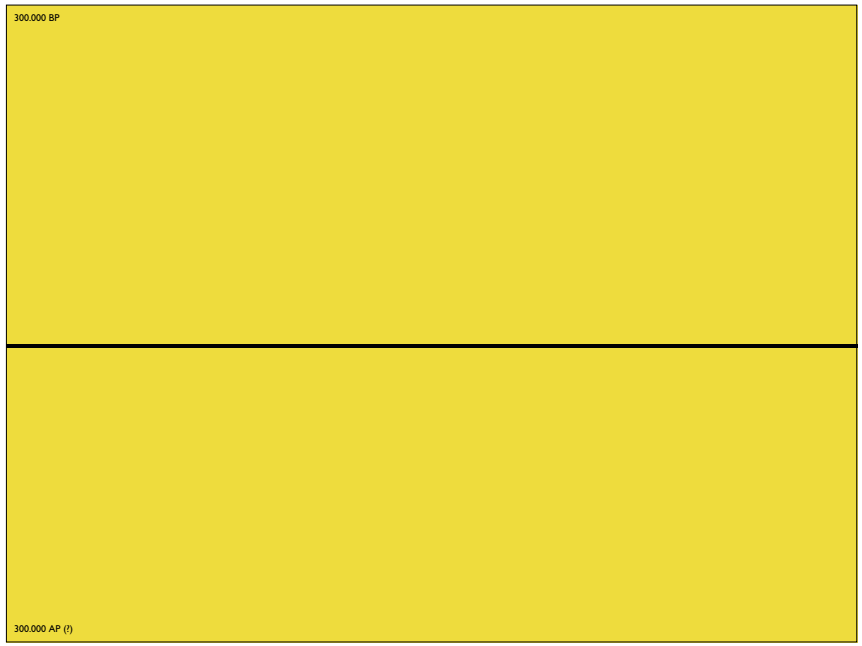
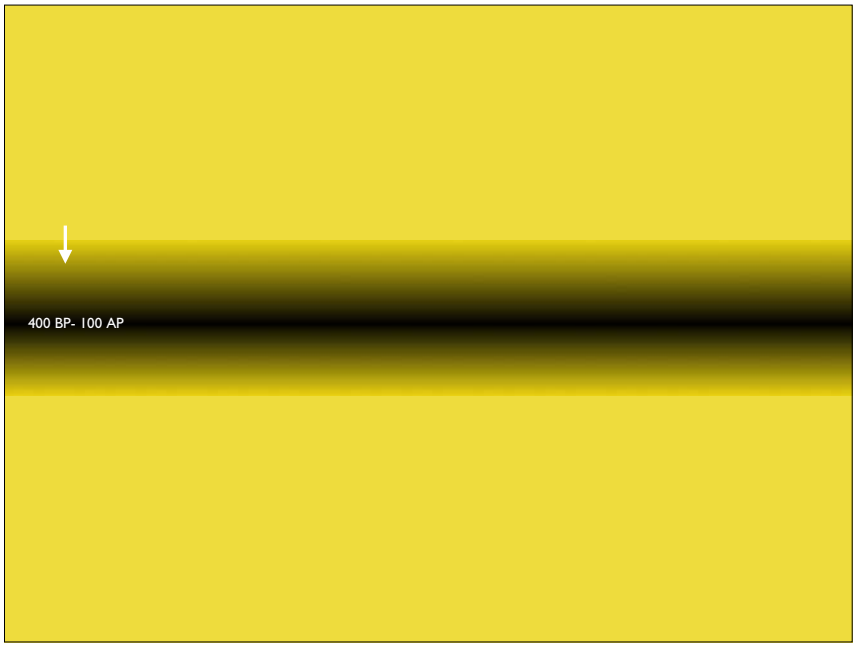
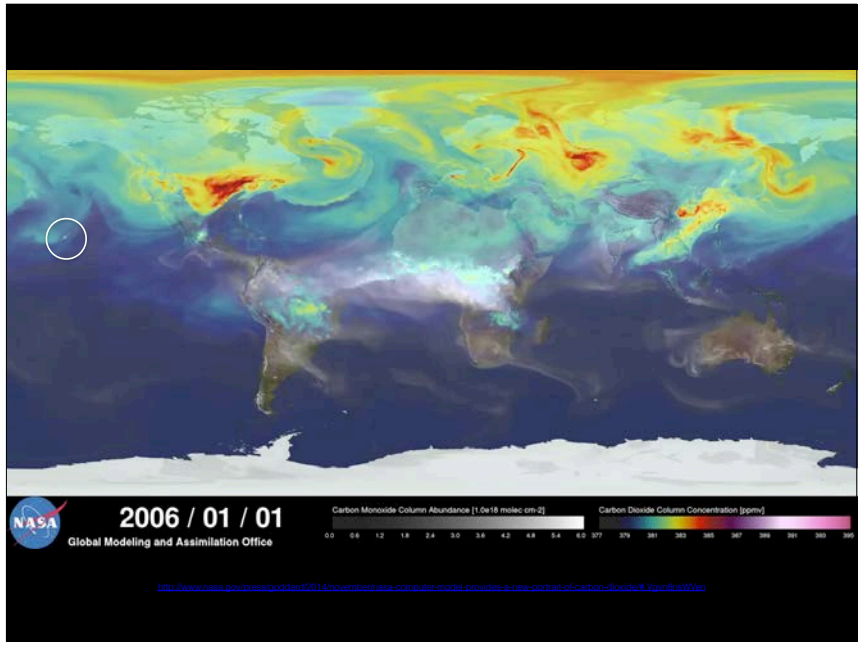

ENE
RG
R
UIM
TE
IE
The City of Tomorrow
TU-Delft, 9 maart 2018
Dirk Sijmons
Dirk Sijmons
FABRICations
H+N+S Landschapsarchitecten
POSAD spatial strategies
Studio Marco Vermeulen
NRGlab/Wageningen Universiteit
Vereniging Deltametropool
EEN NATIONAAL PERSPECTIEF


VOOR
WO
ORD
TO
DO
LIST
CON
T E
XT
IN
KA
ART
ONT
WE
RP
BESPAAR
WARMTE
ZON
CO2
WIND
ES
SA
Y


300.000 BP
300.000 AP (?)


400 BP- 100 AP


2006 / 01 / 01
Global Modeling and Assimilation Office
Carbon Monoxide Column Abundance [1.0e18 molec cm-2]
Carbon Dioxide Column Concentration [ppmv]

