
“Hoezo is een spaarlamp duurzamer dan een
ouderwetse gloeilamp?”

Duurzaamheidsverwarring als opstapje naar
betekenisvol natuurkunde-onderwijs

53st WND-conferentie, 14-15, december, 2018, Noorwijkerhout

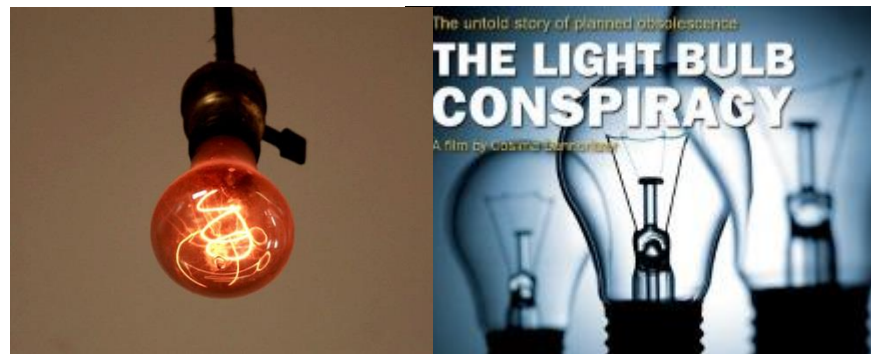
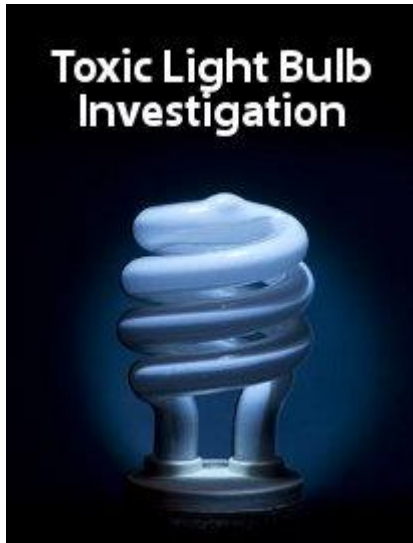
Arjen Wals



Inhoud

- Duurzaamheid is complex, vaag, bedreigend en urgent – ‘aantrekkelijk onduidelijk’
- Hoe slim is je smartphone? Voorbeeld van inclusief relevant, responsief en reflexief bèta-Onderwijs
- Didactische uitgangspunten voor duurzaamgericht natuurkunde-onderwijs

Eens – oneens? Een spaarlamp is duurzamer dan een gloeilamp



Stellingen – eens of oneens....

- Elektrisch rijden is duurzamer dan het rijden op benzine
- Zonnepanelen zijn niet duurzaam omdat ze gebruik maken van grondstoffen die eindig zijn
- Het gebruik van je eigen mok voor de koffie is duurzamer dan het gebruik van een kartonnen bekertje (plastic?) bekertje
- Kernenergie is vooralsnog de meest duurzame vorm van energie
- ++++++





Source: The Guardian

Image: Esteban De Armas/Shutterstock.com

It's official: scientists say we're entering Earth's sixth mass extinction

And humans may struggle to survive it.

FIONA MACDONALD 22 JUN 2015



THE SPECTATOR

11 July 2009 www.spectator.co.uk £2.95

**RELAX:
GLOBAL
WARMING IS
ALL A MYTH**



MOST USED Climate Myths

and what the science really says..

- 
- 1 - Climate's changed before
 - 2 - It's the sun
 - 3 - It's not bad
 - 4 - There is no consensus
 - 5 - It's cooling
 - 6 - Models are unreliable
 - 7 - Temp record is unreliable
 - 8 - Animals and plants can adapt
 - 9 - It hasn't warmed since 1998
 - 10 - Antarctica is gaining ice
- [View All Arguments...](#)

BEYOND 'FAKE NEWS'

10 TYPES OF MISLEADING NEWS

propaganda  <ul style="list-style-type: none"> adopted by governments, corporations and non-profits to manage attitudes, values and knowledge appeals to emotions can be beneficial or harmful 	partisan  <ul style="list-style-type: none"> ideological and includes interpretation of facts but may claim to be impartial privileges facts that conform to the narrative whilst forgoing others emotional and passionate language 	IMPACT  neutral  low  medium  high MOTIVATION  money  politics/power  humour/fun  passion  (mis)inform
clickbait  <ul style="list-style-type: none"> eye catching, sensational headlines designed to distract often misleading and content may not reflect headline drives ad revenue 	conspiracy theory  <ul style="list-style-type: none"> tries to explain simply complex realities as response to fear or uncertainty not falsifiable and evidence that refutes the conspiracy is regarded as further proof of the conspiracy rejects experts and authority 	
sponsored content  <ul style="list-style-type: none"> advertising made to look like editorial potential conflict of interest for genuine news organisations consumers might not identify content as advertising if it is not clearly labeled 	pseudoscience  <ul style="list-style-type: none"> purveyors of greenwashing, miracle cures, anti-vaccination and climate change denial misrepresents real scientific studies with exaggerated or false claims often contradicts experts 	
satire and hoax  <ul style="list-style-type: none"> social commentary or humour varies widely in quality and intended meaning may not be apparent can embarrass people who confuse the content as true 	misinformation  <ul style="list-style-type: none"> includes a mix of factual, false or partly-false content intention can be to inform but author may not be aware the content is false false attributions, doctored content and misleading headlines 	
error  <ul style="list-style-type: none"> established news organisations sometimes make mistakes mistakes can hurt the brand, offend or result in litigation reputable orgs publish apologies 	bogus  <ul style="list-style-type: none"> entirely fabricated content spread intentionally to disinform guerrilla marketing tactics; bots, comments and counterfeit branding motivated by ad revenue, political influence or both 	

