Water and Waste Environmental Engineering Lab

WWEELab - UNIVPM

WWEELab R&D&I activities booklet 2016-2020

Group Coordinator:

Prof. Eng. Francesco FATONE, PhD, IWA Fellow

Group Technical Director:

Prof. Eng Anna Laura EUSEBI, PhD

Group Members:

Eng. Çağrı AKYOL, PhD; Eng. Massimiliano SGROI, PhD; Eng. Alessia FOGLIA; Eng. Giulia CIPOLLETTA; Eng. Enrico MARINELLI; Eng. Serena RADINI; Eng. Cecilia BRUNI; Eng. Paolo CROCETTI; Dr. Marco PARLAPIANO; Eng. Nicola LANCIONI; Eng. Corinne ANDREOLA; Dr. Marika FANTONI

UNIVERSITÀ POLITECNICA DELLE MARCHE

OUR DASHBOARD
2016-2020

15 staff members

11	1	1	1	1
Engineers	Chemist	Environmental Scientist	Senior project manager	Plant operator

3,66 mln €
from EU-funded R&D&I projects

350 K €
from environmental scientific and technical consultancy

40
Scientific publications

268
Total Impact factor

6.7
Average Impact factor

15
Edited international journals

40
Master students

OUR TEAM

Prof. Eng. Francesco FATONE, Phd Full Professor Chemical Engineering GROUP COORDINATOR

Eng. Giulia Cipolletta
PhD candidate

Eng. Serena Radini,
PhD candidate

Prof. Eng. Anna Laura Eusebi, Phd Assistant Professor Sanitary Environmental Engineering, GROUP TECHNICAL DIRECTOR