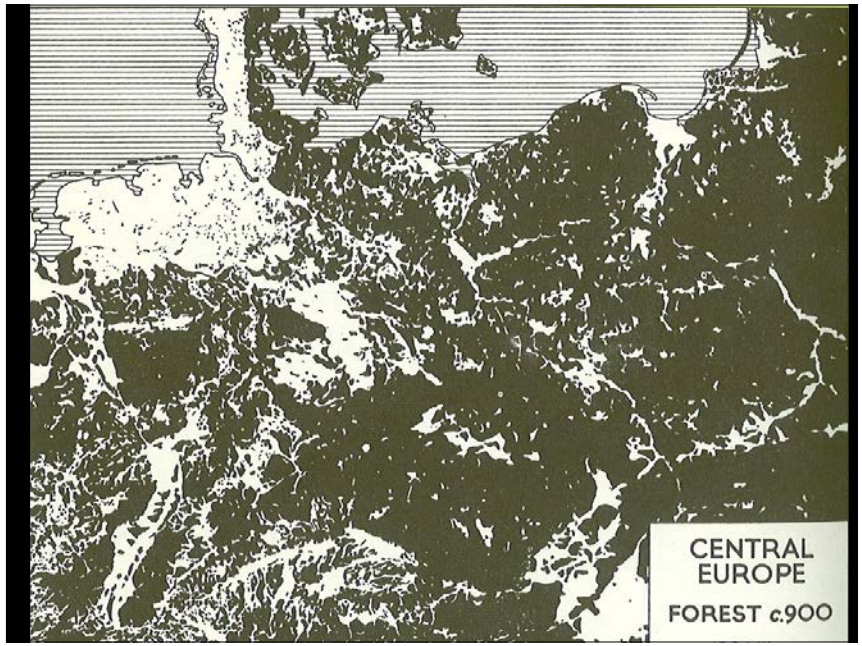

300 million years of fossil solar-energy
burned up in 500 years

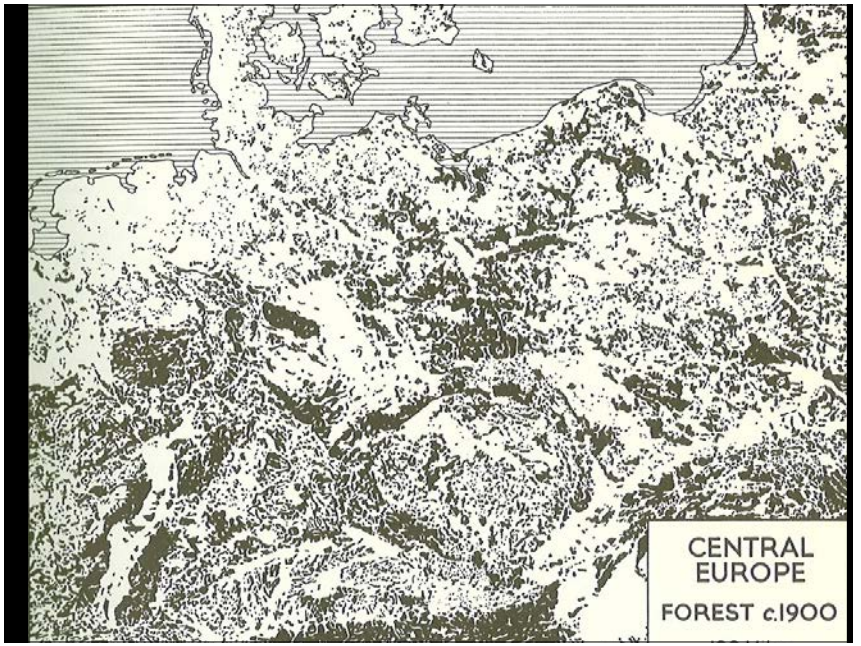

300 million years of fossil solar-energy
burned up in 500 years

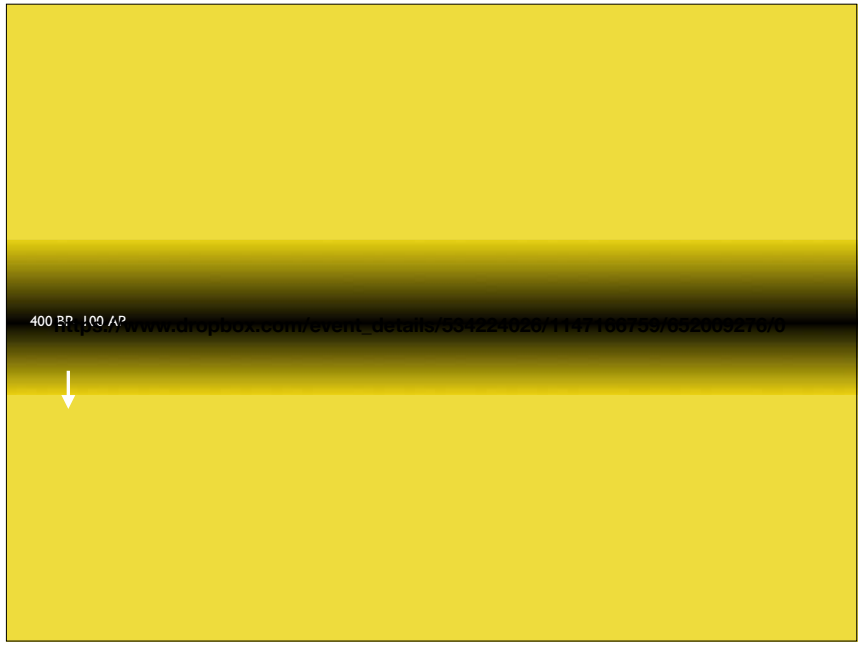

300 million years of fossil solar-energy
burned up in 500 years


300 million years of fossil solar-energy
burned up in 500 years
copyright www.pandion.nl

