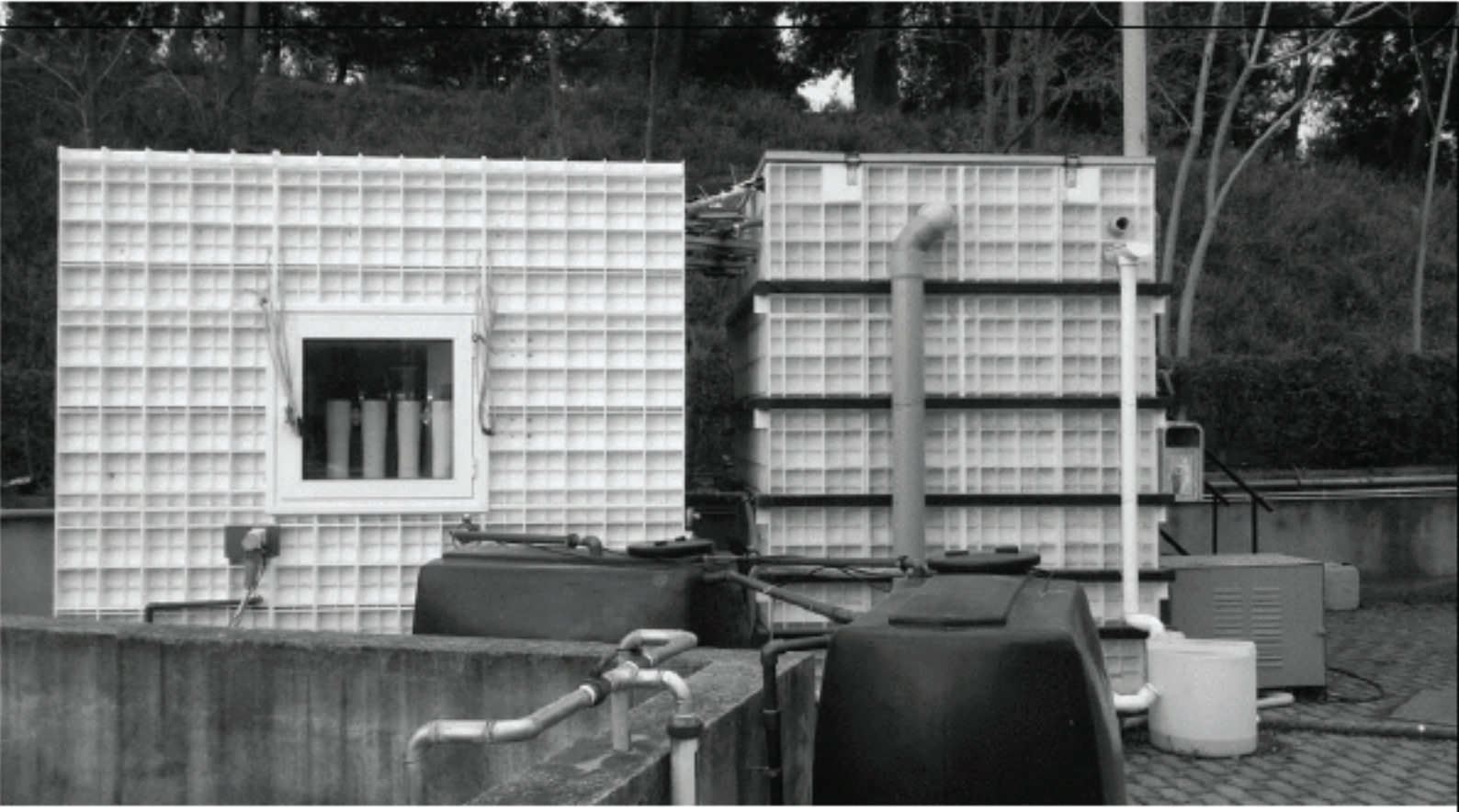

DESSIN RESEARCH PROJECT: Sewer Mining for Urban Re-use enabled by Advanced Monitoring Infrastructure

