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INNOQUA

Innovative bio-based on-site Sanitation for Water and Resource Savings

HABITAT III QUITO - OCTOBER 2016

Nicolas SALMON – YES Innovation + Grace Yepez Arquitectura
Maria Augusta Hermida – Universidad de Cuenca
Stefan Reuter, BORDA

Once upon a time…

NOBATEK headquarters
Anglet, France
June 2016

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Wastewater treatment

two strategies

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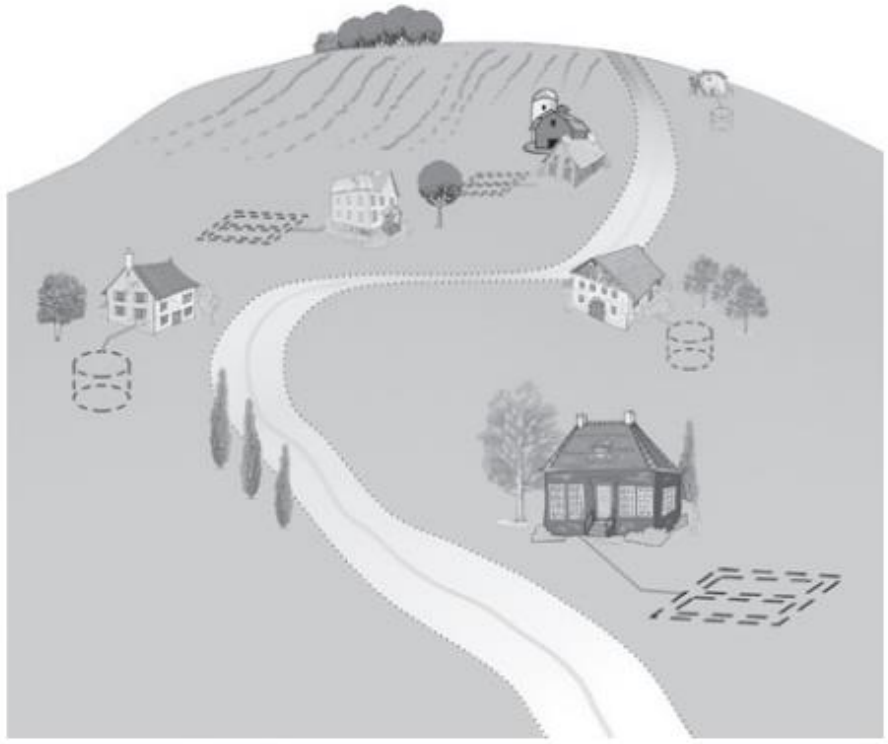

Autonomous sanitation

Collective sanitation

INNOQUA: context

In the world

2.5 billion people do not have access to adequate sanitation

1000 children under 5 **die each day** because of water and hygiene related diseases

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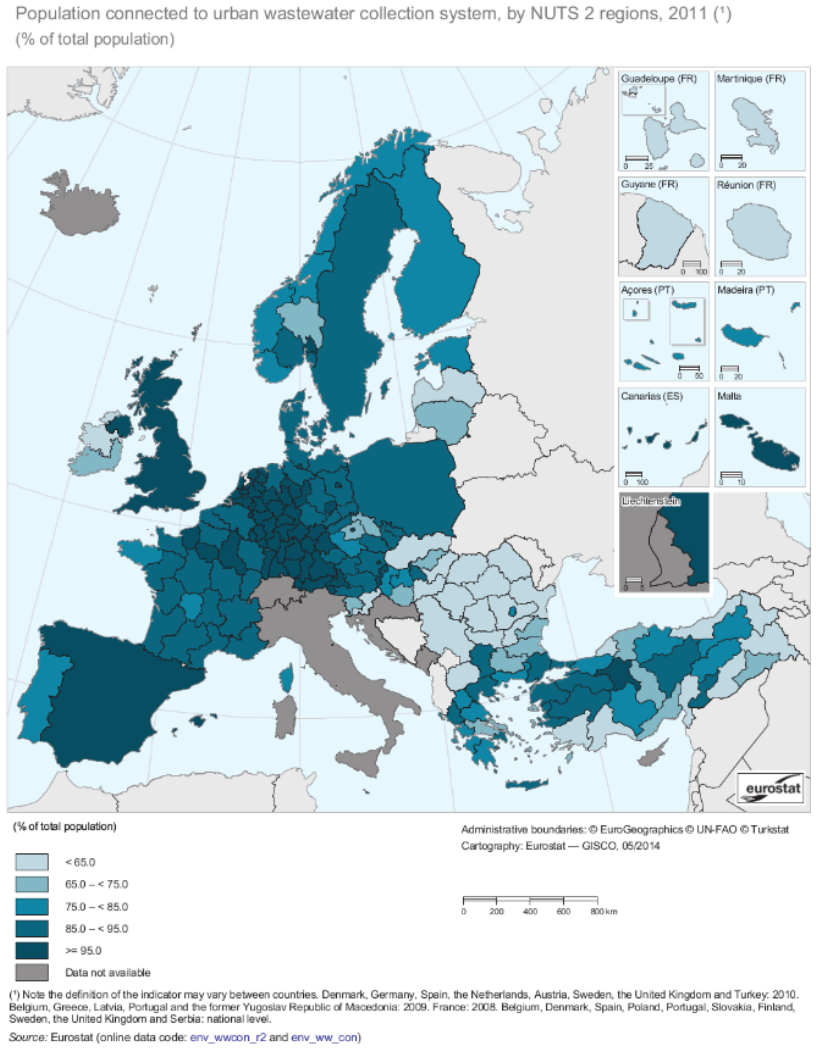
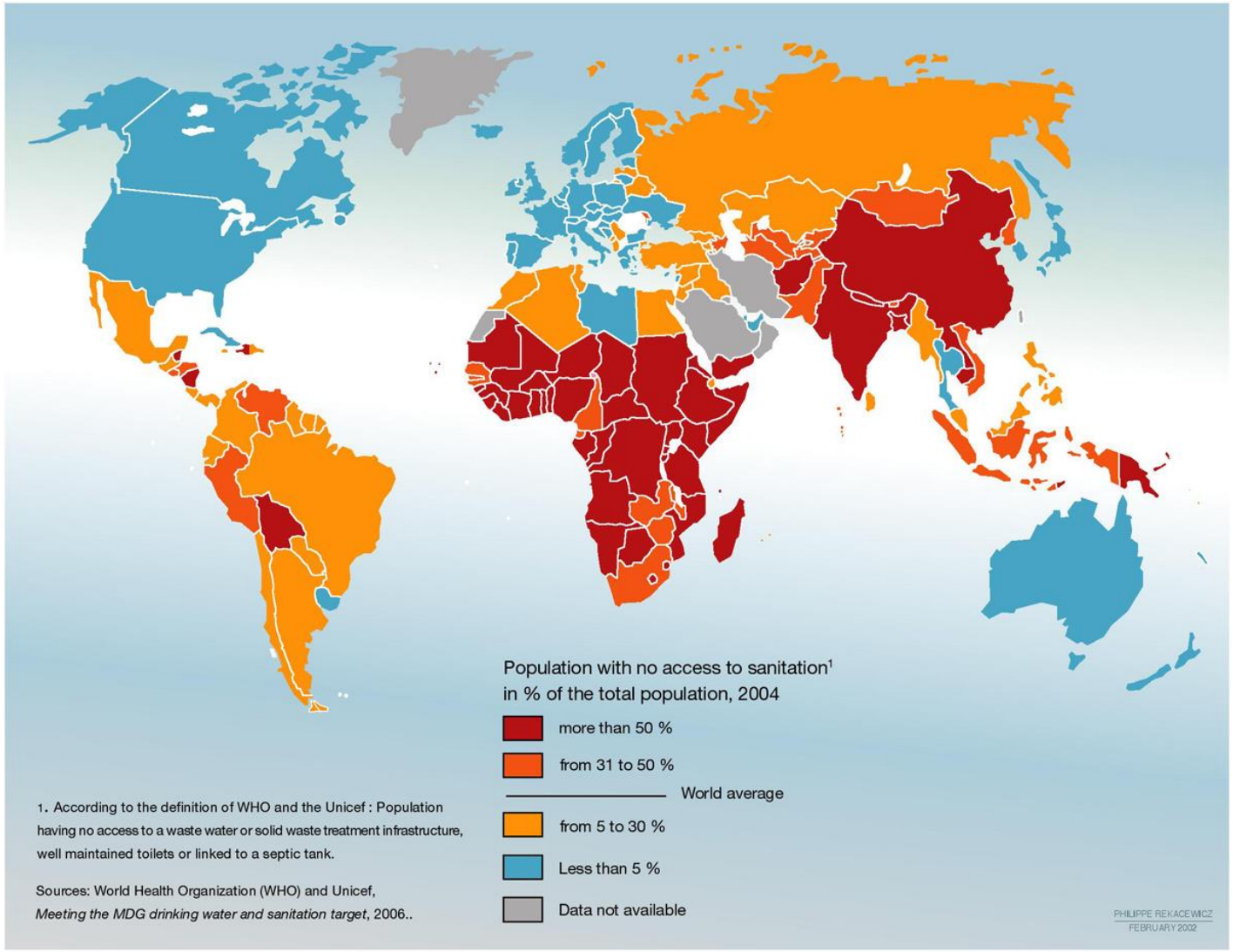
INNOQUA: context