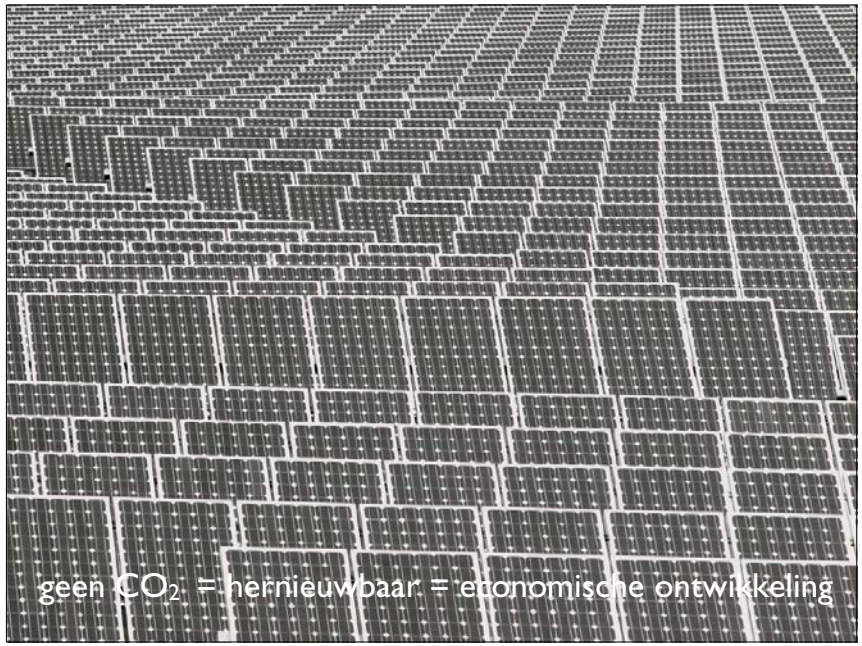

burning biomass

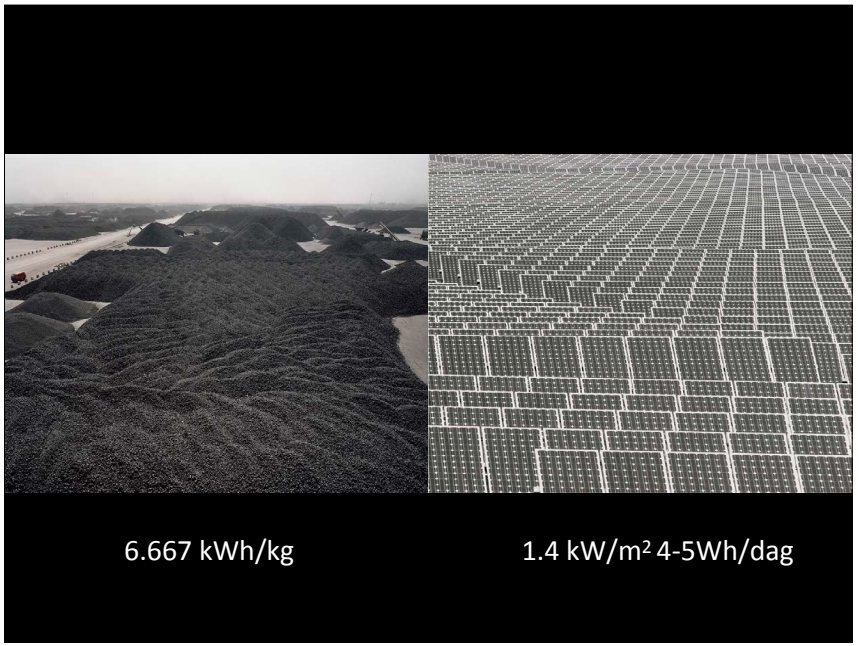

CENTRAL
EUROPE
FOREST c.900

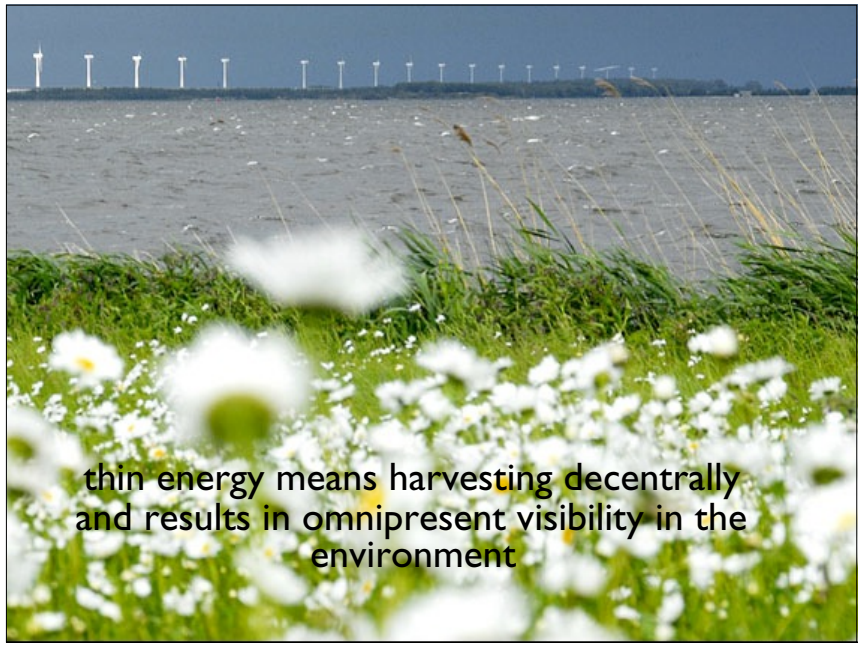

CENTRAL
EUROPE
FOREST c.1900

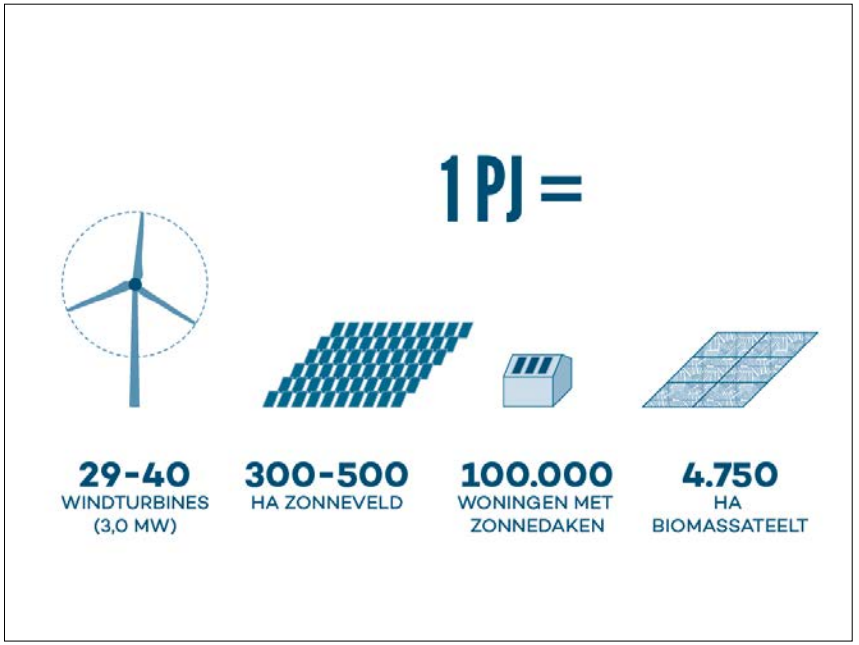

400 BP 100 AP


economische ontwikkeling = fossiele energie = CO_2


geen CO_2 = hernieuwbaar = economische ontwikkeling

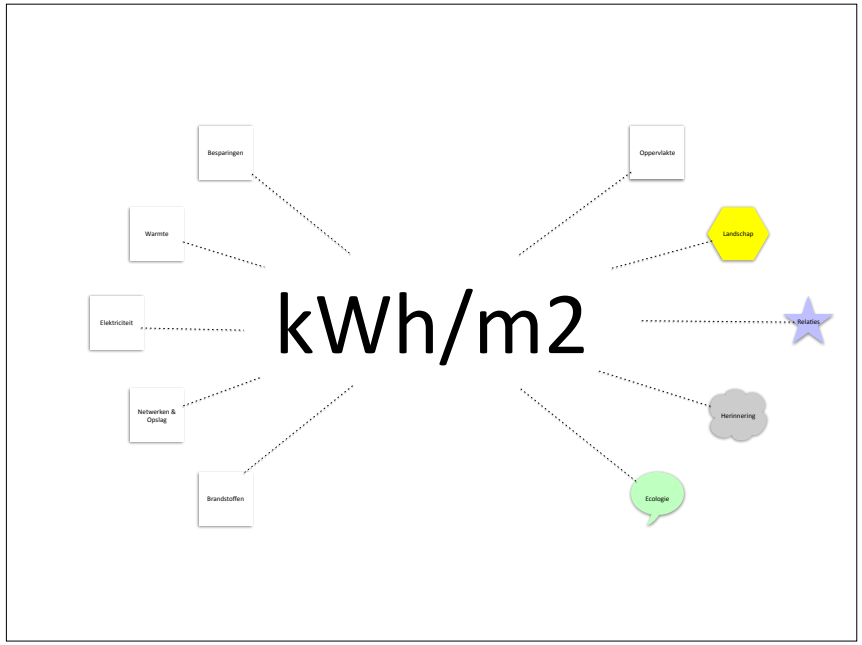

6.667 kWh/kg
1.4 kW/m² 4-5Wh/dag


