LIFE INTEXT PROJECT

LAYMAN'S REPORT

INText

Innovative hybrid INTensive – EXTensive resource recovery from wastewater in small communities

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End date: 30th June 2024
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Total funding received 1.596.470 €

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The Life INTEXT consortium

aqualia	Project coordinator Continental demo site management
aimen TECHNOLOGY CENTRE	Sludge Wetlands design EC monitoring
AARHUS UNIVERSITY	GHG monitoring P recovery
AUTARCON	Advanced disinfection treatments
Agencia de Medio Ambiente y Agua de Andalucía, Junta de Andalucía	Mediterranean demo site management Comm. and dissemination
Future Intelligence TELECOM ENGINEERING COMPANY	Smart irrigation system.
projar Group	Floating helophytes treatment design
SAVEA by CATALI	Treatment wetlands design and execution
syntea	Treatment wetlands construction (Talavera site
ecoBiRD	Treatment wetlands design monitoring and scientific management

Wastewater Treatment for Small Communities: A Sustainable Approach

Wastewater Treatment in small communities remains a significant challenge across Europe, particularly in countries in which small and dispersed settlements are predominant. Despite recent advancements, there is a pressing need to shift the paradigm at a smaller scale, avoiding excessive energy consumption and complex procedures that come with high operation and maintenance costs.

Experience has shown that solutions designed for large cities are neither suitable nor affordable for small populations. This underscores the importance of sustainable technologies that minimize energy waste. In recent years, nature-based approaches have emerged as viable solutions to address water scarcity in small communities. These approaches align with the circular flow economy concept, preventing the squandering of scarce elements like phosphorus.

LIFE INTEXT aims to validate improved EXTensive technologies in two innovation spaces located in Toledo and Seville. The project also focuses on producing valuable products from wastewater, including water for reuse, phosphorus and nitrogen recovery, energy generation, and the removal of emergent pollutants.

The demonstration sites have been set up to host LIFE INTEXT solutions, with the aim of paving the way for wider adoption in Europe and worldwide. The continental demonstration site is the **INTEXT Platform**, a **completely new experimental area** where INTEXT technologies are being tested. The Mediterranean demonstration site is located at the Experimental Centre for Water Technologies (CENTA) located in Seville, which has been in existence for more than 35 years and where two of these technologies have been implemented by adapting pre-existing ones. Each demo site has been thoughtfully configured, taking into account the prevailing climate conditions specific to its location.

Our Vision for a more sustainable wastewater treatment

The LIFE INTEXT project aims to demonstrate innovative resource recovery technologies for wastewater treatment in small communities across both Mediterranean and Continental climates. Our full-scale demonstrations operate under **real** environmental conditions.

The **LIFE INTEXT concept** embodies a harmonious blend of cutting-edge technologies, meticulously tailored to address the challenges faced by small urban agglomerations. These technologies are carefully categorized into the following components:

1. **Pretreatment Units:** These initial stages ensure that the incoming wastewater is properly prepared for subsequent treatment.
2. **Primary treatment:** is the first stage of the purification process. In this stage, a large part of the suspended solids present in the water are eliminated.
3. **Secondary Treatment Units:** Here, biological processes transform pollutants into benign substances for the aquatic environment receiving treated water.
4. **Tertiary Treatment Technologies:** The final touch—advanced methods polish the water to meet stringent quality standards.
5. **Irrigation:** A sustainable solution, utilizing treated water for nourishing green spaces and crops.

THE OBJECTIVES

- ✓ **Wastewater treatment system robustness against environmental and pollutant load variations**
- ✓ **Reduction of investment and maintenance costs**
- ✓ **Reduction of the required area per population equivalent**
- ✓ **Quantification and assessment of greenhouse gases emissions reduction**
- ✓ **Assessment of emergent pollutants removal**
- ✓ **Disinfection and water reuse**
- ✓ **Decision Support System based on Life Cycle Analysis**
- ✓ **Validation of technologies broadly used in the north and center of Europe**

With these objectives**, LIFE INTEXT** aims to boost wastewater treatment, resource recovery and, overall, the sustainability in small communities.