In Europe, still a lot to be done:

Eastern countries, Ireland, specific areas (mountain, coast), agriculture…

INNOQUA: context



In Latin America:
very low level of water treatment

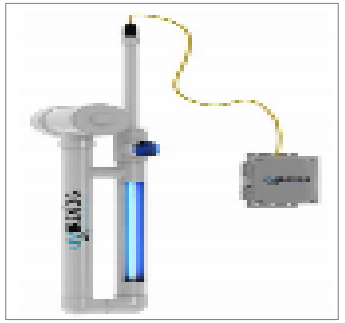
INNOQUA: OBJECTIVE 1

- To integrate individual, low cost, sustainable and biologically-based water sanitation technologies
- Capable of performing a whole water treatment cycle
- Available in multiple modular configurations adapted to local contexts and markets.

4 initial technologies + TICs:

Lumbrifilter

Daphniafilter



UV Disinfection

Bio Solar Purification

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INNOQUA: Technologies

1. Lumbrifilter

Eisenia andrei

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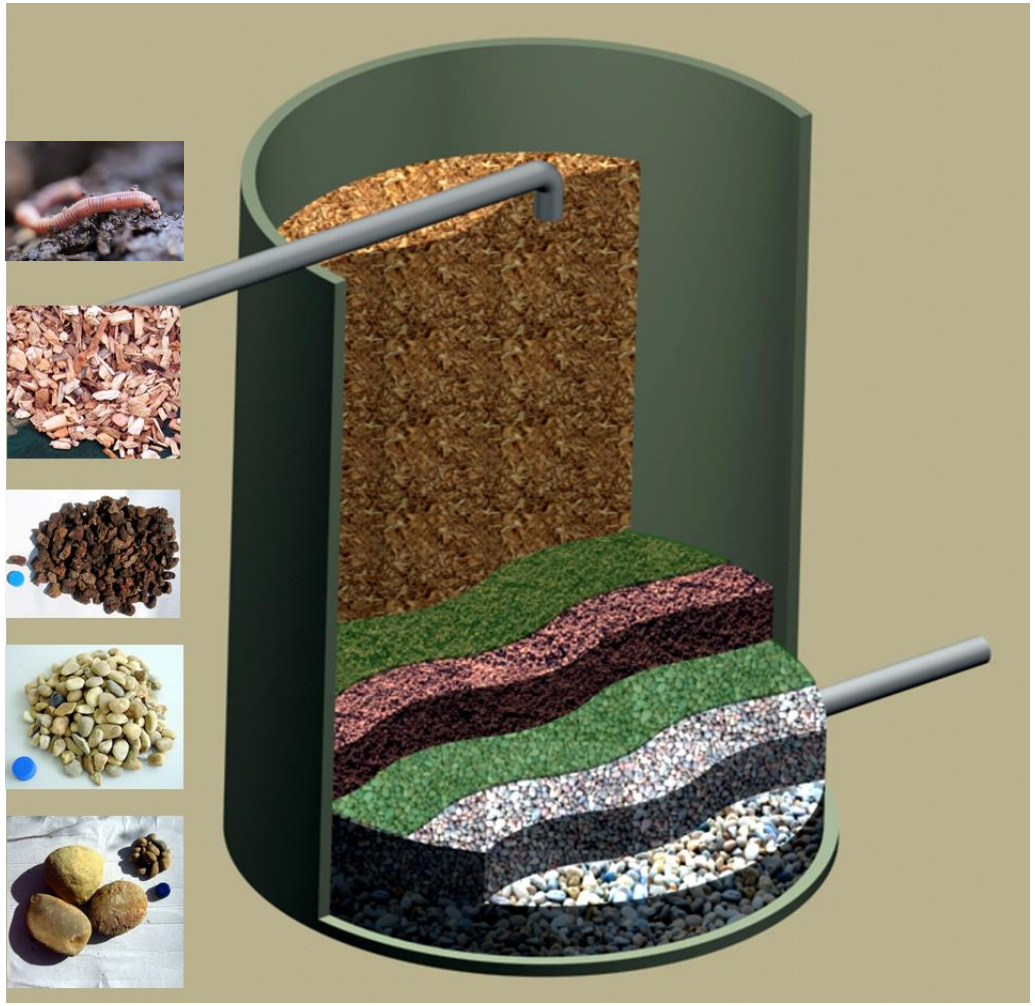
INNOQUA: Technologies