thin energy means harvesting decentrally
and results in omnipresent visibility in the
environment

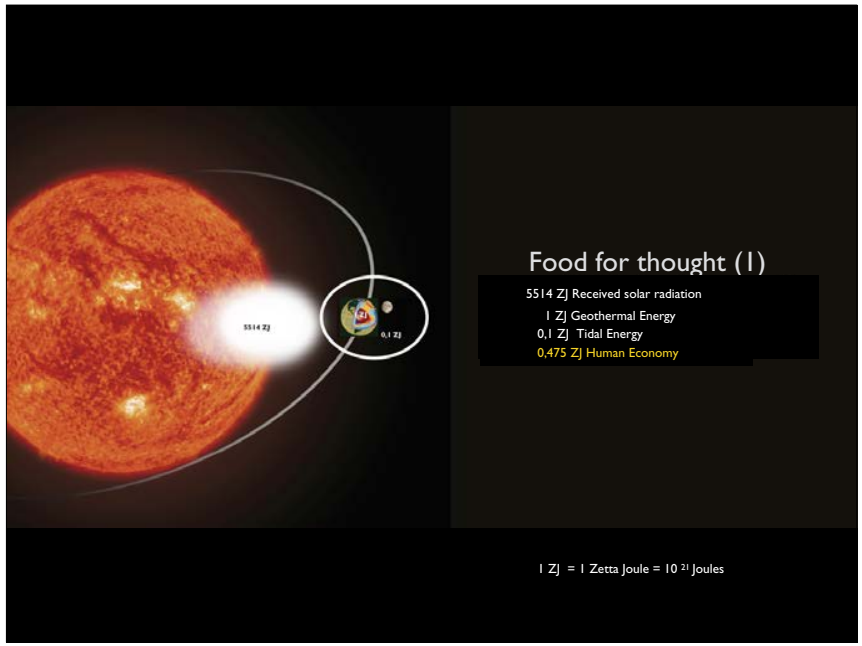

1 PJ =
29-40
WINDTURBINES
(3,0 MW)
300-500
HA ZONNEVELD
100.000
WONINGEN MET
ZONNEDAKEN
4.750
HA
BIOMASSATEELT

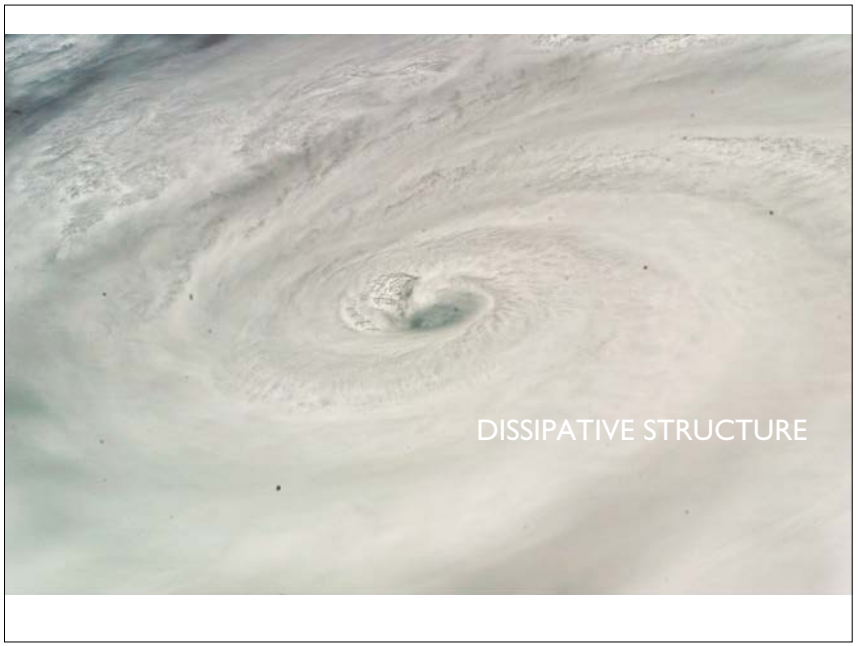

EVERY
WHERE


VARA


Besparingen
Oppervlakte
Warmte
Landschap
kWh/m2
Elektriciteit
Relaties
Netwerken & Opslag
Herinnering
Brandstoffen
Ecologie


