

### just out.....

"The Intergovernmental Panel on Climate Change (IPPC) has just published its latest Working Group II report detailing impacts, adaptation, and vulnerability associated with climate change. The picture it paints with respect to the consequences of continued climate change is rather bleak.

For example, the report discusses the risk associated with food insecurity due to more intense droughts, floods, and heat waves in a warmer world, especially for poorer countries."

source: The Guardian, March 30, 2014



### programa Biosfera : pB What is it?

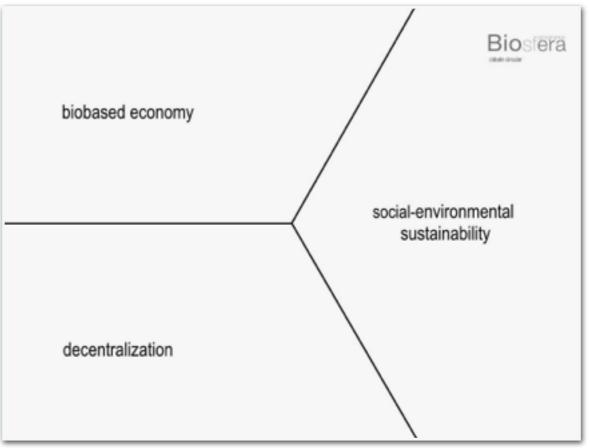
Programa Biosfera (pB) is an Dutch-Brazilian platform for cooperation that develops systems that can pilot and showcase a biobased, circular economy in Brazil.

By linking notions of biobased economy, decentralization and social-environmental sustainability, the vast potential in Brazil for the roll-out of this biobased, circular economy is made accessible for international actors.

pB was created in 2012 as a Dutch-Brazilian initiative. Through an initial phase of networking and development, the ongoing collaboration with Dutch, Brazilian and international partners led to the consolidation of pB as a registered brand and an IP portfolio.

At present pB is being formalised as:

- A Brazilian based service and consultancy firm: *Biosfera Services*
- A Brazilian based not-for-profit Institute: Instituto Biosferica





### programa Biosfera : pB What is it?

Through facilitating collaborative R&D trajectories geared towards industrial pilots, business development, innovation and design, the pB showcases are to accelerate the very implementation of a biobased, circular economy, adapting Dutch state of the art, innovative praxes, methodologies and technologies to the Brazilian context and reality.

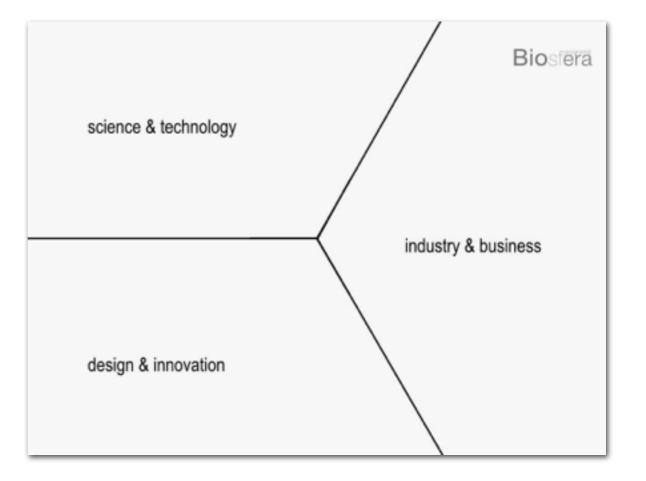
So far, two systems have been developed:

#### Bambu Base Biológica (BBB):

Bambu Base Biológica entails the industrialization of native bamboo in Brazil for the biobased economy.

#### Cidade Circular (CC):

Innovation and design for urban solutions and socialtechnologies: the *City as Biorefinery* 



## Bambu Base Biológica: biorefinery schematic



CULTIVATION & LAND USE	PRIMARY BIOMASS	SECONDARY BIOMASS	TERTIARY BIOMASS	
	residuals strandwoven & laminates	residuals paper & pulp (sludge)		
REGENERATION REMEDIATION RECOVERY RESTORATION	extraction silica (skin) & fibres	PHARMACEUTIC	thermochemical conversion	BIOFUELS & BIOMATERIALS
	preprocessing (liquifying)	CHEMICAL	biochemical conversion	
	<ul> <li>&gt; microfibrils for biofibrecomposites</li> <li>&gt; silica for bioceramics &amp; amorphous minerals</li> </ul>	<ul> <li>&gt; recovery contaminants for re-use</li> <li>&gt; biopreservatives &amp; biofilms (food &amp; nutrition)</li> </ul>	> pyrolysis products	<ul> <li>&gt; adaptation for existing (next-gen) bioethanol infrastructure</li> <li>&gt; bioplastics, -polymers, -resins</li> </ul>
ECO <b>FYS</b>	ECO <b>FYS</b>	ECO <b>FYS</b>	ECO <b>FYS</b>	ECO <b>FYS</b>
bioclear	<b>₩ECN</b>	<b>#</b> ECN	<b>₩ECN</b>	<b>₩ECN</b>
🌮 TSP		bioclear		
UNICAMP	UNICAMP		UNICAMP	UNICAMP

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## células de regeneração sistêmica

programa®

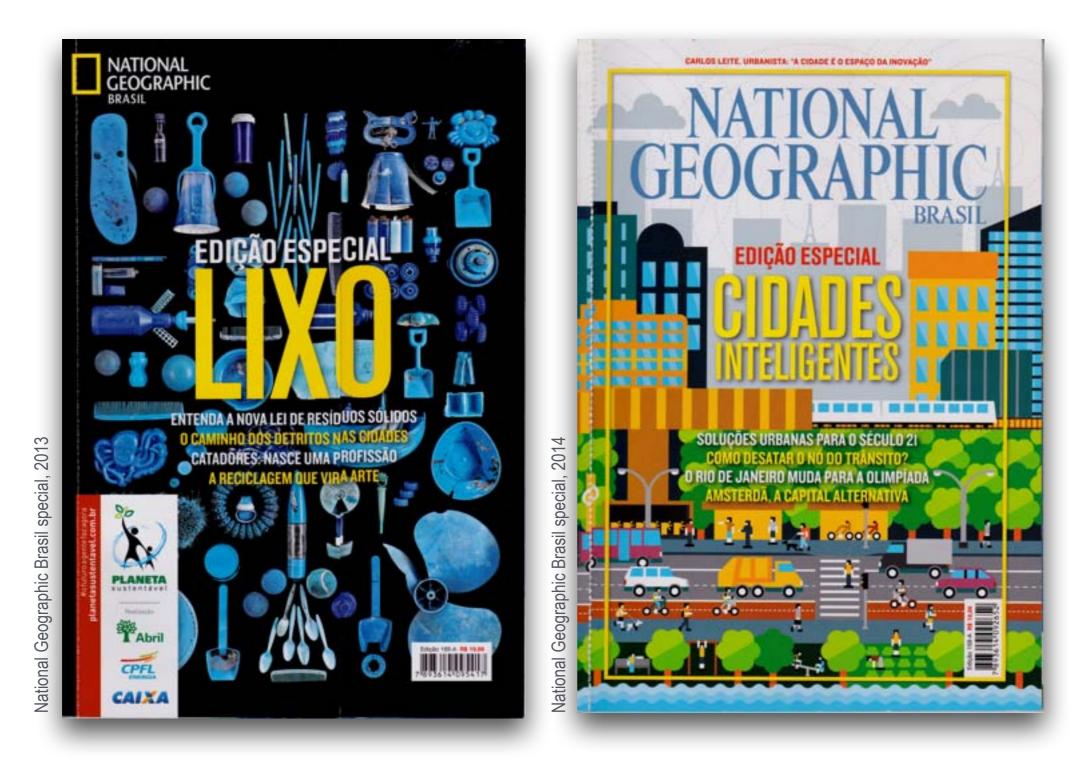
## Cidade Circular Circular City

Inovação e Design para Soluções Urbanas e Tecnologias Sociais Innovation & Design for Urban Solutions and Social Technologies

> Biorrefinaria Urbana The City as Biorefinery

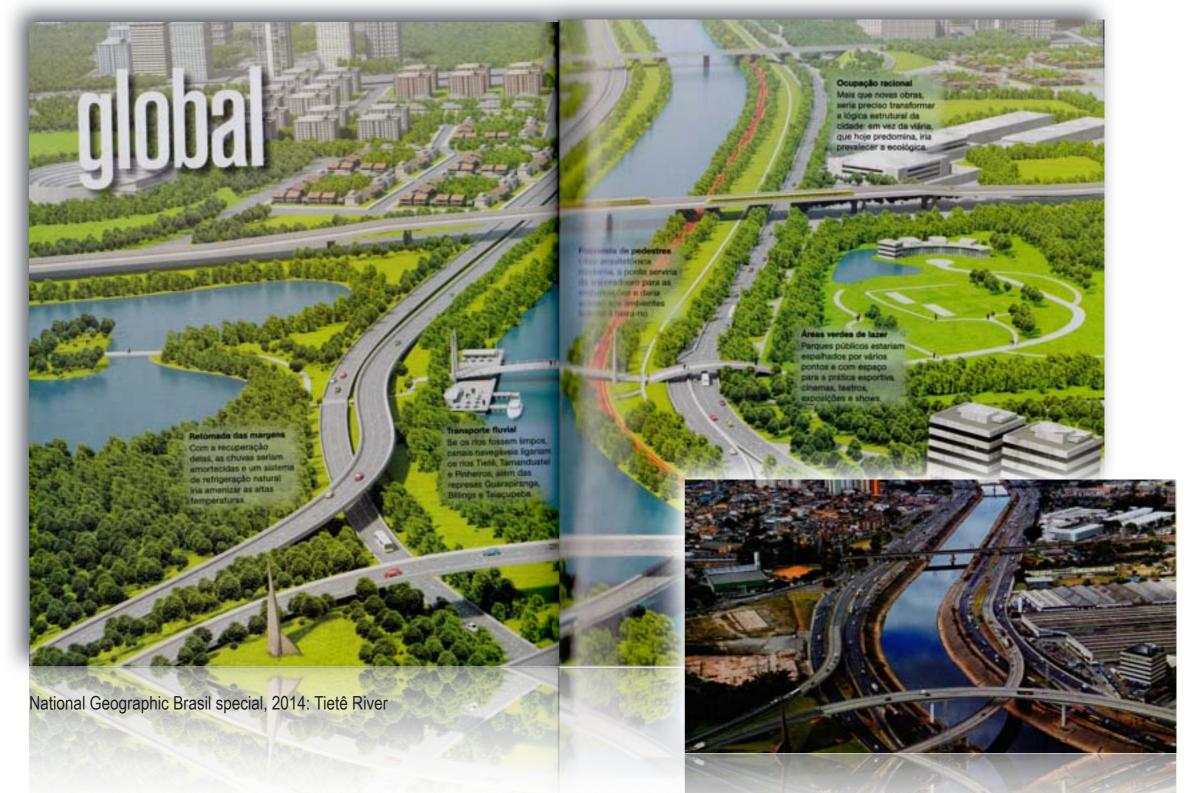


## CC: waste & smart cities in the 'collective consciousness'





### CC: São Paulo: 'before & after'





## CC: Inspiration from a colleague in New York City



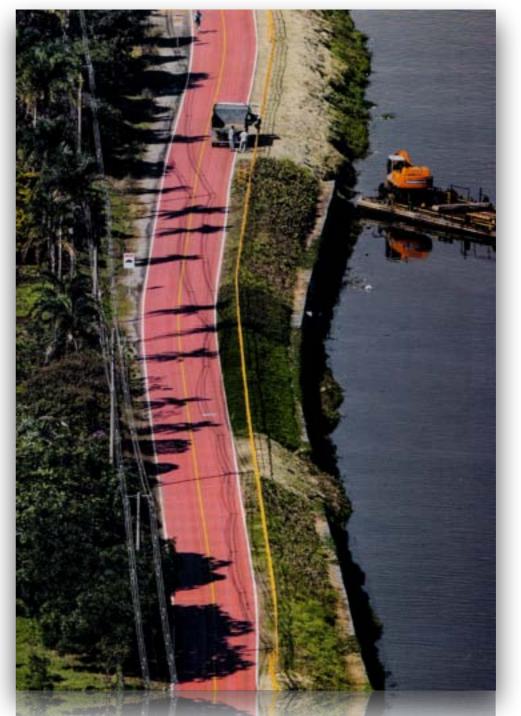
National Geographic Brasil special, 2013: 'Without waste'