1. Lumbrifilter

Eisenia fetida + *Eisenia andrei* + microorganisms (aerobic bacteria)

+

Specific substrate



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INNOQUA: Technologies

1. Lumbrifilter

> Existing plants in France, Chile, China, New Zealand, Italia, Bolivia,…

> Performance*:

Lumbrifilter	
DCO	51,2 (83%)
DBO5	7 (94,5%)
MES	12,8 (74%)
N kjeldhal	5-12 (93-97%)
N total	50 (50%)
P total	6,2 (30/35%)
Turbidity	87%

> Cost* :

	Lumbrifilter	Activated sludge	Lagoon	Bacterial bed
Investment	76 225	227 150	116 623	177 603
Workforce	4 957	8 597	4 487	6 422
Energy consumption	804	2 721	0	485
Exploitation	5 761	11 318	4 487	6 907

** Data based on Combaillaux (France) 15 years explotation*

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INNOQUA: Technologies

2. Daphniafilter

Daphnia

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INNOQUA: Technologies

2. Daphniafilter

Universitat de Girona

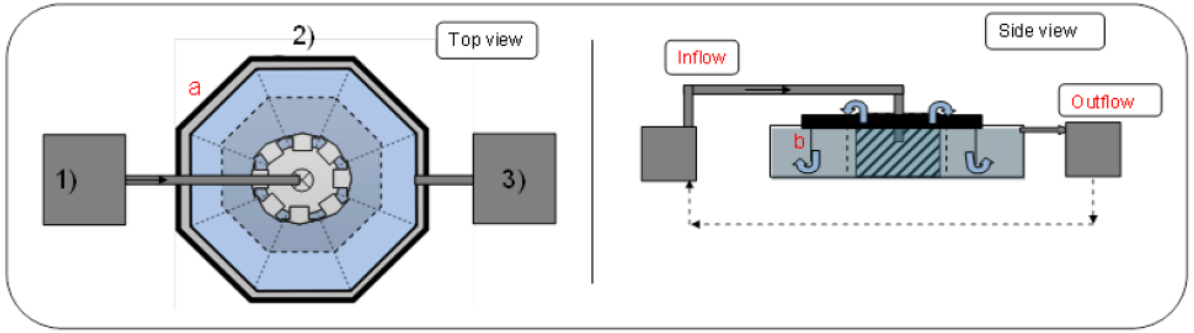

Figure 20 - Scheme of the both views: a) top and b) side of Daphniafilter system. 1) Collecting chamber, 2) main daphnia filter unit and 3) collecting tank.

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INNOQUA: Technologies

2. Daphniafilter

15 years of research, multiples pilot sites in The Netherlands and in Spain

PERFORMANCE

Table 7 - Comparison of the inactivation rates of different water reclamation treatments on the Costa Brava (data from the Costa Brava water agency (http://www.ccbgi.org/reutilitzacio.php, March 2013); *[13]).

Water Reclamation Plant	Treatment (after secondary level)	Inactivation rates, **ulog**		
		E.coli	SRC	Somatic coliphages
El Port de la Selva	Coagulation, flocculation, multi-layer pressure filtration, UV+Chlorination	3.5	2.9	3.5
Empuriabrava	Constructed wetland system	2.2	1.1	-
Torroella de Montgri	UV+Chlorination	2.1	1.1	-
Pals	Chlorination	3.3	1.0	-
Castell-Platja d'Aro	Sand filtration, UV+Chlorination	4.5	1.3	-
Tossa de Mar	Coagulation, flocculation, sedimentation Sand filtration, UV+Chlorination	4.5	2.8	3.2
Pilot plant biological filtration	4-day retention time in Daphnia mesocosmos	2.7	1.9	-

INNOQUA: Technologies

2. Daphniafilter

15 years of research, multiples pilot sites in The Netherlands and in Spain

PERFORMANCE

Total nitrogen and phosphorous concentrations: reductions of 47% and 58% respectively, mainly due to nutrient uptake of algae (phytoplankton, attached and filamentous).

Suspended solids: 99% of small suspended particles eliminated.

Emerging and priority organic pollutants (i.e. pharmaceuticals, personal care products, pesticides, antiseptics, fire retardants and plasticizers) with an average removal efficiency of 80%

- more efficient than other conventional tertiary treatments, such as coagulation-flocculation-lamellar sedimentation and UV light-chlorination,
- but slightly lower than advanced oxidation treatments, such as ozonation, Fenton oxidation or membrane-based systems.
- *High removal efficiency of the Daphnia reactor explained by the simultaneous occurrence in the biological filtration systems of biodegradation (e.g. ibuprofen, naproxen and furosemide), photodegradation (e.g. diclofenac and ketoprofen), sorption processes, algae and zooplankton uptake.*

Entirely natural and does not require chemicals or frequent maintenance.

Capable of regulating themselves based on the available food and the physico-chemical environment giving high quality water.

Reduces the concentration of small particles in a similar amount to that found for disc filters without the need of any backwash

Does not require the use of chemicals to aggregate particles > reduced ecological impact and cost of treatment.