THE ATHENS PILOT

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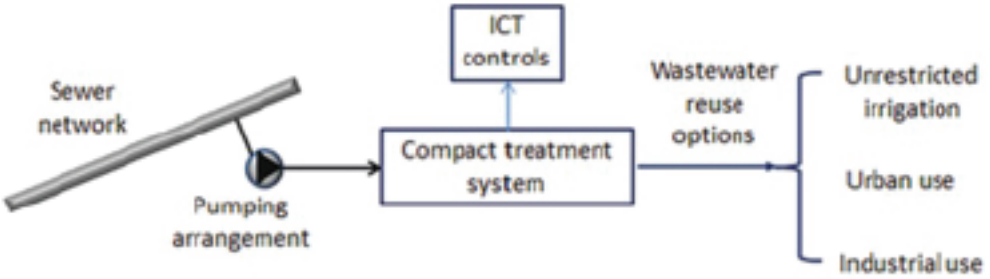
www.dessin-project.eu

DESSIN
DEMONSTRATE ECOSYSTEM SERVICES ENABLING INNOVATION IN THE WATER SECTOR

An innovative solution for Distributed re-use in large urban areas

Sewerage networks have been designed as centralized infrastructure, with end of pipe treatment and hence by definition, away from the points of re-use of treated water, making reuse costly (in terms of energy and infrastructure). However, recent advances in both treatment and ICT present a unique opportunity for a solution to this problem: coupling Membrane Bioreactors with advanced nanofiltration and/or reverse osmosis membranes provides superior effluent quality which can meet the most stringent reuse criteria - packaged in a treatment unit of minimal footprint. In DESSIN we demonstrate fully automated, optimally run, packaged treatment plants suitable for arid and semi-arid regions.