Eng. Alessia Foglia,
PhD candidate

Eng. Corinne Andreola,
PhD candidate

Eng. Cagri Akyol, Phd, PostDoc in Environmental Engineering and Sciences

Eng. Cecilia Bruni,
PhD candidate

Eng. Nicola Lancioni,
PhD candidate

Eng. Massimiliano Sgroi, Phd, PostDoc in EnvironmentalEngineering

Eng. Paolo Crocetti,
PhD candidate

Dr. Marco Parlapiano, Chemist, PhD candidate

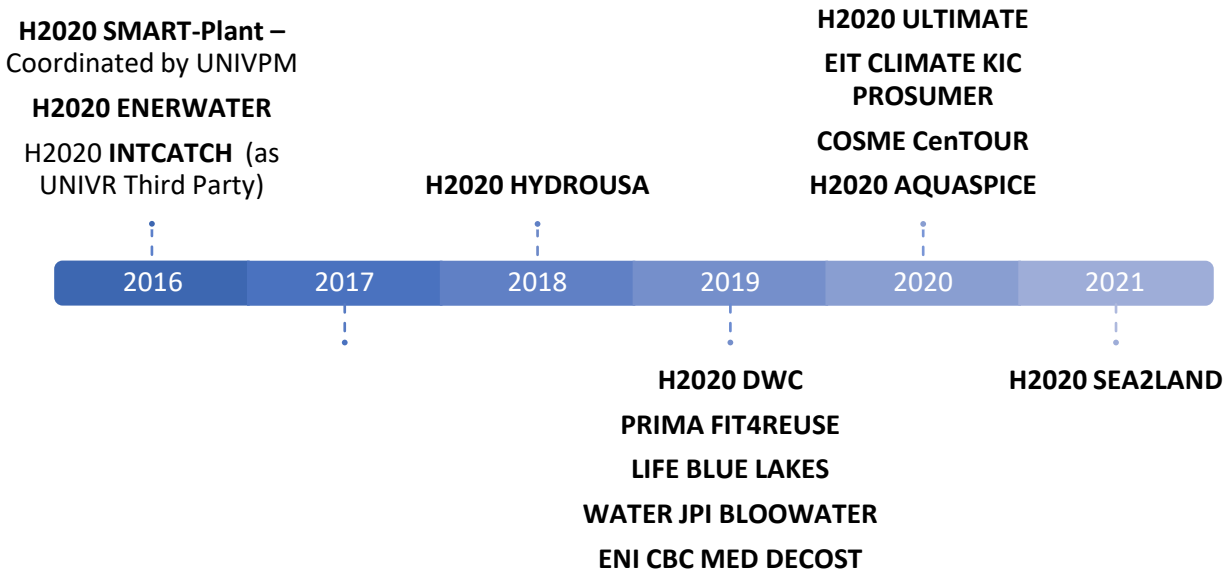
Dr. Marika FANTONI
Project manager

Eng. Enrico Marinelli,
PhD candidate

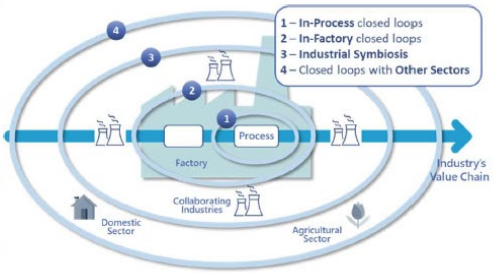
Giorgio Concettoni
Pilot Operator

EU FUNDED PROJECTS

The WWEELab Research Group, coordinated by Prof. Fatone,manages several research projects funded by the main EU research programmes: HORIZON 2020, PRIMA Initiative, WATER JPI, LIFE, ENI CBC MED, Climate-KIC COSME.


H2020 SMART-Plant – Coordinated by UNIVPM
H2020 ENERWATER
H2020 INTCATCH (as UNIVR Third Party)
H2020 HYDROUSA
H2020 ULTIMATE
EIT CLIMATE KIC PROSUMER
COSME CenTOUR
H2020 AQUASPICE
2016
2017
2018
2019
2020
2021
H2020 DWC
PRIMA FIT4REUSE
LIFE BLUE LAKES
WATER JPI BLOOWATER
ENI CBC MED DECOST
H2020 SEA2LAND

AquaSPICE – Advancing sustainability of process industries through digital and circular water use innovations (H2020)



Grant agreement ID: 958396
Status: Ongoing project
Start date: December 2020
End date: May 2024

Funded under: H2020-EU.2.1.5.3.
Overall budget: € 12,847,491,81
EU contribution: € 11,055,247,94
Coordinator: RWTH Aachen University (Germany)

General concept

AquaSPICE aims at advancing efficient and circular water use in Process Industries. It adopts a genuinely holistic approach to boost water efficiency and circularity. This approach is holistic in respect to the following domains: Industrial water use and re-use solutions (typology domain). AquaSPICE aims at materializing circular water use in European Process Industries, fostering awareness in resource-efficiency and delivering compact solutions for industrial applications. That challenging aim necessitates (i) fostering the industrial deployment of innovative water treatment and re-use technologies, (ii) closed-loop practices regarding water, energy and substances, (iii) a system for real-time monitoring, assessment and optimization of water (re-)use at different interconnected levels and (iv) an effective organisational, regulatory and business framework. AquaSPICE not only offers these but demonstrates the effectiveness, supported by the breadth of European process industries providing evidence on the achievement of the aforementioned aims. AquaSPICE's innovations emanate from the requirements of six (6) Case Studies, involving eight (8) industrial actors (Dow, BASF, Water-Link, Solvay, ARETUSA, Agricola, JEMS and TUPRAS) in six (6) EU countries (Germany, Netherlands, Belgium, Italy, Slovenia and Romania) and one (1) associated country (Turkey).

