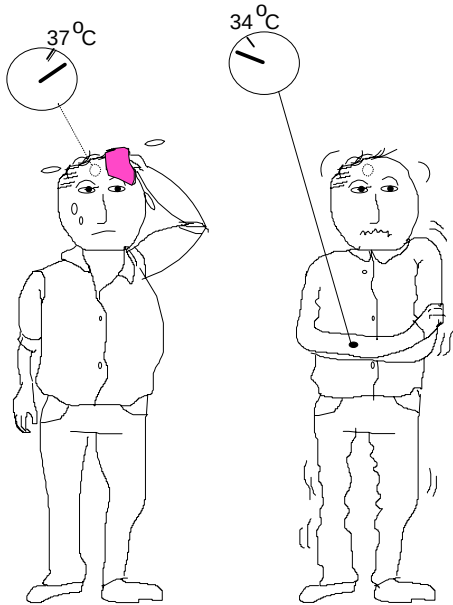




Gebouw & Binnenklimaat- en energie-installaties

Comfort

Milieu



Luchttemperatuur

Wand, plafond en vloer
temperatuur

Luchtbewegingen (snelheid
en temperatuur)

Vochtigheid

Kleren

Activiteit



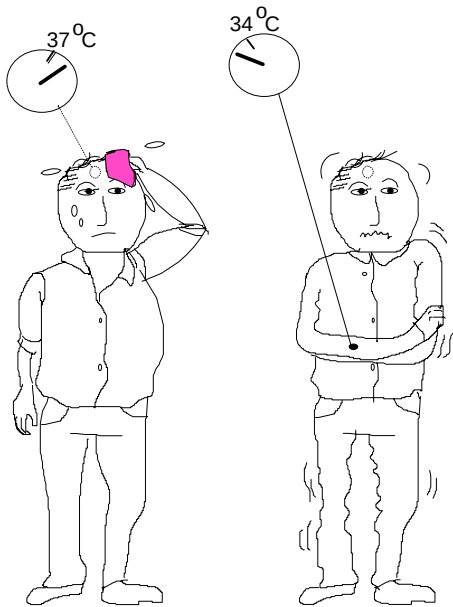
Energiegebruik

Materiaalgebruik

Gebouw & Binnenklimaat- en energie-installaties

Comfort

Milieu



Luchttemperatuur

Wand, plafond en vloer
temperatuur

Luchtbewegingen (snelheid
en temperatuur)