Who will benefit from Life INTEXT?

Small communities

The project directly targets small communities facing the challenge of proper wastewater treatment. By applying innovative water treatment and reuse solutions, LIFE INTEXT aims to improve water availability and quality for these communities.

Environment

The project's focus on sustainable water management contributes to environmental conservation, reducing pollution, using resources efficiently and minimizing the impact of treatment systems benefits the natural environment.

Policy makers and planners

LIFE INTEXT provides knowledge on effective water treatment strategies. Policy makers and urban planners can learn from the project's approaches to address water management in a holistic way.

Research and innovation community

The project's hybrid treatment technologies, nutrient recovery methods, emerging pollutant reduction, water regeneration and decision support systems contribute to scientific knowledge. Researchers and innovators can build on these findings for future advances.

General public

Through accessible communication, both using social media and on-site presence, LIFE INTEXT raises awareness of water-related challenges and sustainable solutions.

Demonstration sites, the heart of Life INTEXT

INTEXT Platform

The INTEXT platform in Talavera de la Reina, Toledo, has been purpose-built during the project, in the WWTP that serves the town. The configuration of the Talavera WWTP allows the INTEXT platform to simulate uncontrolled discharges and periods of high hydraulic load. It spans over a surface area of 6000 m^2, housing a set of 16 different technologies designed to meet the needs of 1.100 inhabitants. The INTEXT platform in Talavera WWTP included technology and innovation systems like:

1. Pretreatment units: This includes PUSH® reactors (EP 3009 408 B1)

2. High Rate Algae Ponds: These systems use algae to treat wastewater. The algae consume nutrients in the wastewater, thereby improving its quality.

3. Floating Constructed Wetlands: These are man-made ecosystems that mimic natural wetlands. They are designed to improve water quality by removing pollutants through natural processes.

4. Solar Anodic Oxidation for Water Disinfection: This is a disinfection process that uses solar energy to oxidize and remove contaminants from water. Oxidation is a chemical reaction that involves the transfer of electrons, which can break down harmful substances.

5. Nutrients Recovery by Innovative Adsorption Materials: This technology uses adsorption materials to recover nutrients from wastewater. Adsorption is a process where certain molecules are attracted to a surface and stick to it, allowing for the separation of different substances.

6. Smart Irrigation System: This system uses the treated wastewater for irrigation, optimizing water use. This not only conserves water but also utilizes the nutrients in the wastewater to benefit plant growth.

7. Sludge treatment wetlands: These systems dewater and progressively mineralize sludges from the different wastewater treatment units for biofertilizer production and energy saving.

The INTEXT Platform at Talavera de la Reina

Advanced disinfection


Nutrient recovery

Smart irrigation

The Mediterranean demo site at CENTA

The Mediterranean Demo Site is implemented at CENTA, which belongs to the Agency of Environment and Water of Andalucia. Originally promoted by the Ministry of Environment of the Junta de Andalucía, CENTA has established itself as an undisputed international benchmark since its research journey began in 1990. Additionally, CENTA serves as a platform for technology transfer and knowledge dissemination, playing a vital role as a social catalyst through its international cooperation programs and environmental awareness initiatives.

Since its conception in the late 1980s as a key element of the R&D Plan for Non-Conventional Technologies for Wastewater Treatment, CENTA has been dedicated to the development, implementation, and promotion of non-conventional technologies for treating wastewater generated in small municipalities since its inception. As Living Lab in the field of wastewater, its working model allows the interaction of the quadruple helix of innovation: government, academia, business and end users. These efforts focus on sustainable and ecologically sound solutions to address the challenges of wastewater treatment.

The impact on the environment of INTEXT solutions

During the Life INTEXT project, both Life Cycle Analysis (LCA) and Life Cycle Costing (LCC) have been performed on the INTEXT solutions.