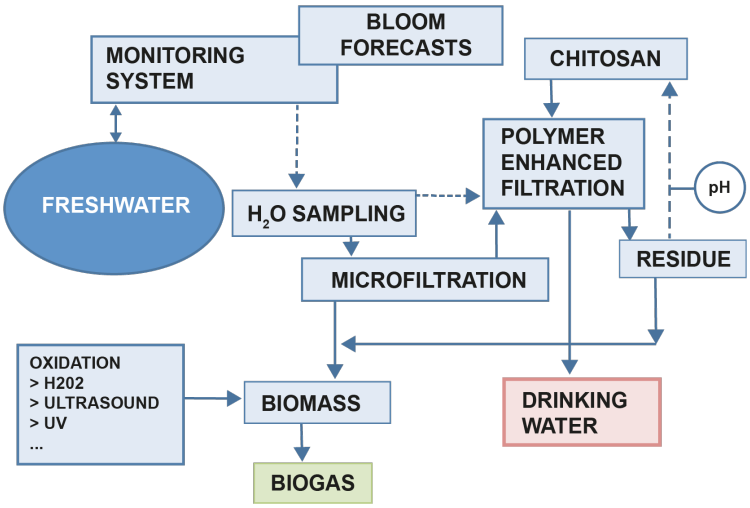
The role of UNIVPM in AquaSPICE

UNIVPM gives efforts to optimise industrial water cycles towards increased energy and carbon efficient water re-use in the Rosignano Solvay industrial site (Tuscany, Italy). In particular, the industrial wastewater resulting from the Peroxide and Peracetic Acid production amounts to about 20 m3/h and is characterized by high concentrations of TOC/COD, nitrates, sulphates and, to a lesser extent, phosphates and hydrogen peroxide. The organic consists mainly of phthalic acids and derivatives of phthalic acids, other acids and linear organic di-acids, alcohols and di-alcohols and aromatic compounds. The metals are essentially those coming from stainless steel and carbon steel since the plant is mostly built in stainless steel with some parts in carbon steel. Nitrates and sulphates derive from acidification processes using nitric acid and sulfuric acid, mineral alkalinity given by sodium hydroxide. The proposed solution validates a pilot-scale technology for the treatment of the industrial used water up to the limits for discharge in municipal sewers. By this way this flow can be further treated in ARETUSA reclamation plant and finally re-used for cooling processes back in SOLVAY chemical plant. The pilot-plant will be validated in real environment along with a techno-economic feasibility assessment and digital integration with the industrial production site.

Expected impacts

The AquaSPICE project will have demonstrable impact on EIP Water, one of the five initiatives within the EU 2020 Innovation Union, and will address the thematic priorities and cross-cutting themes with particular emphasis on 'Water reuse and recycling', 'Water and wastewater treatment', 'Water governance', and 'Decision support systems and monitoring'. The expected impacts include, but not limited to: significant reduction of the current use of fresh water resources, significant steps towards near-zero discharge using closed-loop systems in industrial processes, significant increase of the recovery of water, energy and/or substances and materials and increase of resource and water efficiency by 30% compared to the state-of-the-art.

BLOOWATER - Supporting tools for the integrated management of drinking water reservoirs contaminated by Cyanobacteria and cyanotoxins (WATER JPI)



Status: Ongoing project
Start date: April 2019
End date: April 2022
Funded under: Water JPI 2018 JOINT CALL WaterWorks RID, Ministero dell'Istruzione dell'Università e della Ricerca (Italy), FORMAS (Sweden), Research Council of Norway (Norway)
Overall budget: € 996.882,00
EU contribution: € 834.423,00
Coordinator: ENEA (Italy)

General concept

The main objective of the BLOOWATER project is to produce informational resources for Public water supply systems and Agencies to prepare and respond to the risk of the cyanotoxins in drinking water. Practically the project proposes innovative technological solutions that are aimed to develop a methodological approach based on the integration of monitoring techniques and treatment of water affected by toxic blooms (multiple barrier approach). BLOOWATER will integrate innovative methodologies into a multisensor platform to improve water quality through the development of effective low-cost and functional measures into prompt and opportune intervention procedures for efficient and sustainable management of the water resource. The project intends to develop and implement methods to treat freshwater with more efficient processes (PEUF) and will definine diagnostics protocols through the integration of innovative techniques for water monitoring, aimed at creating forecasting models and systems of surveillance and early warning of toxic blooms. These will allow immediate actions such as opportune potabilization treatment. The development of specific algorithms will allow advanced processing of the different spectral and toxicity data to produce predictive and early warning models of toxic blooms useful for stakeholders and in particular for treatment plant operations.