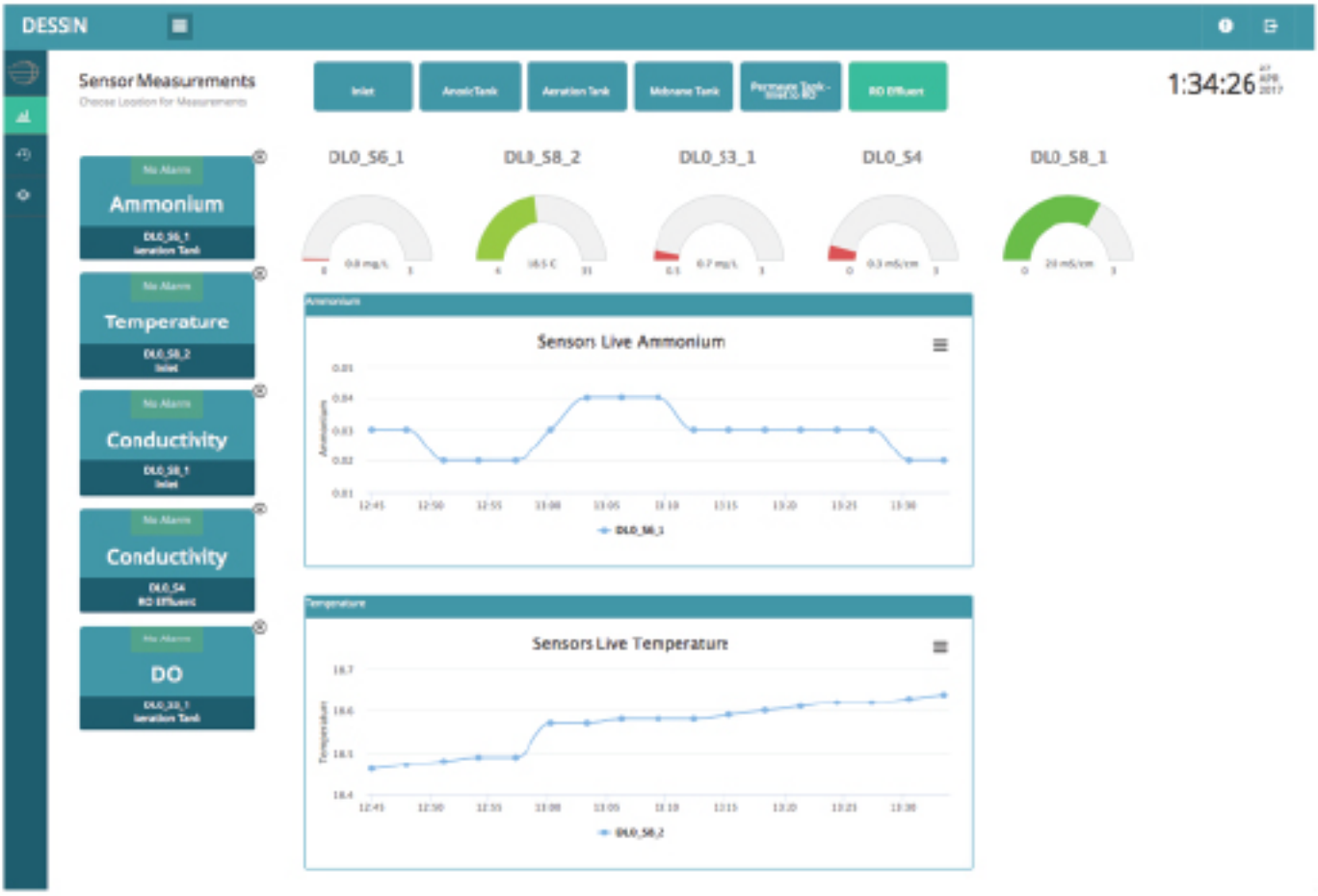


Benefits

- Increase reuse efficiency
- Decrease transaction costs
- Increase % of reused water
- Improve urban quality of life
- Create new market for SMEs

DESSIN Operator Dashboard

The DESSIN Dashboard is an innovative, real-time data monitoring web platform that facilitates remote operation. It allows the operators to oversee the correct functioning of the waster-water treatment plant in a fast and reliable way. Measurements from the existing installations are displayed in the form of gauges, graphs and tables through the Graphical User Interface.



Benefits

- Real-time monitoring of water properties
- Embedded alerting mechanism
- Provision of historical data
- Dynamic and responsive design
- Ease of Use

Quality control

Parameters	Influent[1]	MBR effluent	RO effluent	Legislation limits[2]
TSS	164 ±72 [3]	<DL[7] for 80% of samples	<DL[7]	≤2 for 80% of samples[5] ≤10 for 80% of samples[4]
BOD_5	141 ±64 [3]	0.9 (average) 1.6 for 80% of samples	≤1 for 80% of samples	≤10 for 80% of samples[4,5]
CODt	424±86 [3]	23±9.5 [3]	< 10 (average)	
CODs	171±25 [3]	23±9.5 [3]	< 10 (average)	
TN	81(average)	-	12 (average)	≤15[4,5]
NH_4-N	55±15 [3]	0.25±0.3 [3]	-	≤2[4,5]
TP	8.8±0.7 [3]	5.9 ±1 [3]	< 0.5	
Turbidity	-	0.04 (median)	-	≤2 (median)[4,5]
TC	>10^7	307±390 [3] 578 for 80% of samples 1115 for 95% of samples	ND[8]	≤2 for 80% of samples[5] ≤ 20 for 95% of samples[5]
FC	>10^7	1±1.8 [3]	ND[8]	-
EC	>10^7	0.8±1 [3] ≤ 2 for 80% of samples ≤ 2 for 95% of samples	ND[8]	≤5 for 80% of samples[4] ≤50 for 95% of samples[4]
Nonylphenol	11542 (average) 13705 (max)	747 (average) 968 (max)	58 (average) 75 (max)	<2000 (max value)[6]

[1]refer to filtered wastewater; [2]refer to the Greek legislation regarding wastewater reuse (Joint Ministerial Decision 354/8-3-2011); [3]average ± standard deviation; [4]refer to the limit values set in the Greek legislation for wastewater reuse for unrestricted irrigation and/or industrial reuse; [5]refer to the limit values set in the Greek legislation for urban reuse and/or groundwater recharge; [6]refer to the limit value set in the Greek legislation for every type of reuse for WWTPs with a population equivalent greater than 100,000; [7]Limit of detection; [8] Not detected.

Cost estimation

Unit	Capital Cost (€/ m^3)	Operational Cost (€/ m^3)	Total Cost (€/ m^3)
MBR-UV	0.36	0.5	0.86
MBR-UV-RO	0.42	0.65	1.07

Commercial advantages

- The MBR unit is a hybrid technological product that on the one hand employs membrane technology to treat sewage and on the other hand, in case this function fails, can operate as conventional type of WWTP.
- MBR and RO units are constructed as individual containers that are joined together in one containerised compact system offering ease of transportation.
- Depending on the needs of the application units can be offered either individually or in combination.
- The designed solution integrating the use of plastic containers allows the system to be underground positioned, thus having no aesthetic impacts on the surrounding area.

