



# Horizon2020 case studies on wastewater treatment technologies in the Mediterranean

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# Ongoing Horizon2020

- Can **Horizon2020 projects** lead to the development of novel and **marketable** technologies for wastewater treatment in the Mediterranean?

Our H2020 Projects	Activities
SMART-PLANT	Retrofitting and upgrading existing wastewater treatment plants to recover resources from wastewater and promote energy efficiency
HYDROUSA	Recovering non-conventional water sources by applying low cost and nature based solutions in water scarce decentralized areas
INTCATCH	Innovative water monitoring technologies Treatment of combined sewer outflows (CSOs)
C-FOOT-CTRL	Online monitoring of greenhouse gas emissions in WWTPs

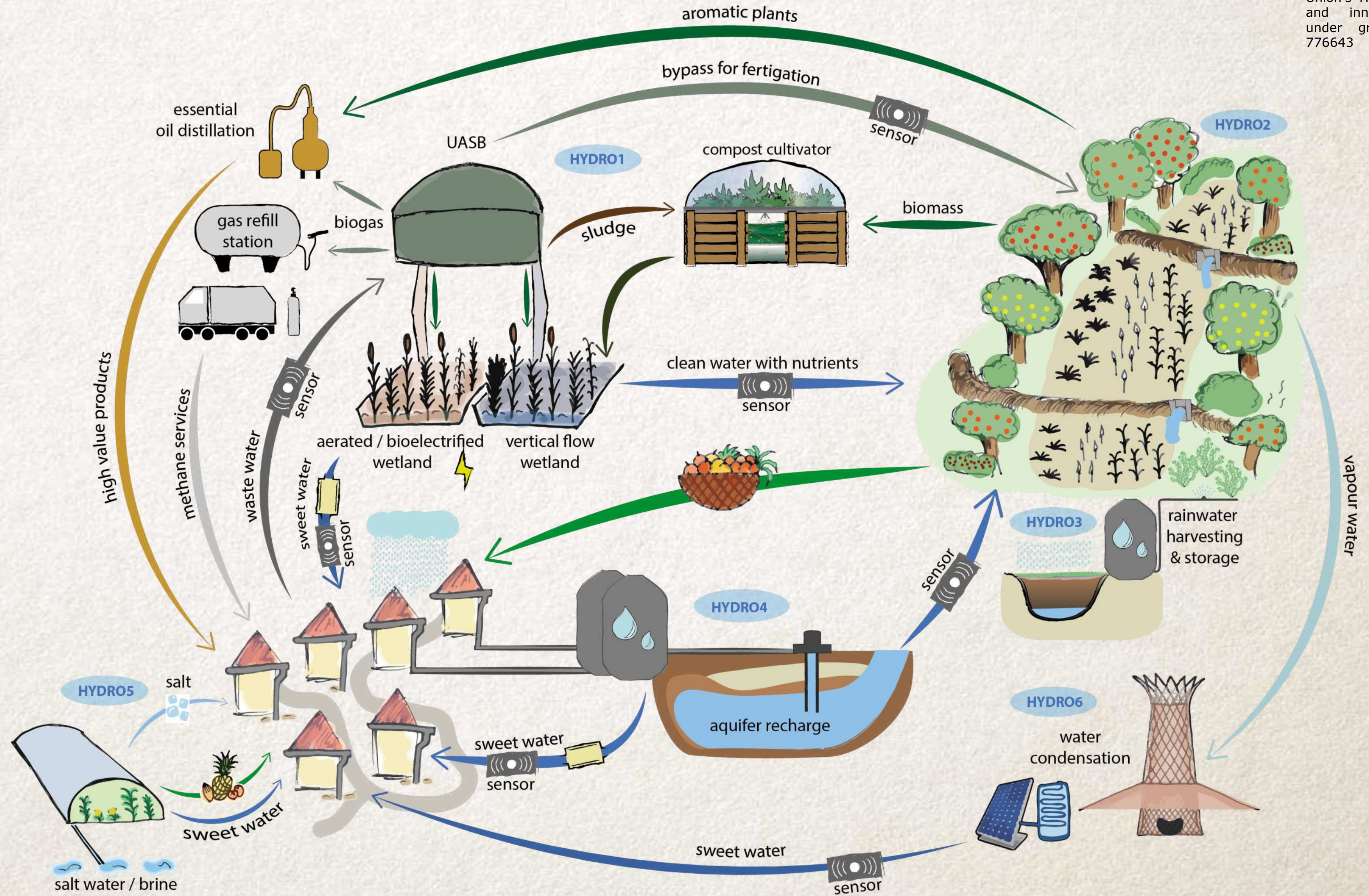




# HYDROUSA Circular Approach



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 776643

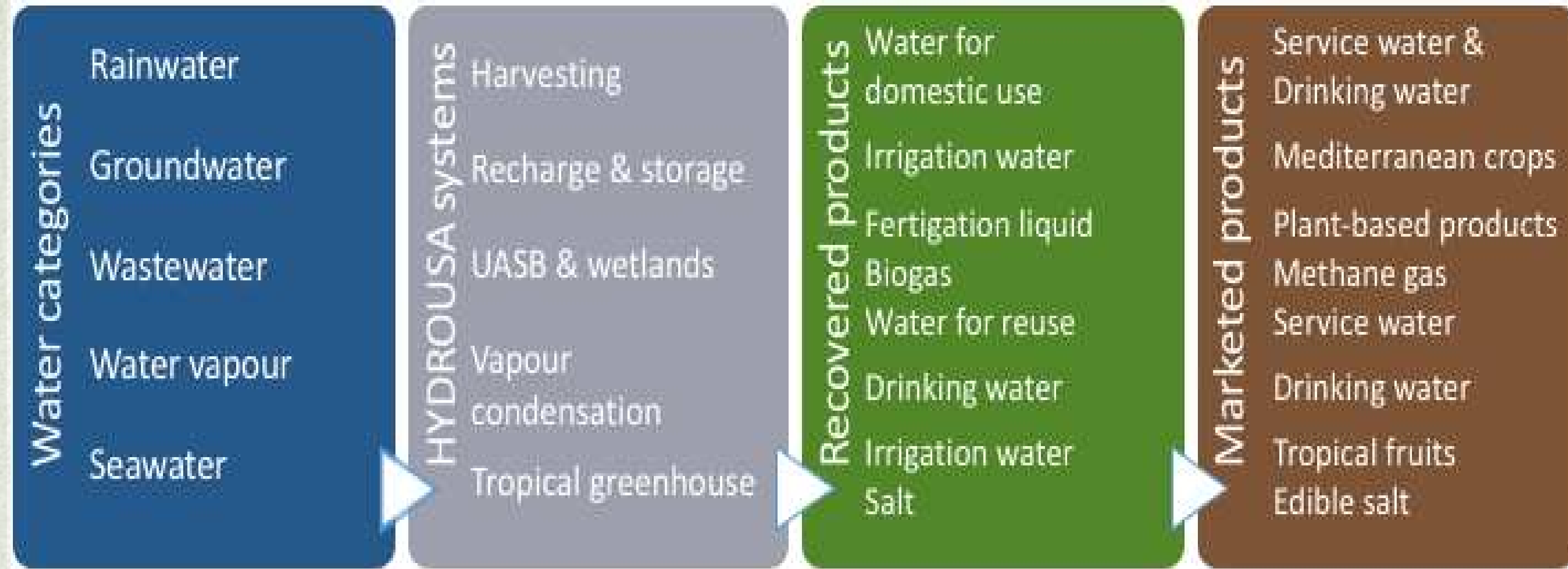




# HYDROUSA Project



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- ❖ Demonstrate the feasibility of **innovative, nature based technologies** to **recover** and **preserve** valuable materials and energy from different types of water
- ❖ Demonstrate **innovative supply chain** within the concept of the circular economy
- ❖ **Decrease water acquisition cost**
- ✓ Applicability in **coastal areas** and in **islands**, particularly suitable for medium-small and decentralized regions
- ✓ Integrating within the supply chain **citizen and farmer based activities**
- ✓ Promote **novel agricultural practices and precision irrigation** within the water-food-energy nexus