LCA is a powerful tool used to analyze the environmental impact of a product, process, or activity throughout its entire life cycle. It considers the complete history of the item under study, from its inception to its eventual disposal.

LCA examines all stages of a product's life cycle, including its origin (extraction and processing of raw materials), production, transportation, distribution, use, maintenance, reuse, recycling, and eventual disposal in a landfill. By identifying critical stages or elements in the process, LCA helps us focus on finding alternative solutions. This holistic approach provides insights into the environmental aspects associated with a product or service.

Informed decision-making for sustainability relies on understanding the environmental factors alongside economic and social considerations. LCA provide us the knowledge needed to make informed choices for a better future.

LCC involves analyzing all costs associated with a product or service from its conceptualization to the end of its useful life. It encompasses both visible and less apparent monetary flows throughout the product's entire life cycle.

In LCC, direct costs are easily visible and include expenses related to production (such as raw materials, energy, and labor) and indirect costs may be less obvious, such as productivity losses due to waste for manufacturers or health problems caused by pollution in society.

Taking a holistic approach, LCC enables informed decision-making by considering both economic and environmental factors when evaluating options. It provides a comprehensive understanding of the financial impact associated with a product or service.

The feasibility of INTEXT solutions

Wastewater treatment is a constant challenge around the world. Growing populations, rapid urbanization and industrialization have increased the pollutant load in our water sources. The need to find sustainable and efficient solutions to treat this water is more urgent than ever.

In this context, Intext technologies have emerged as an innovative response. These technologies are based on advanced engineering principles and biotechnology. They provide effective and environmentally friendly treatment. But how can their feasibility be assessed?

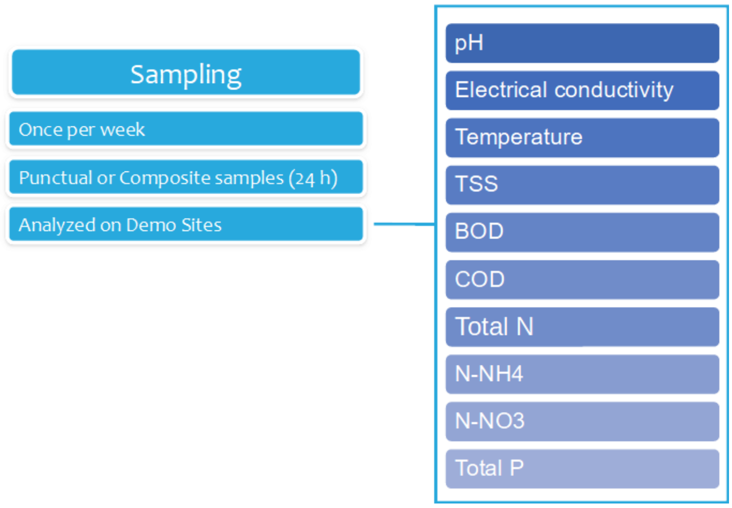
Sample analysis is a fundamental tool in assessing the viability of Intext technologies. Since their start-up, samples of raw and treated water are taken at regular intervals. These samples are subjected to a series of tests and analyses to measure various parameters. This provides an assessment on four key aspects:

1. **Removal efficiency:** the reduction of specific pollutants such as organic matter, nutrients (nitrogen and phosphorus), and toxic compounds is analyzed. Removal efficiency is essential to ensure that treated water meets quality standards.

2. **Adapting to change:** Environmental conditions and contaminant loads can change over time. Sample analysis allows us to assess how Intext technologies adapt to these changes.

3. **Process stability:** The stability of the treatment process is crucial. It assesses whether the Intext technologies maintain consistent performance over time.

4. **Energy and resource consumption:** In addition to removal efficiency, energy and resource consumption is also analyzed. Intext technologies strive to be energy efficient and minimize the environmental footprint.