INNOQUA: Technologies

3. Bio-solar purification

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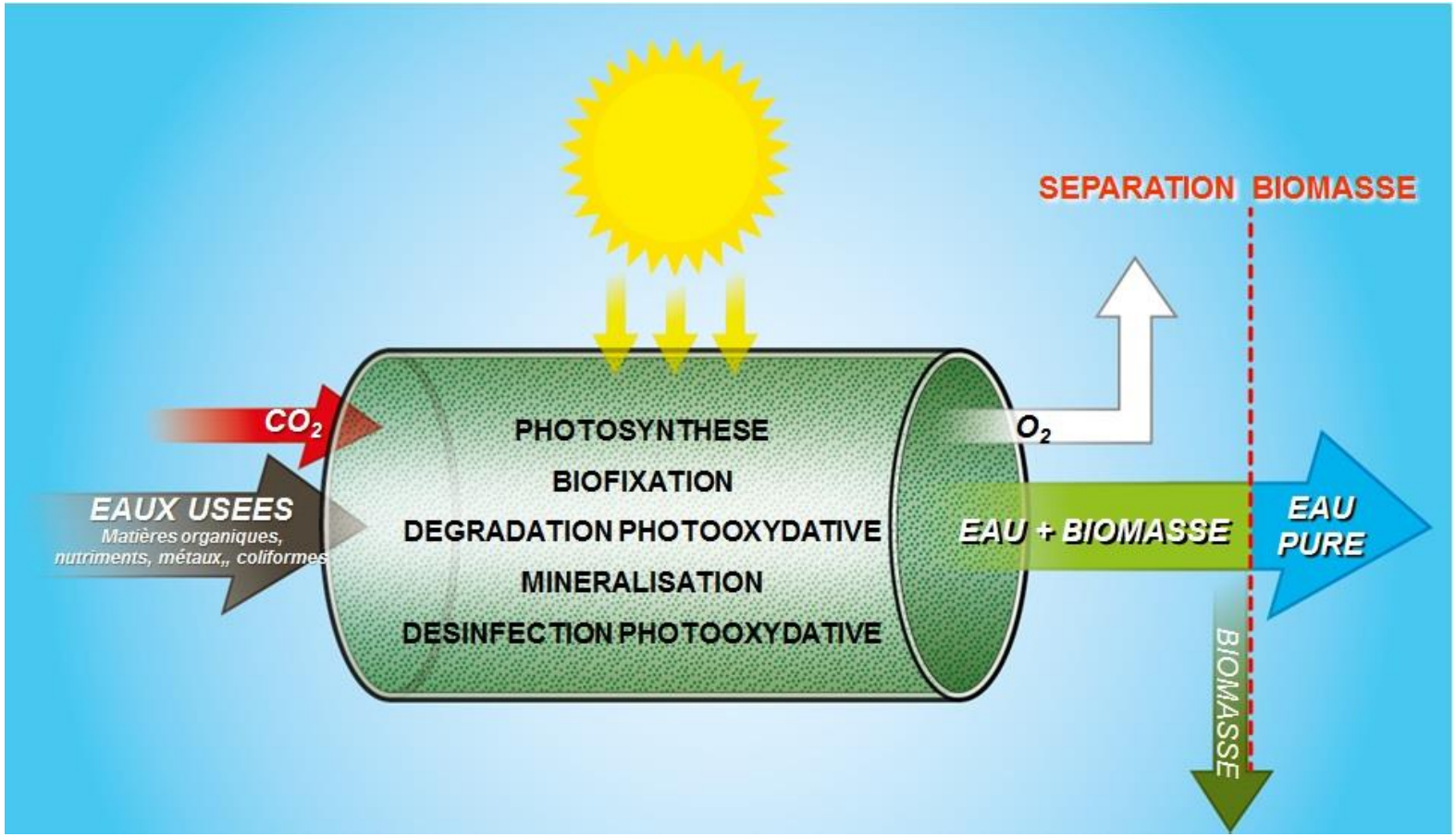
INNOQUA: Technologies

3. Bio-solar purification

HelioPure



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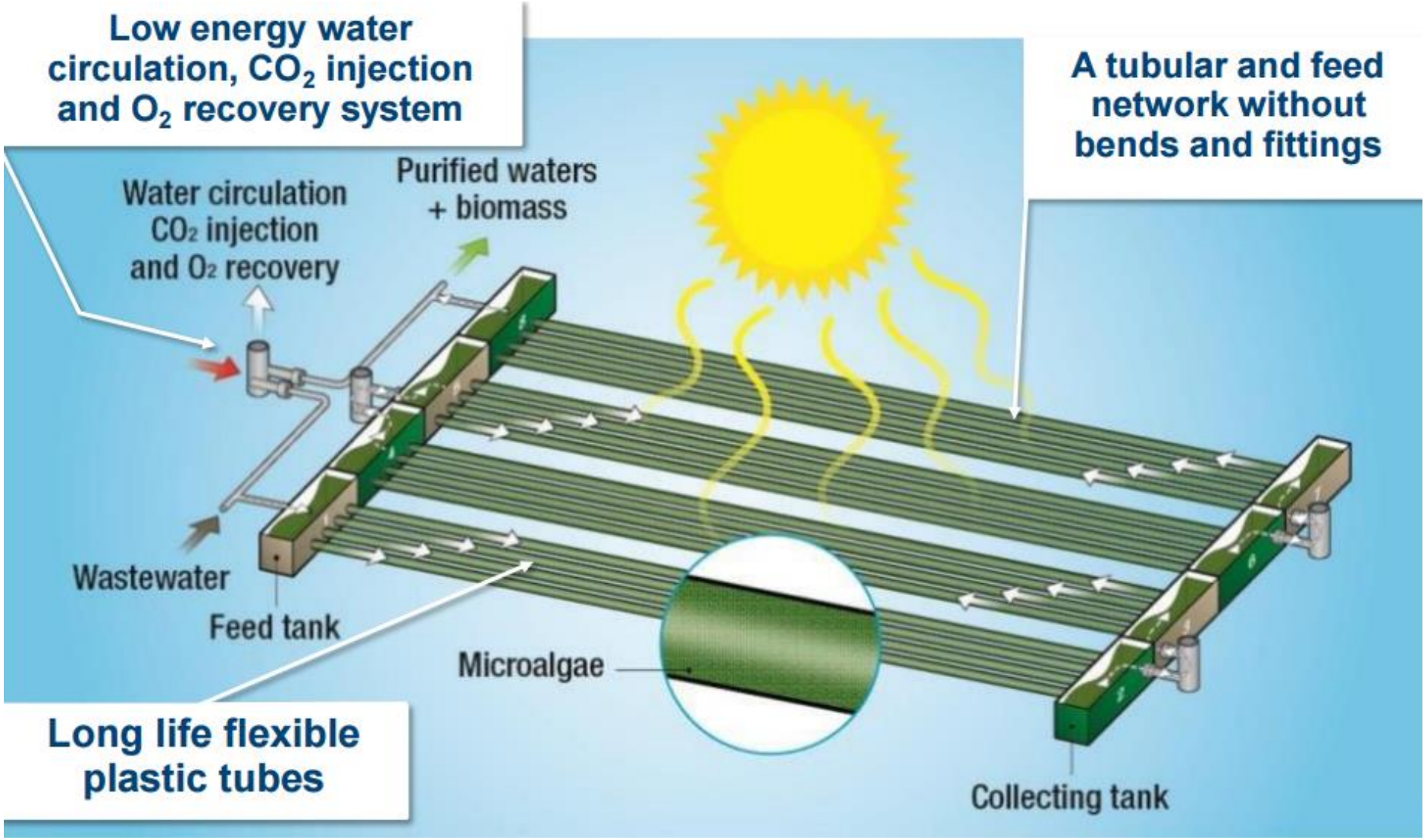
INNOQUA: Technologies