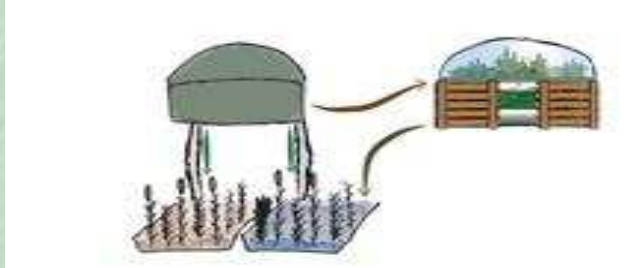
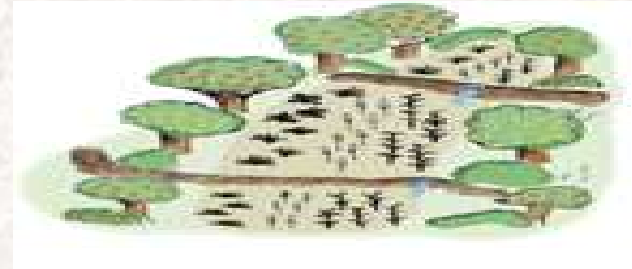
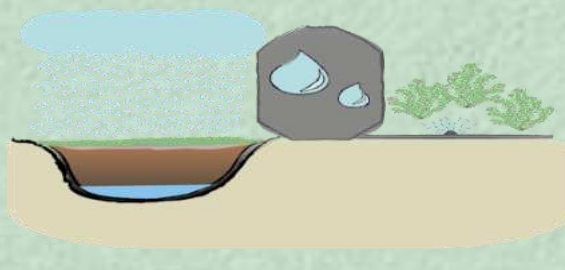
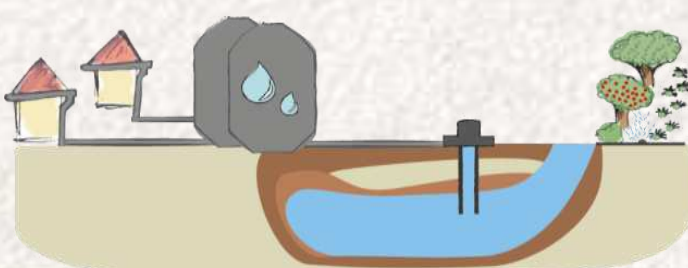

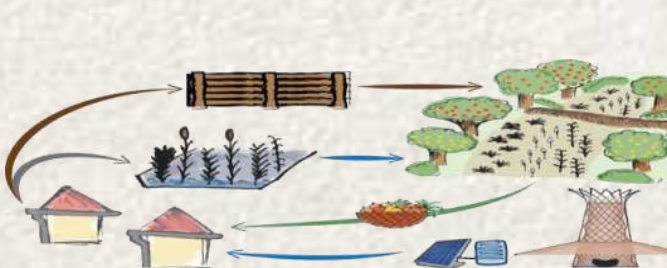


# HYDROUSA

## DEMOSTRATION SITES



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Site	Scheme	Specification	Issue Solved
HYDRO1, Lesvos		Integrated UASB-wetland Anaerobic treatment & sludge composting, water reuse, biogas production	No wastewater discharge in the sea; cheaper production of reclaimed water; increasing water supply; recycling nutrients
HYDRO2, Lesvos		Irrigation of agroforestry system with nutrient-rich reclaimed water	Wastewater use for fertigation; no fertilizer import; product diversity; creating resilient ecosystems
HYDRO3, Mykonos		Remote rainwater harvesting system and irrigation of oregano	Cheap water supply in remote areas; create business case with little input
HYDRO4, Mykonos		Domestic rainwater harvesting, aquifer storage and watering of local crops	Increase water supply; production of drinking water; aquifer recharge to reduce saltwater intrusion
HYDRO5, Tinos		Seawater and brine treatment to recover salt and water, produce tropical fruits	Produce sweet water from saltwater/brine; decrease import of tropical fruits; salt production
HYDRO6, Tinos		Water loops in eco-tourist facility	Ecotourist facilities which are self sufficient in terms of water, energy and food production

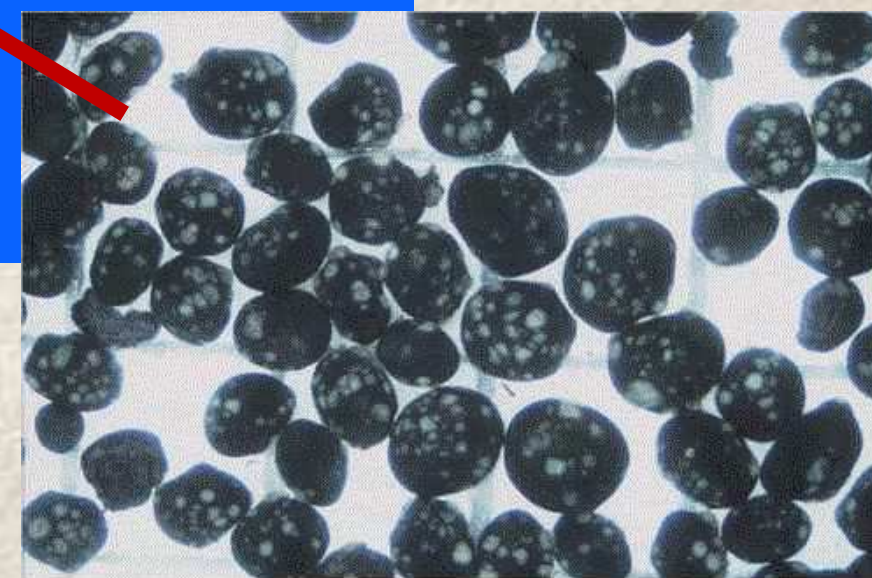
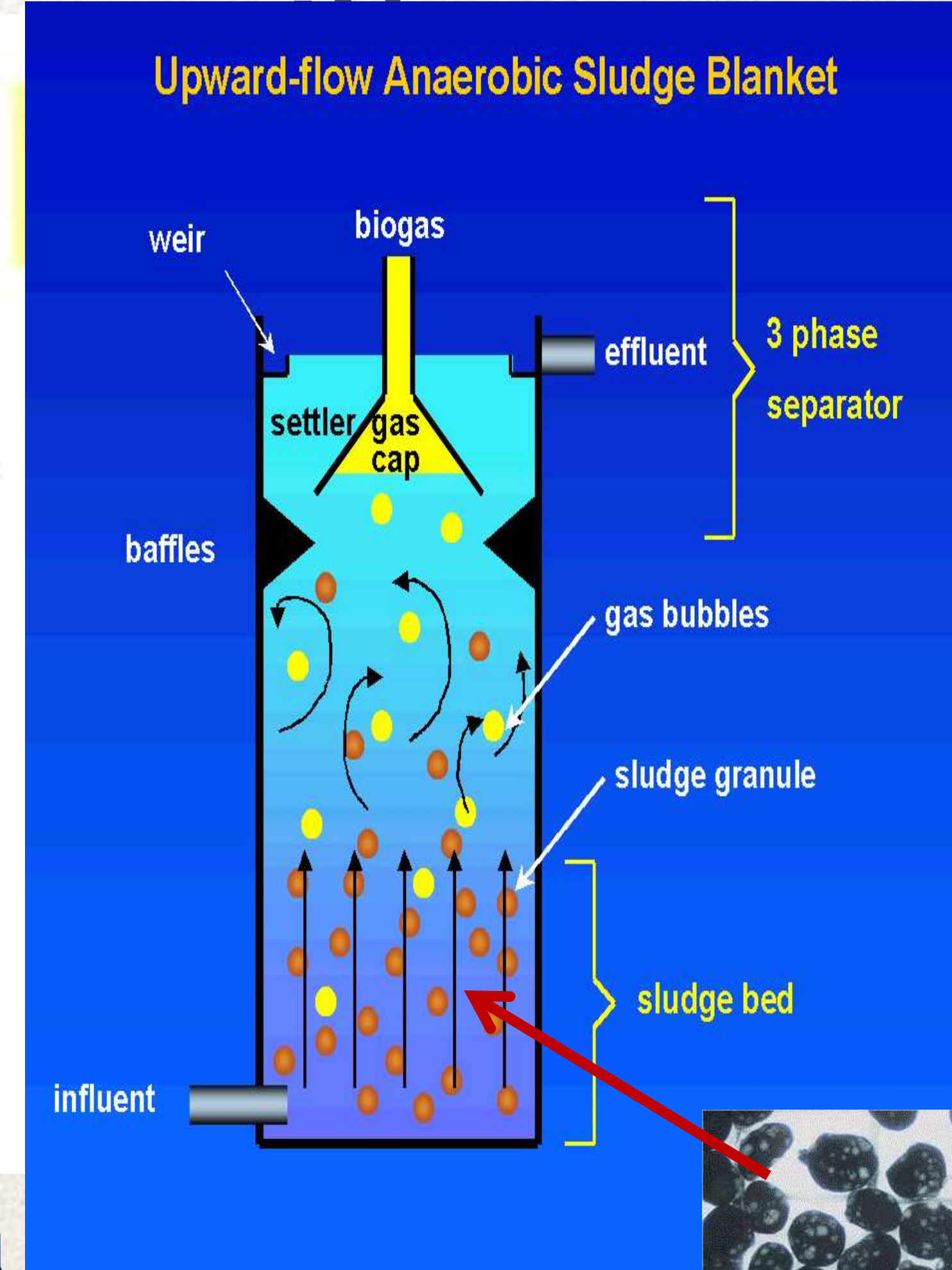
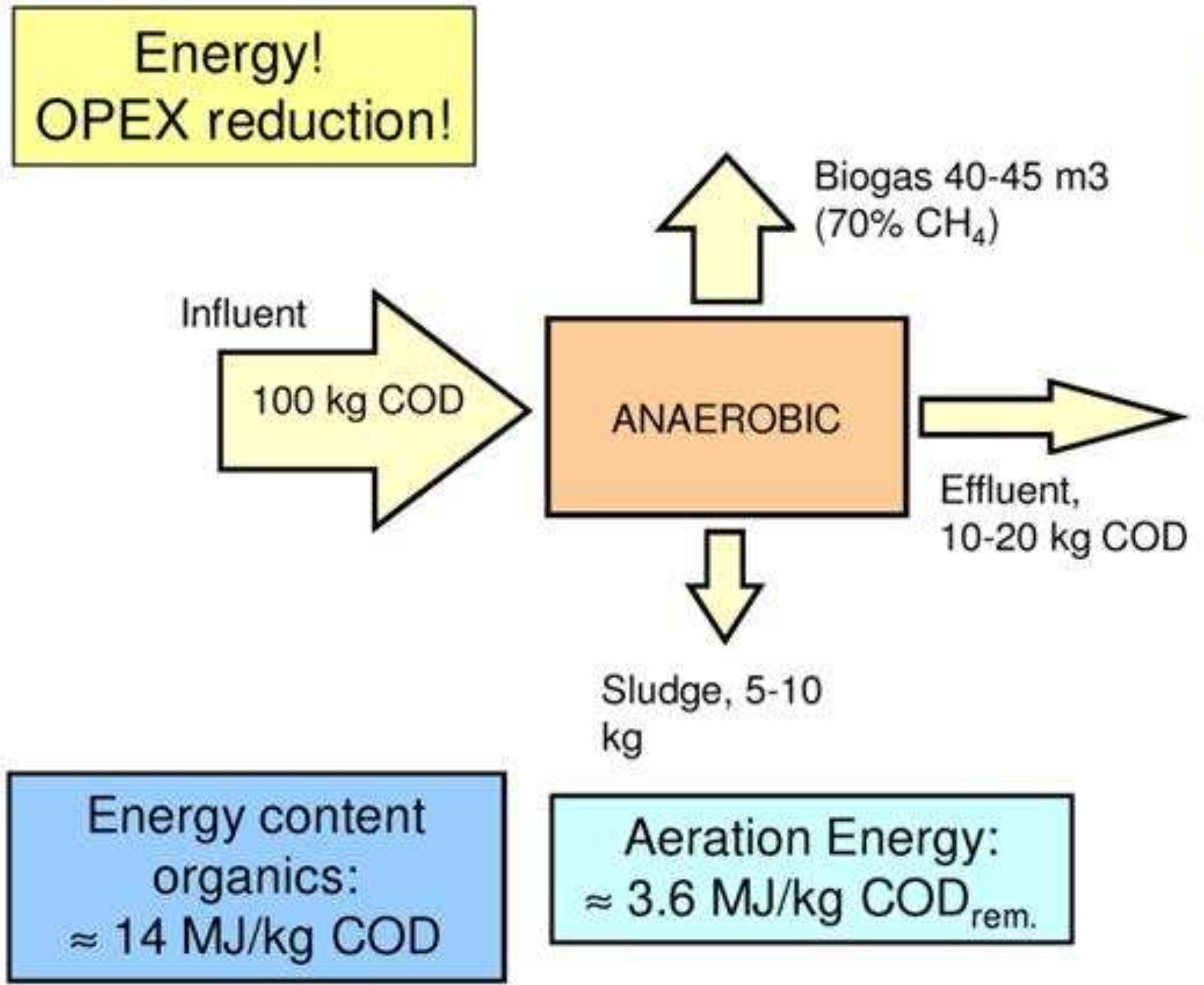