DIG DEEPER...

false attribution authentic images, video or quotes are attributed to the wrong events or person	misleading content does not represent what the headline and captions suggest
counterfeit websites and Twitter accounts that pose as a well-known brand or person	doctored content content, such as statistics, graphs, photos and video have been modified or doctored

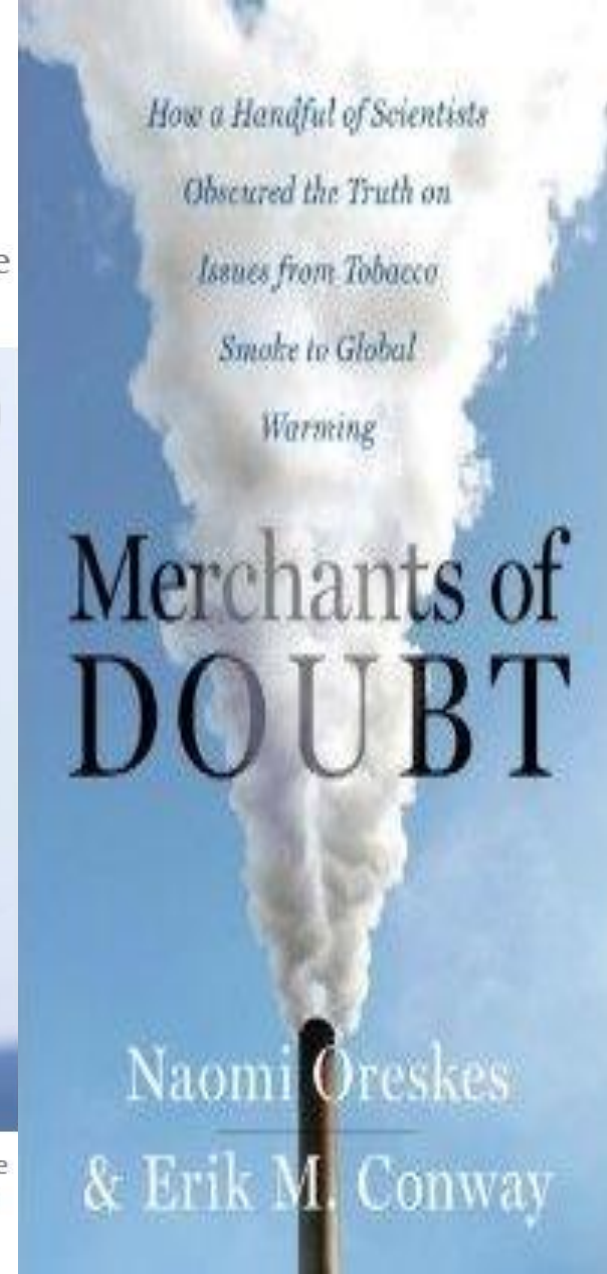

eavi
 MEDIA LITERACY
 for CITIZENSHIP
www.eavi.eu

N.B. The impact and motivation assignments are not definitive and should just be used as a guide for discussion



Doubt over climate science is a product with an industry behind it

With its roots in the tobacco industry, climate science denial talking points can be seen as manufactured doubt



📷 The manufacturing of doubt on climate change science, backed by the fossil fuel industry, has its roots with the tobacco industry's assault on climate science in the 1960s. Photograph: Richard Hamilton Smith/Richard Hamilton Smith/Corbis

Source: [The Guardian](#)



Donald J. Trump
@realDonaldTrump



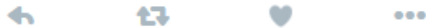
Following

Snowing in Texas and Louisiana, record setting freezing temperatures throughout the country and beyond. Global warming is an expensive hoax!

RETWEETS 428 LIKES 358



1:27 AM - 29 Jan 2014



Donald J. Trump
@realDonaldTrump

Follow

Any and all weather events are used by the GLOBAL WARMING HOAXSTERS to justify higher taxes to save our planet! They don't believe it \$\$\$\$!

RETWEETS 297 LIKES 206



1:40 PM - 26 Jan 2014



Donald J. Trump
@realDonaldTrump



Following

The concept of global warming was created by and for the Chinese in order to make U.S. manufacturing non-competitive.

RETWEETS 24,831 LIKES 14,654



2:15 PM - 6 Nov 2012



Donald J. Trump
@realDonaldTrump



Following

NBC News just called it the great freeze - coldest weather in years. Is our country still spending money on the GLOBAL WARMING HOAX?

RETWEETS 2,089 LIKES 1,019



5:48 PM - 25 Jan 2014



plantbottle™

up to 30% plant-based
100% recyclable bottle

redesigned plastic,
recyclable as ever.





WEL OF NIET SPORTEN
DIT WEEKEND?