DESSIN has been awarded!

DESSIN and EYDAP SA have been awarded during the 6th "European Business Awards for the Environment".DESSIN EYDAP and its partner institutions in DESSIN (NTUA, CHEMITECH and TELINT), promoted the idea of an innovative small footprint sewer mining packaged treatment unit for urban reuse enabled by Advanced Monitoring Infrastructure (AMI) and Decision Support System (DSS).

Excelled in two categories:

- Products & Services Award
- Business & Biodiversity Award

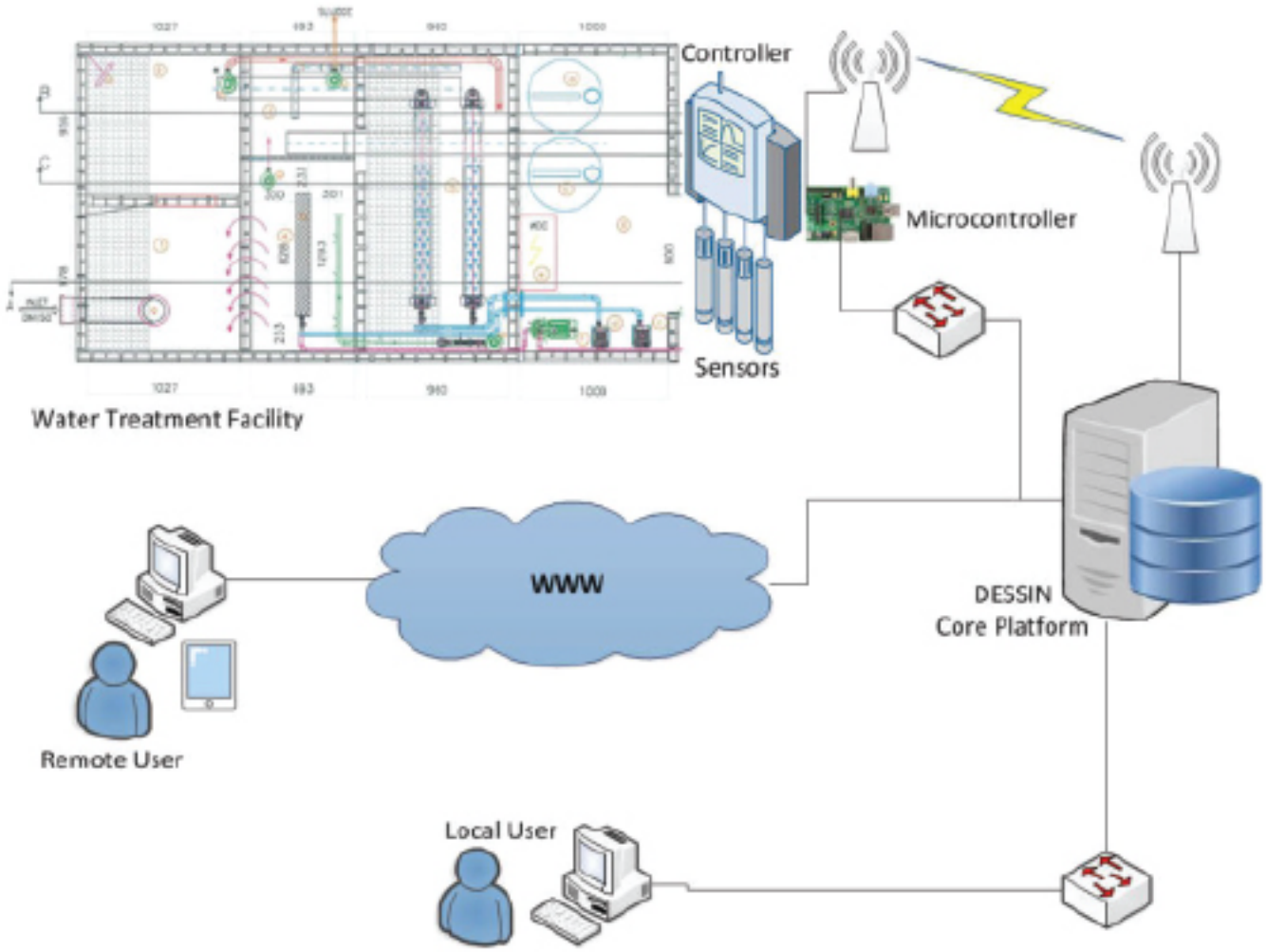
(Right) Photo from the ceremony that took place in Eugenides foundation, Athens, Greece at 19/10/2016.