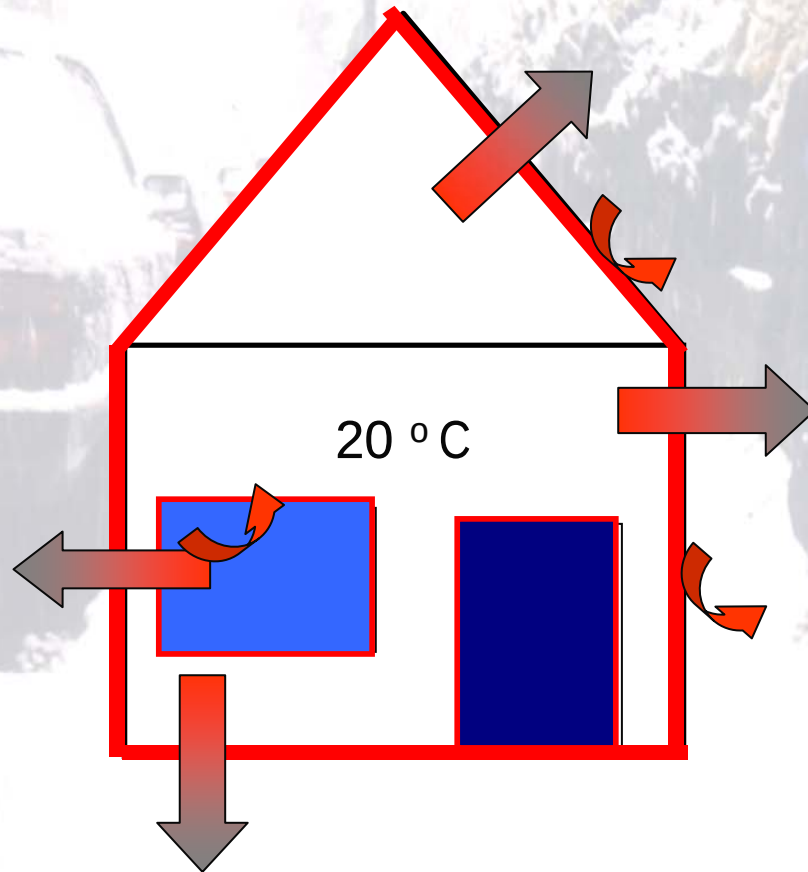
Vochtigheid

Kleren

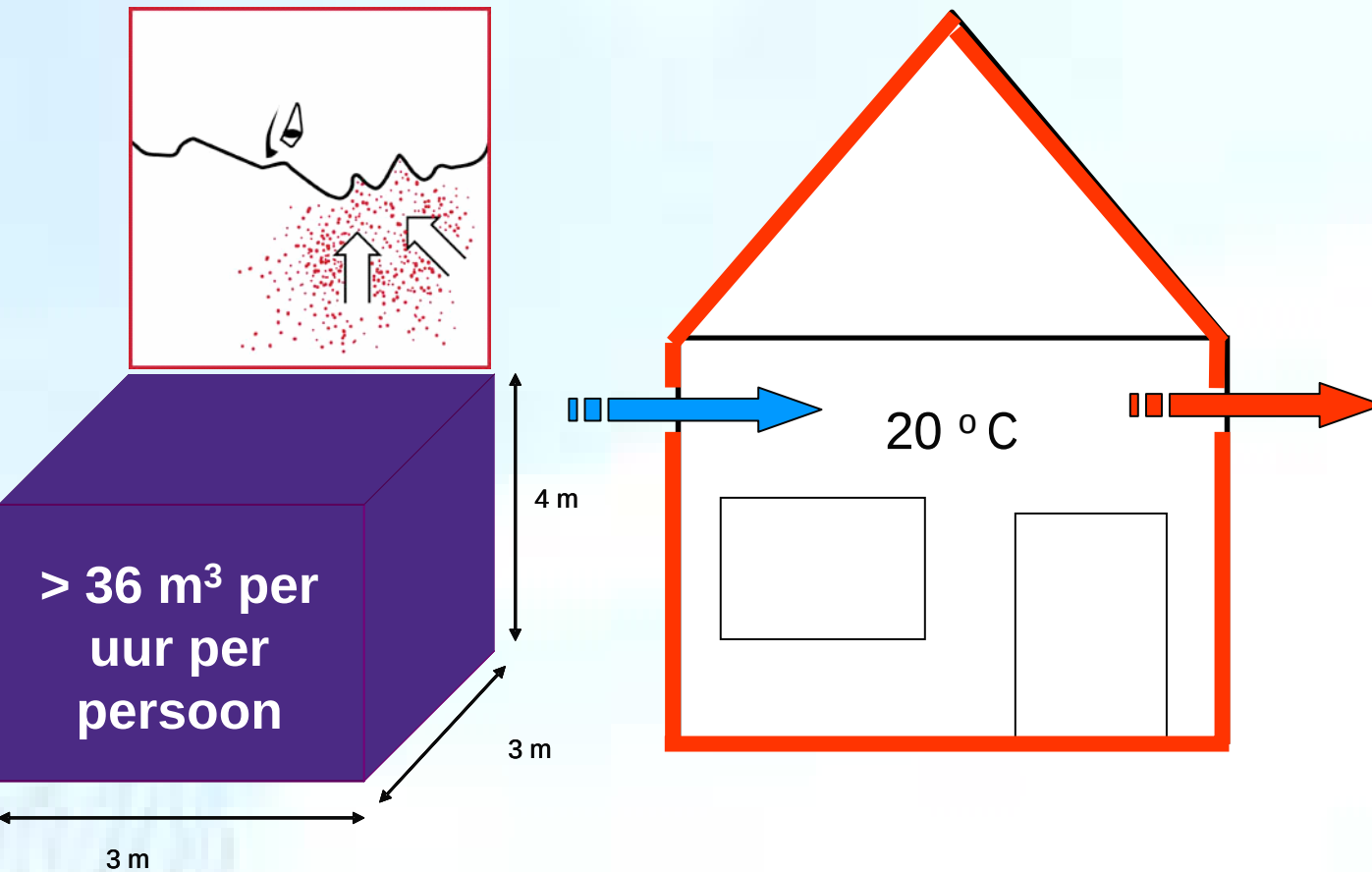
Activiteit



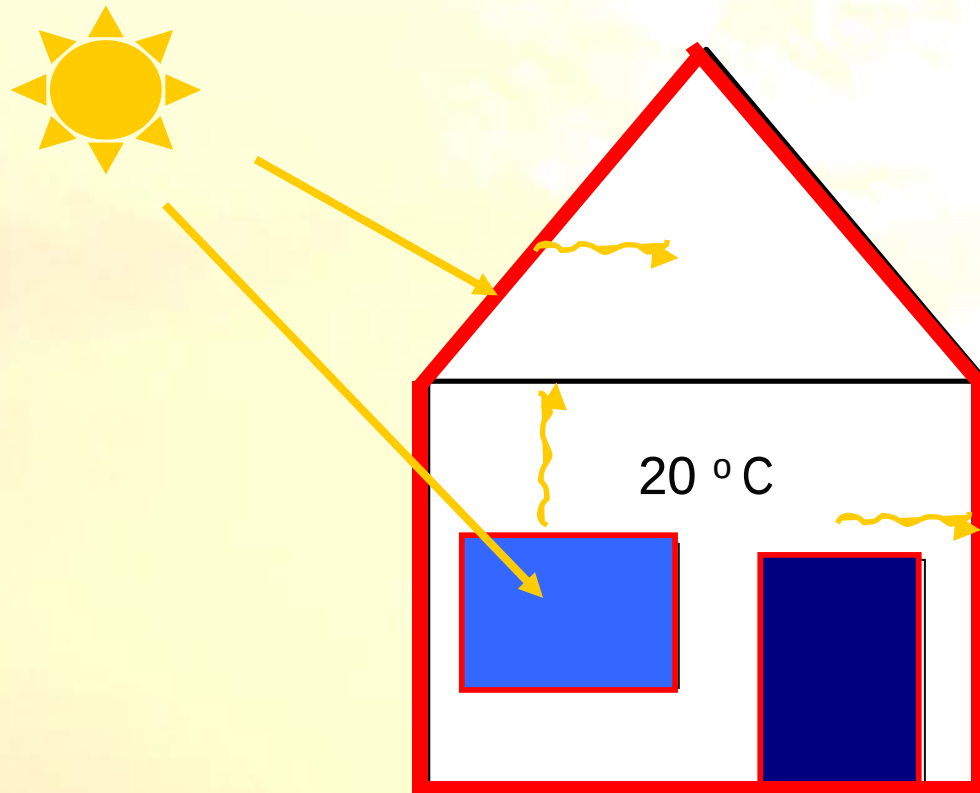
1) Transmissie door de constructie



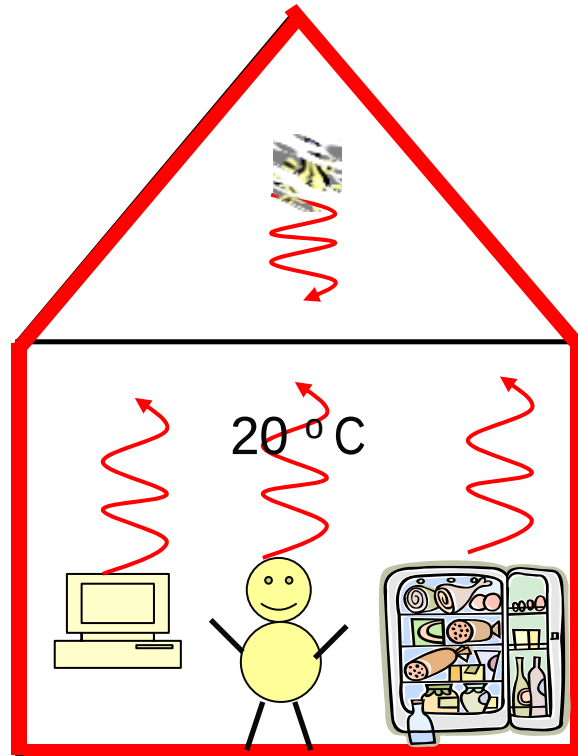
2) Infiltratie en ventilatie

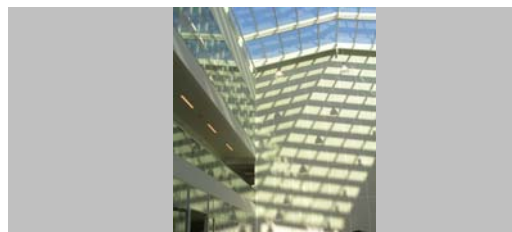


3) Zon

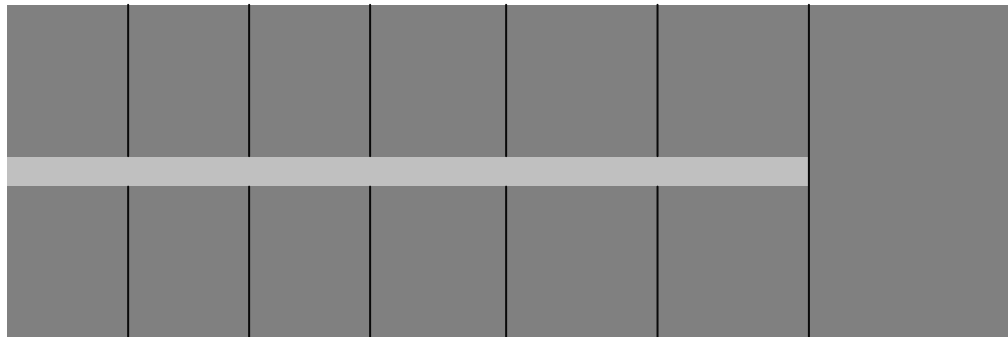
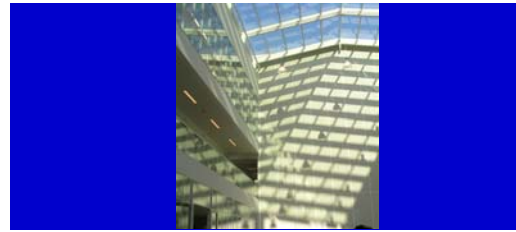


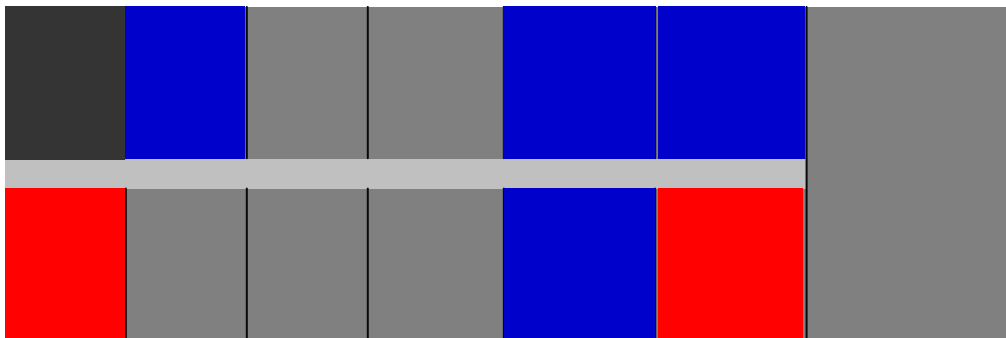
4) Interne warmteproductie

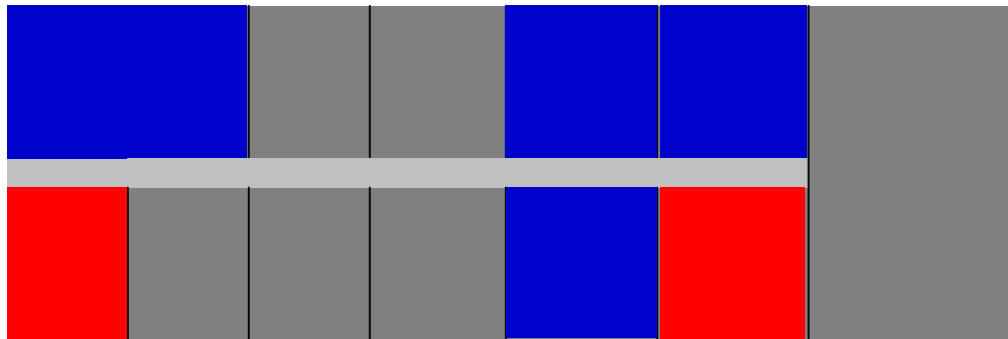
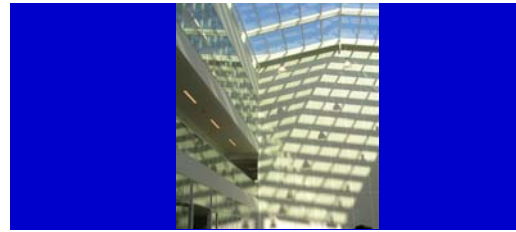


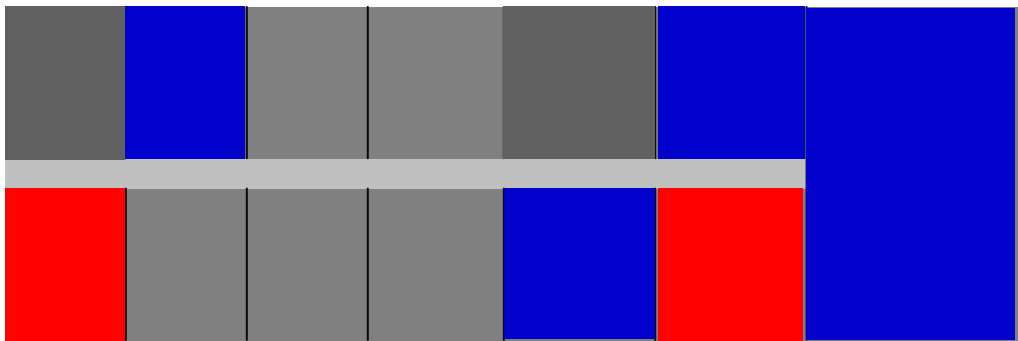


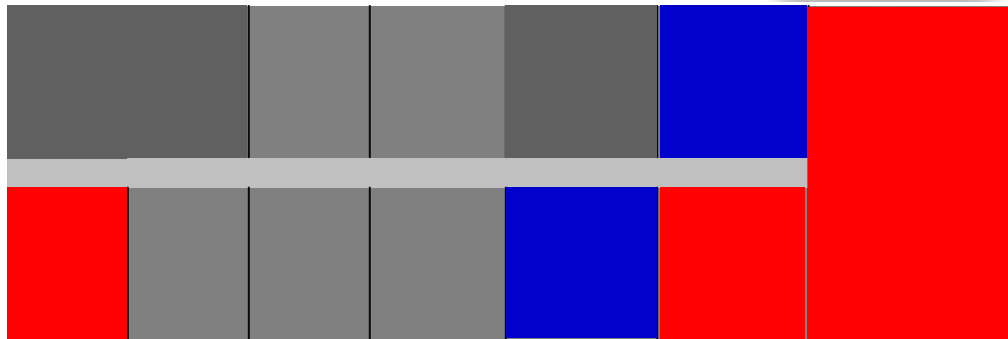
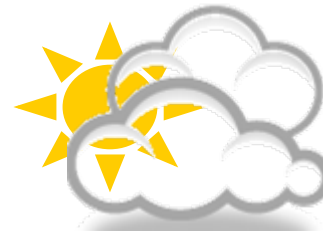
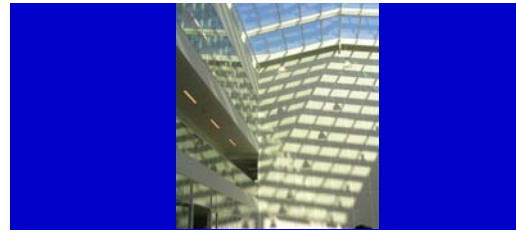