# Treatment for **high rate** anaerobic technology



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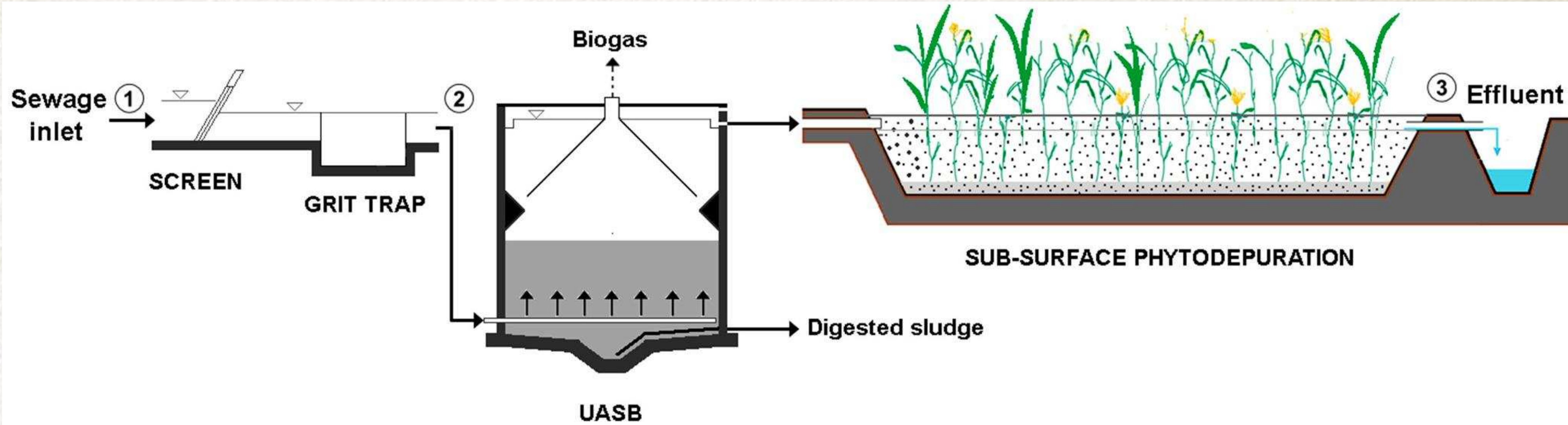