Other analyses have been performed at a higher rate, as they are not control parameters of the operation of the systems, such as **emerging pollutants** and **greenhouse gases**. Their importance is key when assessing the environmental impact of **Intext** solutions. These analyses provide a more complete and detailed view of the environmental effects of the technologies used in wastewater treatment.

1. **Emerging Contaminants**: These are chemicals that are not included in standard water quality tests, but are present in the environment due to human activities.

   Examples of emerging contaminants include pharmaceuticals, personal care products, pesticides and industrial chemicals. Assessing their presence and concentration in treated water is crucial to understand their impact on aquatic ecosystems and human health.

2. **Greenhouse Gases.** Greenhouse gases (GHG) contribute to global warming by trapping heat in the atmosphere. In the context of wastewater treatment, GHGs can be generated during organic matter decomposition processes.

   Assessing and quantifying GHG emissions is essential to minimise their climate impact and to design more sustainable systems.

In short, these analyses complement the assessment of INTEXT technologies, enabling informed decision making and considering not only the contaminants removal efficiency but also their environmental footprint.

Some data about the Intext solutions

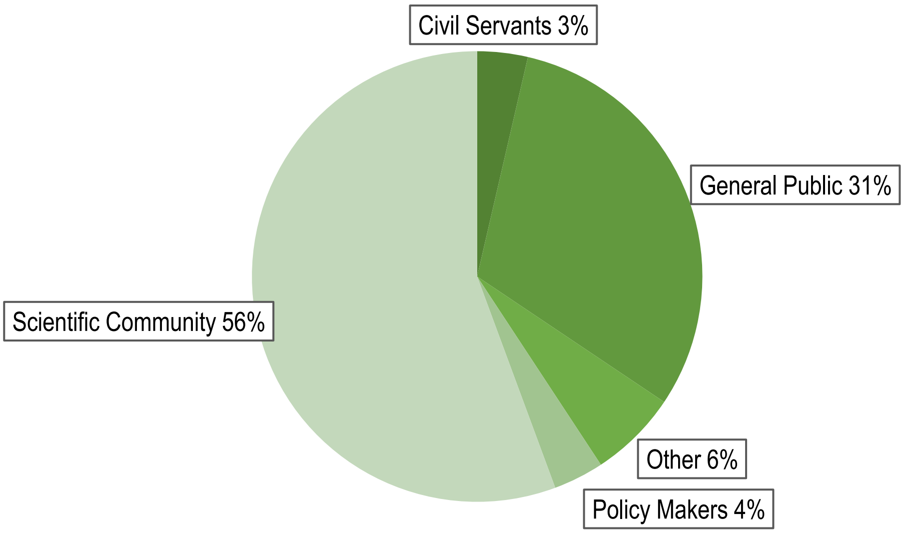
Since the startup of the INTEXT solutions in 2022, the Continental Demo Site at Talavera de la Reina and the the Mediterranean Demo Site at CENTA has…

	Continental	Mediterranean
Treated water	48.927 m^3	19.000 m^3
Samples analyzed	949	n/a
Analysis performed	4.113	3.000
Solids removed	9,1 Tons	4,2 Tons
Total organic matter removed	11,8 Tons	9,9 Tons
Biodegradable organic matter removed	7,8 Tons	6,1 Tons
Nitrogen removed	570 kilograms	450 kilograms

Some figures about Communication and Dissemination

Activities on C&D	281
Total Audience	> 6 M
Organized Workshops / Conferences	2 / 2
Participation in conferences, workshops, etc	27
Press releases	125
Non Scientific publications	46
Training activities	5
Visits to demo sites	62

Visitors to Demo sites >1300



Social Media

life-intext.eu

- 6390 users
- 53 News
- 4 Newsletters

Life IntExt

- 294 followers
- 64 posts
- 48921 impressions
- 1504 interactions
- 165 shares
- 16 comments

@IntextLife

- 114 followers
- 46 posts
- 14805 impresiones
- 449 engagements

@LifeIntext-ch3il

- 3 shared videos
- 475 views