ENGINEERING (IN) THE ANTROPOCENE

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KIVI JAARCONGRES
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Urban-by-Nature?
- Surface temperature
- Population
- Energy use/CO₂ concentration
- Loss of tropical rainforest and land reclamation
- GDP
- Species extinction
- Water use
- Motor vehicles
- Paper use
- Fisheries exploited
- Ozone depletion
- Foreign investments
The Silent Majority
Civil Engineers as the Master Planners of the 20th Century
Source: The U.S. Bureau of Labor Statistics
From: Pierre Belanger, Landscape Infrastructure, 2013
antropocene

- influencing geochemical cycles;
- influencing sediment flows;
- influencing ocean currents;
- influencing climate;
- influencing biodiversity;
- influencing landuse (agric. + urbanization);
biosphere  technosphere
• hybridisation of geo chemical cycles;
• hybridisation of sediment flows;
• hybridisation of ocean currents;
• hybridisation of climate;
• hybridisation of land-use: urban landscapes;
no way back: the arrow of time
no elsewhere: no ‘new frontier’ left
IABR--2014 Urban by Nature

DC I: HET VERKENNEN VAN DE ONDERGROND
plannen in een onbekende wereld

Hal I: DE AARDE EEN TUIN
bemiddelde relaties (groen)milieubeleid

Brabantstad

Hal III: STRATEGIEËN VOOR HET STADSLANDSCHAP

New York/New Orleans

Hal II: HET METABOLISME VAN DE STAD
(grijs) milieubeleid

Rotterdam

RHRM: PURE VEERKRACHT
stedelijke ecologie

Texel
IABR topics for engineering (in) the Antropocene

- decoupling growth and footprint?
- ecology as the new engineering
- learning to ride the tiger
- synthesizing

- engineering the transition to renewables
- enhancing biodiversity as planned side-effect
- adaptation to climate change
- mutual opening up between designers and engineers

- savings: assisting to a prosperous way down
- inverse engineering: retrofitting old mistakes
- dealing with uncertainties
- sectoral vs integral

- fine-tuning the urban metabolism
- nature technique as the civil engineering for the advanced
- steering in dialogue with the ecosystem
- generalist: oversee cascading effects when one part fails
IABR topics for engineering (in) the Antropocene

decoupling growth and footprint?

ecology as the new engineering

learning to ride the tiger

synthesizing

engineering the transition to renewables

enhancing biodiversity as planned side-effect

adaptation to climate change

mutual opening up between designers and engineers

savings: assisting to a prosperous way down

inverse engineering: retrofitting old mistakes

dealing with uncertainties

integral vs sectoral

fine-tuning the urban metabolism

nature technique as the civil engineering for the advanced

steering in dialogue with the ecosystem

generalist: oversee cascading effects when one part fails
mitigating climate change: engineering the transition to renewables
Engineering angle (1)

- 5514 ZJ Solar Energy received
- 1 ZJ Geothermal Energy
- 0.1 ZJ Tidal Energy
- 0.4 ZJ Human Economy
energy management, the Netherlands 2014
energy management in the Netherlands in 2050 with 80% reduction of CO2
mitigating climate change: engineering energy savings
Engineering angle (2)

- 0.4 ZJ  Human Economy
- 400%  Tidal Energy
- 50%  Geothermal Energy
- 0.007%  Solar Energy Received
fine-tuning the urban metabolism
urban metabolism
Existing principle of organic and human waste

Today, all organic waste is released directly into the lagoon without any treatment whatsoever. The suggested network of Neighborhood Hotspots is able to provide the badly needed waste management, linked to new job opportunities and income for the Makoko community.

Suggested closed-loop cycles of organic/human waste

The Neighbourhood Hotspots with attached biogas plants function as business incubators, knowledge centers, and “brain” of the new waste economy. They are owned and organized by the biogas cooperatives. The Hotspot network will provide income, increase the standard of living of the Makoko community and create a more healthy environment. Each of the Hotspots serves as a micro-community center, providing a doctor’s room, shared sanitary facilities, rainwater harvesting, biogas cooking, and a multi-purpose workshop room, proving education opportunities for girls, amongst other features.
adaptation to climate change & steering in dialogue with the system
inverse engineering: retrofitting mistakes
Kallang Riverside park 2.0 Singapore
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- Decoupling growth and footprint?
- Ecology as the new engineering
- Learning to ride the tiger
- Synthesizing

- Engineering the transition to renewables
- Enhancing biodiversity as planned side-effect
- Adaptation to climate change
- Mutual opening up between designers and engineers

- Savings: assisting to a prosperous way down
- Inverse engineering: retrofitting old mistakes
- Dealing with uncertainties
- Engineering in a cultural context

- Fine-tuning the urban metabolism
- Nature technique as the civil engineering for the advanced
- Steering in dialogue with the ecosystem
- Generalist: oversee cascading effects when one part fails
Do engineers work without theory, while architects overdose on it?
From: Pierre Belanger, Landscape Infrastructure, 2013
1964
4x400 Watt
2002: too big for Reykjavik
LCC's 2008
The digital universe is made up of images and videos on mobile phones uploaded to YouTube, digital movies populating the pixels of our high-definition TVs, banking data swiped in an ATM, security footage at airports and major events like the Olympic Games, subatomic collisions by the Large Hadron Collider at CERN, transponders on highway tolls et cetera...
## Onbewust (kg) vs. Bewust (kg)