MUCH

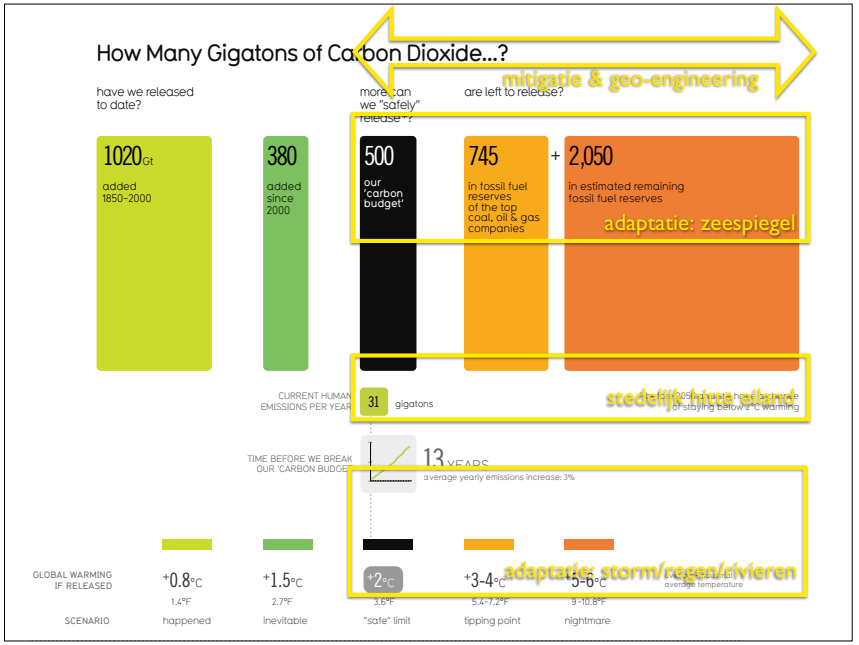

5514 ZJ
0,1 ZJ
Food for thought (1)
5514 ZJ Received solar radiation
1 ZJ Geothermal Energy
0,1 ZJ Tidal Energy
0,475 ZJ Human Economy
1 ZJ = 1 Zetta Joule = 10 21 Joules


DISSIPATIVE STRUCTURE


DISSIPATIEVE STRUCTUUR
zonnestraling 100%
reflexie 15%
evapotranspiratie 66%
restwarmte 15%-19%
1%-5% CO_2 opname
1.000 liter waterdamp/boom/dag
500.000 cal onttrokken warmte

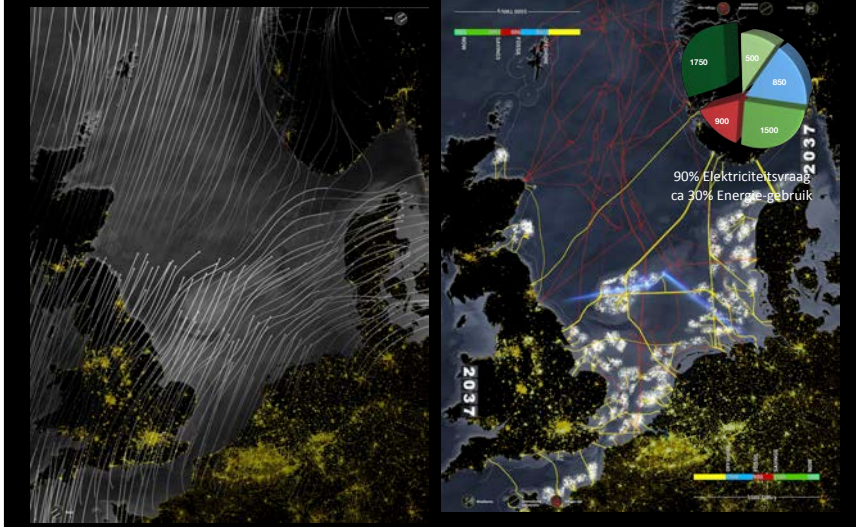

Food for thought (2)
0,475 ZJ Human Economy
400 % Tidal Energy
50% Geothermal Energy
0,007 % Received solar radiation
Harvest without ecological disasters


HURRY


How Many Gigatons of Carbon Dioxide...?
have we released to date?
more can we "safely" release?
are left to release?
mitigatie & geo-engineering
1020Gt
added 1850-2000
380
added since 2000
500
our 'carbon budget'
745
in fossil fuel reserves of the top coal, oil & gas companies
+
2,050
in estimated remaining fossil fuel reserves
adaptatie: zeespiegel
CURRENT HUMAN EMISSIONS PER YEAR
31
gigatons
TIME BEFORE WE BREAK OUR 'CARBON BUDGET'
13 YEARS
average yearly emissions increase: 3%
adaptatie: storm/regen/rivieren
GLOBAL WARMING IF RELEASED
+0.8°C
1.4°F
+1.5°C
2.7°F
+2°C
3.6°F
+3-4°C
5.4-7.2°F
+5-6°C
9-10.8°F
average temperature
SCENARIO
happened
inevitable
"safe" limit
tipping point
nightmare

ENERGIE RUIMTE

Bestuurders bijeenkomst VNG
Nieuwegein, 30 november 2017
Dirk Sijmons



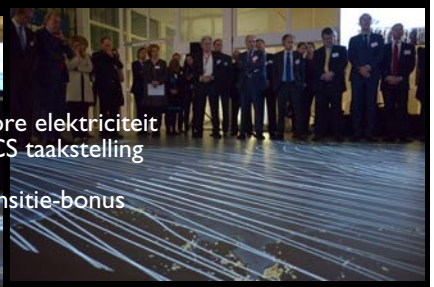
90% Elektriciteitsvraag
ca 30% Energie-gebruik