## CC: Why and for who? the (living) river



National Geographic Brasil special, 2013: Catador do Rio



National Geographic Brasil special, 2014: Pinheiros river



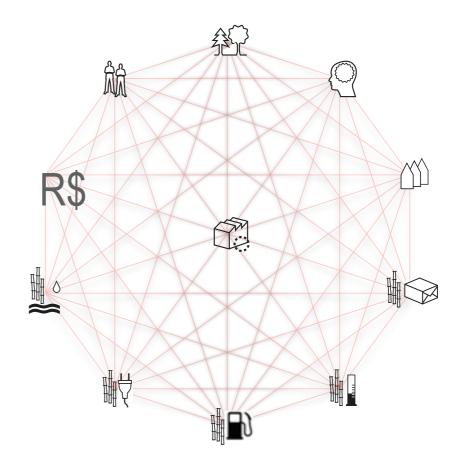
### Cidade Circular : CC What is it?

CC aims to develop an operational platform and productive chain for the valorization of both domestic- and industrial solid waste processing and waste-water treatment using DST.

CC is focusing on catering for the requirements that arise as a result of the changes in solidwaste management and landfill legislation as well as in water standards regulations, tackling challenges brought about by these regulatory changes for the public and private sectors alike.

CC makes the case for a whole-systems approach with regard to distributive utility infrastructures, identifying that no one component can be optimized in terms of its efficiency, if it is not considered within the larger context of its implementation.

The CC approach puts an emphasis on integrated design processes in closing the loops in waste, water and nutrient cycles, increasing social-environmental sustainability, efficiency, self-reliance and the ability to optimise adaptation in multi-parameters urban and environmental scenario's and contexts





### Cidade Circular : CC What is it?

CC offers an integrated service and technology suite, relevant to the required solutions in the São Paulo municipal area.

These solutions will address primarily:

- flooding, and contamination due to flooding of canalised waterways and sewage systems;
- contamination due to landfills and other contaminated areas in the urban context;
- sewage and waste-water treatment requirements that cannot be solved through centralised approaches and technologies;
- the very low ratio of green area per capita, with all of its social-environmental implications;
- the barriers/challenges for the introduction of distributive solid-waste collection, logistics, processing and technologies.

CC is geared towards closing waste- water and nutrient cycles, using volume of scale to transit highend technology into affordable, social technology, combining decentralised sanitation technology with urban agriculture, energy generation to achieve maximum levels of self-sufficiency, resiliency and adaptation.



## CC: arguments for decentralization

decentralisation allows to close the urban cycles: waste, water, energy, nutrients

- unburdening the existing centralised sewage and supply system, as the volume of not-connected households decreases, e.g.:
  - Paralheiros: 56,88%
  - 25% of collected sewage is lost
  - 25,7 of treated water is contaminated
- by decentralisation it is possible to implement a much larger variety of dedicated technologies that can deal with very site-specific problems, including social aspects of sanitation and the introduction of social technologies
- large sewage infrastructure overhauls and implementation in areas cause major logistic and economic disturbances
- large, centralised treatment and processing plants are typically implemented for 30 to 50 years, not allowing to adapt to the changing state of technology or changing urban contexts
- given sufficient volume of scale, DST is cheaper and more efficient than CST, and provides for more opportunities for business development and job creation





## CC: decentralization case-01



MOOCA

- inhabitants: 338.449
- persons/household: 3,0
- % non-sewage: 2,75
- to be serviced with DWWT: 3.102



social technology

#### PERUS

- inhabitants: 583.638
- persons/household: 3,3
- % non-sewage: 28,22
- to be serviced with DWWT: 49.910



## CC: decentralization case-02

Distribution of green area per capita:

 trough 'sponges' and 'biomakeries', new green areas become productive elements in the waste-water treatment cycle. DWWT therefore can now be integrated as green areas in those zones that need them most\*

#### MOOCA

- inhabitants: 338.449
- green area per capita: 0,35m<sup>2</sup>
- total: 120.797m<sup>2</sup>

\*correlation with mortality through acquired diseases associated with contamination)



#### PERUS

- inhabitants: 583.638
- green area per capita: 64,51m<sup>2</sup>
- total: 9.687.9307m<sup>2</sup>

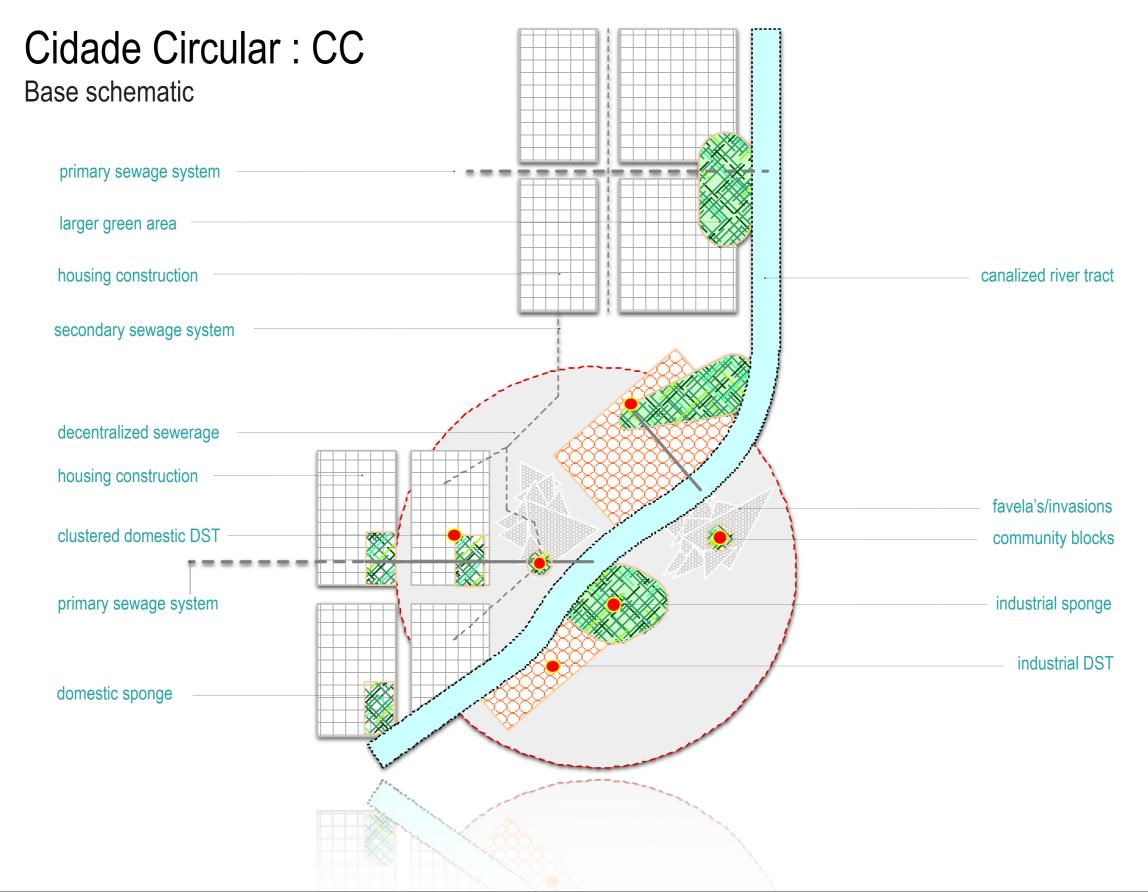


# Cidade Circular : CC

phase 1 objectives

- presentations and talks with the stakeholders from the private, public and institutional sectors;
- locate a number of pilot areas, based on the analysis and evaluation of available data;
- tailor a service and technology suite for each identified pilot area, based on the crossovers between the partners' expertise and technologies on offer;
- dealmaking process and financing;
- start implementing the pilot projects.