## Gatzke Lettinga

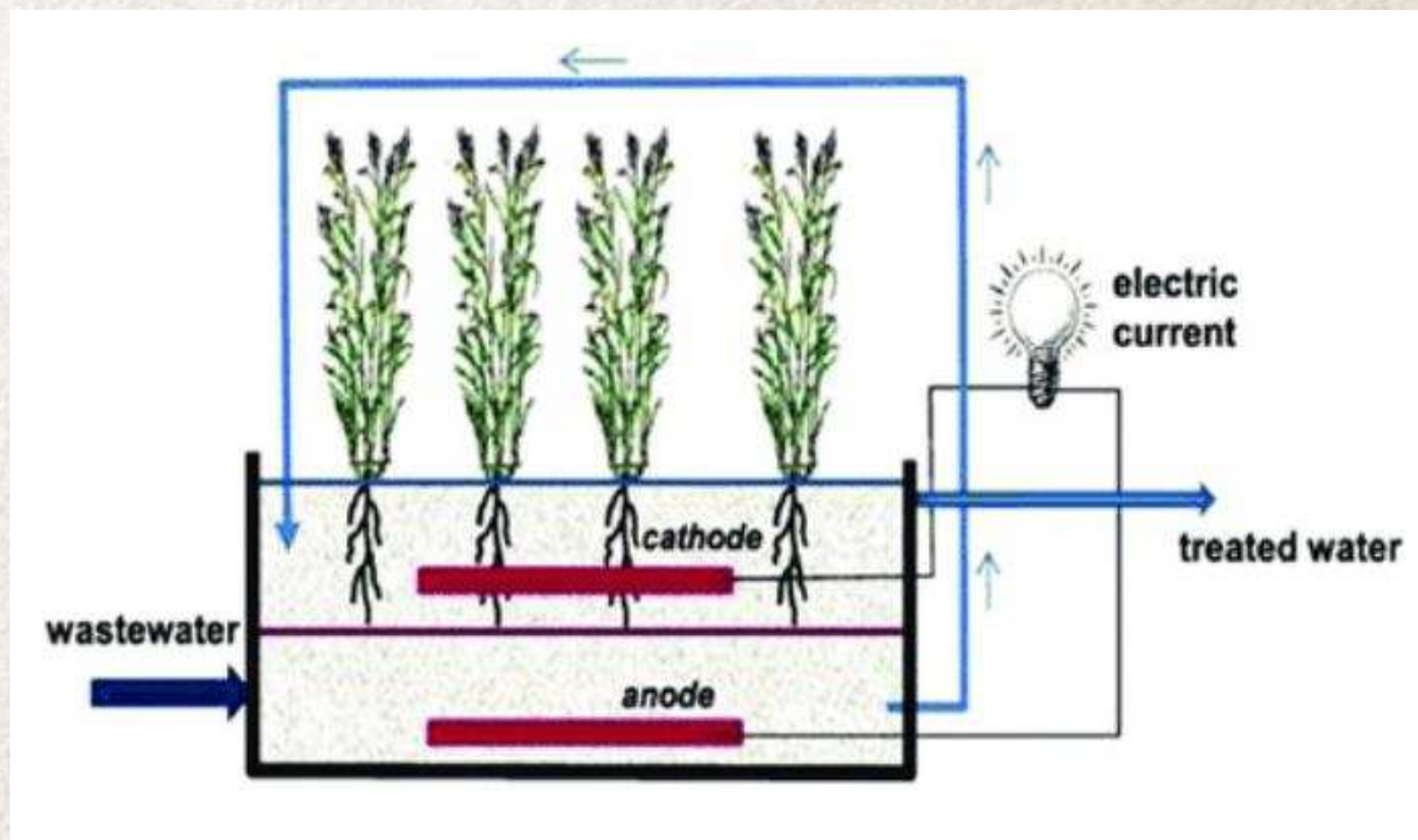
Invented the UASB technology for the treatment of wastewater



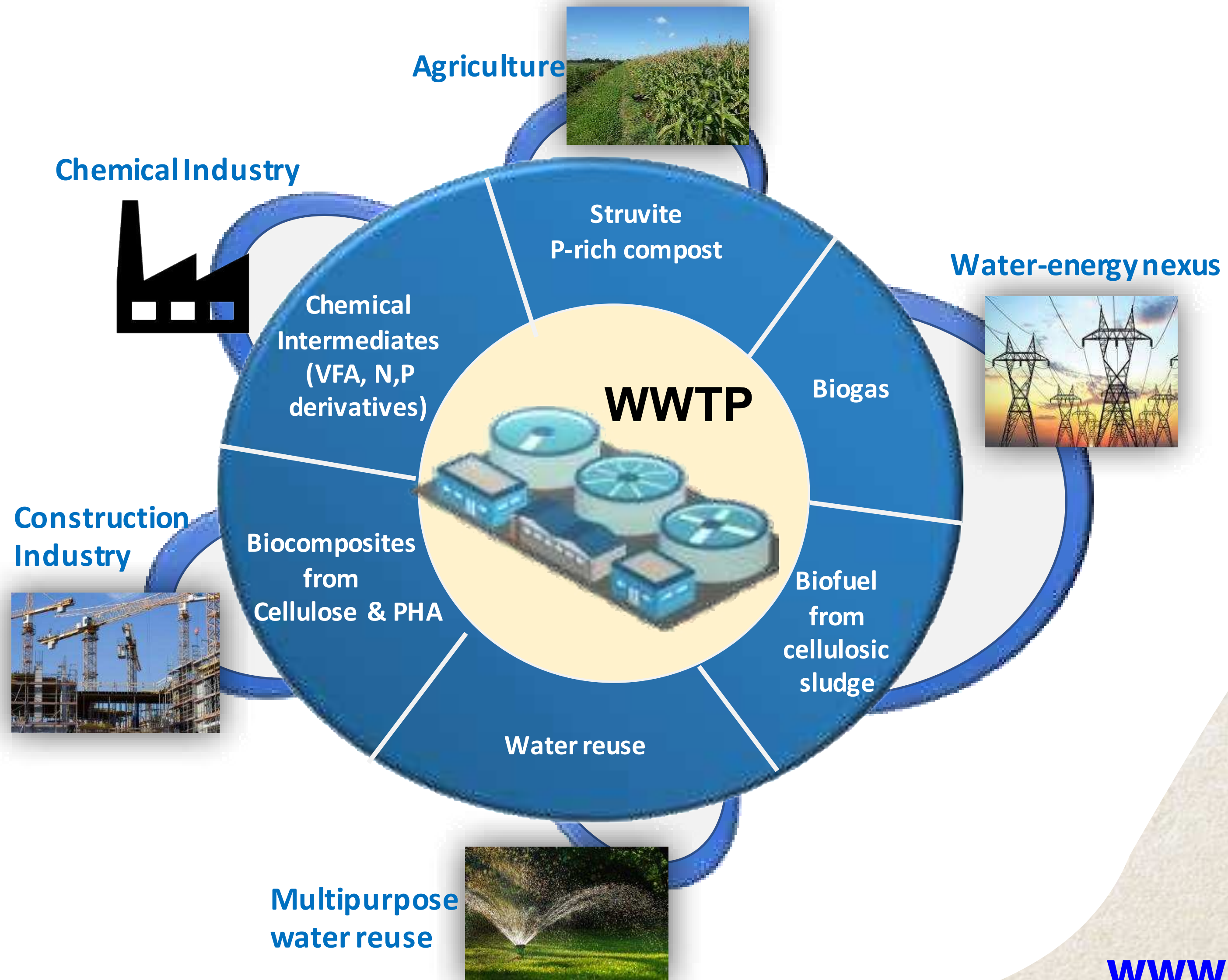
# Integration of UASB-biodiverse wetland