90% of the electricity demand of all the North sea countries
ca 30% total energy use

Nationaal Perspectief Energie en Ruimte

500 PJ Offshore elektriciteit
+ gehele CCS taakstelling

330 PJ Transitie-bonus



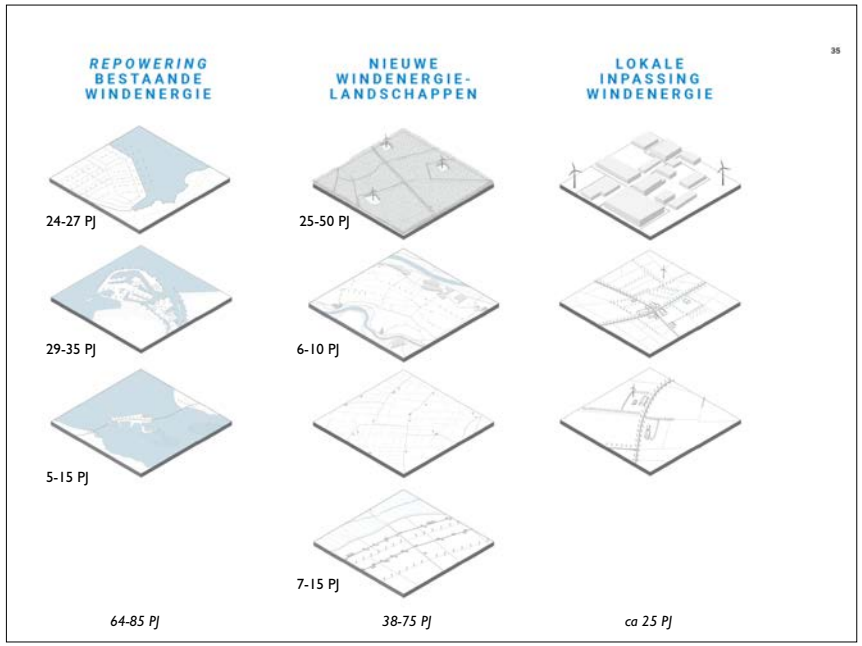
592 PJ Besparingen (25% tov 2014)

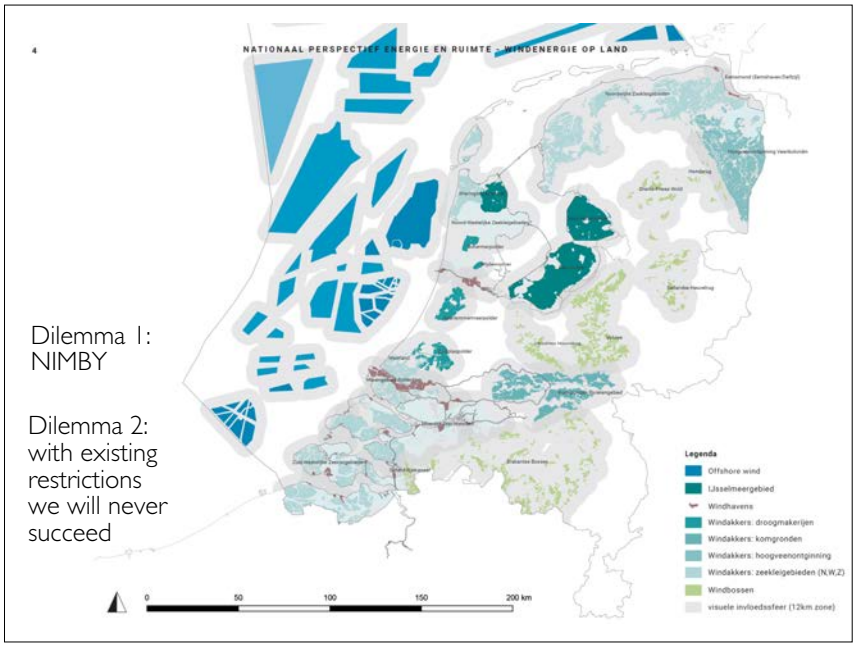
1.120 PJ is dan nog is opgave op land:

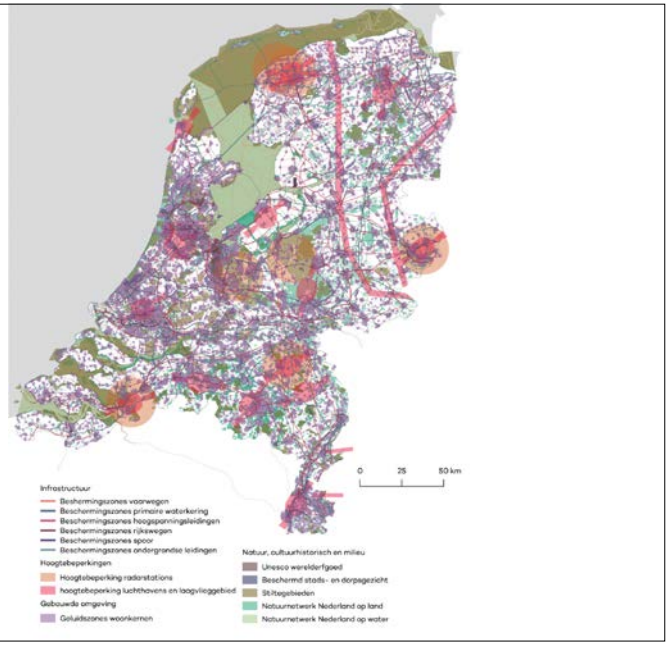
Renewables on land 2050

Energiegebruik 2050				Energieopwekking 2050			
conversie- en transportverliezen	389	PJ		coversie- en transportverliezen	389	PJ	
gebouwde omgeving	506	PJ		offshore wind	500	PJ	
industrie	383	PJ		wind op land	100	PJ	
landbouw, bosbouw & visserij	104	PJ		zon PV	200	PJ	
grondstoffen / overig	407	PJ		**hernieuwbare elektriciteit**	**800**	**PJ**	126 PJ overmaat (H2 > 76 transport, 50 verlies)
transport en mobiliteit	376	PJ					
				omgevingswarmte	170	PJ	+ 39 PJ elektriciteit warmtepompen
				geothermie	400	PJ	
				restwarmte	200	PJ	
				groen gas	50	PJ	
				hernieuwbare warmte	**820**	**PJ**	
				totaal hernieuwbaar op land	*1.120*	*PJ*	
				biomassa (vnl import)	345	PJ	
				fossiele brandstoffen	200	PJ	15 PJ elektr. + 55 PJ transport + 130 PJ hoge temp.
totaal eindgebruik	1776	PJ					
totaal incl. verliezen	**2165**	**PJ**		**totaal opwekking 2050**	**2165**	**PJ**	