The role of UNIVPM in BLOOWATER

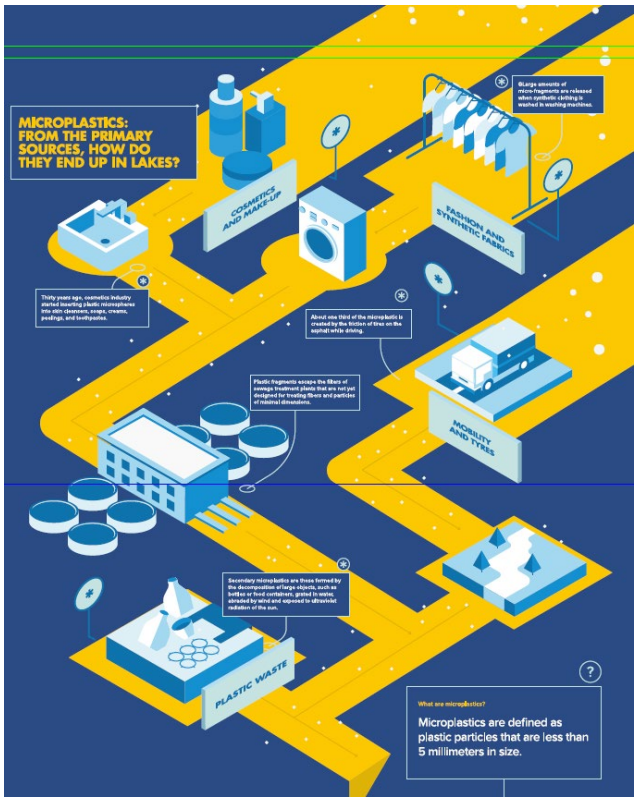
UNIVPM is responsible for determining the treatment efficiencies and the main operative parameters of innovative PEUF configurations for cyanobacteria and cyanotoxin removal initially at laboratory scale. Processes design, development and field validation of the promising water treatment technologies will be further performed at pilot scale. The process validation will be carried out in demonstrative scale (TRL 5-7). The pilot system will be installed in the demo site of Lake Castreccioni (Marche, Italy) and will treat 0.2-0.5 m3/d of surface water. The long-term PEUF operation will be performed at different specific fluxes also to evaluate the cyanobacteria reduction in demonstrative scale. The cyanobacteria removals, the main macropollutants characteristics and the final water quality will be analysed to be compared with the drinking water standards. Finally, a decision support system (DSS) will be developed for the authorities of the involved territories with a tool for the strategic planning of the algal bloom management and in the future to remove the main causes.

Expected impacts

The BLOOWATER will contribute to describe suggestions for managing cyanotoxins issues in raw and treated water. Moreover, the project will provide examples of how public and private utilities can manage this risk. The main barrier/obstacles can be attributed to the inadequate regulations at local level and in particular regarding the management of the single water system supply in the Mediterranean region. An improvement in national (and international) coordination and in particular to start a National project on the control of pollution (and risks) caused by cyanotoxins will be achieved

https://www.bloowater.eu/

BLUELAKES - No microplastics, just waves. (LIFE)



Grant agreement ID: LIFE18 GIE/IT/000813
Status: Ongoing project
Start date: November 2019
End date: November 2022
Funded under: EU LIFE 2014-2020 Program
Overall budget: € 2,530,927
EU contribution: € 1,391,990
Coordinator: LEGAMBIENTE (Italy)

General concept

LIFE Blue Lakes main objective is the prevention and reduction of microplastic waste in Italian and German lakes, by improving plastic-related decision-making processes at local, regional and national levels by addressing key target groups and relevant stakeholders (local administrations, regional agencies for the protection of the environment, companies, citizens, etc.) through participatory processes that will lead to the draft of the Lakes Papers, a voluntary tool with provisions and suggestions aimed at reducing the disposal of microplastics in lakes tailored for all different target groups (institutions, private companies, citizens). The project also foresees a classical awareness raising campaign for citizens along with specific training activities for managers and operators of water and wastewater treatment plants.