CREATIVITEIT



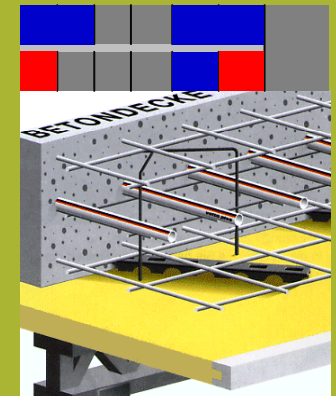
Duurzame installaties

- Lage temperatuur verwarming / hoge temperatuur koeling als (trage maar efficiënte) basis,
 - In combinatie met snel reagerende pieksystemen



Duurzame installaties

- Lage temperatuur verwarming / hoge temperatuur koeling als (trage maar efficiënte) basis,
 - In combinatie met snel reagerende pieksystemen
- Warmte- en koudeoverschot gebruiken



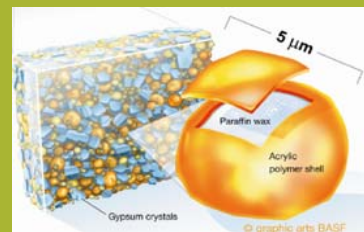
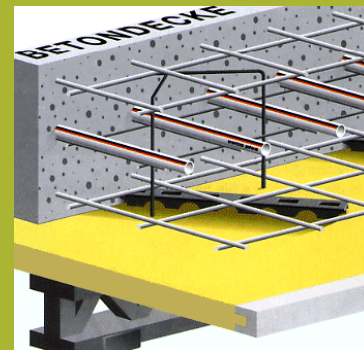
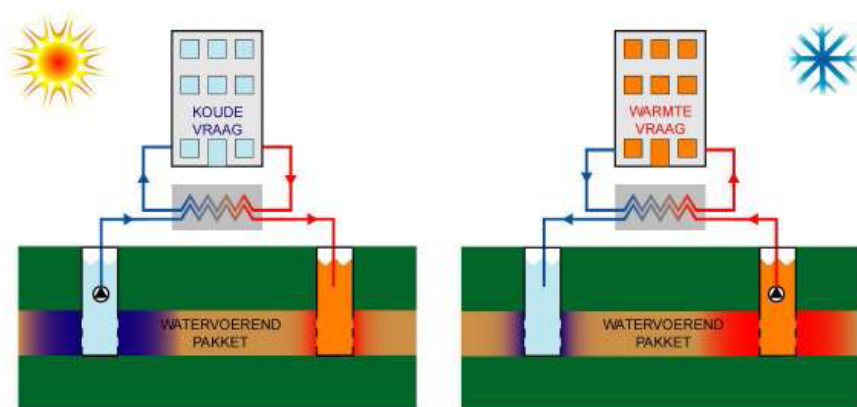
Hernieuwbare energie: warmte & koude

Ongelijktijdigheid vraag en aanbod



Uur/week/seizoen opslag van warmte/koude in:

- gebouw
- phase change materials
- opslagtanks
- grond

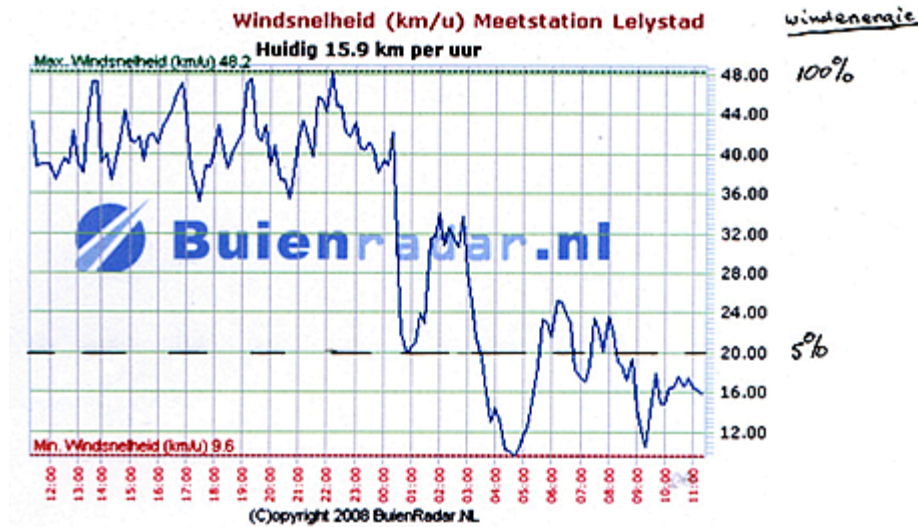


Hernieuwbare energie: elektriciteit

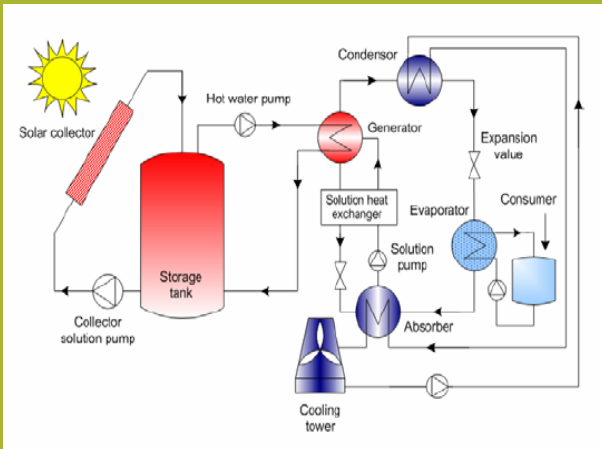
- Ongelijkzijdigheid vraag en aanbod
- Grilligheid aanbod



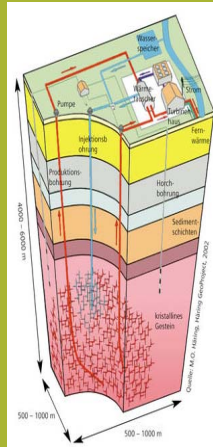
Teruglevering van elektriciteit aan het net



Nog meer creativiteit



Zon gedreven koelmachine



geothermie



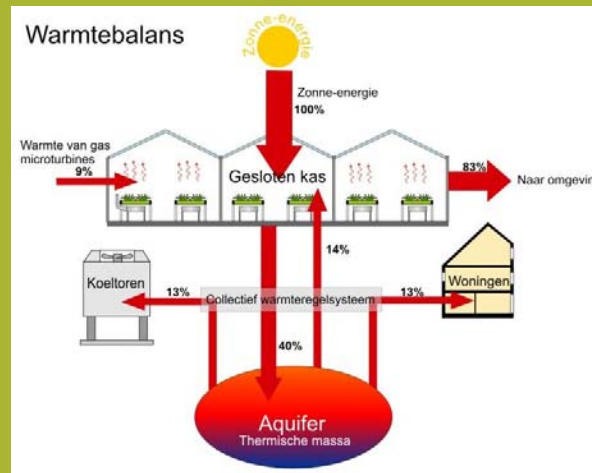
kaswoning



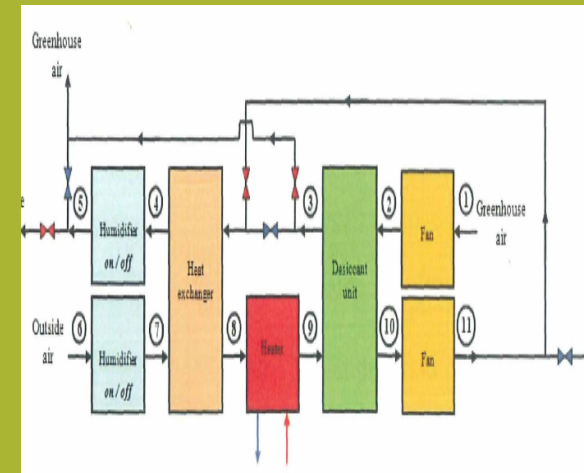
Hre-ketel



Kas met Fresnel lens



Warmte producerende kas



Reversi system

De trends

- Dynamische materialen
- Persuasive technology
- Smart energienetten
- Zelflerende adaptieve controlesystemen