3. Bio-solar purification

HelioPure



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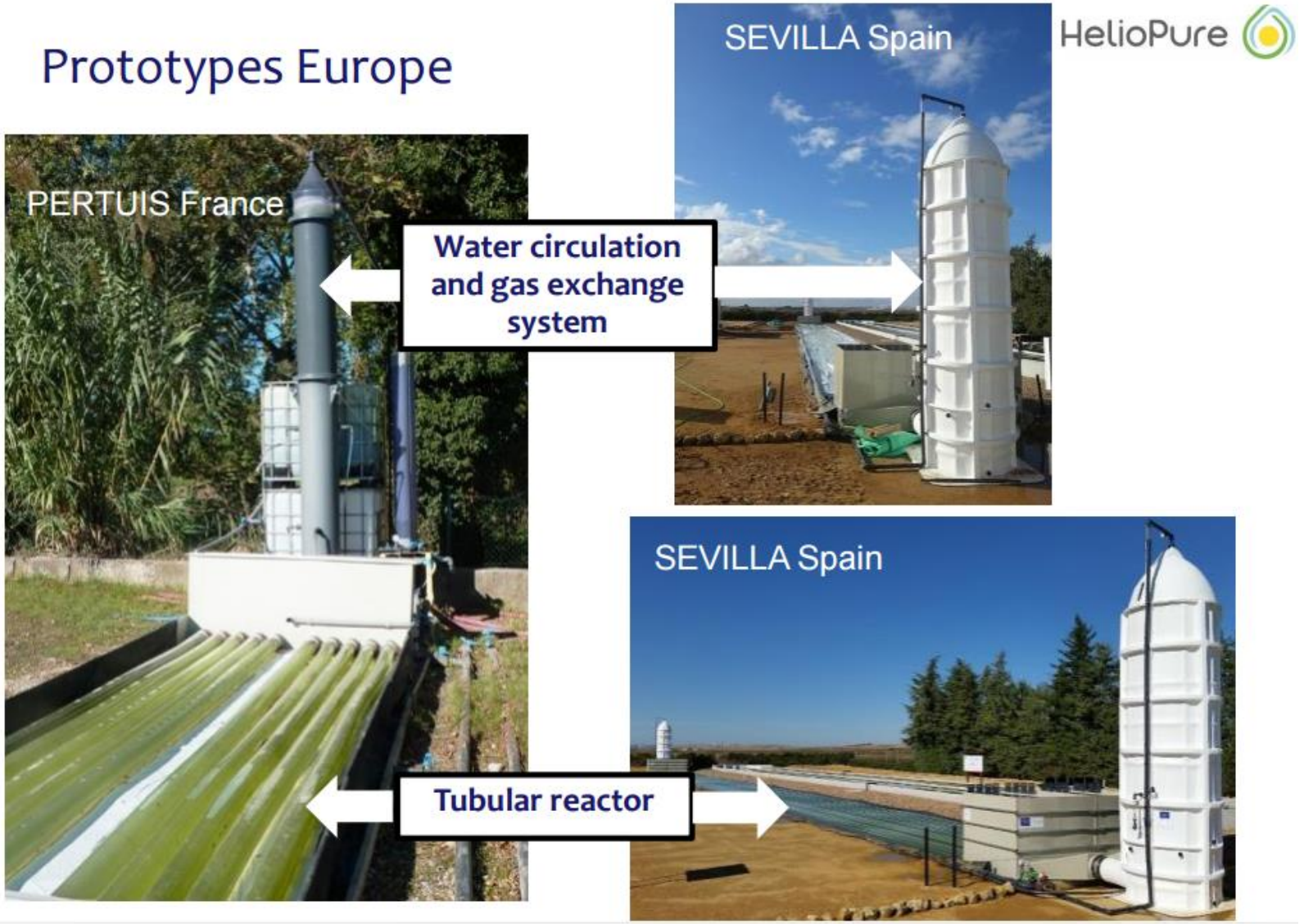
INNOQUA: Technologies

3. Bio-solar purification

HelioPure

Prototypes Europe



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INNOQUA: Technologies

3. Bio-solar purification

HelioPure

Cost:

> Investment costs from 0.2 to 0.4 $/m3 treated water based on 20 years depreciation

> Operating costs from 0.05 to 0.15 $/m3 recovered water

Performance:

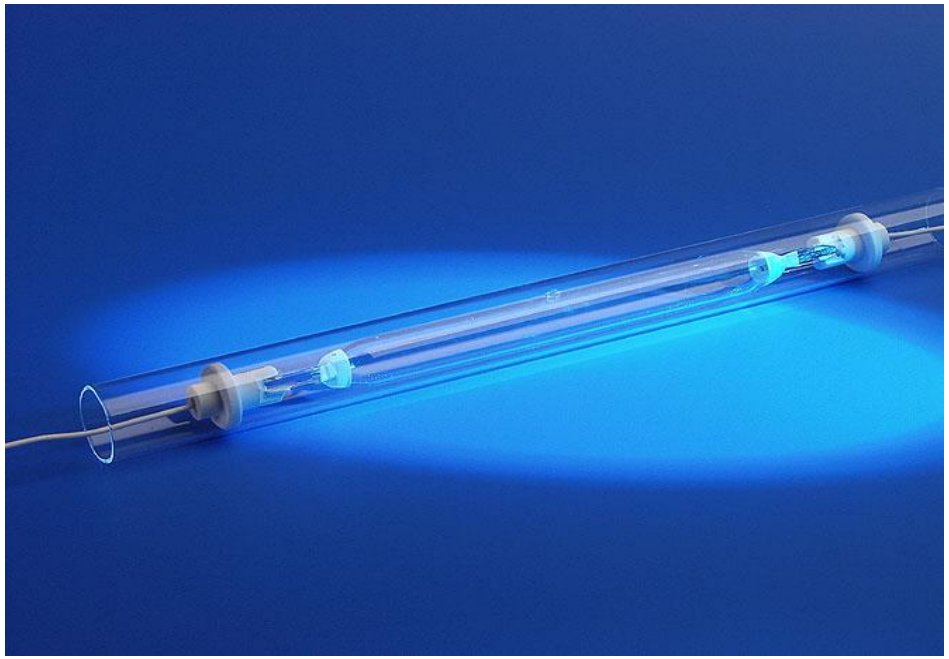
Type of pollutants	Substances	Type of treatment	Treatment performance	Comment
Nutrients	CO2, NO3, NH4, PO4	Uptake	80 - 100%	Pilot testing
Metals	Toxic, rare, radioactive As, Cr, Cd, Cu, Mn, Ni, Hg, Pb, U	Biofixation	60 - 90%	Lab results and publications on microalgae biofixation in open systems HRAP
Pharmaceuticals	Diclofenac Sulfamethoxyazole	Photooxydative degradation	100% 60 - 100%	Lab results and publications
Pesticides	Thiamethoxam	Photooxydative degradation	100%	Lab results and publications
Organic micropollutants	Bisphenol A	Photooxydative degradation	65%	Lab results with selected microalgae strain
Microorganisms	Coliforms and fecal enterococci	Photooxydative disinfection	4 to 6 log decrease	Pilot testing

Parameters	Input HelioPur unit	Output HelioPur unit	Removal performance
Escherichia Coli (Coliforms)	2,8E + 07	< 60	5,7 log (99,997%)
Fecal Enterococci	3,5E + 06	< 60	4,7 log
Total Organic Carbon (mg/L)	210	7,8	96%
Biological Oxygen Demand 5 days (mg/L)	500	3	99%
Chimical Oxygen Demand (mg/L)	1050	32	97%
Suspended Materials (mg/L)	450	17	96%
Total Phosphorous (mg P/L)	10,65	1,75	80%
Total Kjeldhal Nitrogen (mg N/L)	73,44	23,35	68%
Ammonia (mg N/L)	42,9	0,5	98%

INNOQUA: Technologies

4. UV disinfection

berson masters in uv



Medium pressure lamp

InLine range with medium pressure lamps

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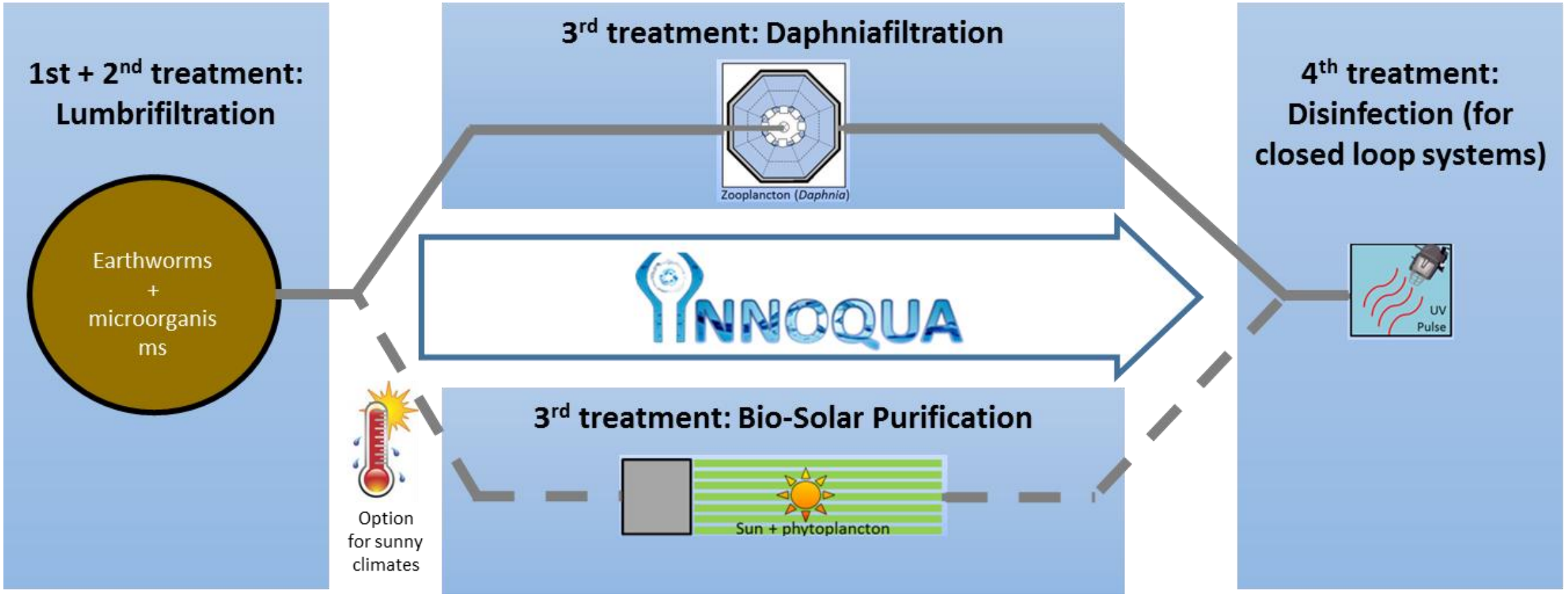
The INNOQUA System