# Bio-electrified wetland



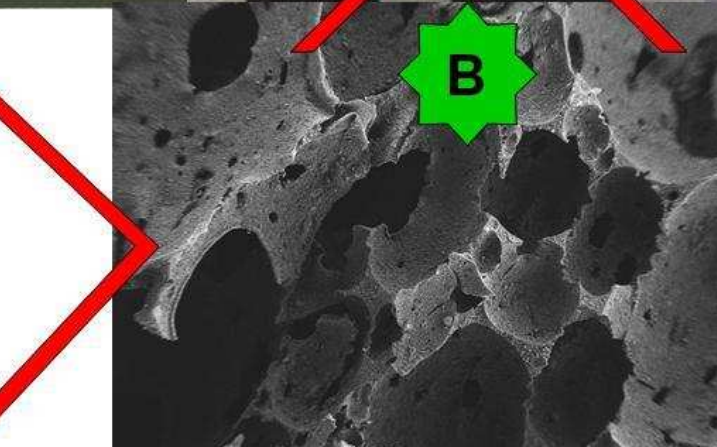
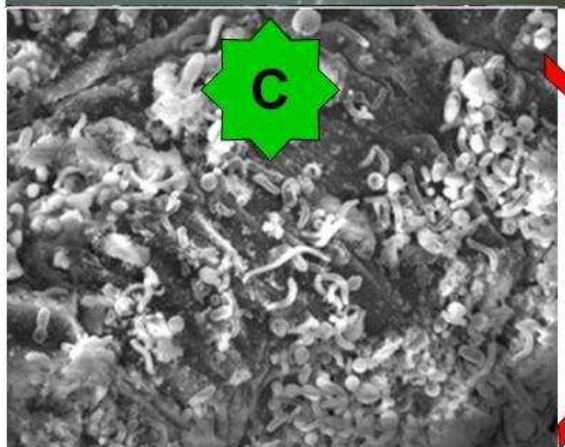
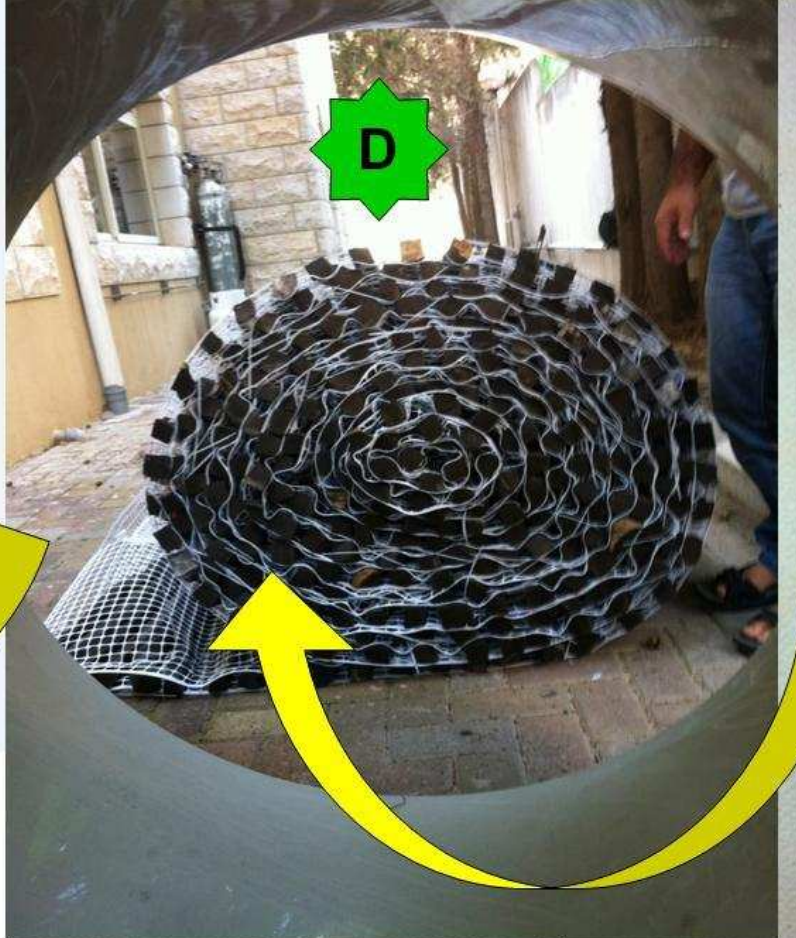
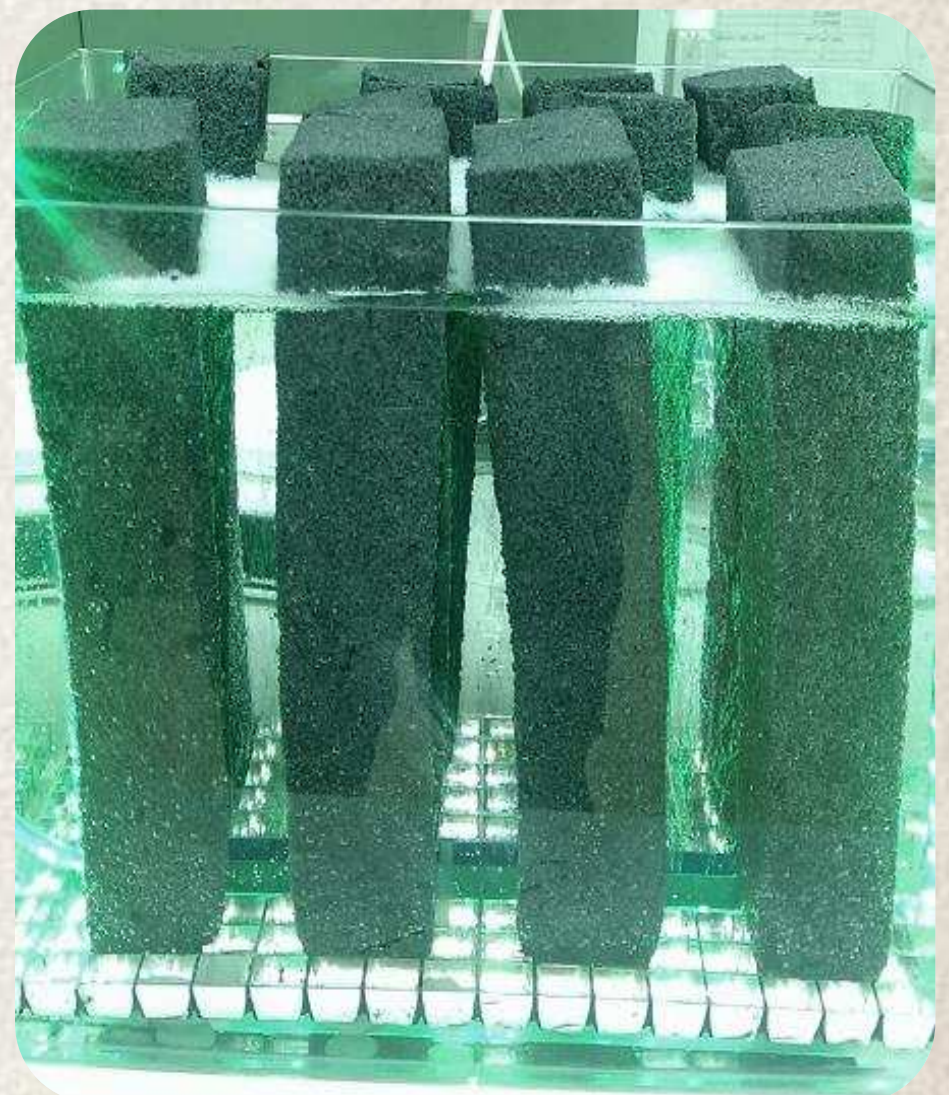
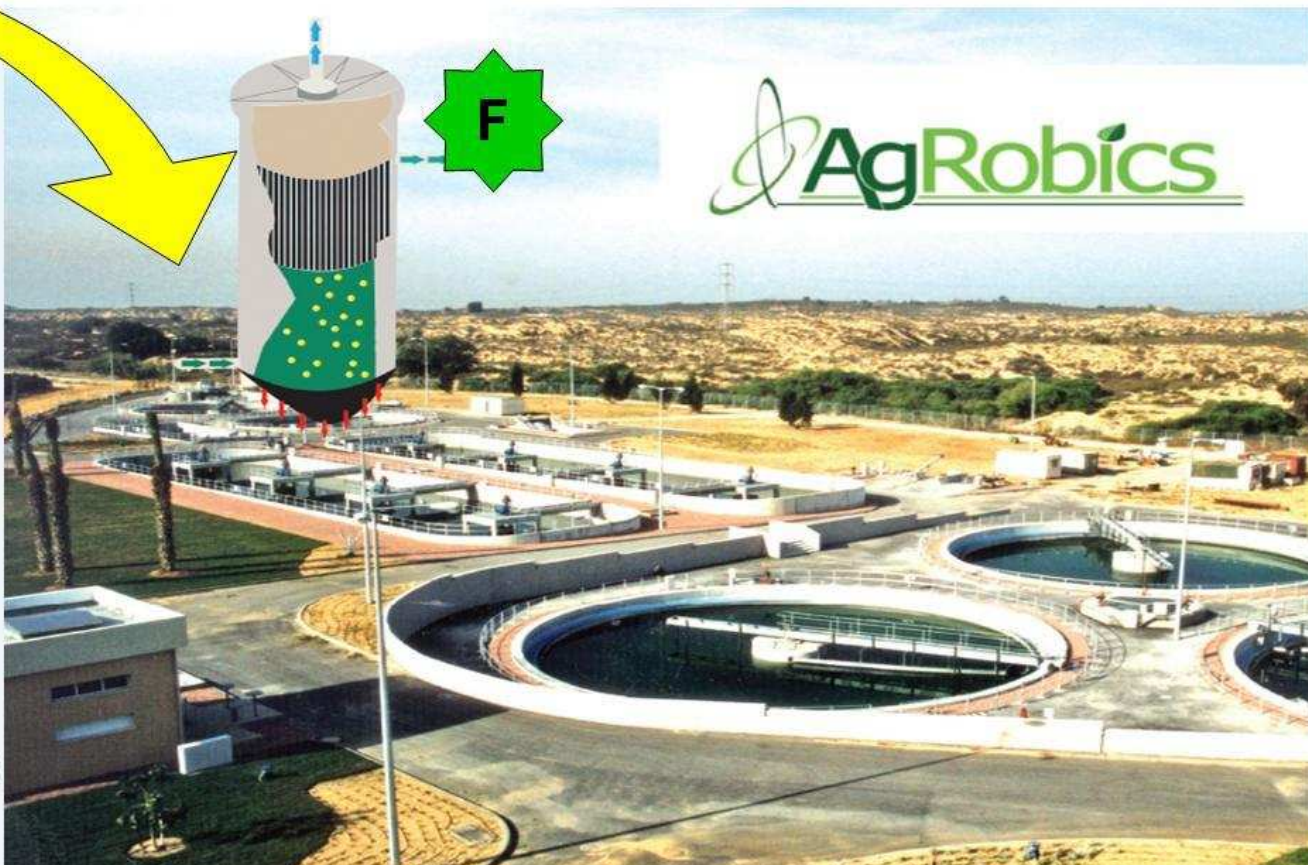
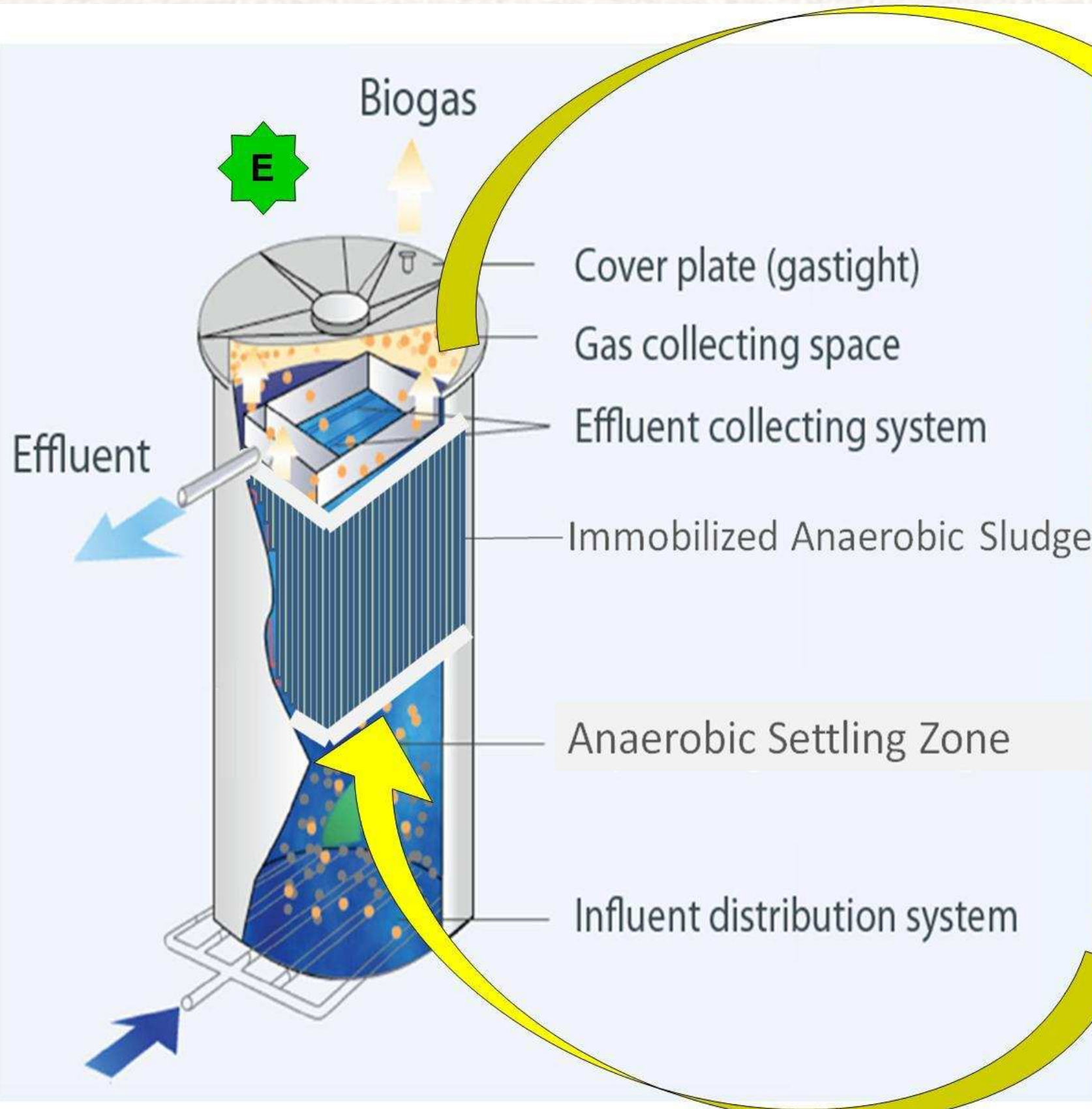
# SMART-Plant Project