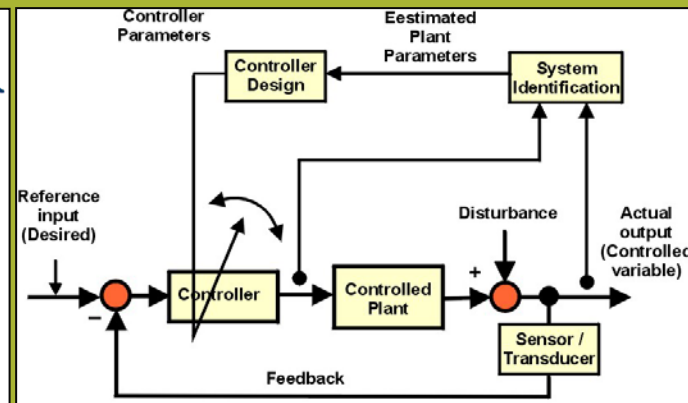
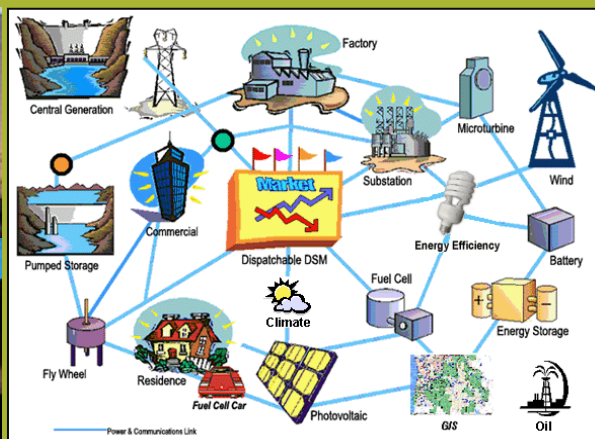
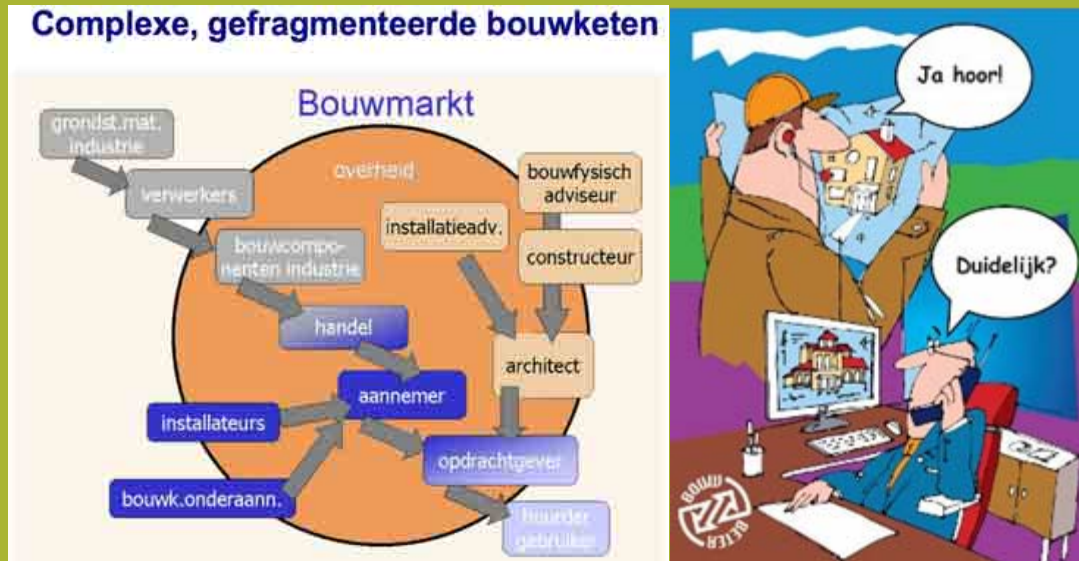


Fig.16: An adaptive control system

DEGELIJKHEID & VAKMANSCHAP

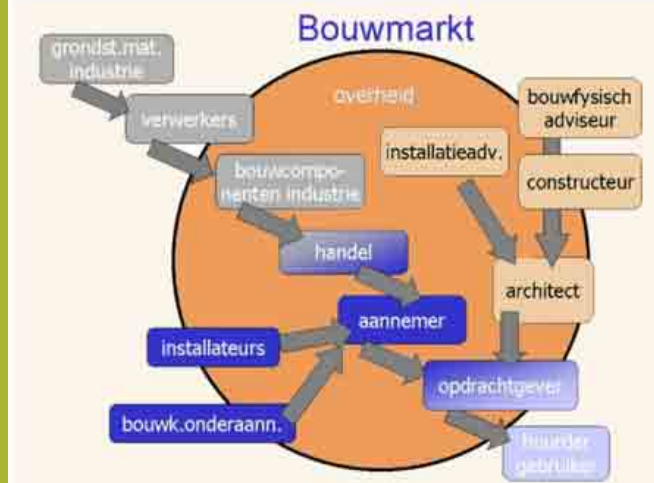


De niet-technische barrières



De niet-technische barrières

Complexe, gefragmenteerde bouwketen



Techniek is niet vanzelfsprekend: waar zitten de kennishiaten?





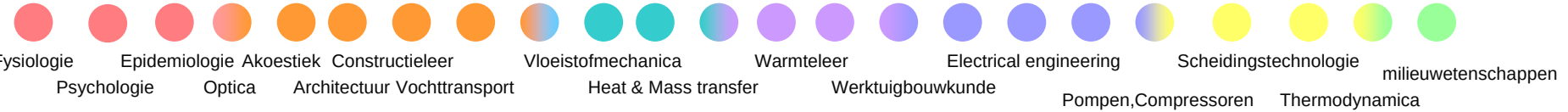
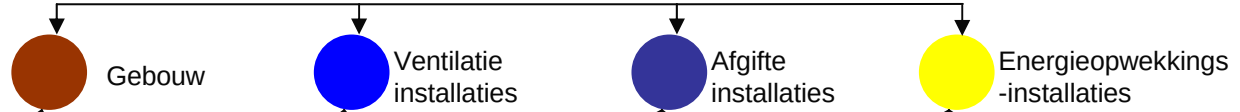
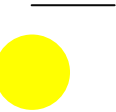
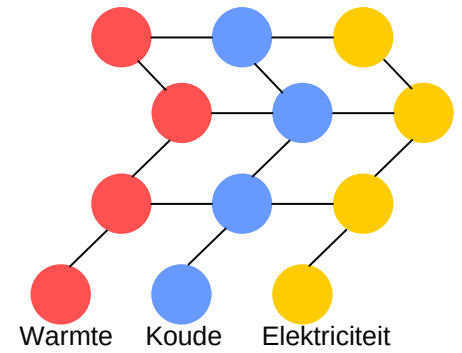
Comfort en
gezondheid