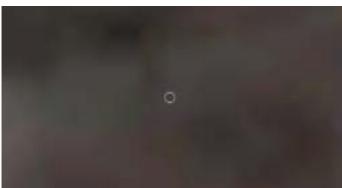






## CC : ratio of scale





1m:100m



1m:10.000m



#### 1m:10m



#### 1m:500m



#### 1m:50.000m



#### 1m:50m



#### 1m:1000m

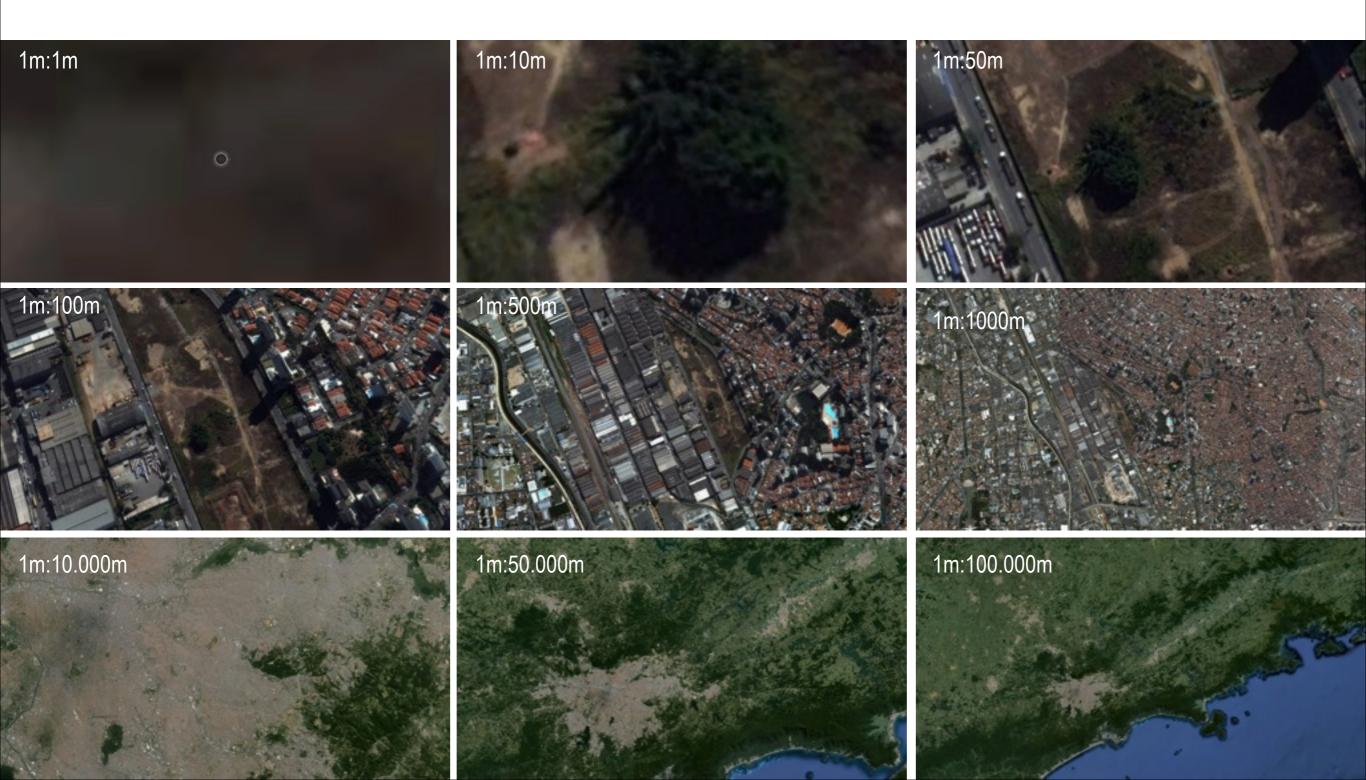


#### 1m:100.000m





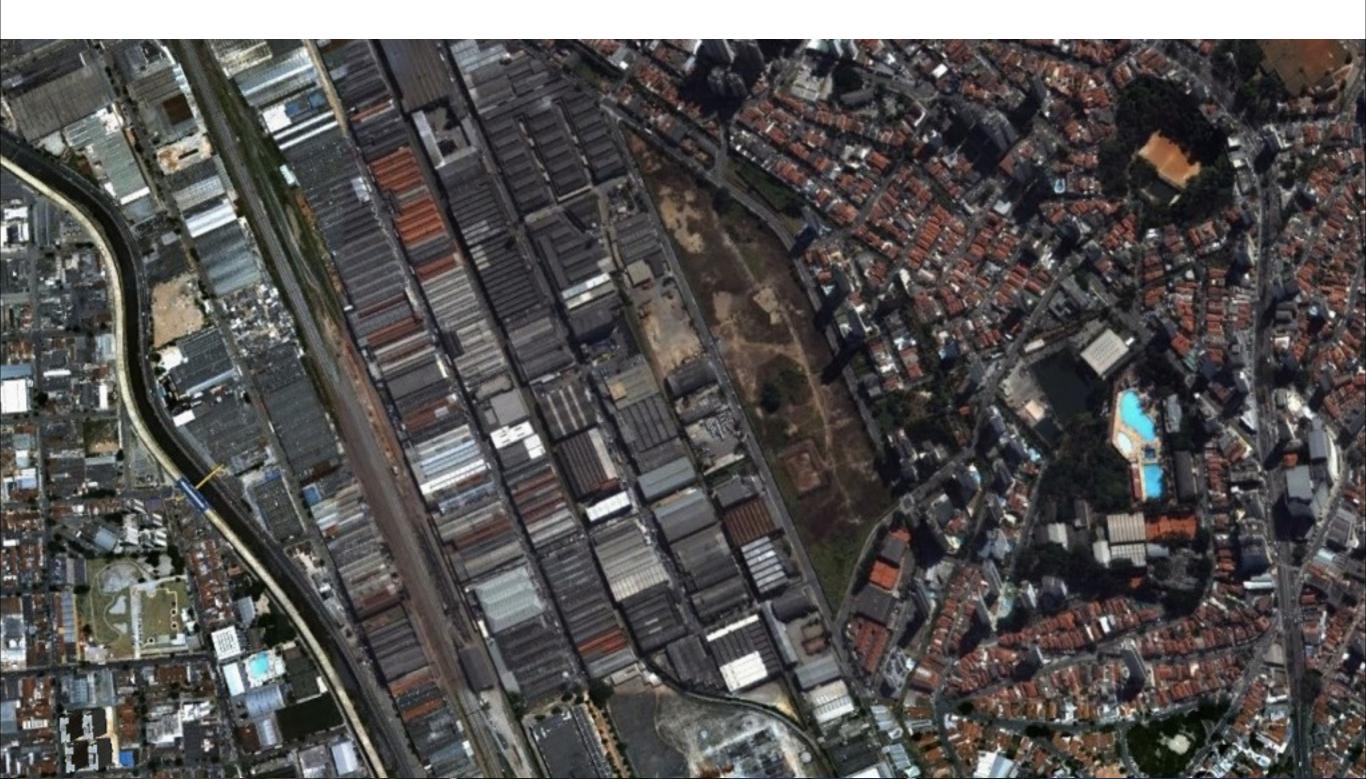
### CC : ratio of scale





## CC : ratio of scale: MOOCA

prospective pilot area

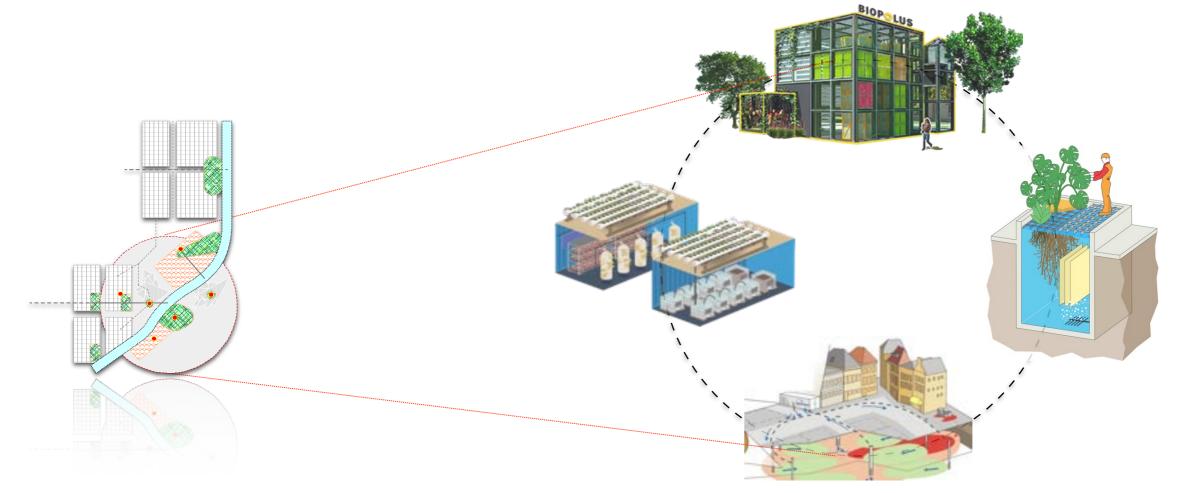


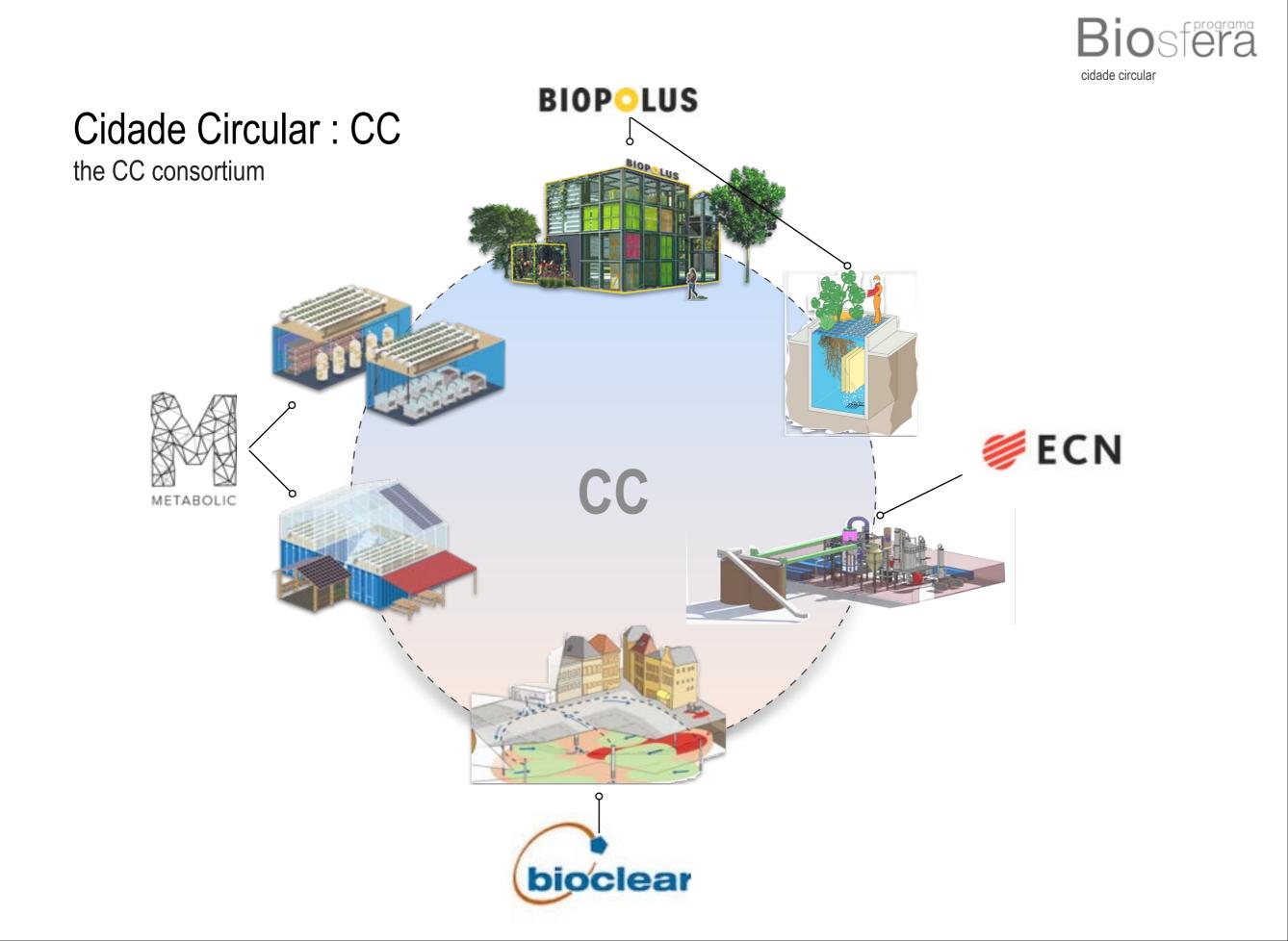


## Cidade Circular : CC

Base schematic: soil & water bioremediation

- to use natural degradation wherever possible;
- to help and increase this capacity when and wherever possible with biological means;
- to create productive chains out of DW<sup>2</sup>T<sup>2</sup>, that on top of re-use and recycling, recover compounds for varying industrial uses ('grondstoffenfabriekjes').