# Using immobilized microorganisms in full-scale anaerobic systems





# Demo-scale plants



25 m<sup>3</sup>/d



150-200 m<sup>3</sup> /d Demo-scale



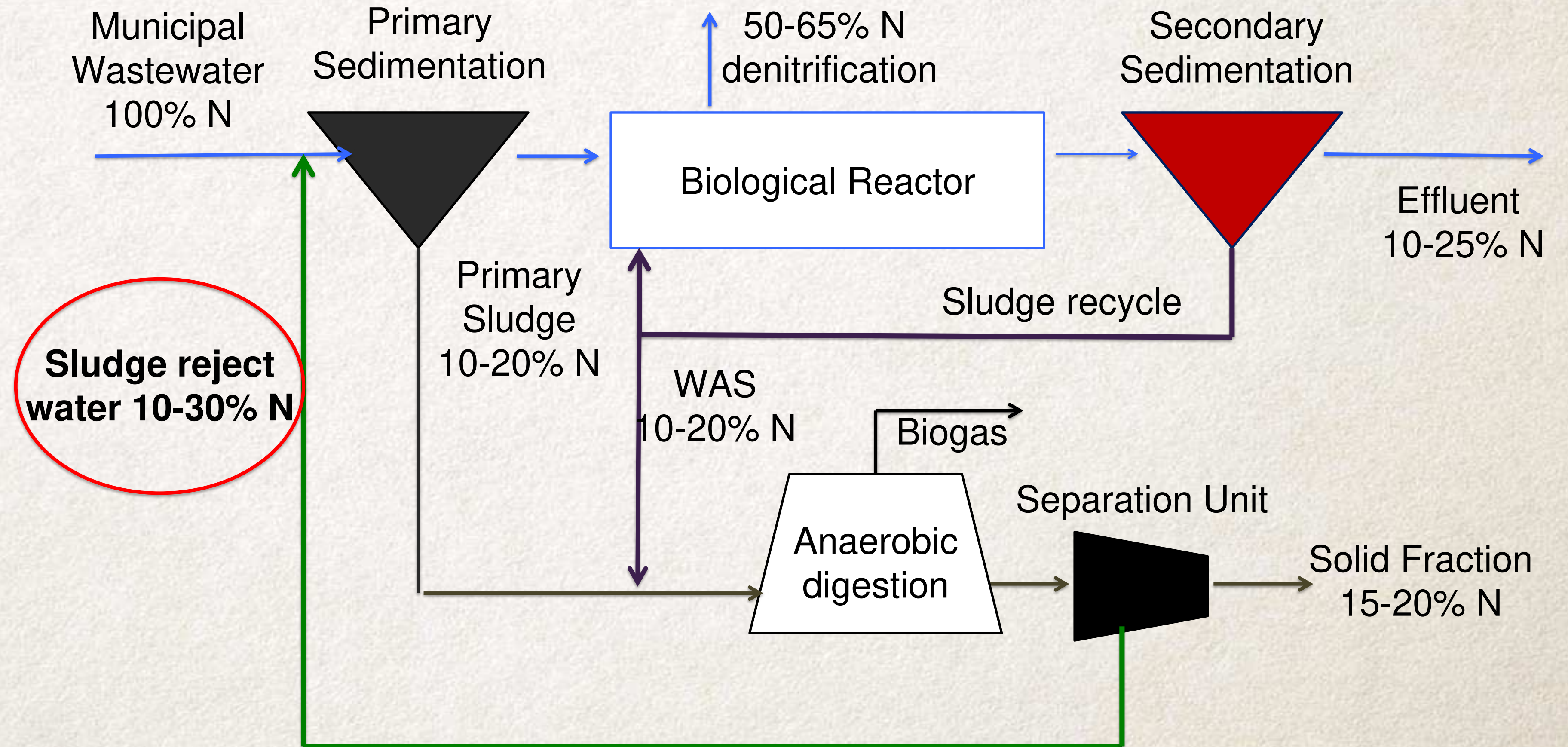
❖ **+15%** more biogas

❖ **-10%** less sludge

**Karmiel WWTP**



# Conventional WWTP scheme





# Implementation of full scale S.C.E.N.A. system



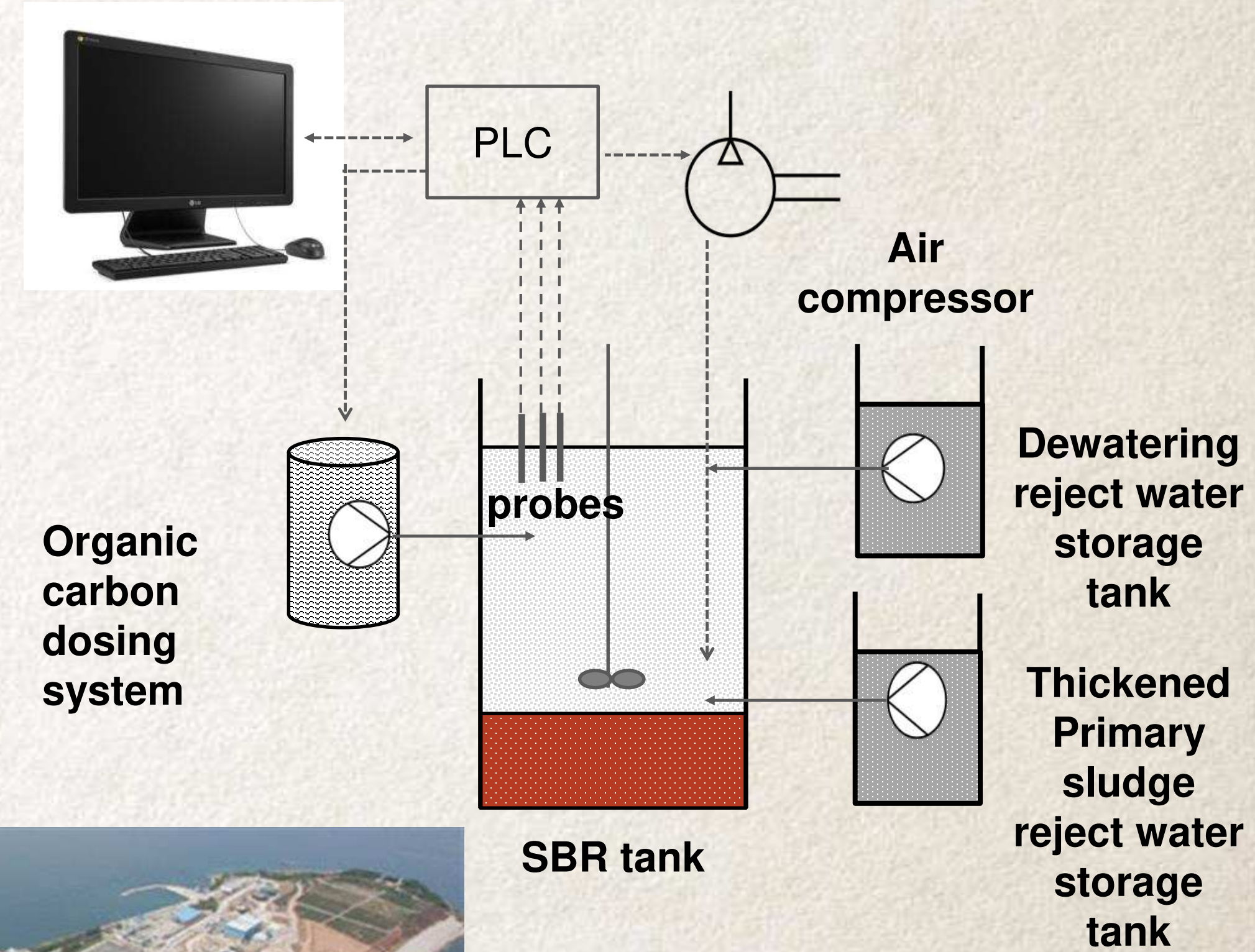
Flowrate [m <sup>3</sup> /d]	35 - 40
N load [kgN/d]	35 - 42
P load [kgP/d]	1 - 2

**Carbonera WWT**  
**Italy**

- ❖ 5-6 kWh/kgNrem
- ❖ >80% TN removed
- ❖ >70% TP removed