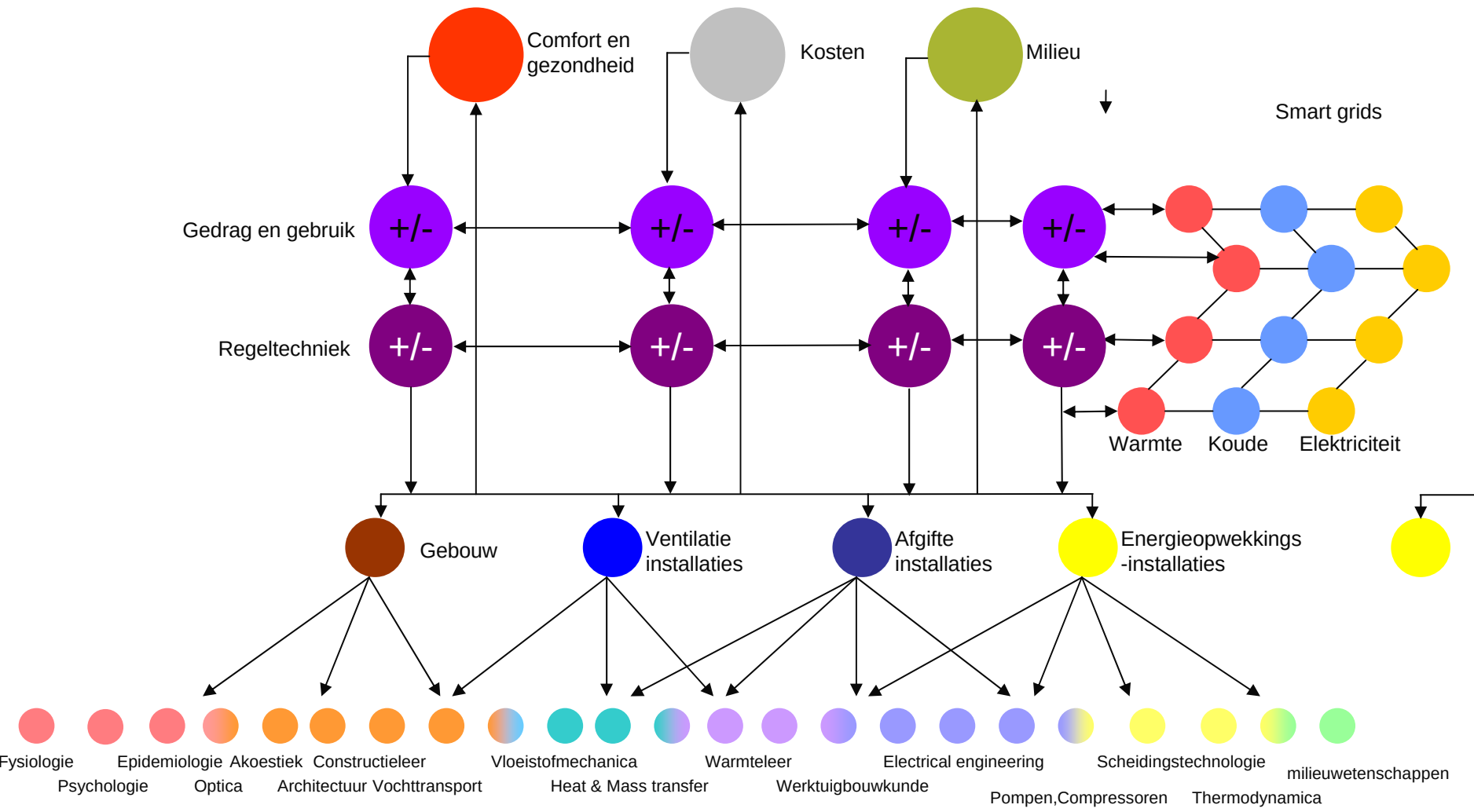


Kosten

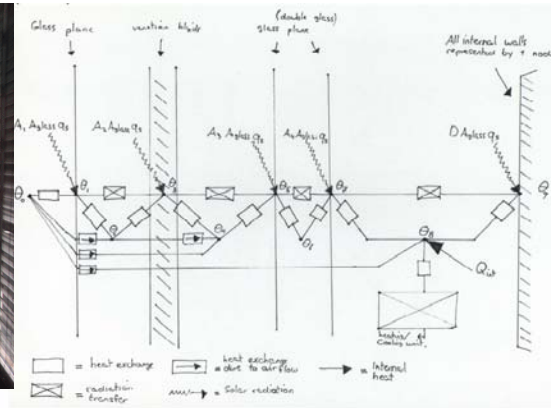


Milieu





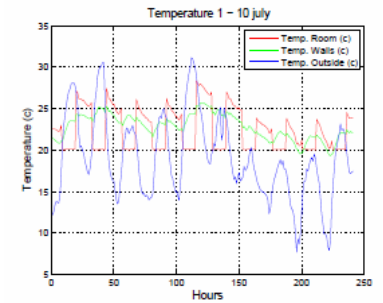
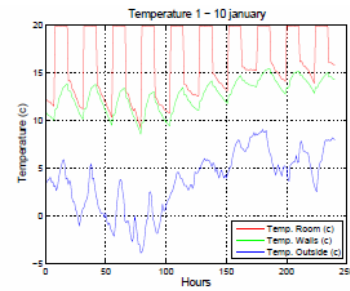
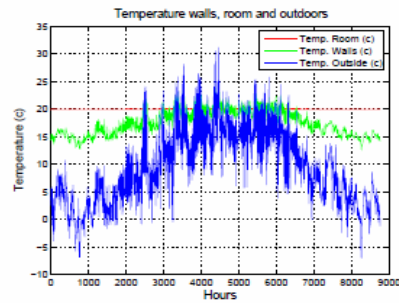
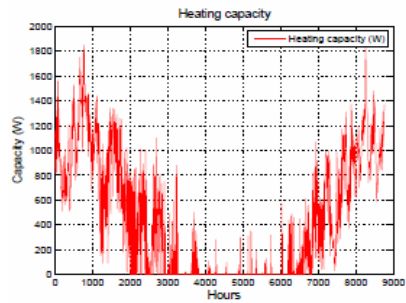
MODELLEREN EN SIMULEREN: GREEP KRIJGEN OP COMPLEXITEIT

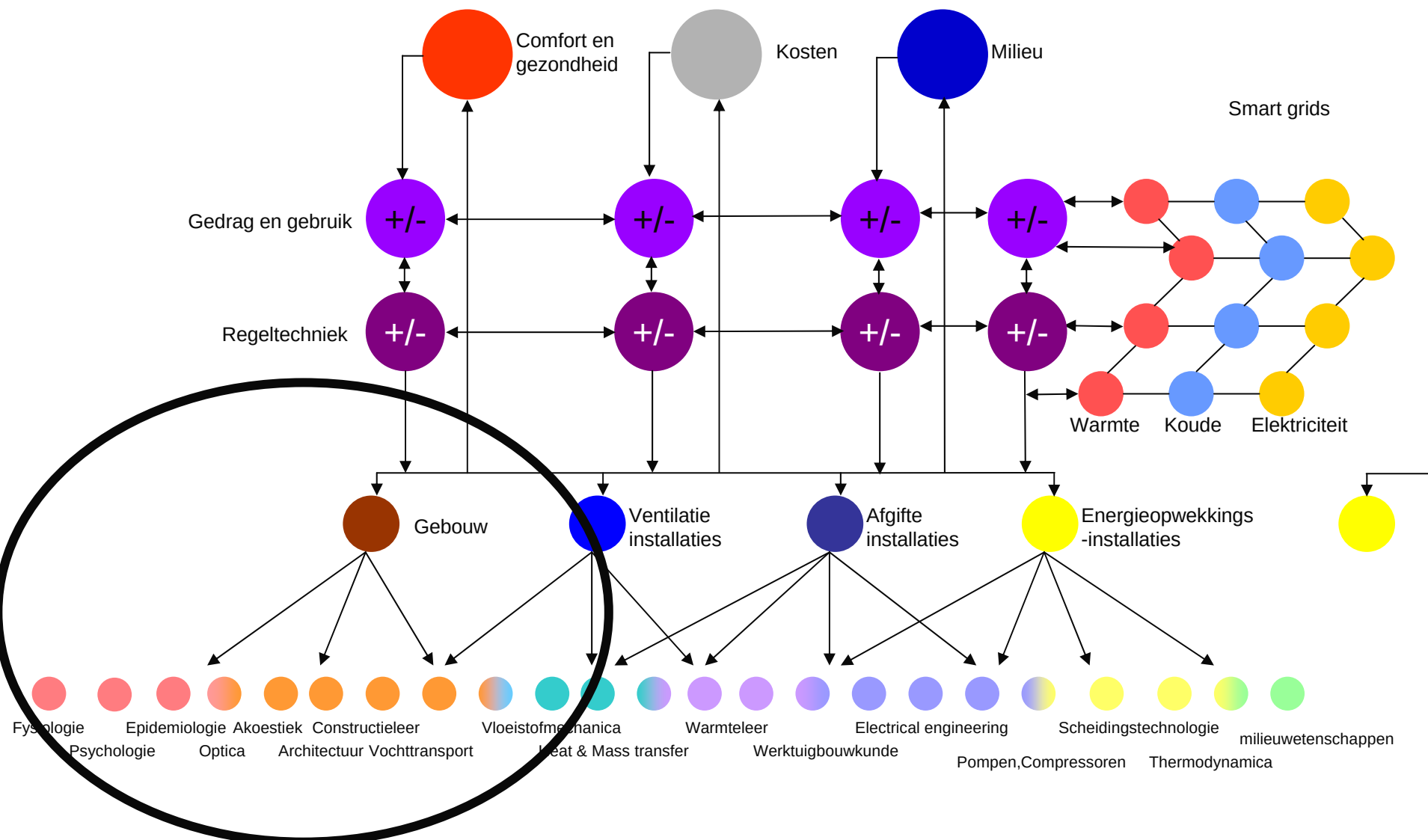


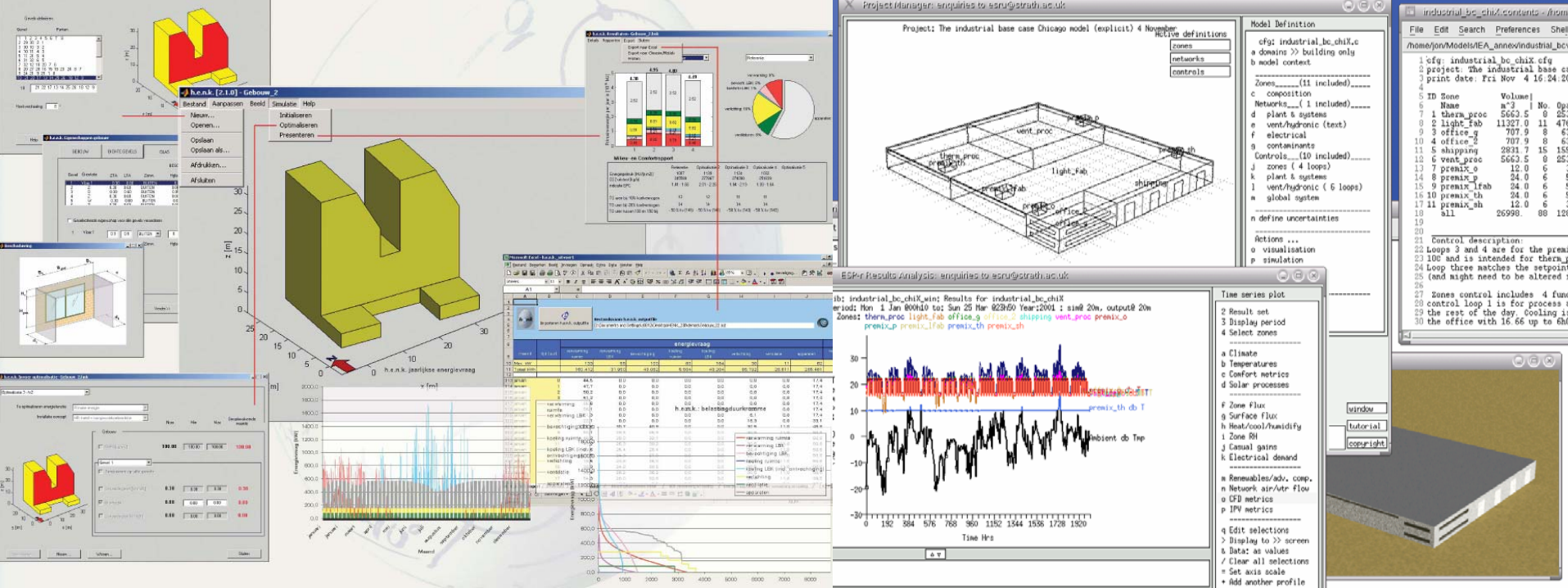
```
I = 50*thickness_wall-2;
% Response factors
X0 = 2/pi*(lambda_walls*rho_walls*cp_walls/dt_response)*0.5;
X1 = -X0*(2-2)*0.5;
X2 = -X0*(2*2*0.5-3*0.5-1*0.5);
X3 = -X0*(2*3*0.5-4*0.5-2*0.5);
% error and corrected response factors
error = X0*X1*X2*X3;
X2_corrected = X2 - error/(1-1-2);
X3_corrected = X3 - error/(1-1-2);
X = [X1; X2_corrected; X3_corrected];
X = A_walls*X;
```

We need to define a vector to count if it's office hours or not. That's done by this piece of code. H will be 1 inside office hours and 0 outside office hours.