## CCConsortium

Dutch platforms for circular economy & biobased economy







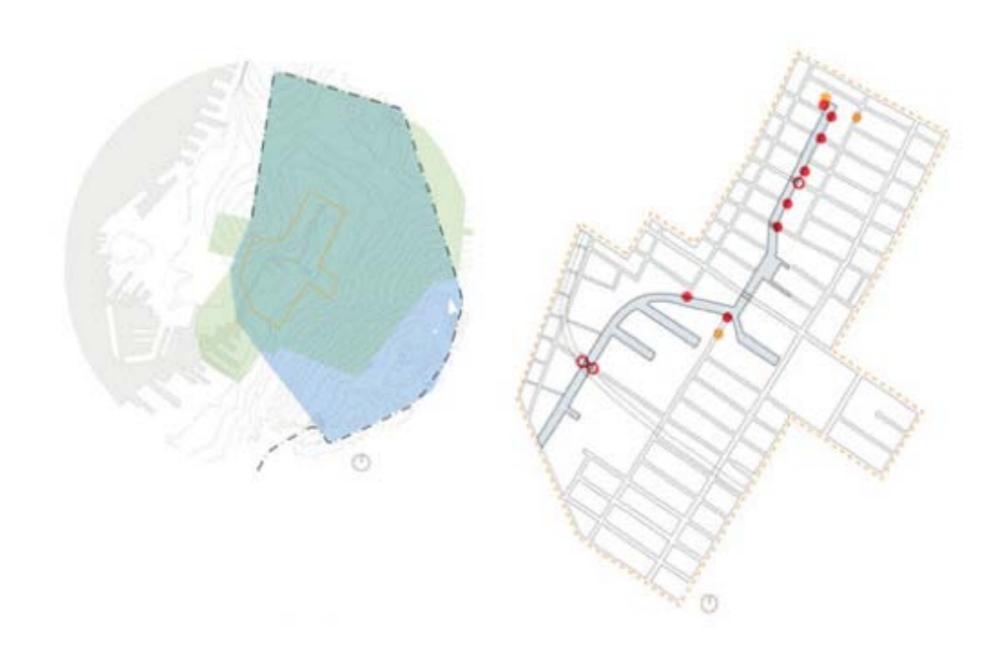






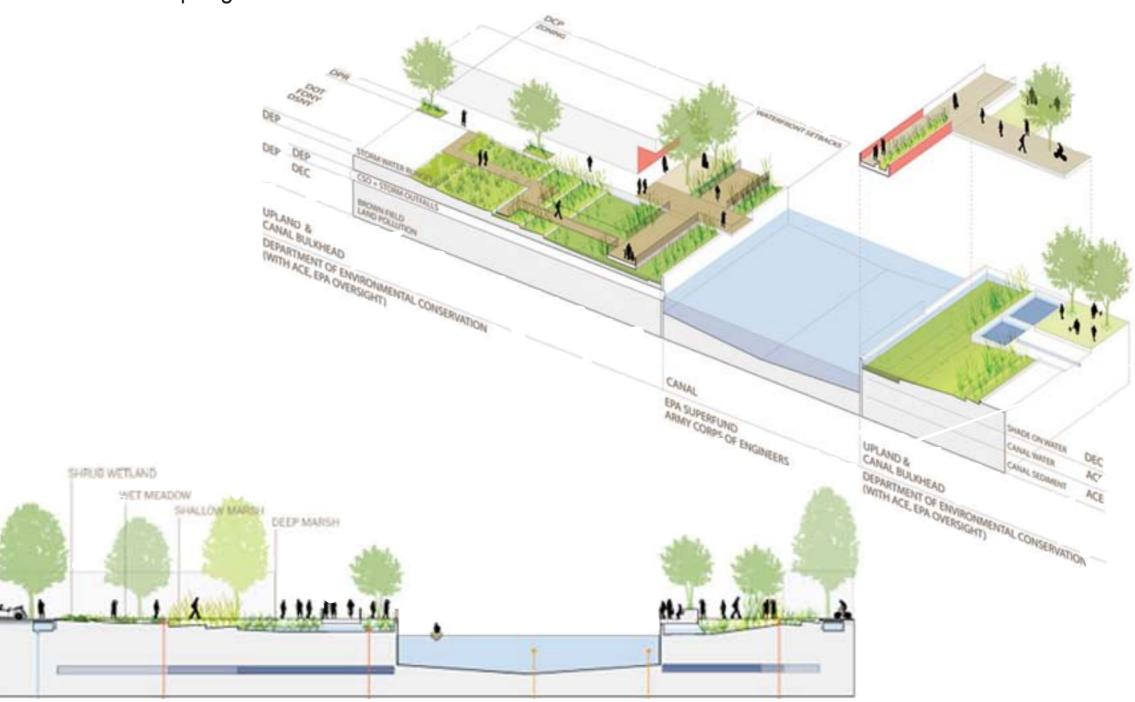
### dlandstudio

### CC: dlandstudio Gowanus Canal Sponge Park





### CC : dlandstudio Gowanus Canal Sponge Park





STATISTICS.

-











#### Soil & Water

Soil bioremedation (Natural attenuation, Biostimulation, Bioaugmentation) Performance, control and supervision of biological soil/water remediation Sustainable use (cycling) and buffering capacity of soil

#### Safety & control

Detection, monitoring and control of biofouling, biocorrosion (MIC) and pathogens Monitoring and control of biological processes (fermentation, sampling strategies, risk-assessments etc)

#### **Biobased production**

Valorisation of wastes and residues (biogas, green chemicals, fertilisers) Recycling of nutrients (N,P,K)

#### **Bioclear laboratories**

Analyses for: ecological and soil quality, product quality/safety Development of custom-made analyses, validation and implementation of techniques





- Soil remediation
- Water treatment
- Ecological risk assessments



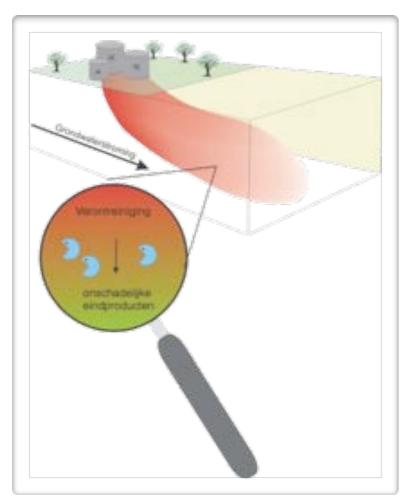
assessment > consultancy > implementation > monitoring > evaluation





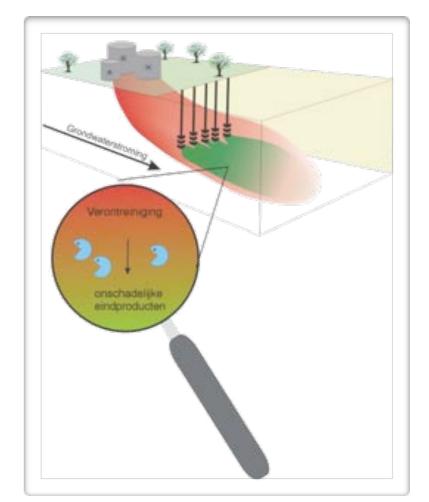
#### Natural Attenuation (NA)

- complete degradation only if natural conditions are suitable
- no actions required
- this situation is rare (< 5%)



#### Stimulated degradation

- a limitation inhibits natural attenuation
- create optimal conditions
- add nutrients and/or carbon source
- add bacteria > bioaugmentation







Reference Project: TCE concept\_bio-augmentation: Historical Area, The Hague Centre

- In-situ cost-effective, sustainable;
- Anaerobic bioreactor used to inoculate soil and groundwater with naturally occurring contaminantdegrading organisms;
- Result: 50-70% cost reduction;
- Very effective in urban are;
- Comparable and relevant to contaminated areas in São Paulo.



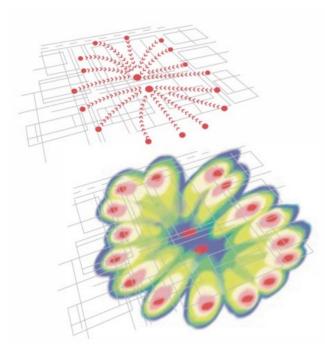


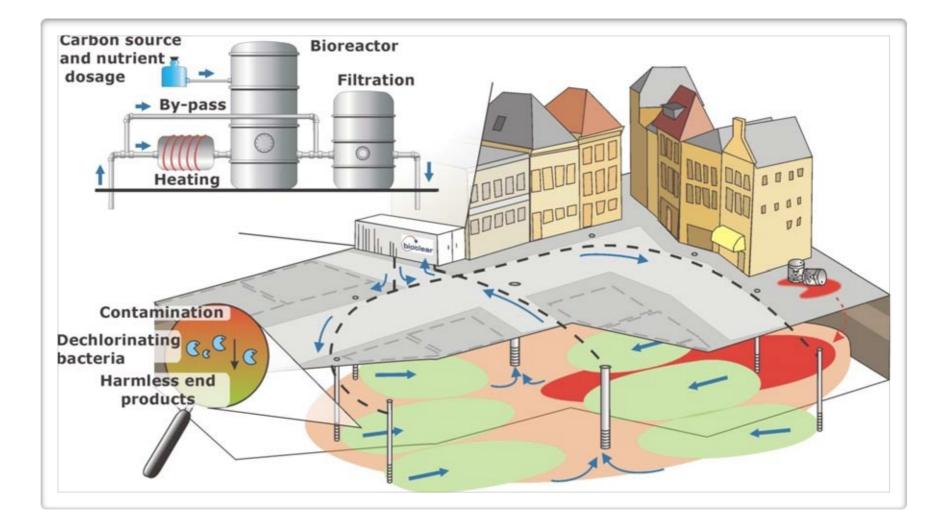






#### Reference Project: TCE concept\_bio-augmentation: Historical Area, The Hague Centre

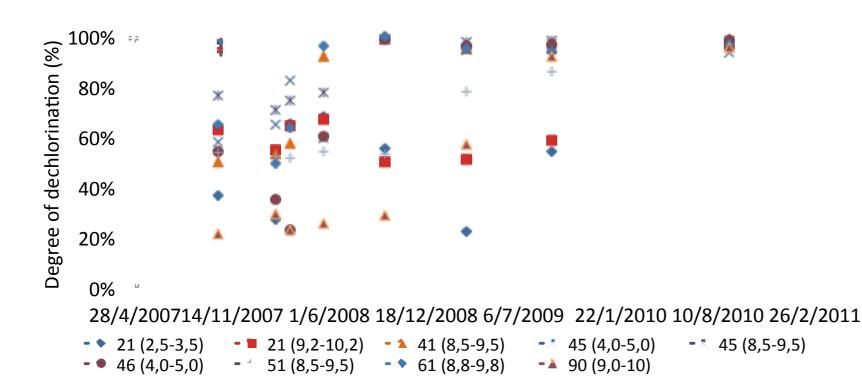








- goal: PCE <20 μg/l; TCE<262 μg/l; DCE<10 μg/l; VC<2,5 μg/l</li>
- After 2 years: 8 out of 9 wells < remediation target
- Sept/2010: Site remediated (80.000 m3 soil volume)
- In-situ treatment of TCE plume within 3 years
- Total actual costs € 441.000 (= 5,51 euro / m3 )