Upscale opportunities

Deployment in the east coast of Attica for:

- **Urban green**
- **Reduced water treatment cost**
- **Reused water withdrawal to avoid saltwater intrusion**

ICT View of Athens Pilot



Characteristics:

Interface for retrieving sensor data (Options: Modbus)

Communication between Controller and DESSIN Platform: Wired or wireless LAN (WiFi)

Local and remote users are able to connect

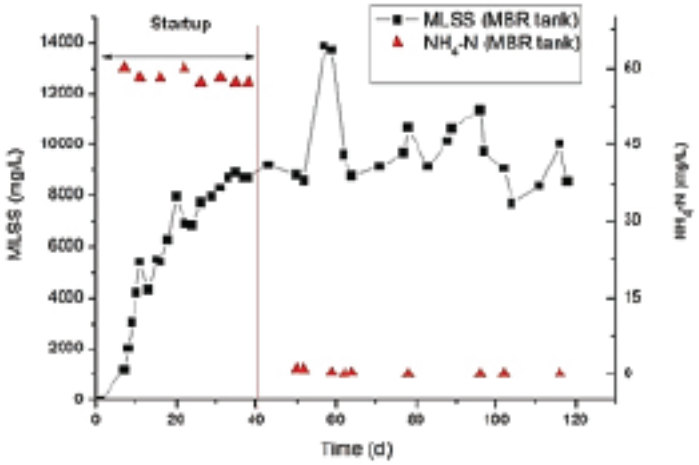
OGC Sensor Web Enablement compliant, using:

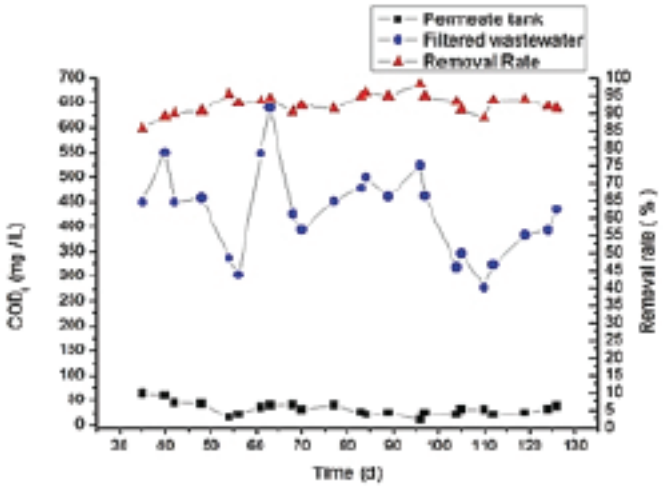
- SensorML Schema
- Observation & Measurements (O&M)
- Sensor Observation Service (SOS)
- Sensor Event Service (SES)

Treatment process

Double-membrane treatment scheme (MBR-RO) achieves very high quality of treated effluent that meets all the **national and international** criteria set for all types of non-potable wastewater reuse at a rather **moderate cost**.

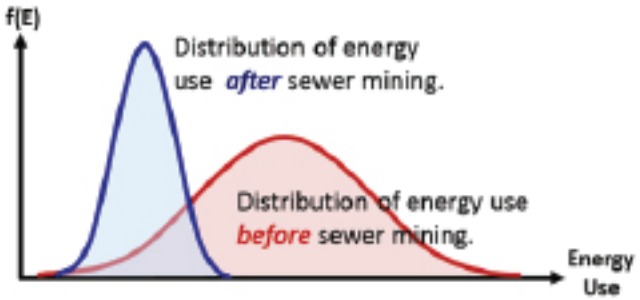
The elimination of **organic carbon** and **pathogenic content** is complete while the filtration process manages a reduction of pathogens without the addition of **chemicals**, thus avoiding the production of secondary pollutants.





Ecosystem services

A watered park from sewer mining works as a local temperature regulator, reducing temperature deviations, via the control of latent heat fluxes. Water-enhanced microclimate control benefits household budgets as less money is spent on energy use for heating/cooling.



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