# Implementation of S.C.E.N.A. system



## Psyttalia WWTP, Greece



❖ **>80%** TN removed

❖ **>90%** NH<sub>4</sub>-N removed





# Cellviation cellulose recovery, CirTec

2009-2015: Several pilot scale implementations at real environment

SMART-Plant



2016-2020: Development and optimization of demo with capacity of 80 m<sup>3</sup>/h producing approx 300 kg/d cellulose



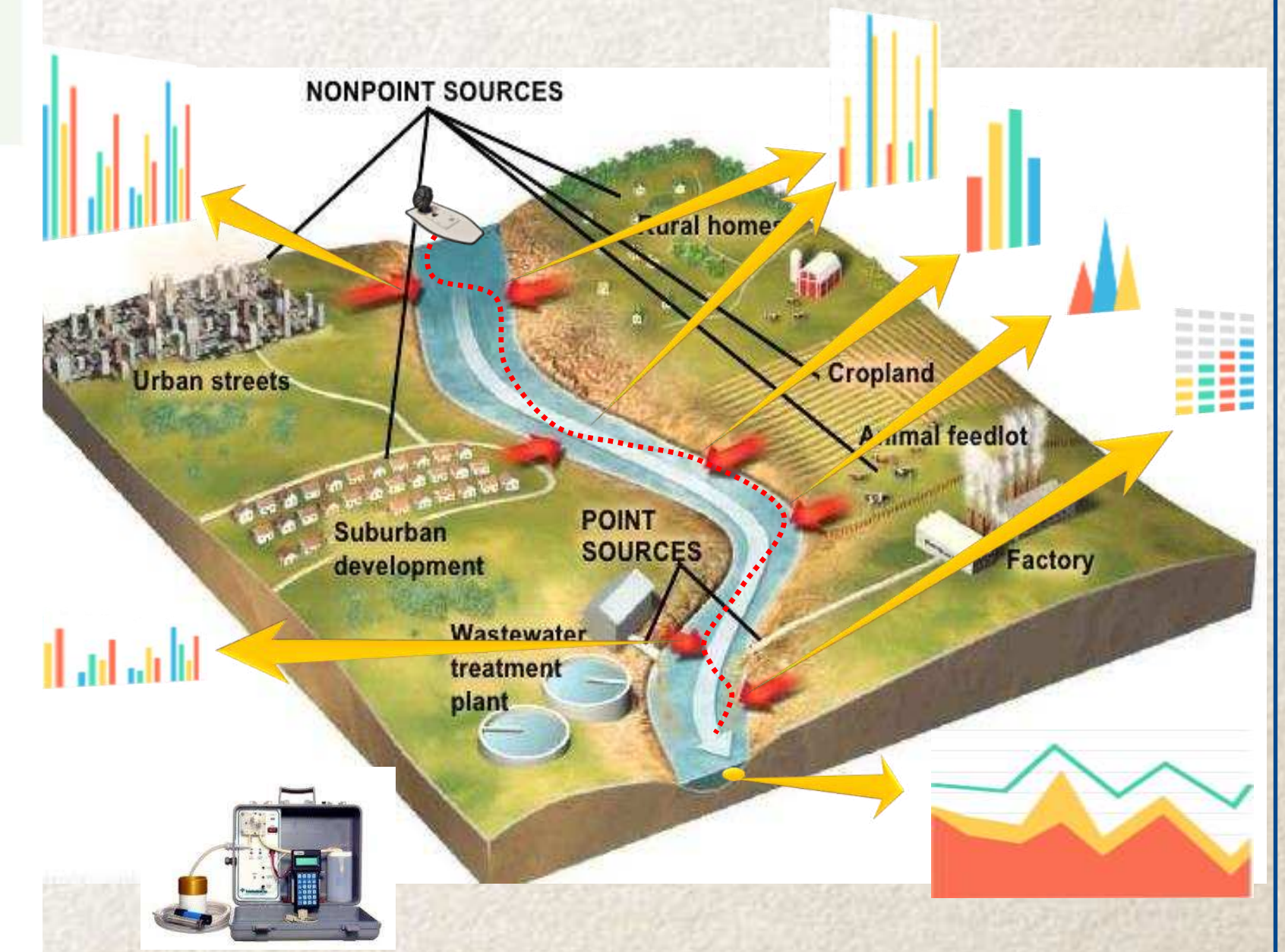
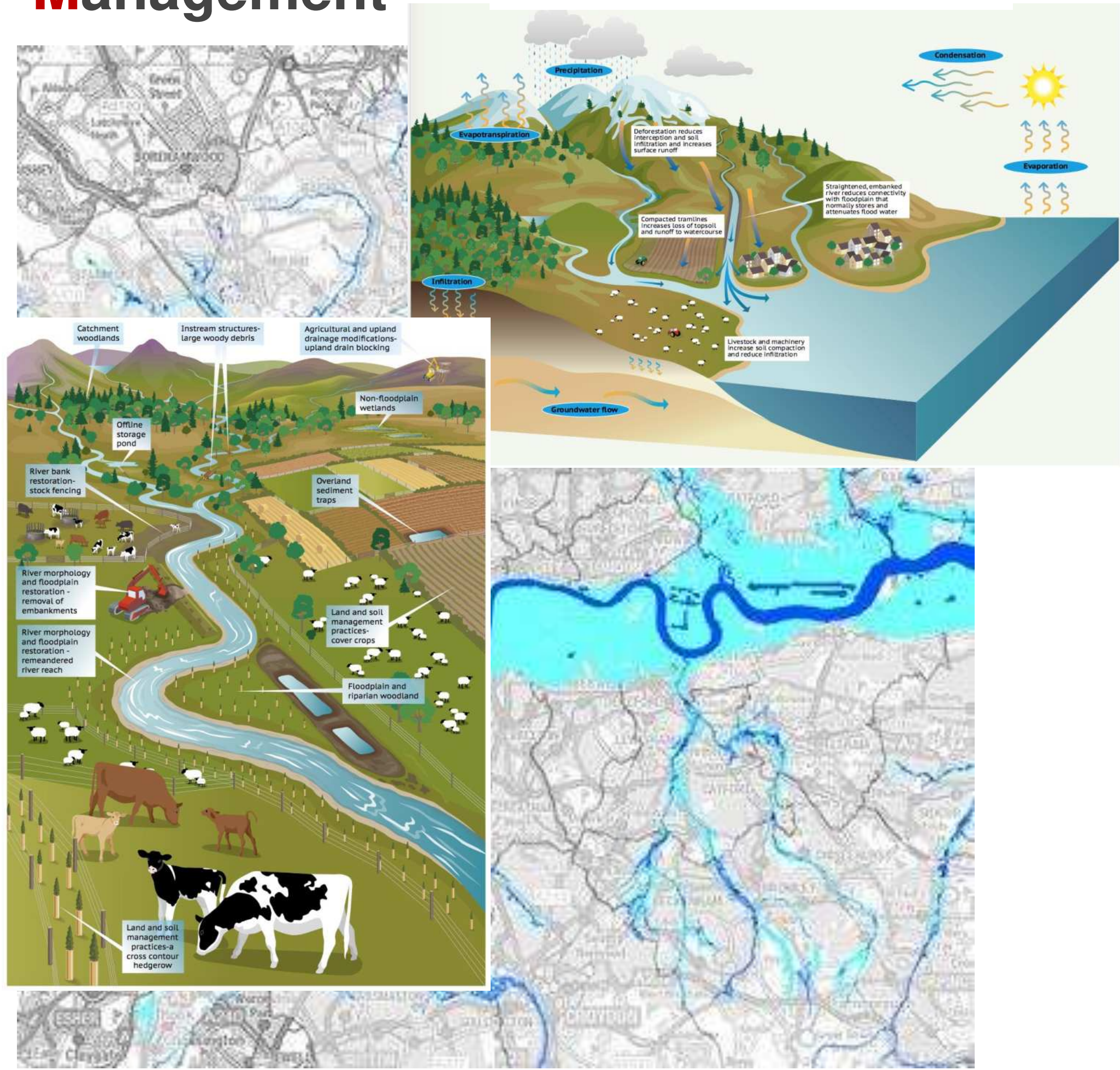
- Create a constant stream of re-used cellulose, by a validated process
- Validated application of sustainable re-use
- Develop other applications (bio-composites, insulation material)