#### Status TCE-concept:

- 9 sites in The Netherlands and 1 in Denmark succesfully remediated
- 2 sites in progress right now
- Very large volumes treated (500.000m<sup>3</sup>)

Parameter	P&T	TCE-concept	Ozone
Energy	700.000 KWH	63.000 KWH	600.000 KWH
Per m <sup>3</sup>	8,8 KWH/M <sup>3</sup>	<b>0,8 KWH/M</b> <sup>3</sup>	7,9 KWH/M <sup>3</sup>
CO <sub>2</sub> -total	397.000 KG	36.000 KG	361.000 KG
	5,0 KG/M3	0,45 KG/M3	4,5 KG/M3

- Adapting Bioclear expertise to the Brazilian reality
- Participating in pilots and showcase projects in remediating contaminated municipal areas
- Biostimulation and bioaugmentation (using phytoremediation)
- Providing consultancy and establishing Brazilian protocols



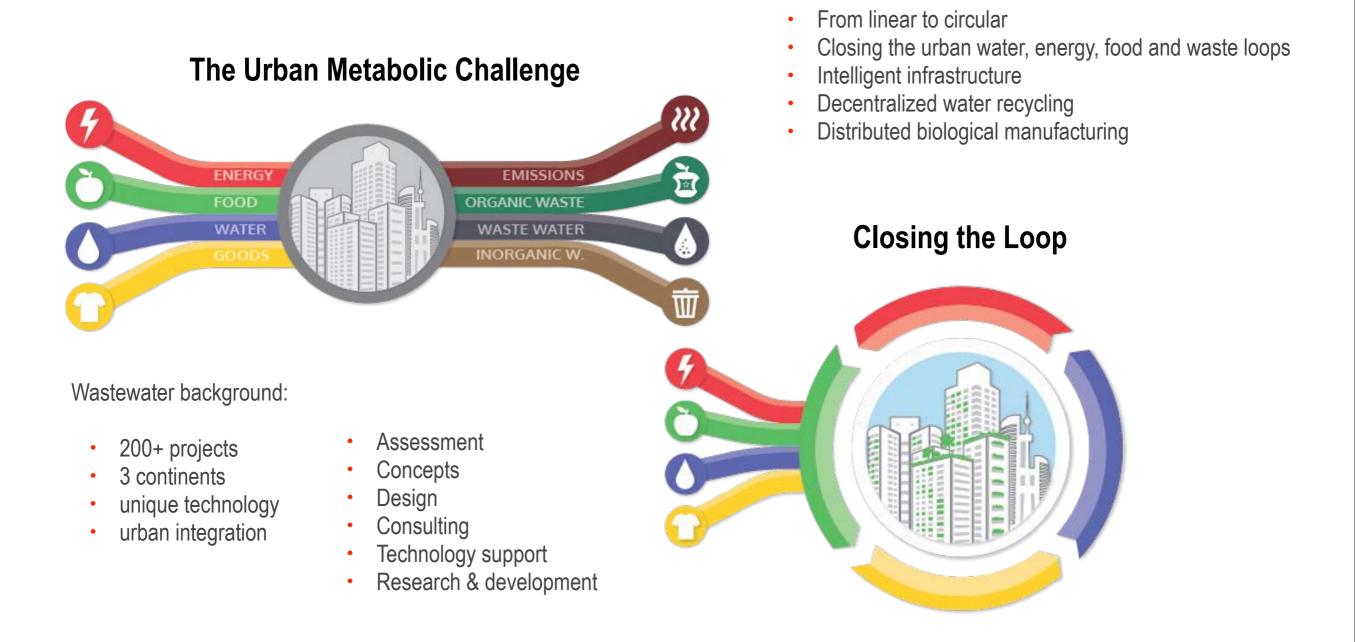






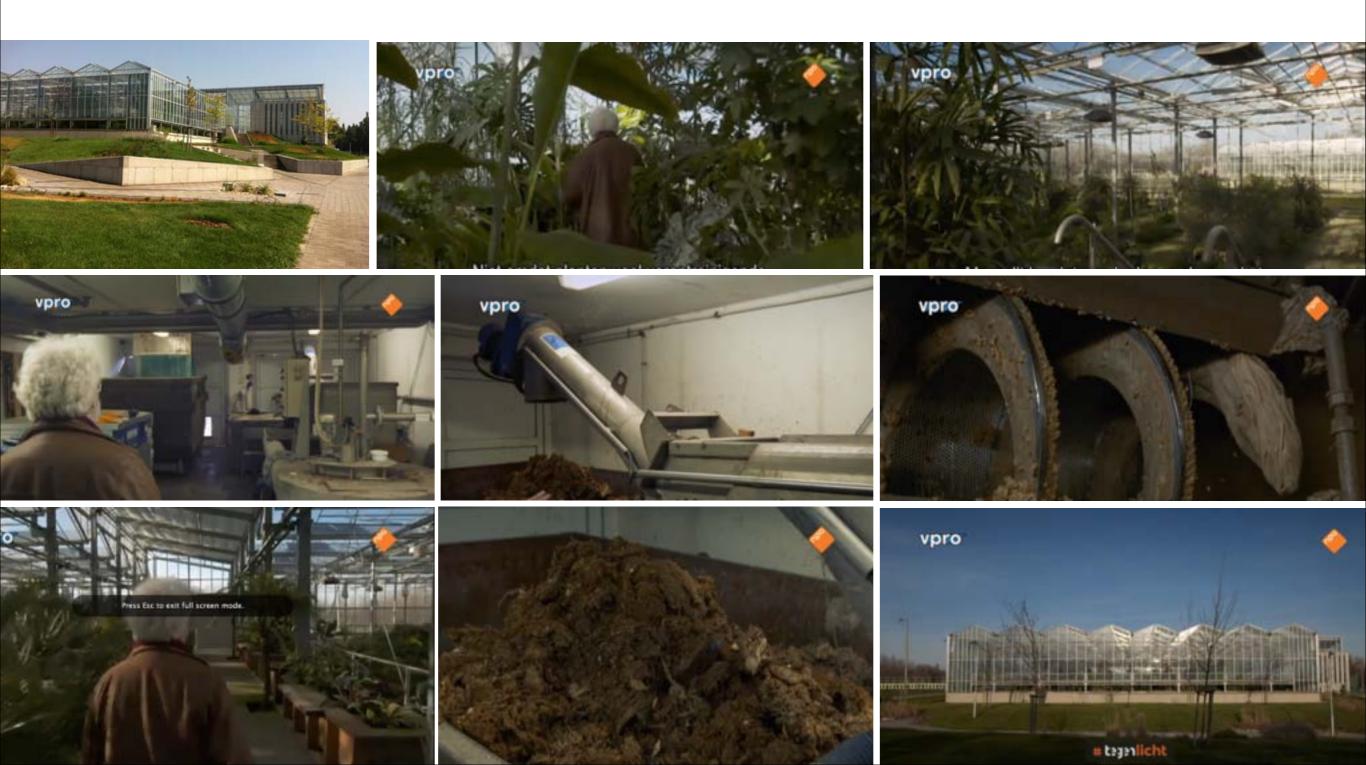
## CC : BIOPOLUS

Overview: circular economy



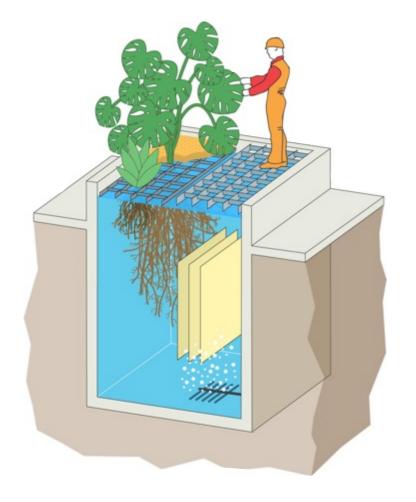


Pilot treatment plant: 400m<sup>2</sup> services 10.000 people: decentralised & cost efficient