The role of UNIVPM in BLUELAKES

The occurrence of microplastics in drinking and wastewater treatment plants as well as in combined sewer overflows is determined and the removal efficiency of different processes is evaluated by UNIVPM. The results will be deployed to develop operative manuals and training activities, in order to support water utilities and public authorities that face the emerging problem of microplastics in water environment. The outcomes of the UNIVPM activities will be exploited to improve microplastics management strategies and to optimize treatment processes in order to reduce microplastics impacts on the environment. The results will not only support the technical aspects, but also engage stakeholders and increase public awareness about the microplastics presence in water and boost decision making for public authorities and municipalities to cease the problem.

Expected impacts

LIFE Blue Lakes approach and initiatives are expected to boost European and national political decision makers to adopt appropriate regulations to reduce plastic and micro-plastic litter in lakes. Furthermore, the project will contribute to more sustainable production and consumption: Companies from economic sectors which are using micro plastics will be motivated to substitute these substances. Citizens will be sensitized to avoid products which include or create micro plastics and to request the substitution of this ingredient

https://lifebluelakes.eu/

CENTOUR - Circular economy in tourism (COSME)

Grant agreement ID: 951076
Status: Ongoing project
Start date: September 2020
End date: August 2023
Funded under: COSME -call COS-TOURCOOP-2019-3-01
Overall budget: € 1,329,358.42
EU contribution: € 997,018.84
Coordinator: CCIAAM (Italy)

General concept

CENTOUR fosters innovative solutions for sustainable tourism development and management of tourism enterprises, through transnational cooperation and knowledge transfer, in particular toward SMEs focused on local supply chains and developing industrial symbiosis to develop circular business models. The proposal addresses the specific challenge and scope of the topic, as set out in the COSME 2019 Work Programme and in the present Call: strengthening the competitiveness and sustainability of the tourism sector and its contribution to economic growth and jobs in the EU, boosting capacity of tourism SMEs through transnational cooperation and knowledge transfer in the field of sustainability.

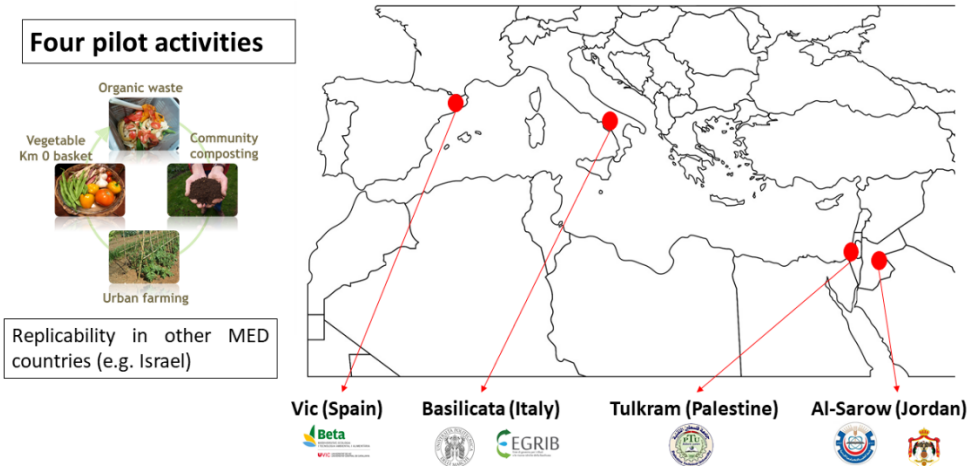
The role of UNIVPM in CENTOUR

UNIVPM develops innovation strategies with a special focus on developing circular supply chain and reverse supply chains solutions. Special attention is paid to three focus themes: - Reducing Food waste in food sector, specifically referring to the reintroduction of the exhausted oil coming from the tourism sector, Plastic free offer and rethinking the packaging through the whole supply chain within single SMEs and at evaluation at system level. - Collaborative consumptions, a communal way to find alternative and efficient business models and at the same time increase the community lead tourism approach. Furthermore, UNIVPM will bring marketing strategies linked specifically to circular tourism and the project results in 2 focus-regions.