<table>
<thead>
<tr>
<th>Onbewust</th>
<th>Bewust</th>
</tr>
</thead>
<tbody>
<tr>
<td>(kg)</td>
<td>(kg)</td>
</tr>
<tr>
<td>Thermostaat op 22</td>
<td>Thermostaat op 18</td>
</tr>
<tr>
<td>Aardbeien als snack</td>
<td>Appel snack</td>
</tr>
<tr>
<td>Dieet met veel vlees</td>
<td>Vegetarisch dieet</td>
</tr>
<tr>
<td>Forensen met de auto</td>
<td>Forensen met de trein</td>
</tr>
<tr>
<td>Douchen</td>
<td>met waterbesparende douchekop</td>
</tr>
<tr>
<td>Waskruis</td>
<td>Wasmachine op 60°C</td>
</tr>
<tr>
<td>Desktop computer</td>
<td>Laptop</td>
</tr>
<tr>
<td>Fles geïmporteerde wijn</td>
<td>Lokale wijn in karton</td>
</tr>
<tr>
<td>Wasmachine op 90°C</td>
<td>Wasmachine op 60°C</td>
</tr>
<tr>
<td>Vaatwasser energielabel D</td>
<td>Vaatwasser energielabel A</td>
</tr>
<tr>
<td>Ademen</td>
<td>Niet ademen</td>
</tr>
<tr>
<td>Computer aan’s nachts</td>
<td>Computer uit</td>
</tr>
<tr>
<td>Fitness op de loopband</td>
<td>Buiten hardlopen</td>
</tr>
<tr>
<td>Koelkast energielabel A</td>
<td>Koelkast energielabel A++</td>
</tr>
<tr>
<td>Gloeilampen</td>
<td>Spaarlampen</td>
</tr>
<tr>
<td>Telefoonlader in stopcontact</td>
<td>Telefoonlader niet in stopcontact</td>
</tr>
<tr>
<td>TV op stand-by laten</td>
<td>TV uitgezet</td>
</tr>
<tr>
<td>Haardroger</td>
<td>Natuurlijk drogen</td>
</tr>
<tr>
<td>20 sigaretten roken</td>
<td>Stoppen</td>
</tr>
</tbody>
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Koolstofbewust leven

Carbon conscious, ‘Tweak your day’

source: UNESCO, Environmental Protection Agency, Energy Information Administration, in: Information is beautiful, David McCandless, 2009
**Clear Standards Carbon Tracker**

- **Max Goal**: 60 kg CO2
- **Actual**: 77 kg CO2

**Graph**
- Chart showing CO2 emissions over months from January to December for max goal and actual.

**Total**:
- **CO2 Total**: 18.6 Tons
- **House**: 4.29 Tons
- **Car**: 11.94 Tons
- **Flight**: 2.38 Tons

**Offsets**: 0 Tons

**Comparison**
- **Your Footprint**: 18.6 Tons
- **Your Offsets**: 0 Tons
- **USA Average Footprint**: 23.4 Tons
- **EU Average Footprint**: 11 Tons
- **World Average Footprint**: 4.3 Tons
• engineers that know when to use a tech fix when an eco fix;

• engineers that dare challenge the decoupling ideology between economical growth and ecological footprints, but dare to work in small steps anyways.

• engineers that can position their work in a societal and cultural context;

• engineers that dare to start working also when not all the knowledge is available (Hoekelinge dam? Garuda?) Building in dialogue with the system. (learning from monitoring);

• engineers that know how to deal with uncertainties in a complex world (riding the tiger);

• Integral vs sectoral specialization

• engineers and designers (don’t stay locked in in your autonomous Buildings) need to open up to each other

• engineers that help us on a ‘prosperous way down’. “you got us into this mess now you get us out of it.”
IABR topics for engineering (in) the antropocene

- Ecology as the new engineering
- Charting the course in a complex world
- Eco-fix vs tech-fix
- Dealing with uncertainties
- Mutual opening between designers and engineers
- Inverse engineering: retrofitting old mistakes
- Learning riding the tiger
- Nature technique as the civil engineering for the advanced
- Steering in dialogue with the system
- Bottom up engineering
attached & responsible

offender and victim
<table>
<thead>
<tr>
<th>era</th>
<th>nature/resources</th>
<th>vector</th>
<th>key notion</th>
</tr>
</thead>
<tbody>
<tr>
<td>modernization</td>
<td>given, source and sink</td>
<td>emancipation</td>
<td>freedom/detachment</td>
</tr>
<tr>
<td>explicitation</td>
<td>nothing for granted</td>
<td>concern</td>
<td>responsible/attached</td>
</tr>
<tr>
<td>antropocenic</td>
<td>?</td>
<td>?</td>
<td>riding the tiger</td>
</tr>
</tbody>
</table>
Engineering 2014

- techniques
- science
- tools
- policy
- standards
- other engineers
- legal
Nature | Society
The Silent Majority
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engineering challenges

- mitigation of & adaptation to Climate Change
- enhancing Biodiversity
- retrofitting Urban Metabolism