Warmtebron

Opgeslagen
zonne-energie uit:



lucht



bodem



water

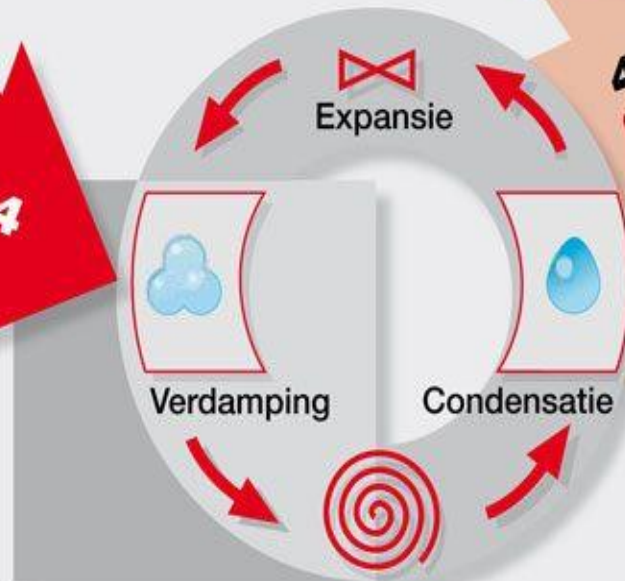
+ Elektrische energie

uit bv waterkracht, windenergie
of elektrische zonnecellen



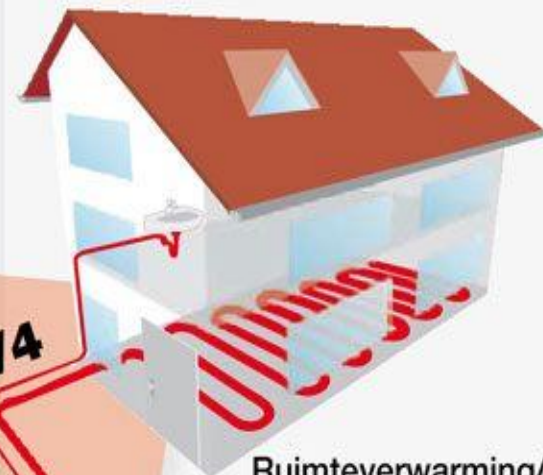
Koude kringloop

Verwarmingskringloop



Compressie

4/4



Ruimteverwarming/
warm tapwater



NRC checkt: 'Elektrische auto's belasten het klimaat'

Dat schrijft *Der Nordschleswiger*, op basis van onderzoek in Zweden.

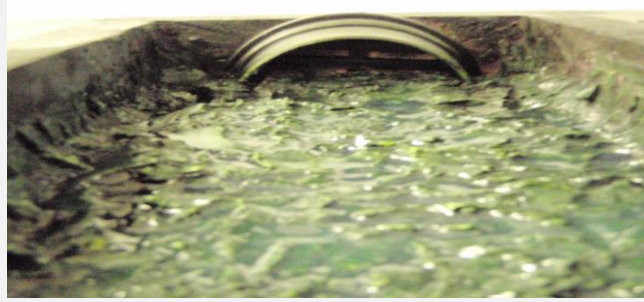
✎ Paul Luttkhuls © 25 juni 2017



ONDUURZAAM

DUURZAAM

BEKEND



EERST
ONBEKEND,
NU BEKEND



ZOU
WELEENS...


wifi





We are the students of today
attending the schools of yesterday
being taught by the teachers of the past-
with methods from the Middle Ages
to solve the problems of the future!



Hoe kun je jongeren betekenisvol betrekken bij het zoeken naar duurzaamheid?

Link to the 3D file
goo.gl/LUI3vx



iPhone 6 (S)



iPhone 6 (C)



iPhone 6 'MacFan' concept | (c)2014 | Martin Hajek | www.martinhajek.com | [@deplaatjesmaker](https://twitter.com/deplaatjesmaker) | martinhajek@outlook.com



Wat zit er in?
Waarom zit het erin?
Waar komt het vandaan?

Begrip

Wat doet het met ons?
Wat doet het met
anderen?

Betekenis &
betrokkenheid

Hoe kan het ons helpen
bij verduurzaming?