Expected impacts

The outcomes of the project will enable an effective support scheme for SMEs to provide them with the necessary skills, knowledge and the appropriate mindset and resources (also in terms of local governance) to develop innovative solutions toward a circular economy, increasing their capacity to rethink their business models, products and services. The results will help the participating SMEs to develop and implement solutions for circular models, in particular foster brainstorming and innovative solutions through design thinking approaches, establishing communities of practices and cross-sectoral cooperation. Furthermore, an enduring network of Institutions will be created that can collaborate on circular economy support schemes for SMEs in the tourism sector and the exchange of practices and results at EU level will be promoted within a circular economy network of stakeholders and the development of an operational framework to replicate the business support scheme elsewhere.

DECOST - Decentralised composting in small towns (ENI-CBC-MED)



Grant agreement ID: A_B.4.2_0095
Status: Ongoing project
Start date: September 2019
End date: September 2022

Funded under: ENI CBC MED
Overall budget: € 3.011.231,44
EU contribution: € 2.710.108,29
Coordinator: University of VIC (Spain)

General concept

DECOST project aims to develop a new framework of waste management, building a closed-loop system of organic waste valorisation, integrating decentralised home and community composting systems with urban agriculture. This goal can only be achieved by using a people-centered approach, empowering civil society and increasing institutional capacity building. Thanks to DECOST, Integrated Municipal Solid Waste Management Plans and pilot initiatives are being implemented in 4 different municipalities in order to reduce food waste, treat 1,500-2,000 tons of organic waste/year and use the produced compost in urban agriculture projects.

The role of UNIVPM in DECOST

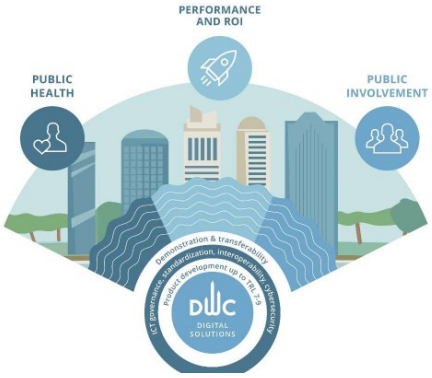
UNIVPM is implementing two different composting approaches in Basilicata, Italy. In Basilicata, two different sites are selected, the town Atella and a peri-urban village of the city of Potenza. Atella hosts the centralized composting system for OFMSW and agricultural waste, while the decentralized composting is being implemented in Potenza only for OFMSW. The solution envisaged for the decentralized Italian site is a combination of community and home composting. The community composting system is based on the application of electromechanical machines located in strategic points inside the urban/residential area of the Macchia Romana district in the municipality of Potenza. The equipment will be used by citizens themselves that are involved in the project. The main purpose of the urban agriculture model to be developed in the Italian case is combining all positive social and environmental aspects of the urban agriculture with the valorisation of compost. First, the possibility of using the compost products in personal gardens or farms (in the case of the centralized project with agriculture waste) will be given to all the citizens contributing to the project. The remaining compost products will be then used in specific urban farming project in order to gain social and educational values. The compost produced with the decentralized system, for example, will be used in the urban gardens already active in the Macchia Romana district in the municipality of Potenza.