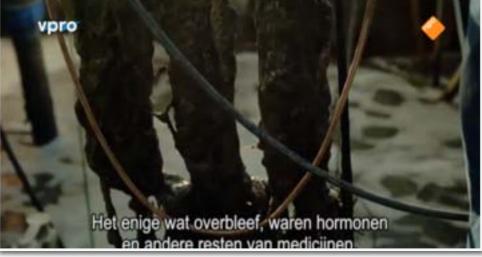




Overview



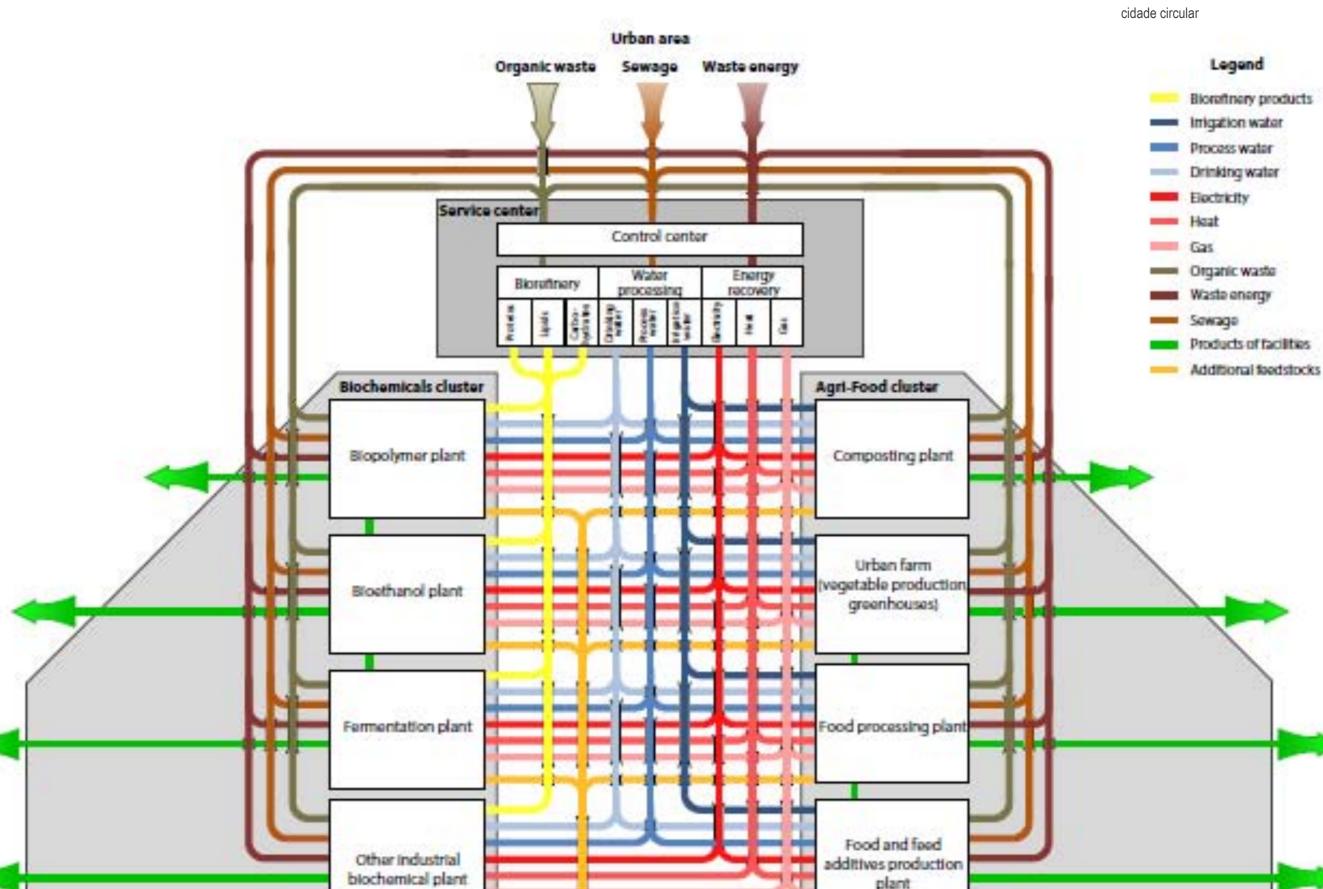






### BIOPOLUS

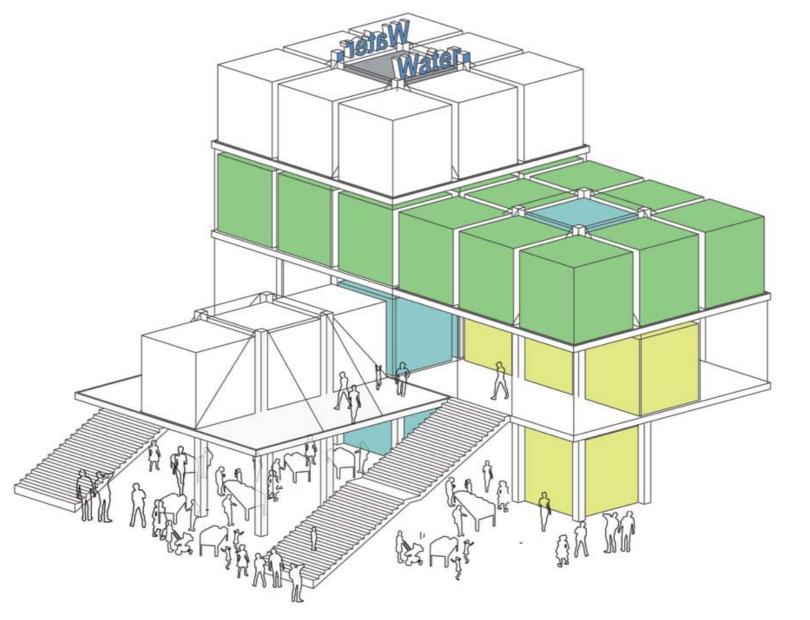
Biosfera





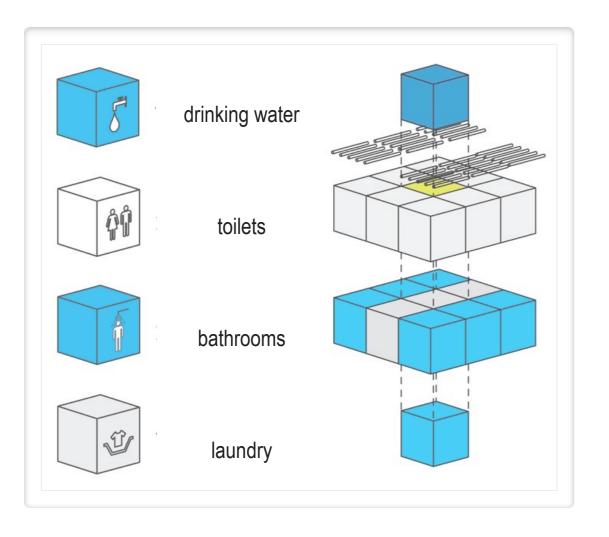
Watermalls as Social Technology: Community Hubs

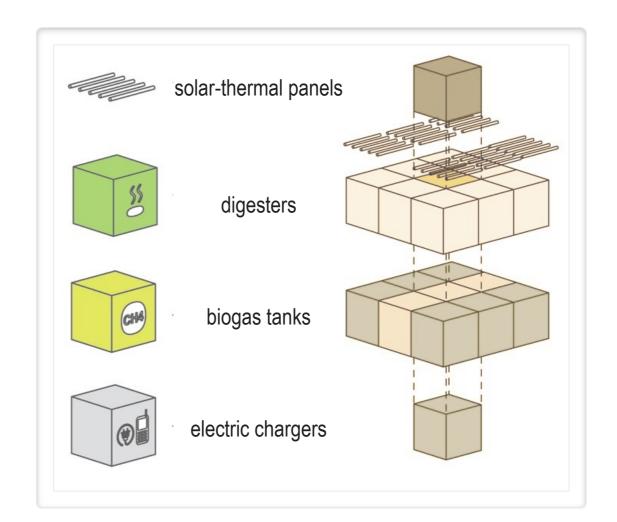
- Modular
- Scalable
- Customisable
- Standardised
- Mass-produced





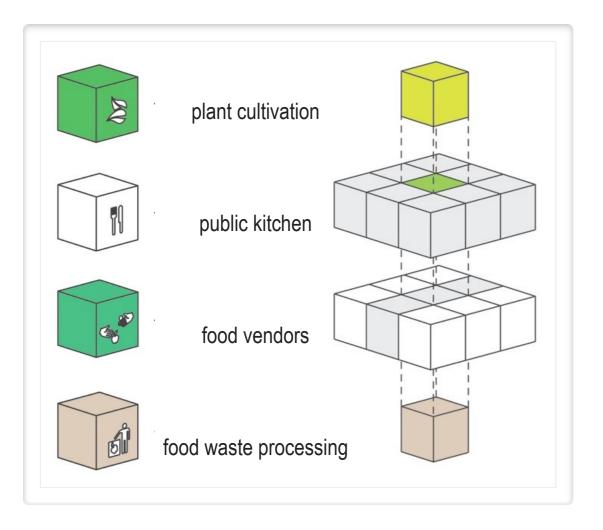
Community Hubs\_Water Block & Energy Block