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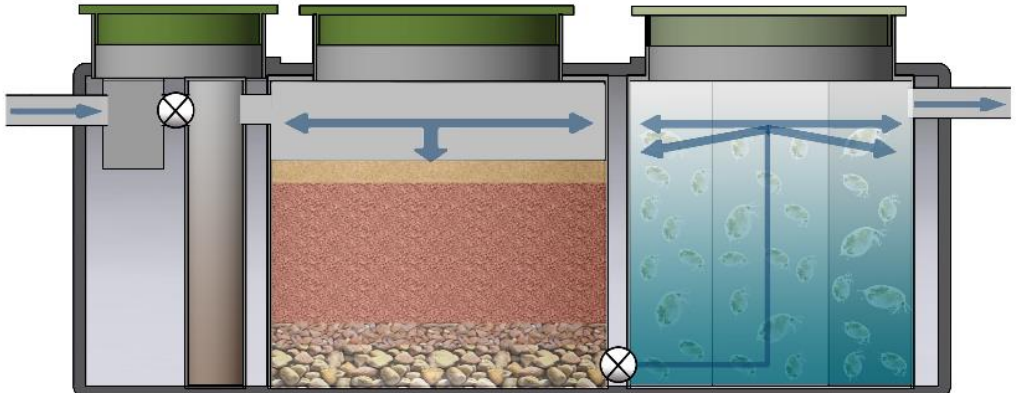
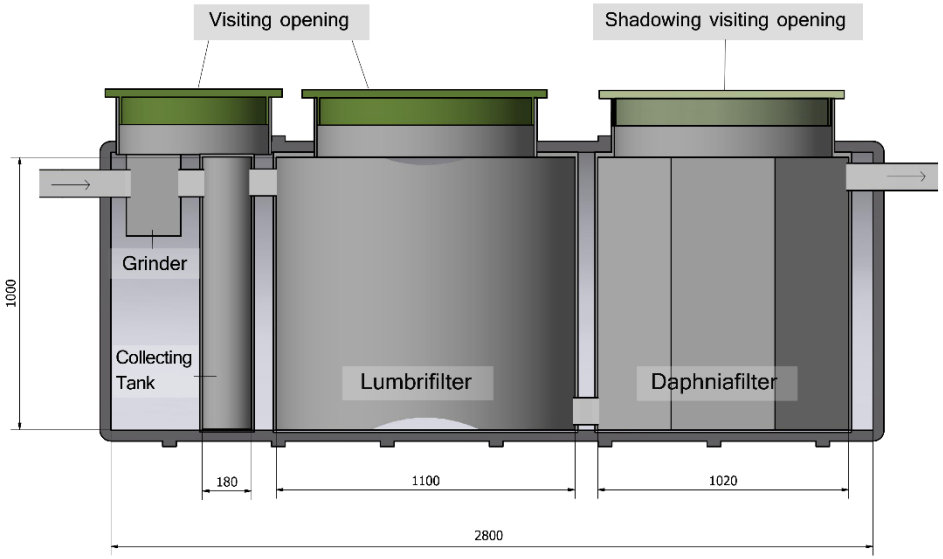
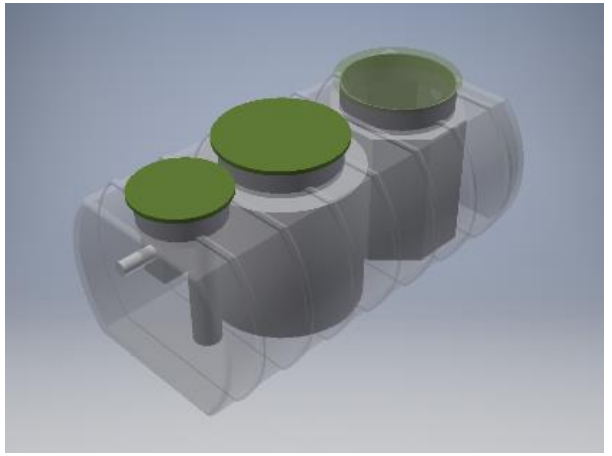
The INNOQUA System







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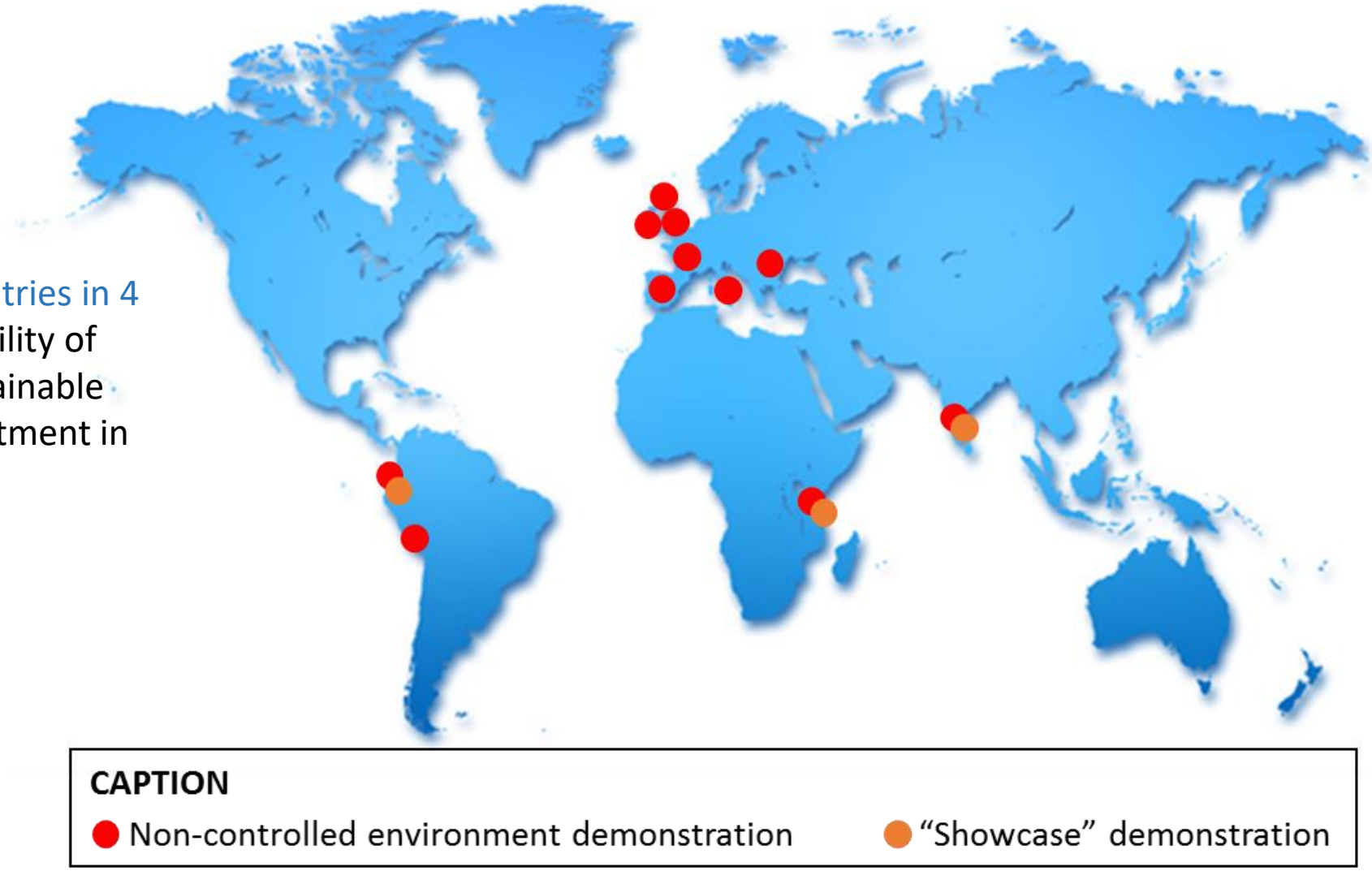
OBJECTIVES 2