Ontwerpen &
handelen



Mobile Phone Composition

Materials Research Institute
Sheffield Hallam University



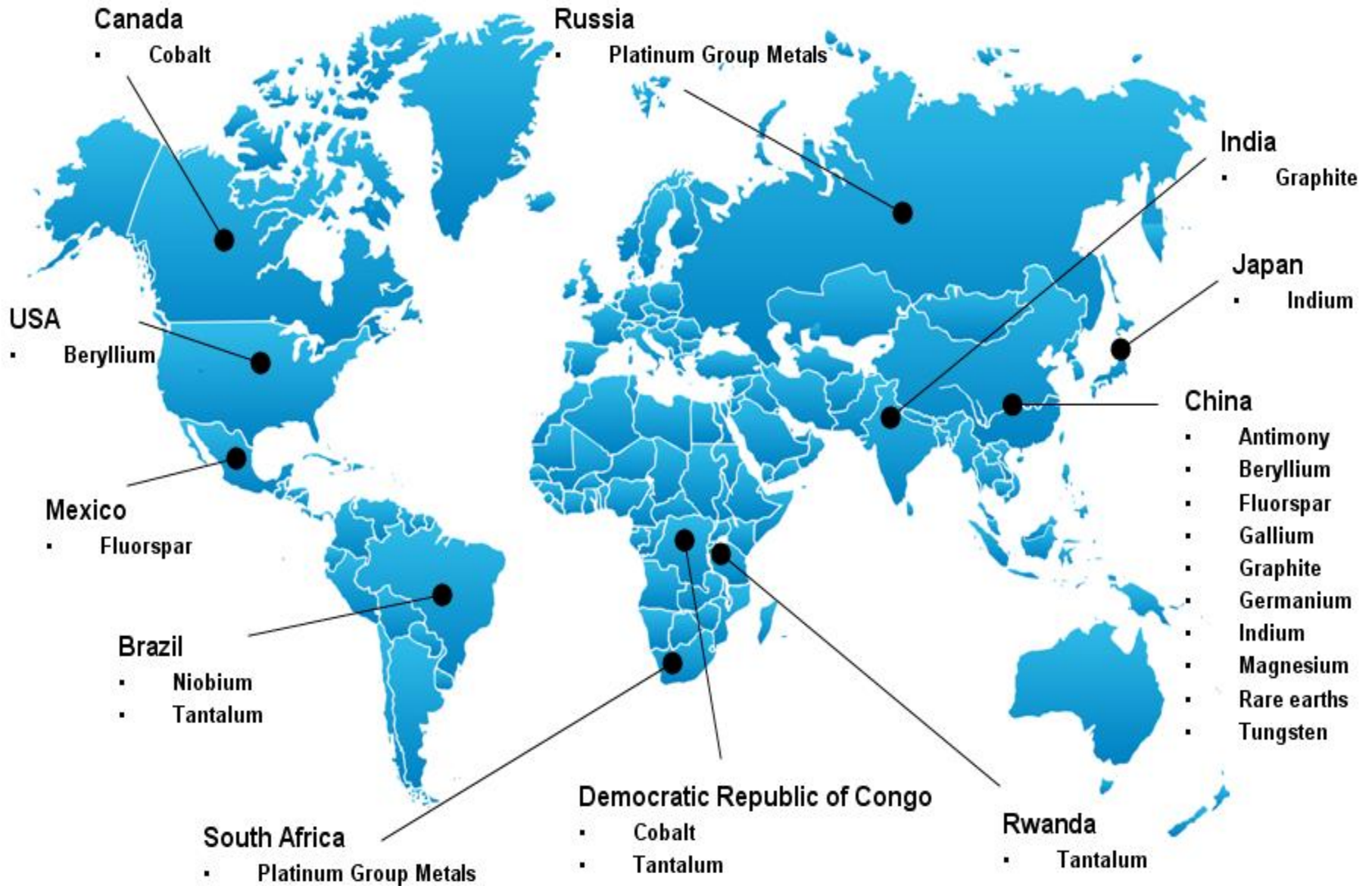
Mostly contained in...

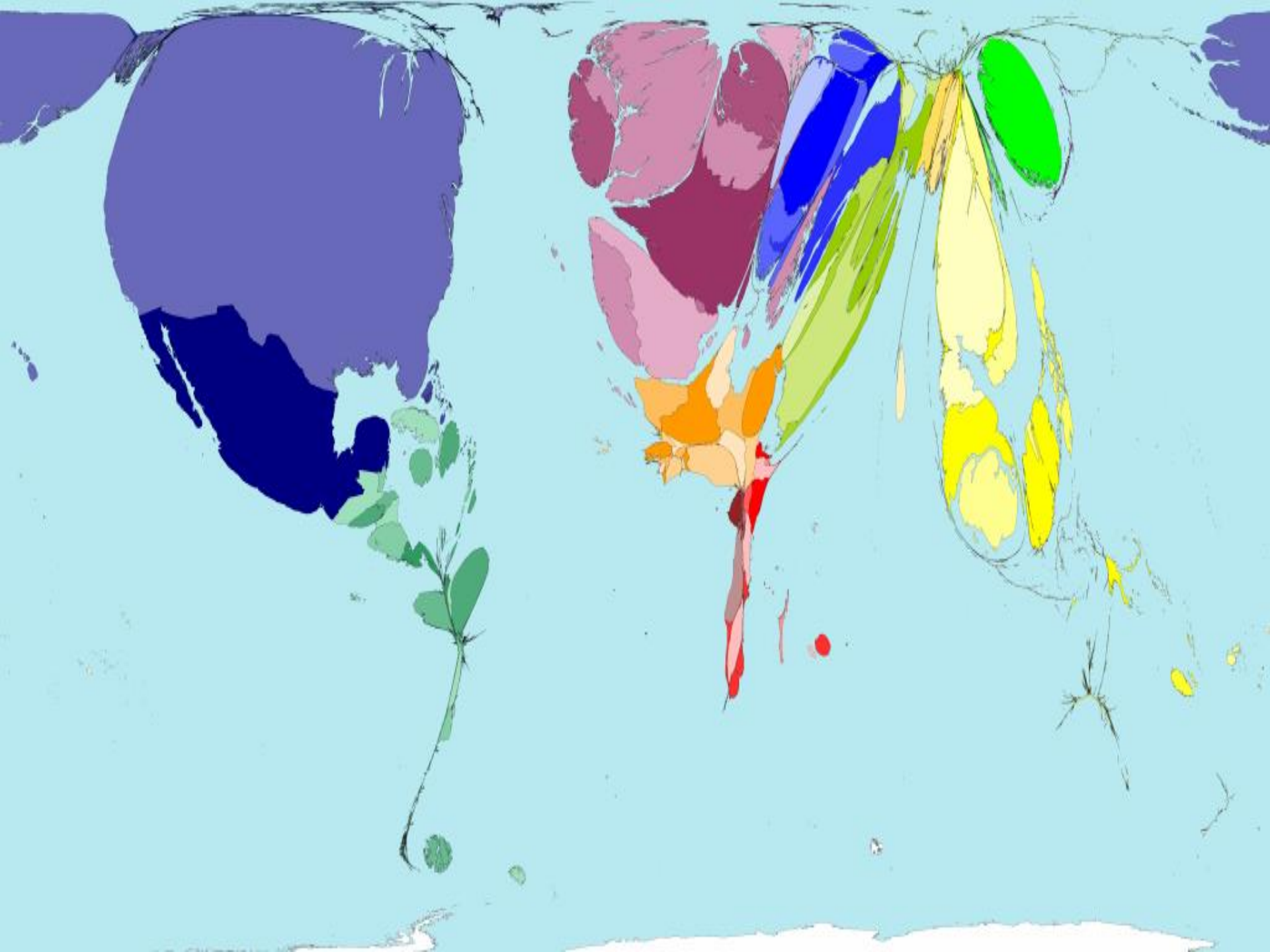
- Circuit Boards
- Screen
- Case
- Chips
- Wires
- Batteries