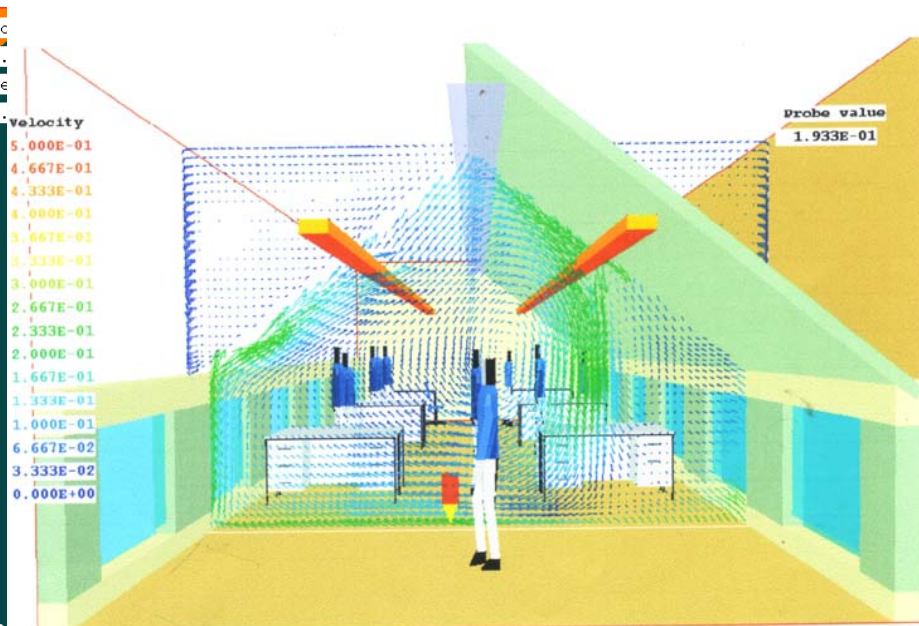
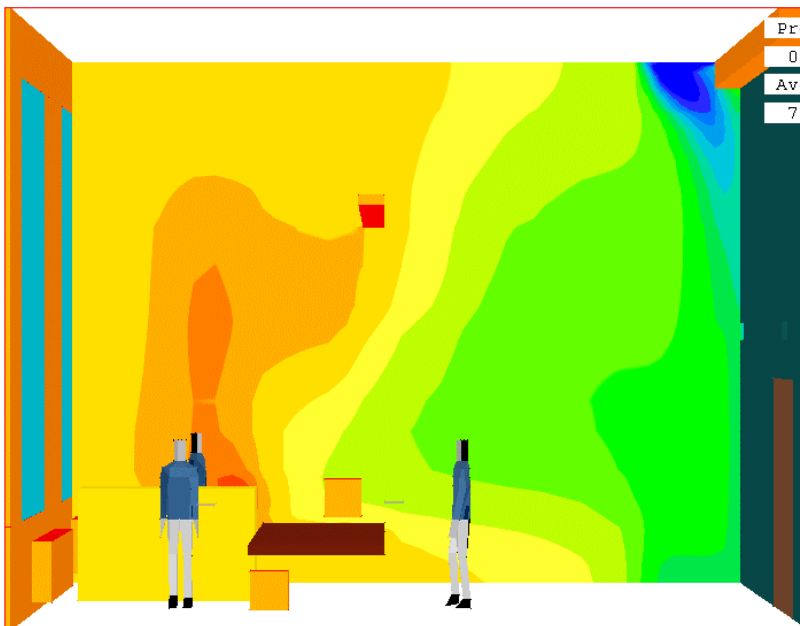
```
H=zeros(length(data),1);
k = 0;
for i=1:length(data)
    if mod(i,24)>=8 && mod(i,24)<=18
        H(i,1)=1;
    else
        H(i,1)=0;
    end
end
if var==1
    H=ones(length(data),1);
end
```