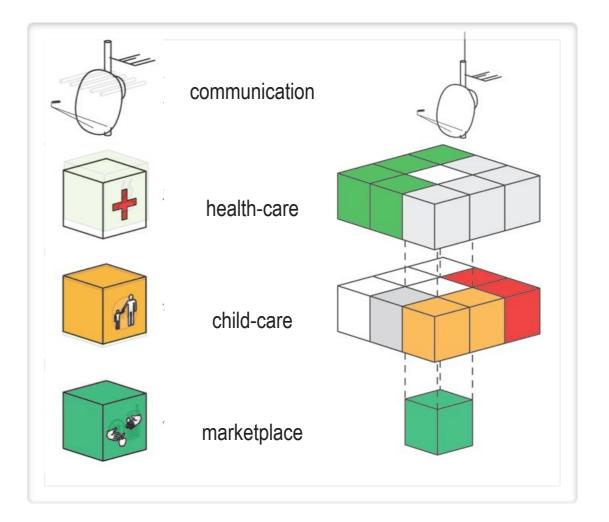




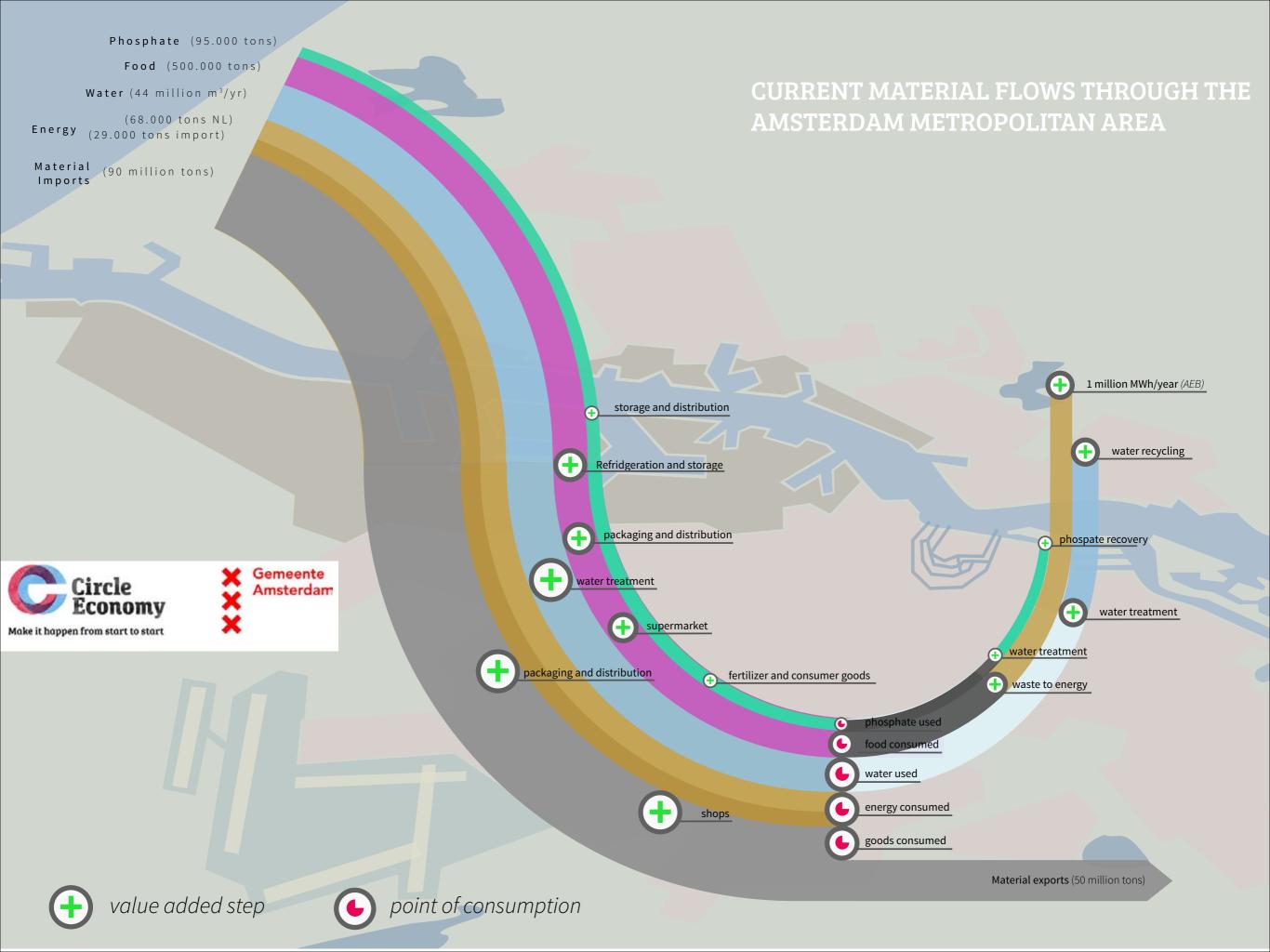


### Community Hubs\_Food Block & Community Block









### closed water and nutrient cycles



The municipality can play a key role in establishing an integrated phosphate strategy. Working with relevant companies, agricultural stakeholders, knowledge institutions, and NGOs can stimulate technological innovation and enable a fully circular phosphate cycle.

Embracing decentralized waste water management can bring many economic and social benefits to Amsterdam. The municipality can lead in coordinating knowledge and planning between relevant stakeholders.

AMSTERDAM

Decentralized waste water management provides an excellent opportunity to "green" port areas. Well designed ecological buffer zones can treat runoff, improve biodiversity, and attract recreational use by citizens in the metroplitan area. The municipality can lead this transition by setting a nature policy in the port, facilitating expansion of buffer areas, and subsidizing green roofs.

### Creating a phosphate market

The Port of Amsterdam has engaged stakeholders on the creation of a secondary phosphate market. A comprehensive "phosphate strategy" should also include stakeholders from the agricultural and consumer product sectors.

> Integrated grey water cleaning with recreational space

Rainwater can stress sewage infrastructure and lead to harmful runoff. Existing parks and marginal lands can be designed to accomodate grey water cleaning. This can be especially important around the port, where health risks associated with runoff are much higher.

ZUIDAS

#### Decentralized urban waste water management

Creatie cluster

Agriculture and Rowers

A decentralized waste water management strategy promotes "smart growth", and rapid response to technological change. Quick-to-build systems offer flexible options for planners to recover heat, nutrients, fertilizer, and energy, which can be distributed to urban farms.

Schiphol Further investments in waste water

Self-sufficient

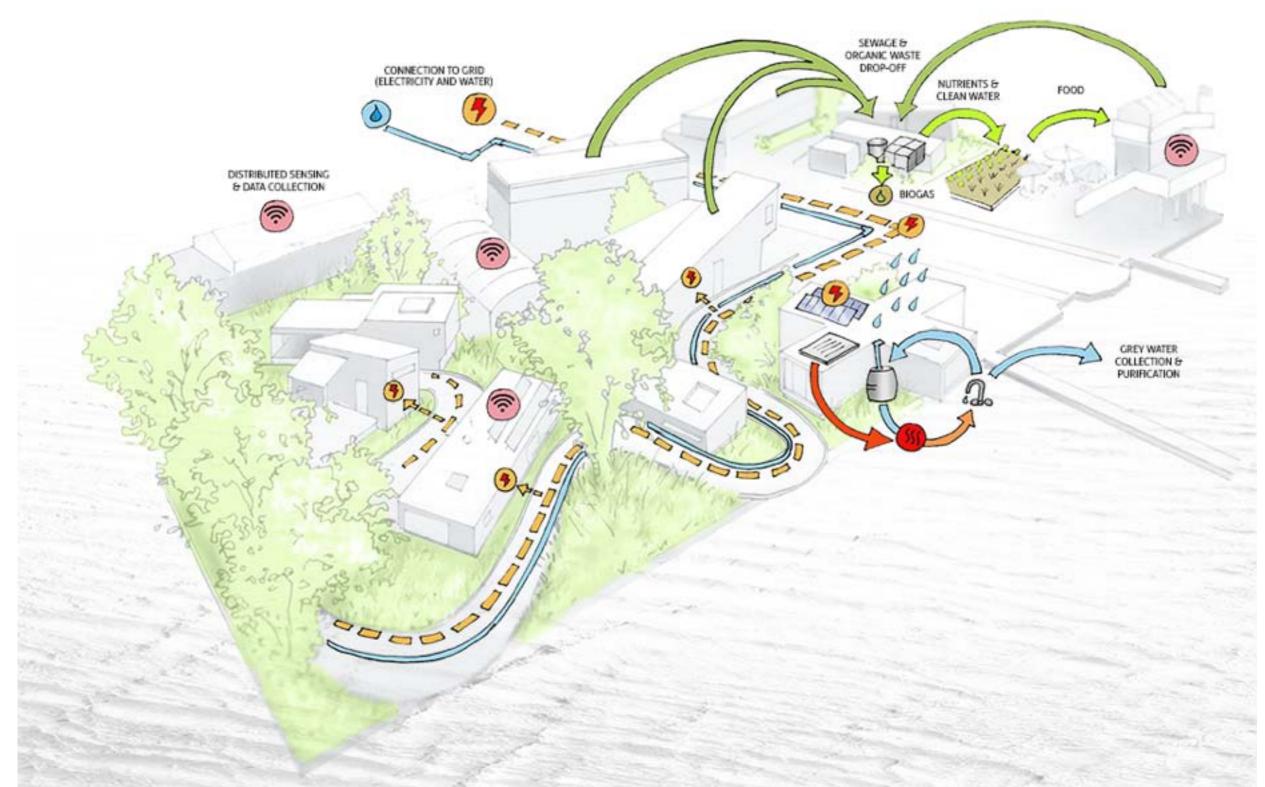
PORT OF AMSTERDAM

cascading and process technologies can yield big improvements in current energy, heat, and nutrient recovery. Creating natural grey water management systems using marginal lands can help make Schiphol water self-sufficient.

SCHIPHOL AIRPORT

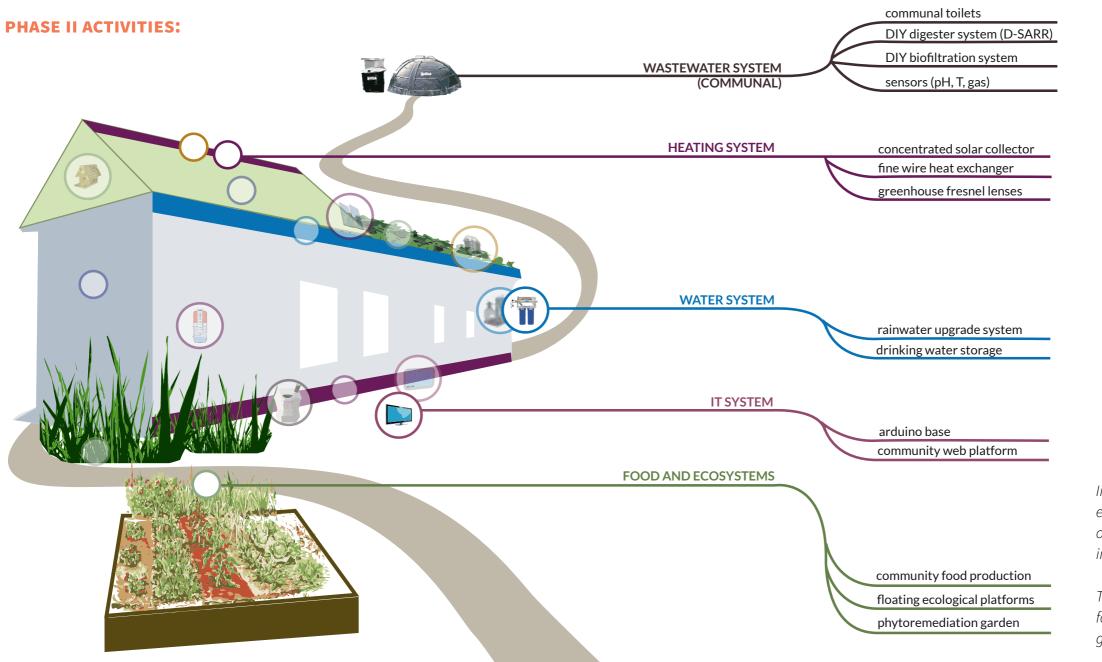






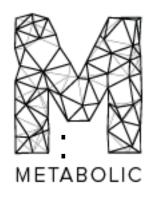






In phase two of the de Ceuvel project, the houseboats will be placed on the site and basic communal infrastructure will be built.

The major interventions proposed for this stage are summarized in the graphic to the left.