9 F Fluorine 0.040	11 Na Sodium 2.75	12 Mg Magnesium 0.934	14 Si Silicon 23.96	15 P Phosphorus 0.688	16 S Sulfur 0.499	17 Cl Chlorine 0.166	19 K Potassium 0.978	20 Ca Calcium 10.94	21 Sc Scandium 0.0032
22 Ti Titanium 1.96	23 V Vanadium 0.046	24 Cr Chromium 0.059	25 Mn Manganese 0.0483	26 Fe Iron 1.52	27 Co Cobalt 0.110	28 Ni Nickel 3.10	29 Cu Copper 25.69	30 Zn Zinc 0.145	31 Ga Gallium 0.156
32 Ge Germanium 0.075	33 As Arsenic 0.185	34 Se Selenium 0.0007	35 Br Bromine 0.0080	37 Rb Rubidium 25.69	38 Sr Strontium 0.123	39 Y Yttrium 0.026	40 Zr Zirconium 0.142	46 Pd Palladium 0.068	48 Cd Cadmium 0.687
49 In Indium 0.033	50 Sn Tin 5.06	51 Sb Antimony 0.060	53 I Iodine 0.414	56 Ba Barium 4.98	60 Nd Neodymium 1.25	64 Gd Gadolinium 0.052	68 Er Erbium 0.0512	69 Tm Thulium 0.011	72 Hf Hafnium 0.004
74 W Tungsten 0.642	77 Ir Iridium 0.036	79 Au Gold 0.484	81 Tl Thallium 0.0028	82 Pb Lead 0.789	83 Bi Bismuth 0.023	85 Am Americium 0.0033			

Mass %

Production concentration of critical raw mineral materials





FAIRPHONE dissect 001 SAGEM MC 820 (1998)



IC's
(silicium in kunststof behuizingen)



Connectoren
(vaak verguld !)



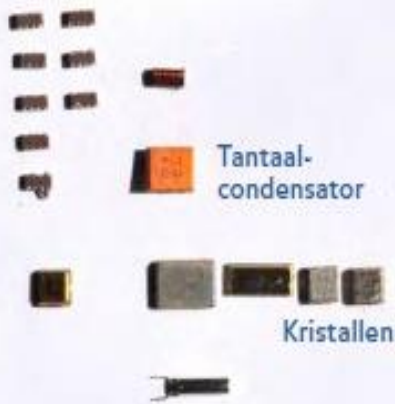
Tantaal-condensatoren



Sub-semblages
(te klein voor vandaag)



Afdek-plaatjes
(metalen)



Tantaal-condensator

Kristallen



Weerstandjes,
Diodes, etc. etc.
(te klein voor vandaag)



De printplaat bevat
nog tin, koper
en soms goud.

Wat zit er in?
Waarom zit het erin?
Waar komt het vandaan?

Wat doet het met ons?
Wat doet het met
anderen?

Hoe kan het ons helpen
bij verduurzaming?



Begrip



Betekenis &
betrokkenheid



Ontwerpen &
handelen



Conflict minerals

Bron: returntonow.net/2016/09/25/cell-phones-are-the-new-blood-diamonds/



7-year-old children mine the minerals used to make our cell phones and laptops



Bron: returntonow.net/2016/09/25/cell-phones-are-the-new-blood-diamonds/



© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com



search ID: dfo0593

"THE SAD PART IS THEY'RE TALKING TO EACH OTHER."

Scientists Study Nomophobia— Fear of Being without a Mobile Phone

Is it making us sick

How do you feel when you
misplace your phone?