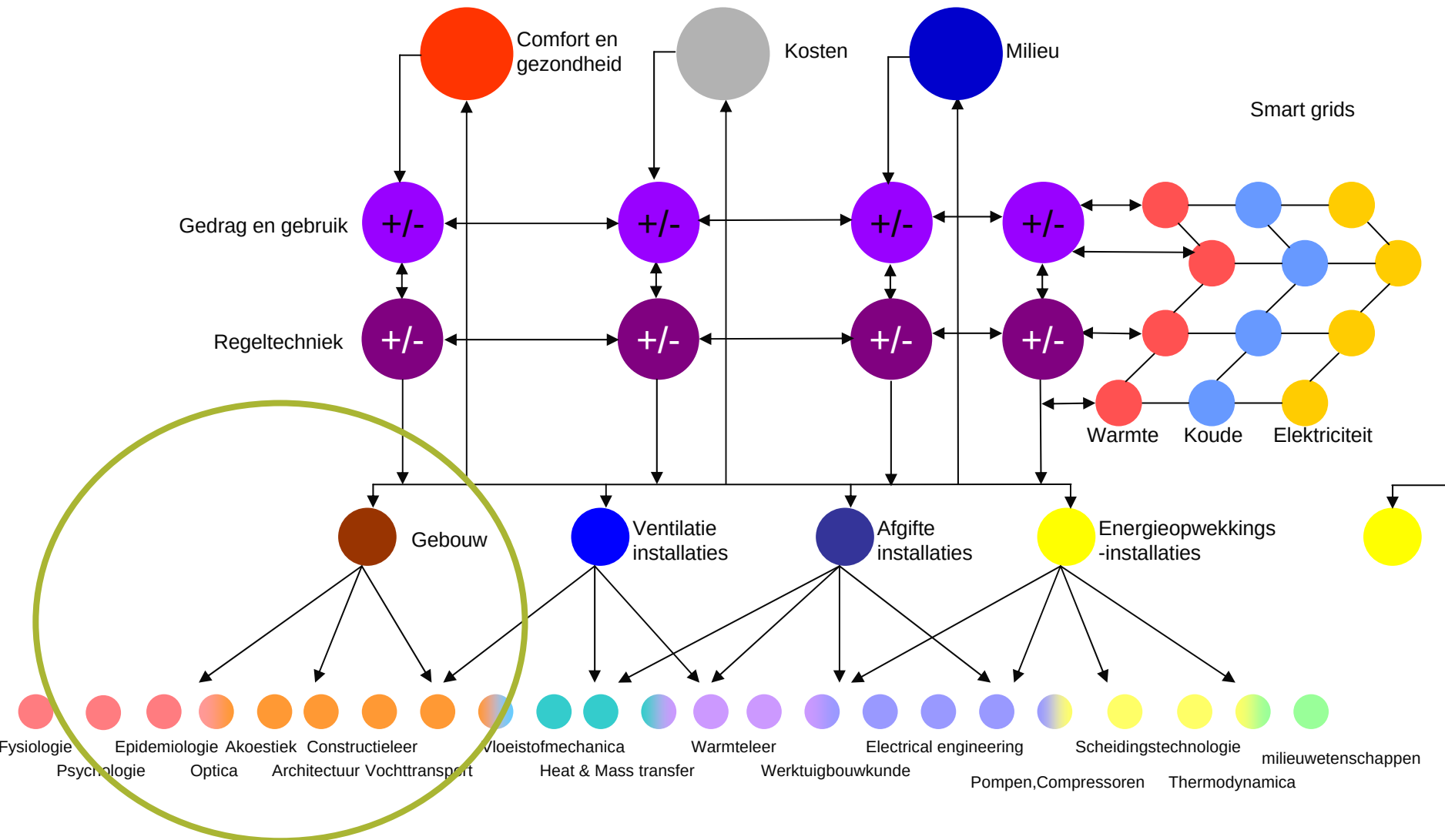


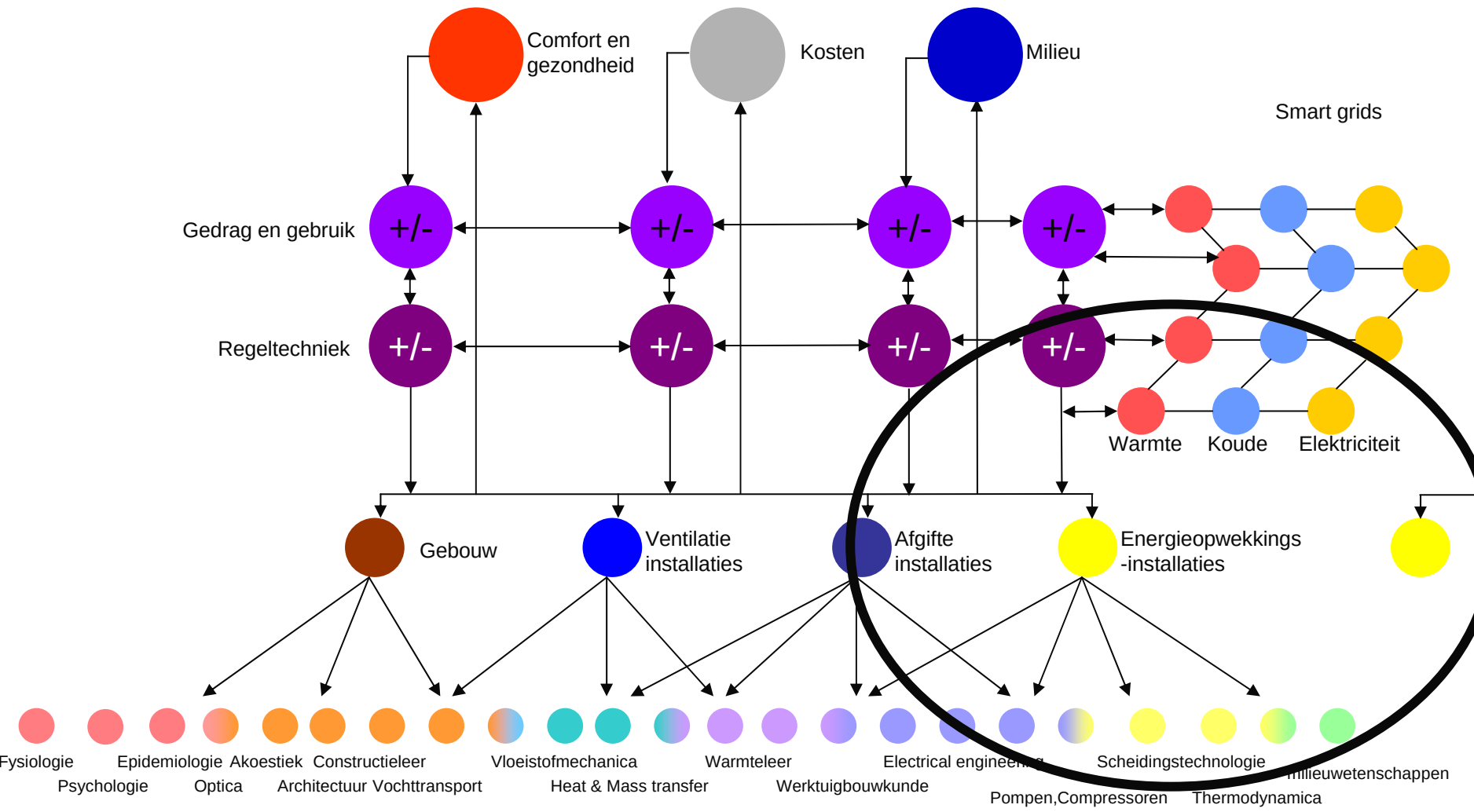


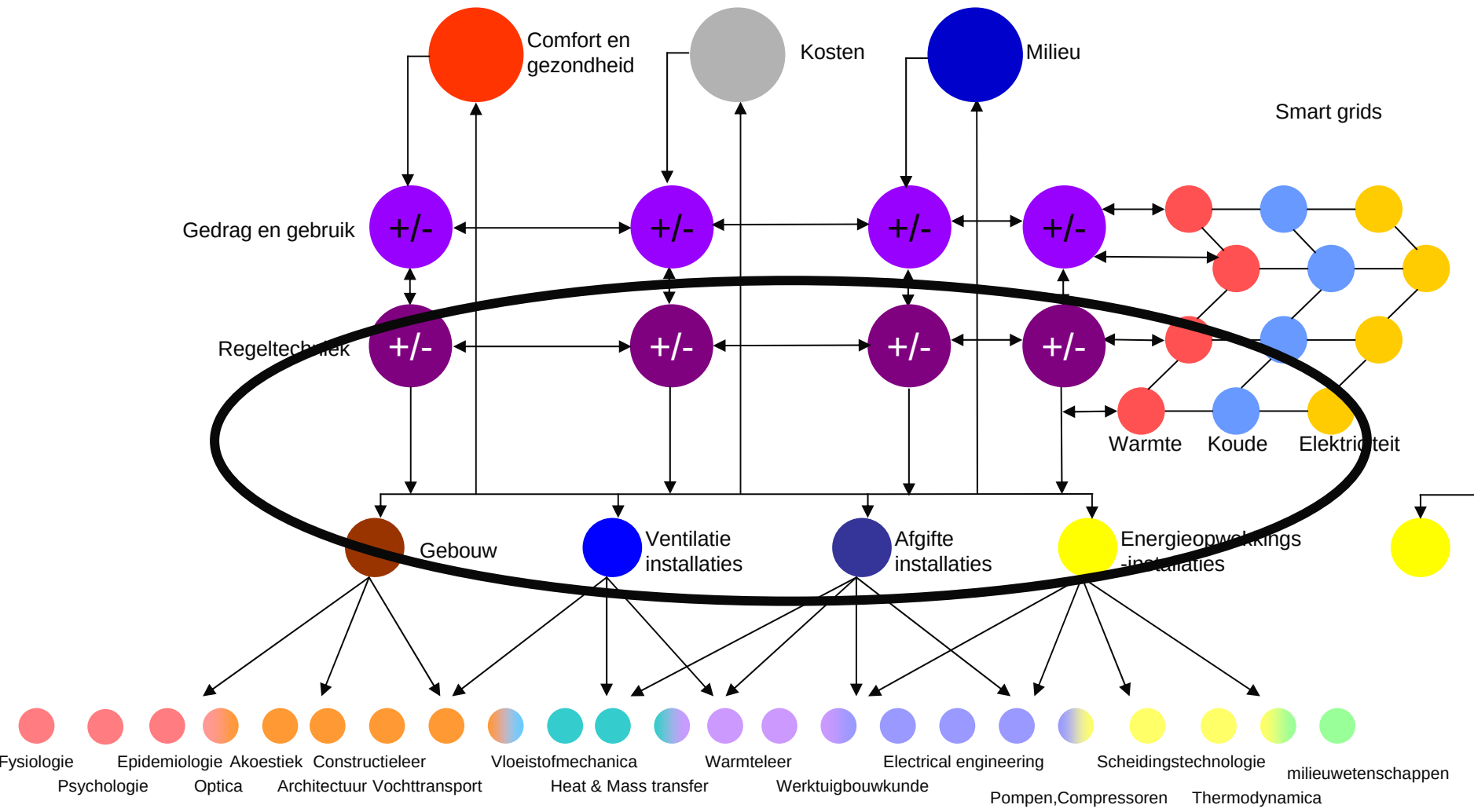


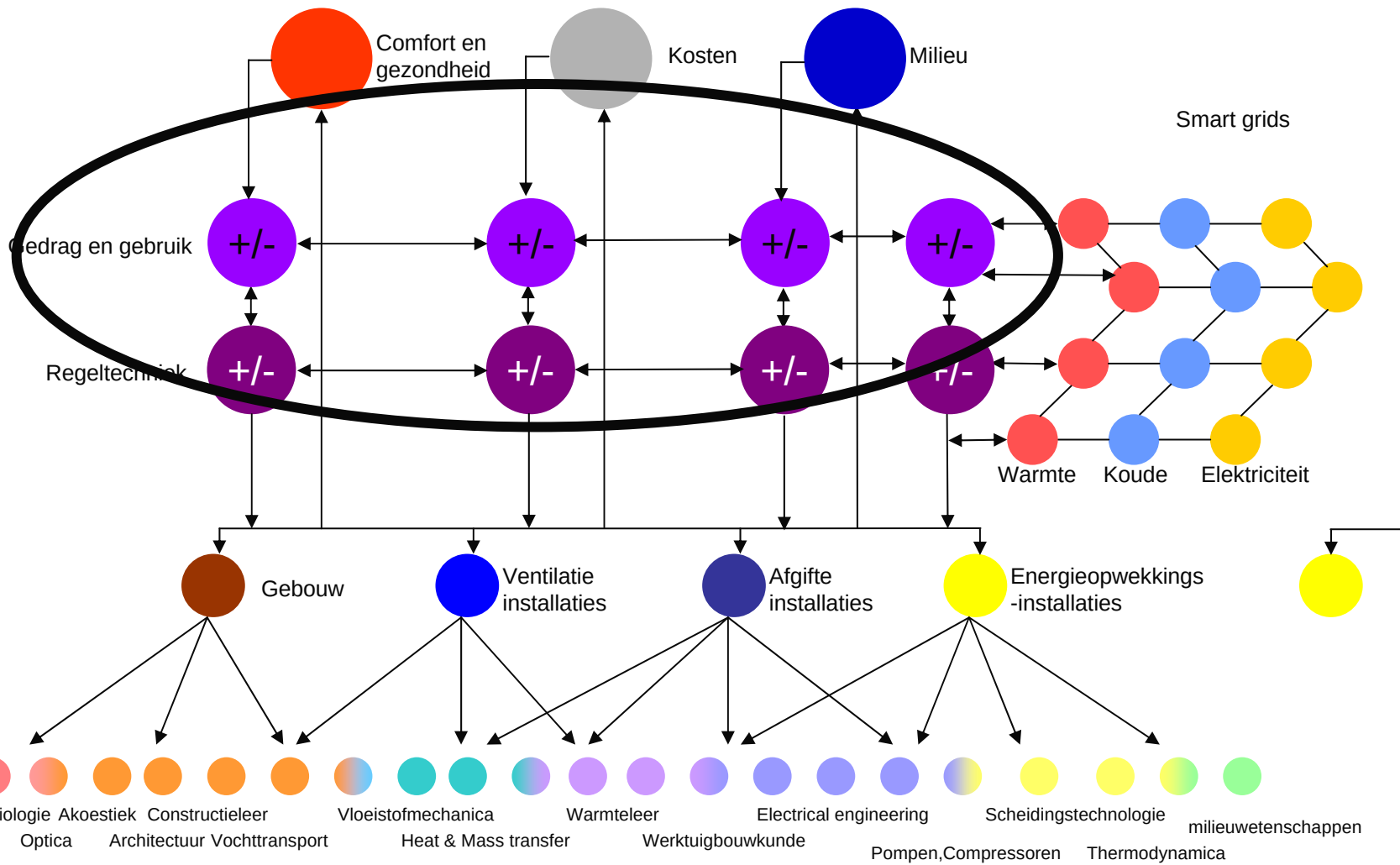
C1
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 1.167E+00
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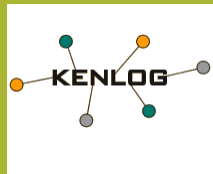