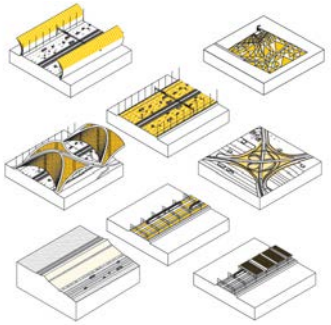
elektricity: wind



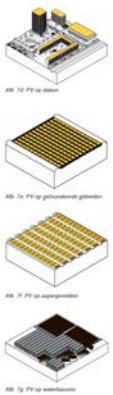




elektricity: solar



80 PJ Overheids gestuurd
(o.a. combinatie infrastructuur)

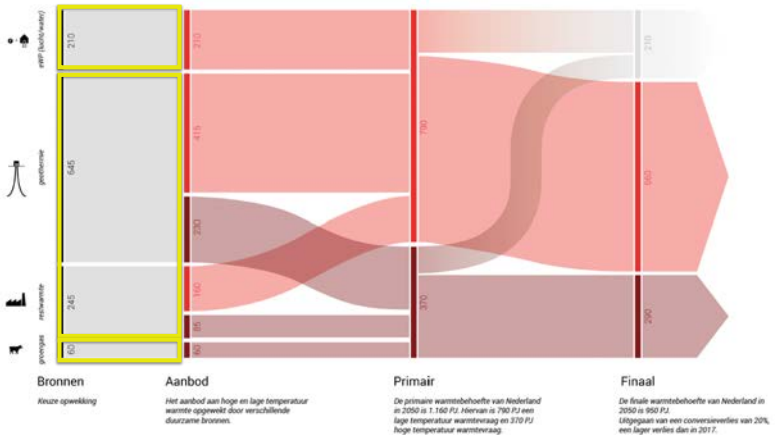


120 PJ Particulieren
(o.a. daken en landbouw)

120 PJ particulier/bedrijven
80 PJ overheden

Dilemma 1:
using e-transition
as a leverage
for A-transition

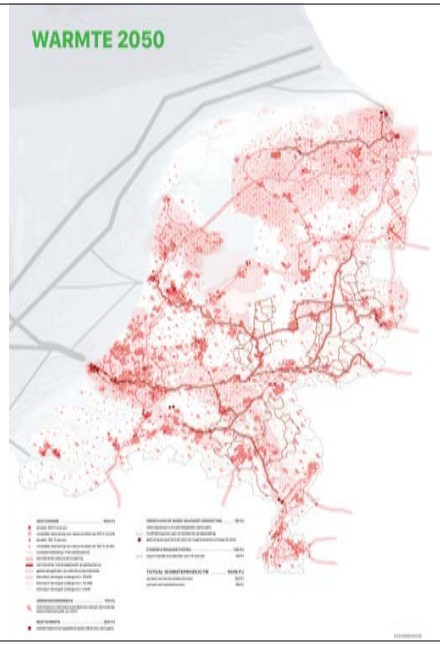
heat



Dilemma 1:
Collective vs Individueal

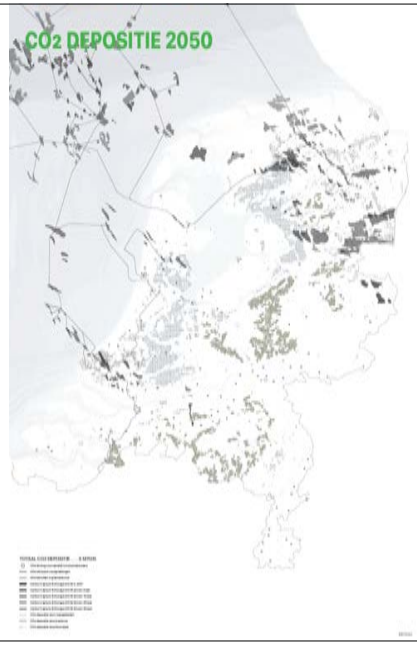
Dilemma 2:
Green gas lock-in?

Dilemma 3:
Social inequility?



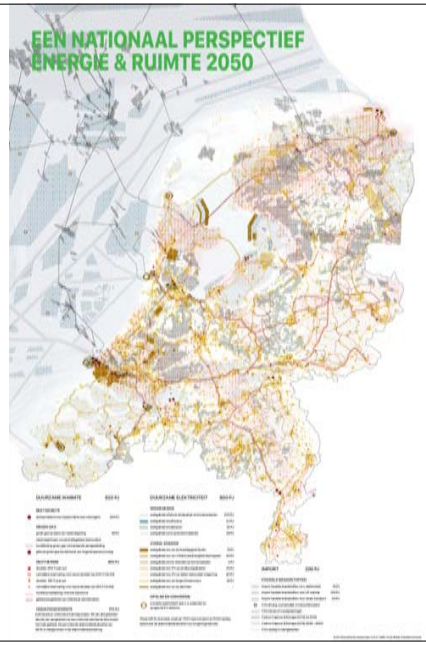
Dilemma 1:
is CCS going to work?

Dilemma 2:
Agricultural transition conditional!