73% Panicked



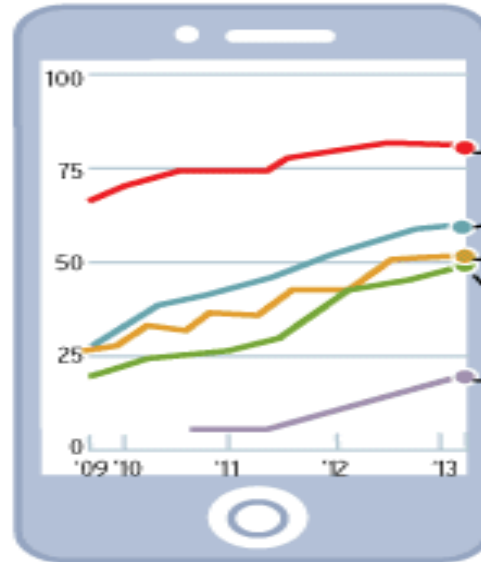
14% Desperate



7% Sick



6% Relieved



Phones have other smarts

The percentage of smartphone owners
who use their phone to ...

81% Send or receive
text messages

60% Access the Internet

52% Send or receive email

50% Download apps

21% Video calls

From dawn to dusk

83%

of millennials, those
age 18-25, sleep with
their cellphone.



62%

of all smartphone users
immediately grab their
phones after waking up.

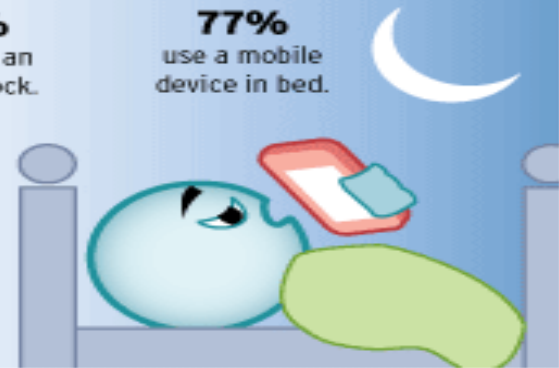
79%
of all 18 to 24-year-old
smartphone users look at
their phones within the first
15 minutes of waking up.

44%

use it as an
alarm clock.

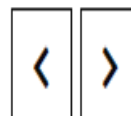
77%

use a mobile
device in bed.





Bron:
www.radiationhealthrisks.com/5g-cell-towers-dangerous/



WHY 5G CELL TOWERS ARE MORE DANGEROUS

Plans to transition to 5G around the world are already underway. It's an exciting and terrifying time for technology. Experts believe the new 5G cell towers are more dangerous than other towers, causing a whole new host of health problems for everyone.

5G cell towers are more dangerous than other cell towers because of the shorter length of millimeter waves (MMV) required to support the bandwidth. According to experts, 5G uses a bandwidth with shorter waves which do not travel through buildings. To make sure the bandwidth is reliable, small cell stations will be everywhere- outside your apartment, corner of a light pole and at the local bakery. Health experts believe 5G will have a devastating impact on our health.

Q Search

RECENT POSTS

[15 Ways To Protect Yourself From Cell Phone Radiation](#)

[Can Cell Phone Use Cause Brain Tumors?](#)

[Cell Phone Radiation and Babies](#)

[Do Bluetooth Earbuds Cause Brain Tumors?](#)

[Are Smart Meters Really Dangerous?](#)

[Smart Meter Guard Product Review](#)

[Does WIFI Create Health Problems?](#)

[Wifi Router Guard Product Review](#)

[HF-35C High Frequency Analyzer Product Review](#)



Wat zit er in?

Waarom zit het erin?

Waar komt het vandaan?

Wat doet het met ons?

Wat doet het met
anderen?

Hoe kan het ons helpen
bij verduurzaming?



Begrip



Betekenis &
betrokkenheid



Ontwerpen &
handelen



We are following this road to a fairer phone

Made with care
Building relationships
for better practices,
from working
conditions to recycling

Precious materials
Conflict-free, fair
resources that put
people first

Smart design
Open and responsible
design for easy repair
and fair electronics

Health promoting
Low radiation, non-
toxic

Clear deals
Fair, transparent
pricing and production
plus an opportunity to
support change

Lasting value
Addressing the entire
lifespan of mobile
phones and their
baterie





Op Schiphol kun je fietsend je telefoon opladen

Auteur: Erwin, gepost 23-05-2014 om 21:01  3 Reacties





WAGENINGENUR
For quality of life



UNIVERSITY OF GOTHENBURG

Waar zit de natuurkunde?

- Straling
- Trillingen, golven en geluid
- Warmte en materialen
- Elektriciteit en magnetisme
- ???