# INTCATCH - Development and application of Novel, Integrated Tools for monitoring and managing Catchments



## Natural Flood Management





C-FOOT-CTRL

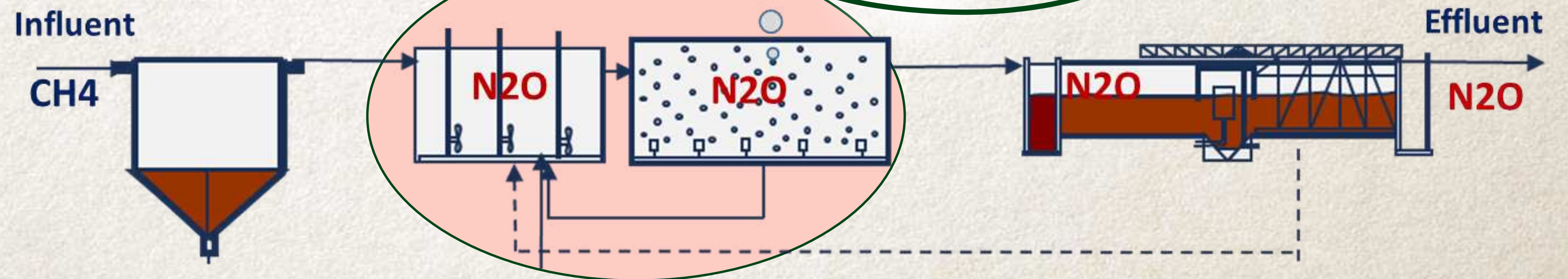


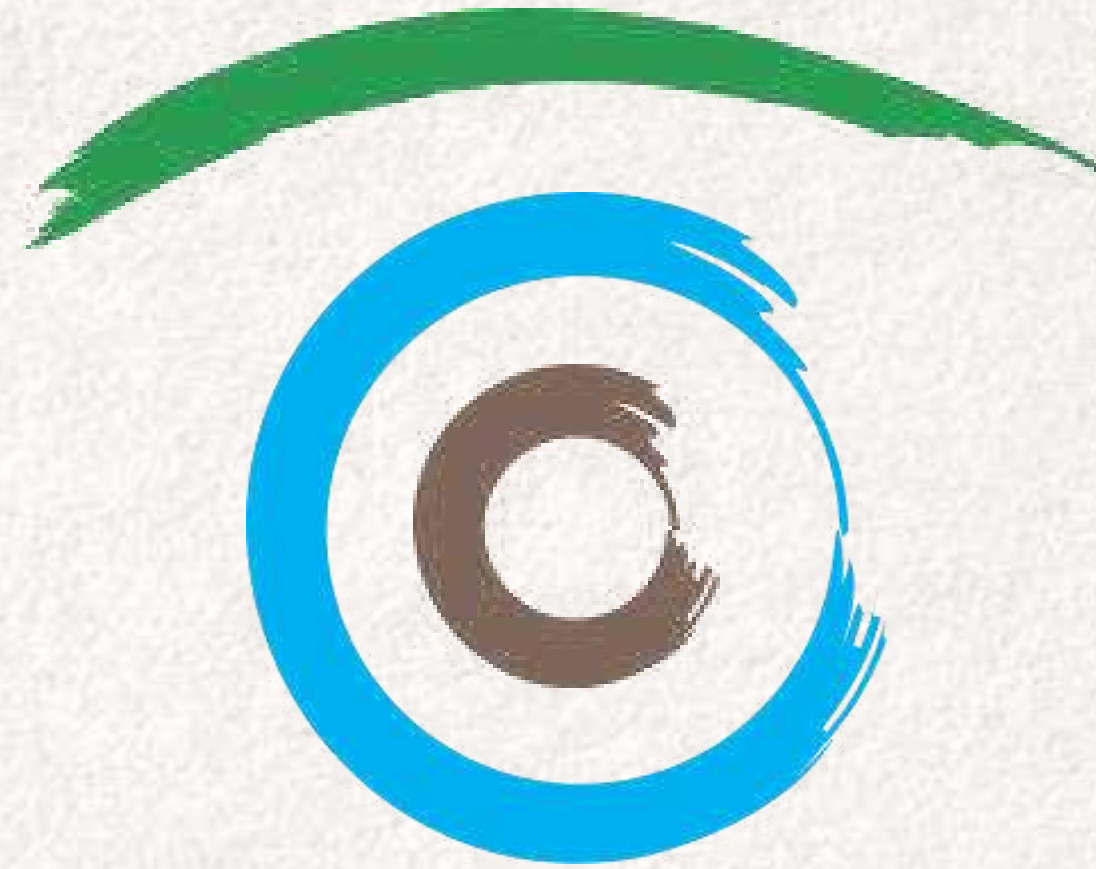
# Developing on line tools to monitor, control and mitigate GHG emissions in WWTPs

- Calibration free
- No calibration gases
- Fully automatic



N<sub>2</sub>O, CH<sub>4</sub>





<https://www.hydrousa.org>

# Thank you



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