LECTORAAT ENERGIE & DE GEBOUWDE OMGEVING

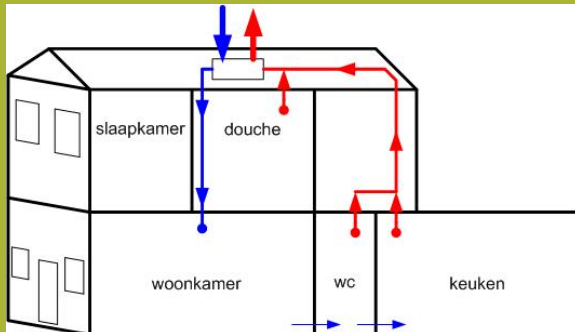
Bedrijfsprojecten



Kweekflats



CO₂ neutrale
wijk



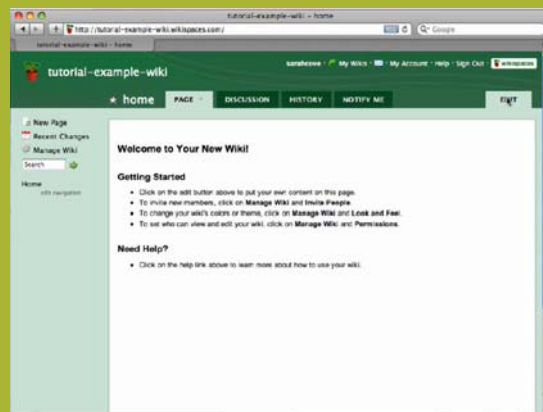
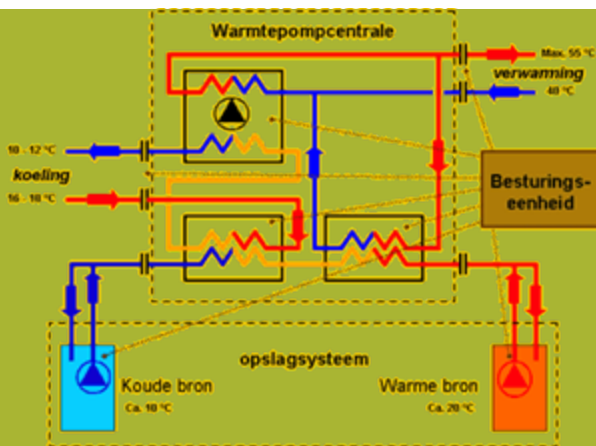
Energiebesparing in woningen, Ecohuis



Validatie model betonkernactivering

Kennisoverdracht: wiklimaatinstallaties

- Didactisch tool
- Kennisdatabank
- Ingang voor ontwerpers, monteurs, studenten
- Gekoppeld aan modellen

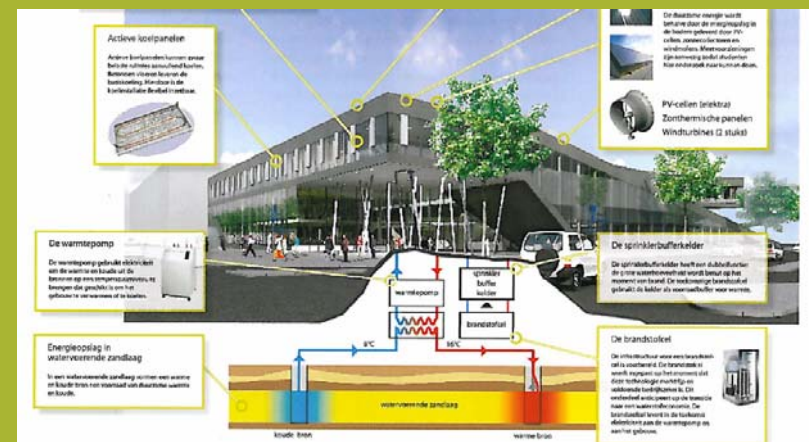
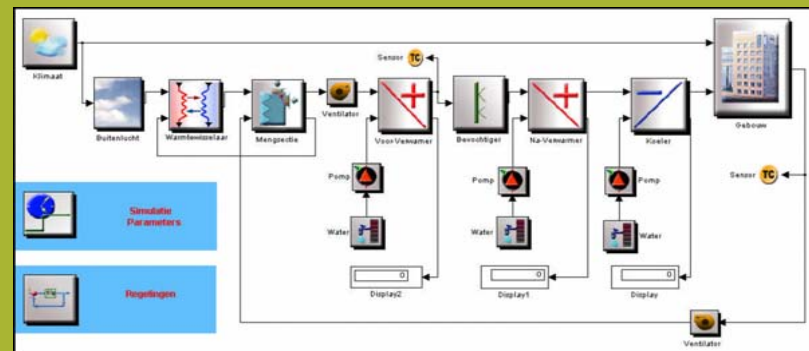


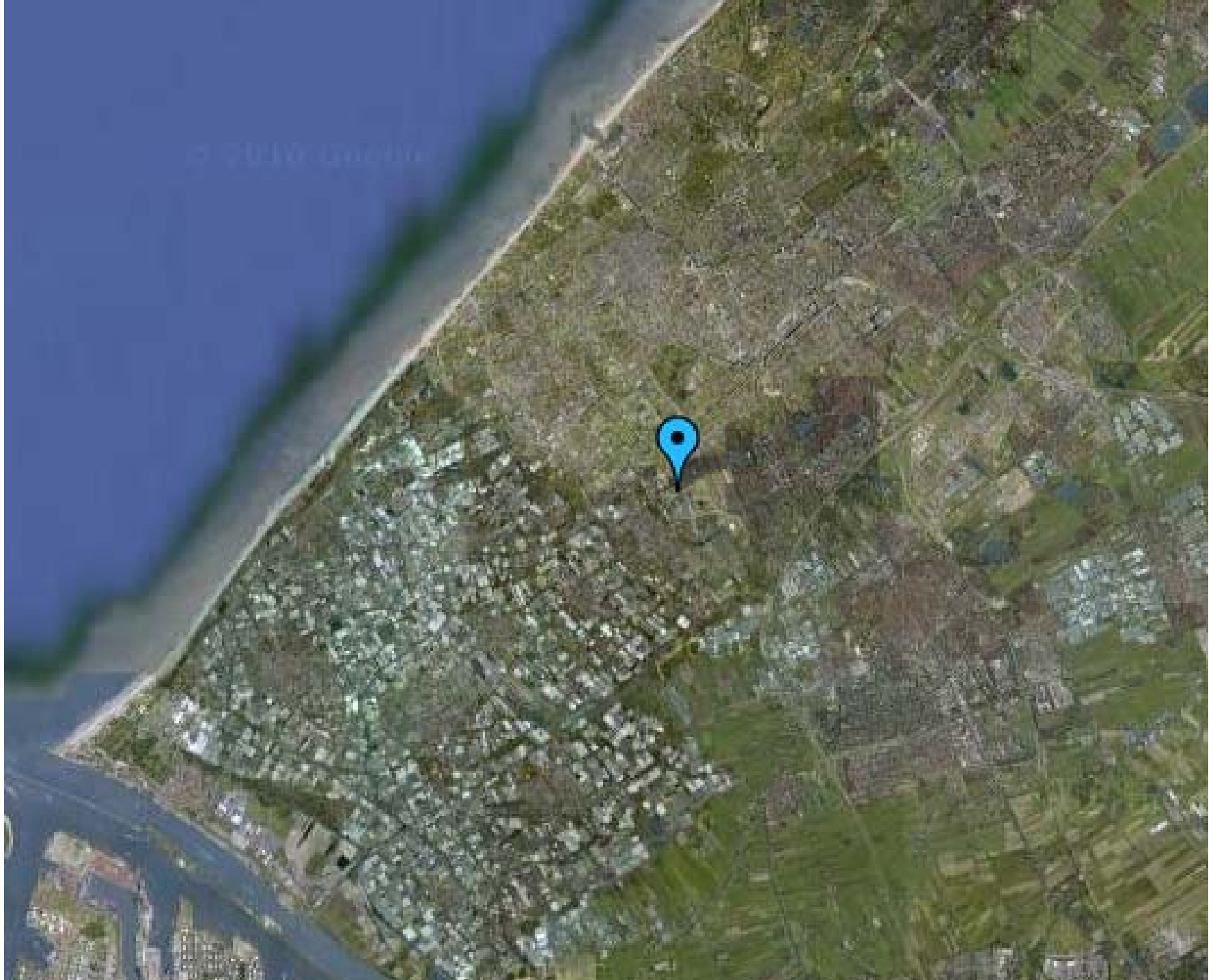
Gebouwbeheersysteem

- GBS als diagnose instrument voor optimaal klimaatbeheer
- GBS als besturingsmodel bij veranderende huisvestings situatie
- De toekomst: zelf lerende adaptieve GBS



Modellenbibliotheek voor installaties en regelstrategieën: CLIMASIM





Climate Adaptive Glastuinbouw: Inverse modelling



Ministerie van Economische Zaken

Productschap



Tuinbouw



DE HAAGSE
HOGESCHOOL



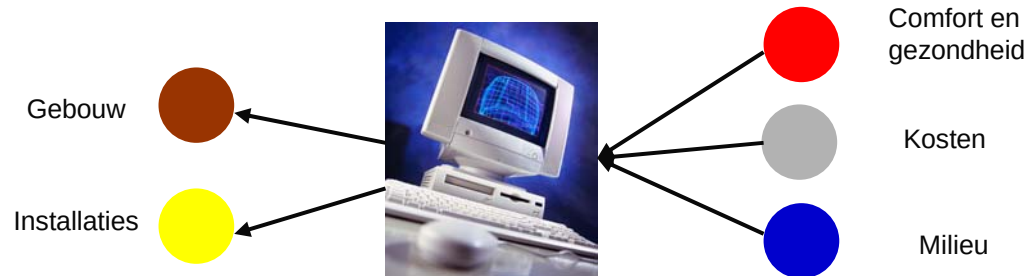
WAGENINGENUR
For quality of life

TU/e

TU Delft



Energiebesparing: 70%?





Arie Taal
(Climasim)



Frans Joosstens
(GBS)



Joep de Groot
(Wiki)



Johan Woudstra
(Draadloze energie)





No-nonsense energieontwerp: Tussen creativiteit en degelijkheid

Laure Itard, lector Energie & de Gebouwde Omgeving