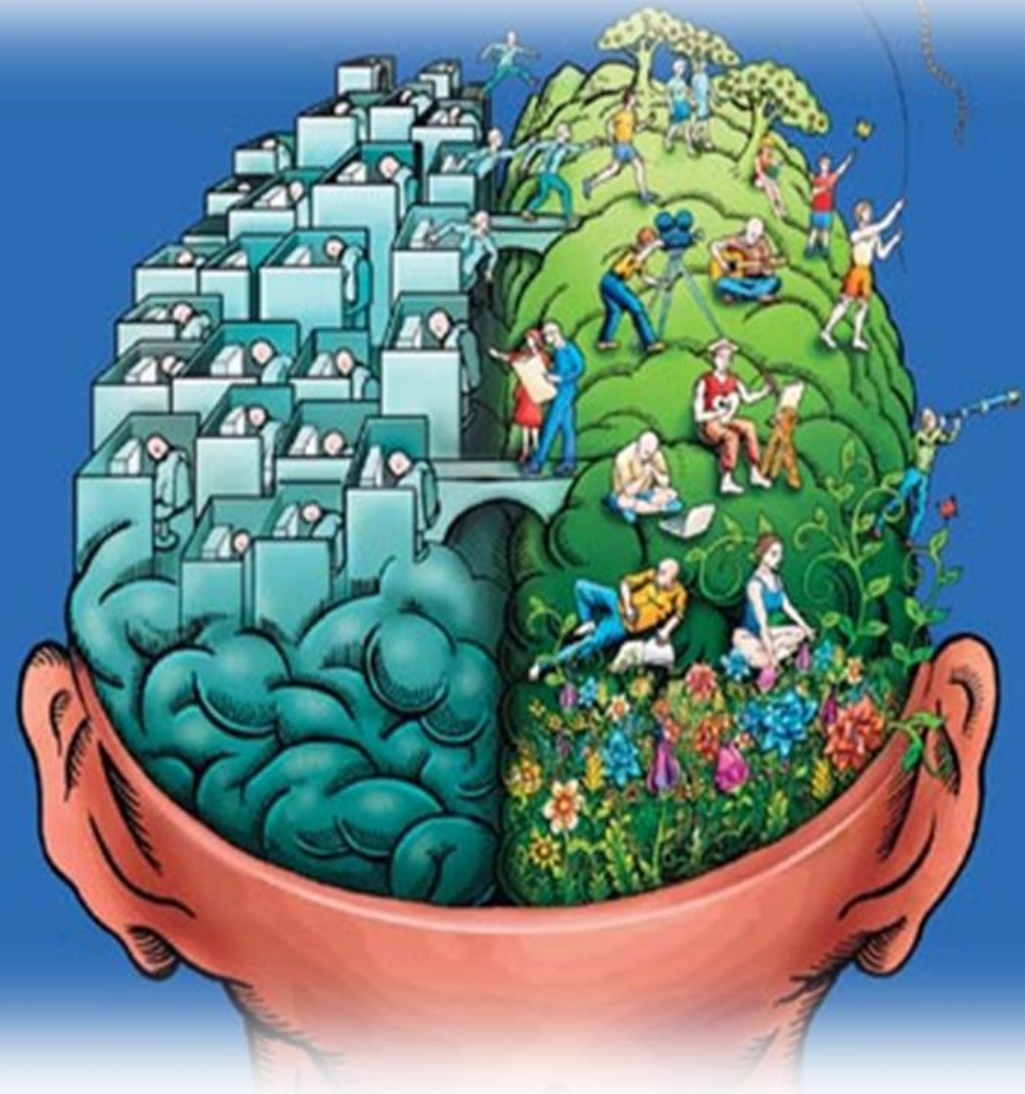
Waar zit de duurzaamheid?

- Maatschappelijke context
- Relaties met andere vakken/domeinen/pijlers
- Normatieve richting
- Handelingsperspectief

.....

DE VIER KERNCOMPETENTIES VAN LEREN VOOR DUURZAAMHEID

- Leren en eigen maken van kennis en inhouden (kringlopen, cradle-to-cradle, evenwicht, grenzen, systemen, afhankelijkheden.).
 - Ontdekken en begrijpen van nieuwe manieren van denken zoals kringloopdenken (cradle-to-cradle, sluiten van ketens, closed-cycle design), nieuw economisch denken (deeleconomie, betekenismaximalisatie, duurzame krimp) en transitie-denken (met aandacht voor veerkracht, reflexiviteit, kantelpunten).
 - Leren omgaan met complexiteit, diversiteit, verwarring, onzekerheid en ambiguïteit.
 - Maken van ethische en morele afwegingen en het kritisch beschouwen van de waarden die deze afwegingen beïnvloeden. ●
-



Didactische uitgangspunten

- Leefwereld nabij/herkenbaar
- Losmaken & aansluiten bij voorkennis
- Ruimte voor verschillen
- Benutten van dissonantie/controverse/conflict
- CSI – ‘critical sustainability detectives’ – ontdekkend, onderzoekend
- Slim koppelen aan vakinhouden/synchronisatie
- Bieden van handelingsperspectieven

Sustainability is not just something to learn, it's something to live!

STUDENTS SHOULD LEARN ABOUT SUSTAINABLE DEVELOPMENT AND GLOBAL CITIZENSHIP TO HELP THEM UNDERSTAND THE WORLD THEY LIVE IN