### from high-end tech to social tech





### Design

Metabolic designs sustainable urban metabolisms and circular business models for products and services. Our design work is focused primarily on:

- Integrated product design
- Technical designs for cleantech integration in the built environment
- Commercial and urban-scale
   polyculture food systems
- Infrastructure design and transition plans for cities and regions

### Experiment

Research and development is core to our work, which includes understanding local context, testing the efficiency of integrated systems, and experimenting with new materials and technologies. Our work in this area spans:

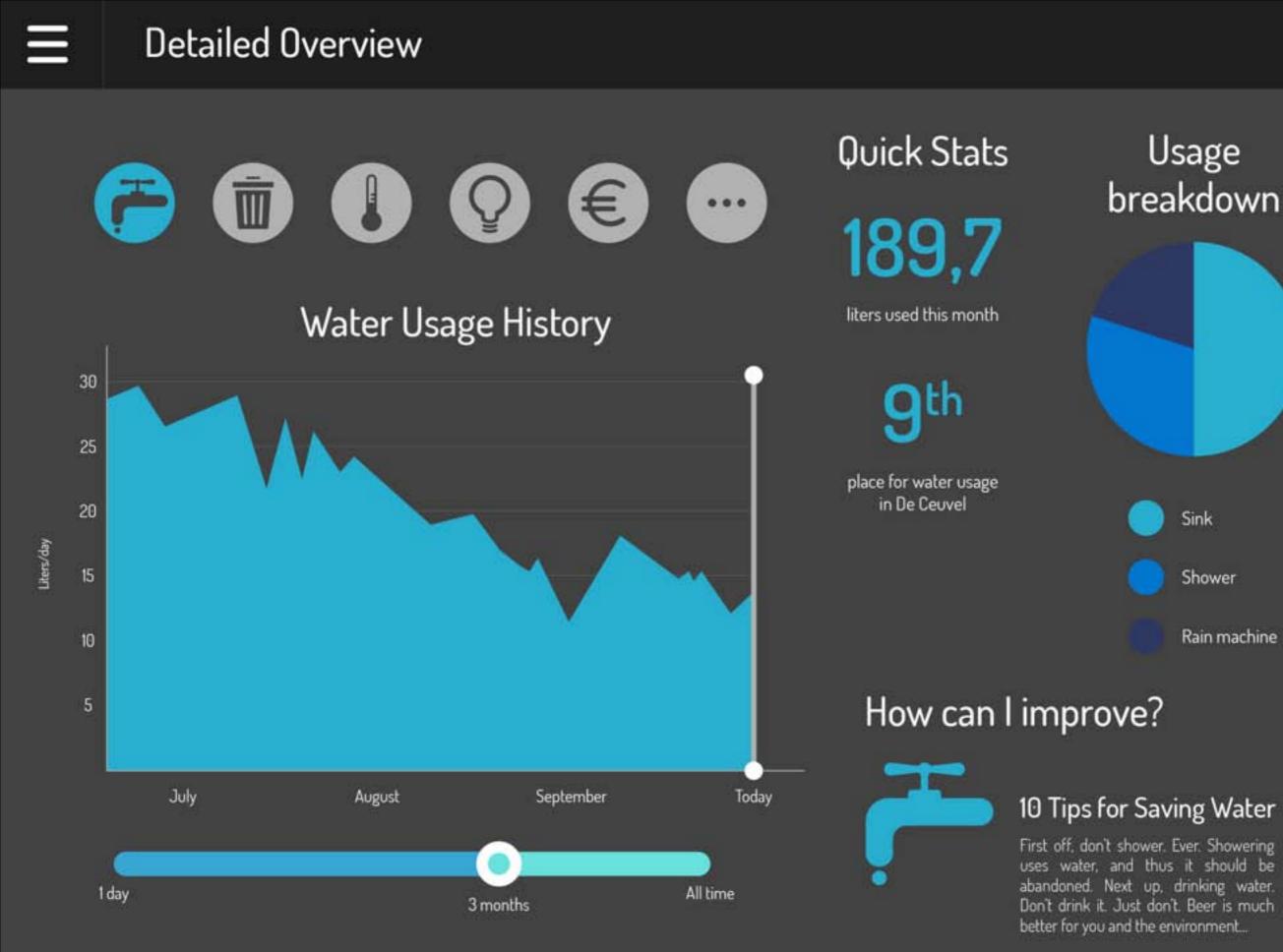
- Applied research in food, materials, sensors, energy, water, and sanitation
  - Integrating technologies to maximize synergies within systems
  - Open-hardware, do-it-yourself (DIY) technology development for poor urban areas

### Build

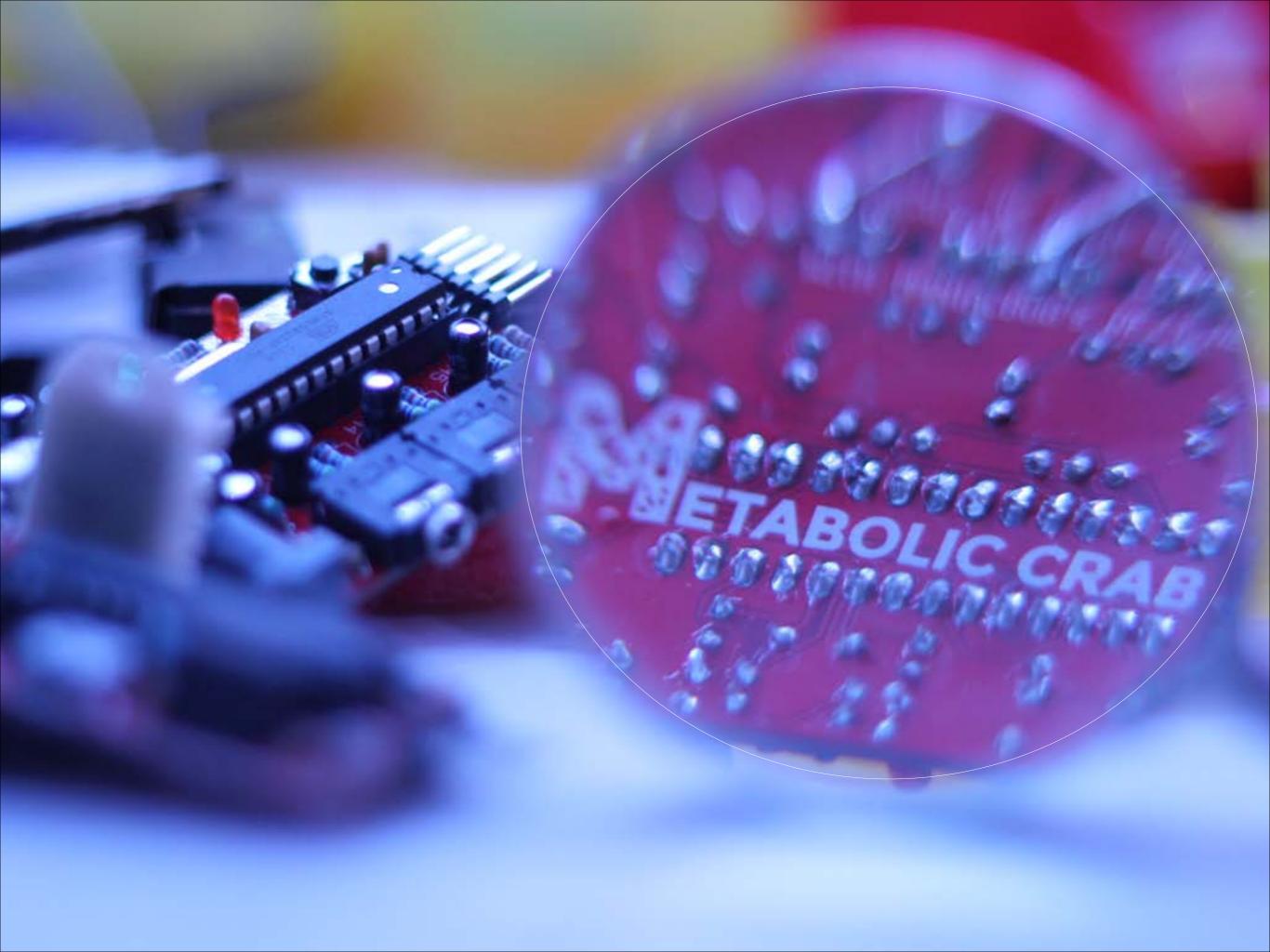
Much of our work starts out as a study or design, but we strive to take projects all the way through to execution. Our most common execution work includes:

- Cleantech installations
- Micro-utility development
- Urban farming kits
- Mobile utility set-ups for off-grid sites





#### Read the full article



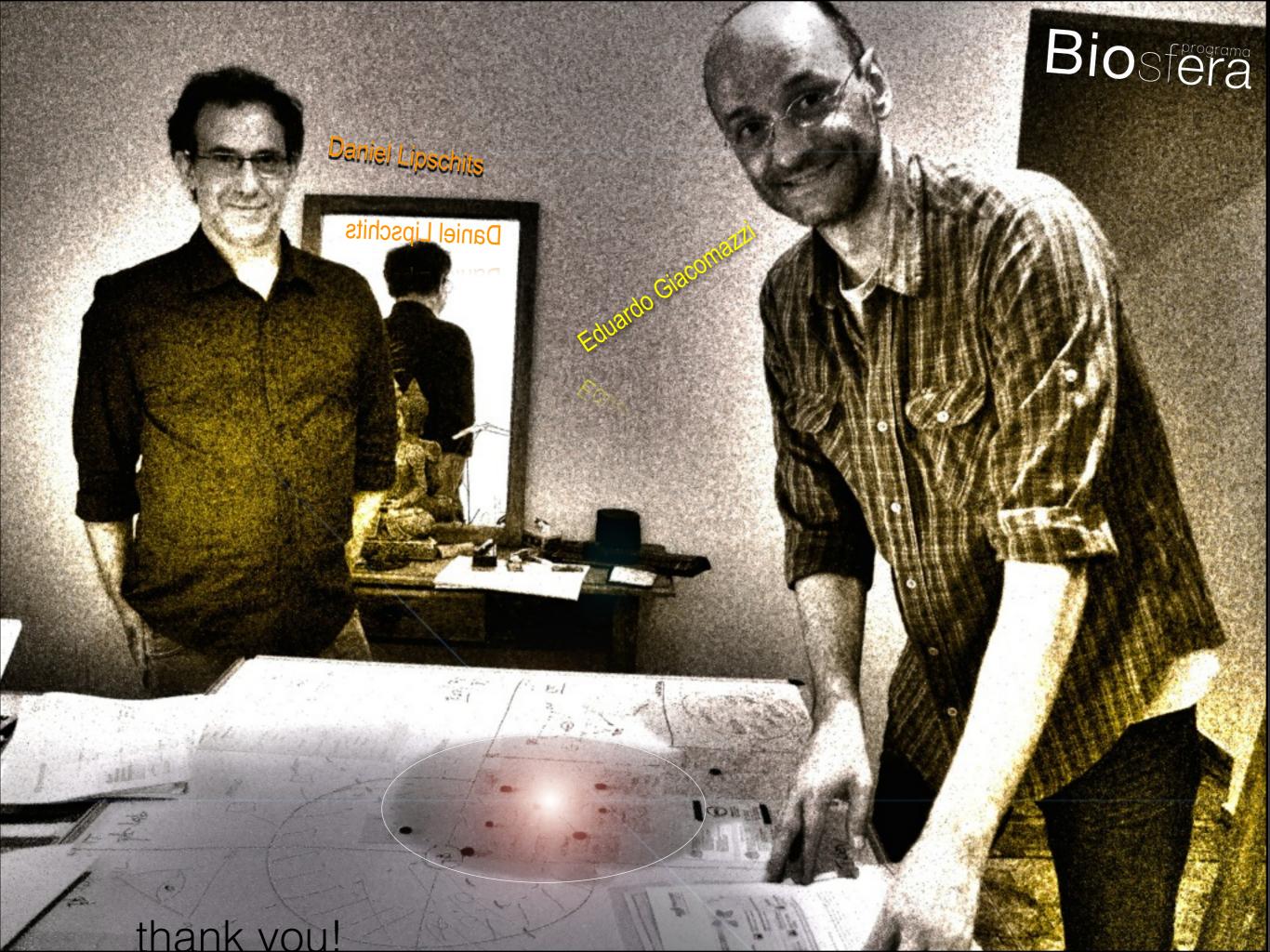


# CC: arguments for decentralization

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