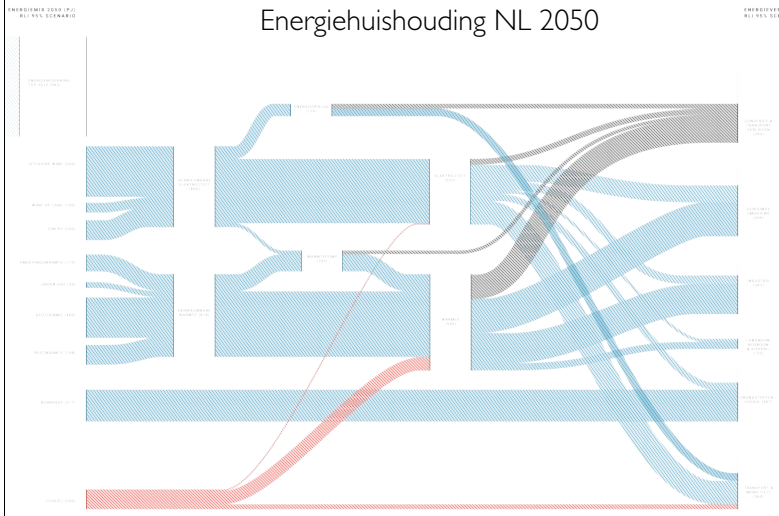


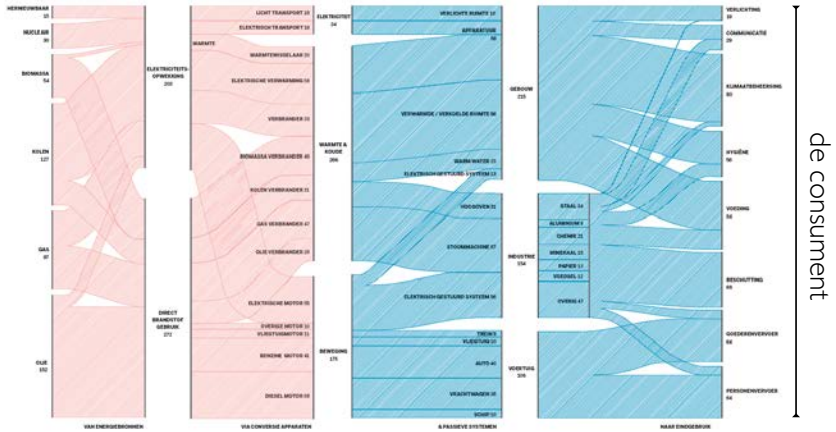
Dilemma 1:
Without RO
it won't work

Dilemma 2:
Equilibrium
top-down/
bottom-up?

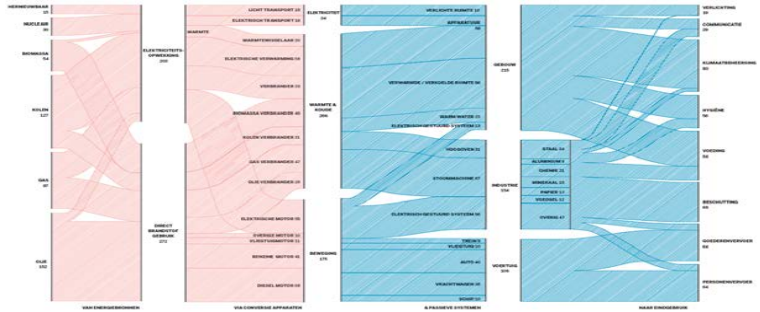


Energiehuishouding NL 2050

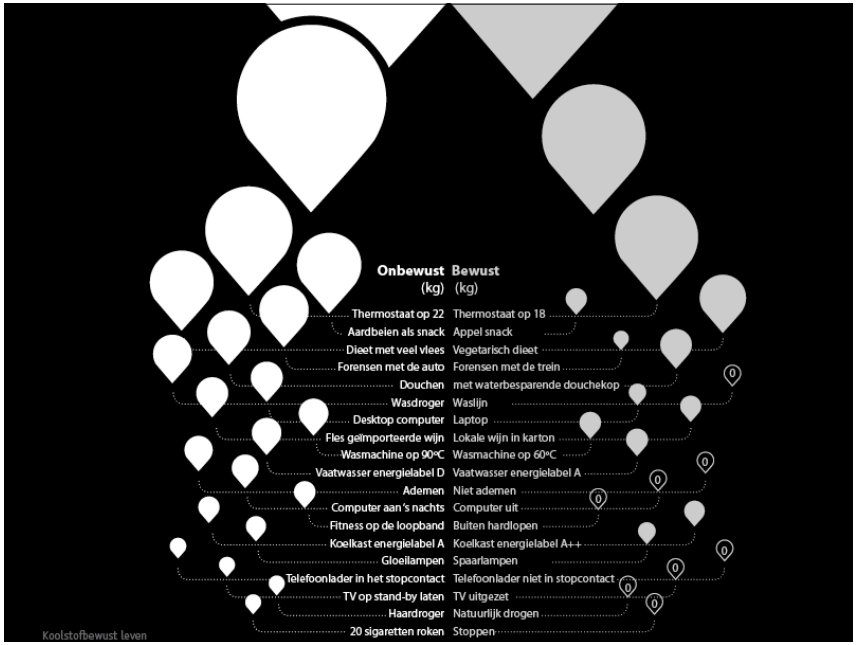


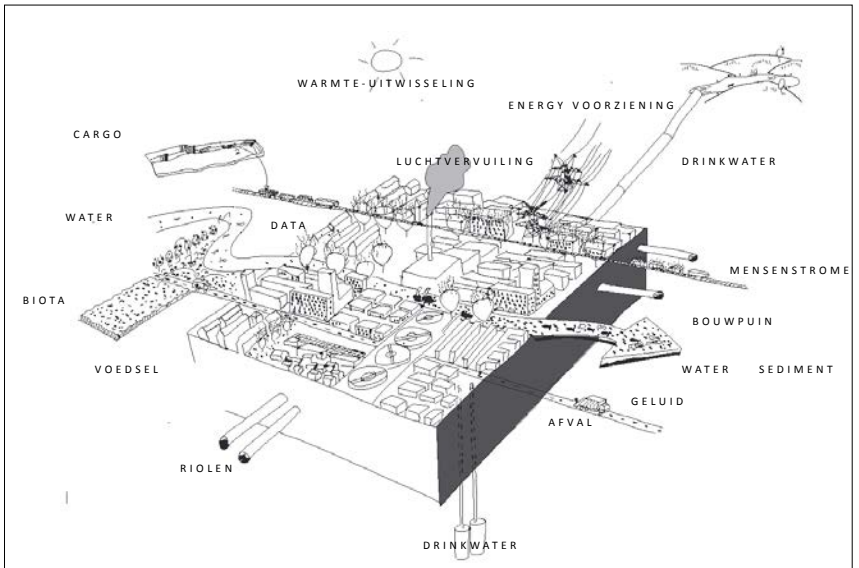


minus 30%



Tokyo 2011 Setsuden - 18%





ENERGY: ONE OF THE TEN FLOWS OF THE URBAN METABOLISM