SCHOOL GARDEN PROGRAMMES CAN TEACH HEALTHY EATING AND HELP BUILD AN EMOTIONAL CONNECTION WITH THE NATURAL WORLD

EDUCATION IS THE BEST TOOL FOR CLIMATE CHANGE AWARENESS

SCHOOLS SHOULD BUILD RELATIONSHIPS AND ENGAGE WITH COMMUNITY ISSUES

SOLAR PANELS



ENERGY SAVING LIGHTBULBS



RENEWABLE MATERIALS

HUMAN RIGHTS
DISCRIMINATION
GENDER EQUALITY
BULLYING

SCHOOL

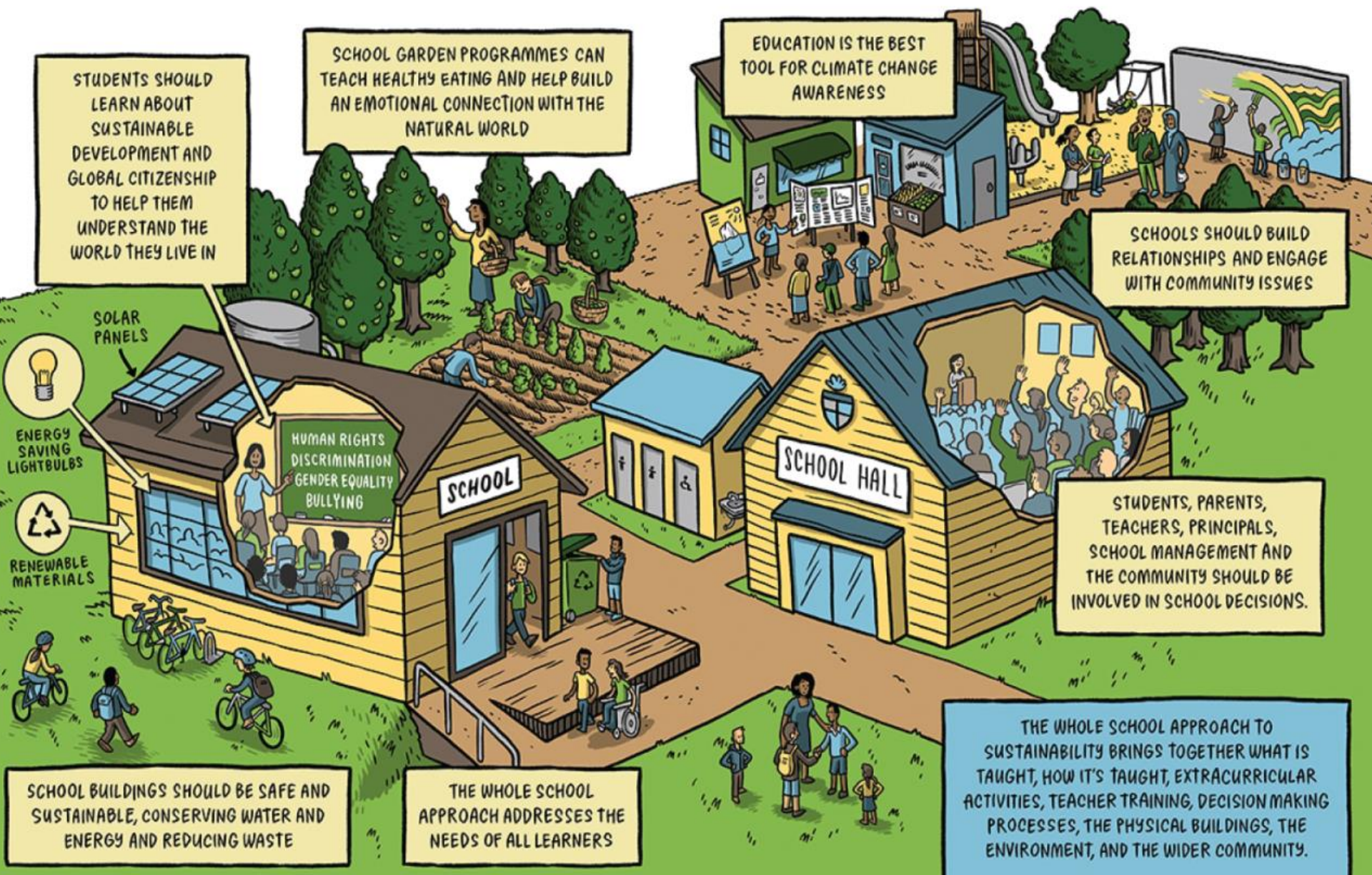
SCHOOL HALL

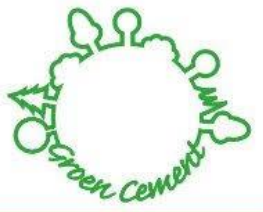
STUDENTS, PARENTS, TEACHERS, PRINCIPALS, SCHOOL MANAGEMENT AND THE COMMUNITY SHOULD BE INVOLVED IN SCHOOL DECISIONS.

SCHOOL BUILDINGS SHOULD BE SAFE AND SUSTAINABLE, CONSERVING WATER AND ENERGY AND REDUCING WASTE

THE WHOLE SCHOOL APPROACH ADDRESSES THE NEEDS OF ALL LEARNERS

THE WHOLE SCHOOL APPROACH TO SUSTAINABILITY BRINGS TOGETHER WHAT IS TAUGHT, HOW IT'S TAUGHT, EXTRACURRICULAR ACTIVITIES, TEACHER TRAINING, DECISION MAKING PROCESSES, THE PHYSICAL BUILDINGS, THE ENVIRONMENT, AND THE WIDER COMMUNITY.





www.groencement.nl

NatuurWijjs



United Nations
Educational, Scientific and
Cultural Organization



UNESCO
Associated
Schools



Eco-Schools



Utrecht
Duurzaam Voortgezet Onderwijs



GEZONDE
SCHOOL



DUURZAME
PABO

curriculum.nu



Het studentennetwerk
voor een duurzame
toekomst



Duurzaam MBO



KlimaatGesprekken

part of Carbon Conversations



UNIVERSITY OF GOTHENBURG

Dank voor
jullie aandacht!



Twitter: @arjenwals

Email: arjen.wals@wur.nl

Blog: www.transformativelaarning.nl

Source: Banksy