- To demonstrate across 9 countries in 4 continents the long term viability of innovative, modular and sustainable solutions for wastewater treatment in real-environment



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Some pilot sites

Office in Anglet, France

Aquaculture in Lozere, France

Island facility in the Highlands, Scotland

Residential area in Bangalore, India

Turistic housing in Sinop, Turkey

PILOT SITES: Latin America

Quito

Casa Armero

Cuenca

Universidad de Cuenca

Arequipa

Fundo Huasacache

OBJECTIVE 3

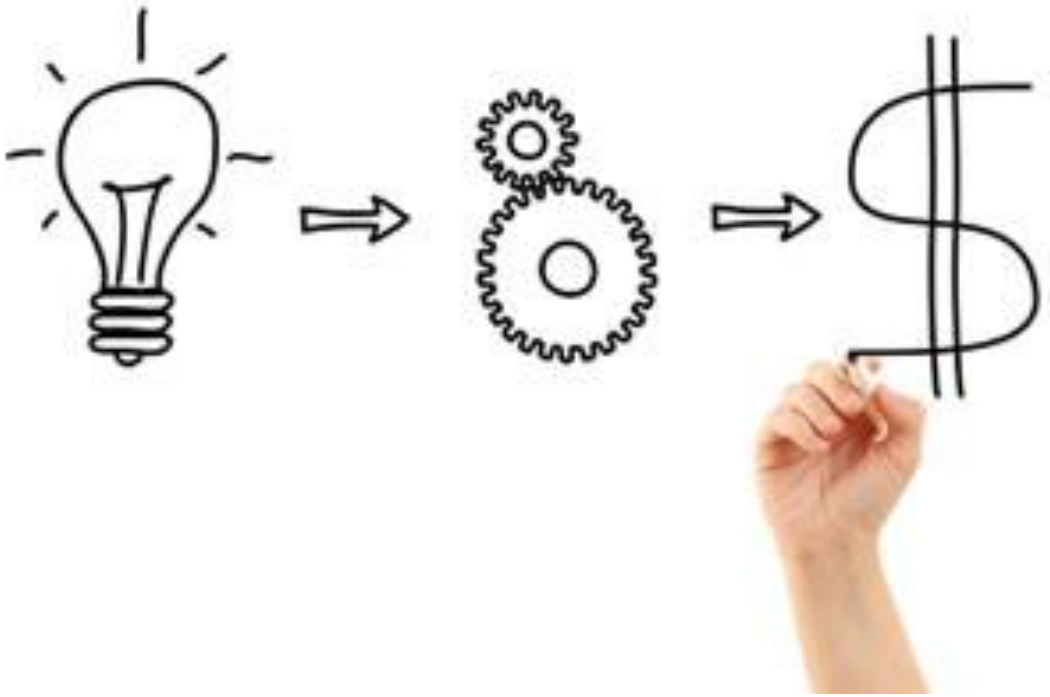
Optimization and sustainability

- Eco design + life cycle assessment
- Resource and energy efficiency
- Local sourcing and re-manufacturing process
- Life cycle cost

OBJECTIVE 4

- To support the commercialization of the proposed solutions in order to encompass pre-commercialization challenges of innovative water solutions

- To start stimulating economic growth, business and job creation in the water sector both inside and outside Europe.



PROJECT DEVELOPMENT

- 20 partners
- Coodinator: Nobatek
- Period: 2016-2020
- Budget: 8 M Euros

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Water Innovations
- Lumbrifilter
- Daphniafilter
- Bio-Solar Purification
- ICT monitoring

Lab scale
- Integrated system design
- Prototyping
- Initial market analysis

Pilot scale
- Small pilot scale
- Initial LCA & LCC
- Engagement with potential end-users and stakeholders

Demonstration
- Large pilot scale integration and demo
- Detailed LCA & LCC
- Firm engagement with all stakeholders

Product
- Final product design
- Commercial spin-out, product licensing, commercial packaging
- Product marketing/sale

RESEARCH

DEMONSTRATION

Inside and outside Europe

Single home

Collective housing
Tertiary building

Developing countries

Aquaculture
Cattle farming

COMMERCIAL EXPLOITATION

NGOs

Social housing

Construction

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PROJECT PARTNERS

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www.innoqua.eu

Stefan REUTER
reuter@borda.de

Dr. Arq. Maria Augusta HERMIDA
augusta.hermida@ucuenca.edu.ec

Dr. Ing. Nicolas SALMON
nsalmon@yes-innovation.com
Tel: 0986054601

YES Innovation / GRACE YEPEZ ARQUITECTURA
www.yes-innovation.com