Expected impacts

Besides diverting a significant amount of organic waste from being disposed of in landfills, the DECOST project will foster food security and accessibility thanks to the support of urban agriculture initiatives. Citizens, especially children, and households, will be encouraged to adopt sustainable behaviours through IT tools and big data analysis. Expected achievements include: 4 new Integrated Municipal Waste Management Plans designed, 4 composting plants created, 1,500 - 2,000 tons/year of total waste recycling capacity installed, 1 smartphone application allowing citizens to monitor their environmental performance in terms of waste sorting and recycling, 40 municipal staff trained and 1 business plan to foster the long-term economic viability of the recycling system developed.

http://www.enicbcmed.eu/projects/decost

DWC - Digital Water.City - Leading urban water management to its digital future (H2020)



Grant agreement ID: 820954
Status: Ongoing project
Start date: June 2019
End date: November 2022
Funded under: H2020-EU.3.5.4., H2020-EU.3.5.2.2.
Overall budget: € 5,878,014,84
EU contribution: € 4,997,161,66
Coordinator: KWB (Germany)

General concept

DWC creates new linkages between the digital and the physical world by developing, assessing and bringing to the market a panel of 18 advanced tailor-made data and digital technologies for integrated water management. DWC digital solutions are being deployed in five major European urban and peri-urban areas, Berlin, Milan, Copenhagen, Paris and Sofia, representing about 30 million inhabitants, i.e. 6% of Europe's population, facing common issues concerning water and wastewater management and digitization, and linked to important events such as the 2024 Olympic Games in Paris. DWC partners consider that the large scale assessment and communication of the benefits provided by the digital solutions in five major cities will serve as lighthouse, raising the awareness of other European cities, including smaller urban areas, and opening new market opportunities for DWC partners and European providers of digital solutions. DWC takes the challenge of developing a large number of solutions (18 DS, TRL 3-7 toward TRL 7-9) that address a wide panel of digital techniques for the all water value chain instead of focusing only on few isolated solutions. DWC considers that this approach is essential to unleash the full potential obtained through the interactions of single digital technologies such as real-time monitoring data empowered by artificial intelligence and mobile visualization tools. DWC solutions have been selected based on their level of maturity, on their market potential and on their high relevance to address current and future water-related issues, namely the protection of human health, the technical, environmental and economic performance and return on investment of water infrastructures as well as the public and end-user awareness on water management.

The role of UNIVPM in DWC

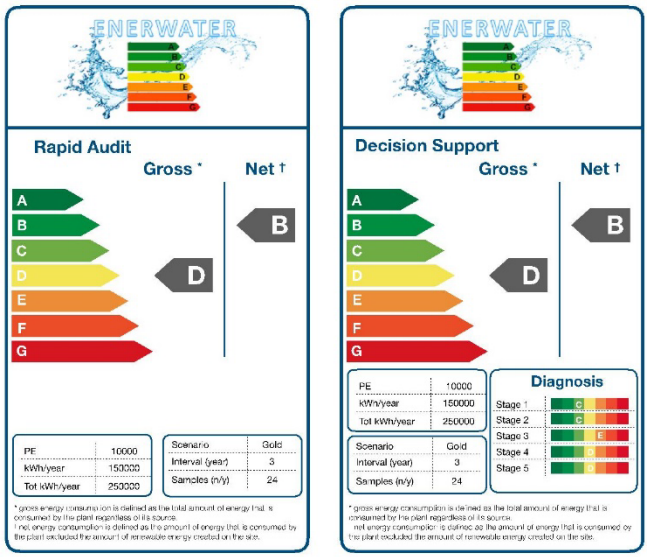
The role of UNIVPM DWC is related to focusing on improved decision making for human health protection. Innovative sensors for measurement of water quality health-risk-related parameters is being integrated in existing infrastructures. The UNIVPM activity allows the set-up of monitoring network for safe water reuse, searching robust correlations between online and lab data to allow real-time decision making based on process-oriented monitoring. UNIVPM also contributes to the development of the digital structure and operation of an Early Warning System for improved decision making for water reuse, integrated in a water reuse risk management approach, in line with the WHO and EU guidelines. UNIVPM leads on wastewater treatment sustainability in local stakeholder training and engagement and will deliver the first versions of the mobile-friendly websites for visualization of long-term conclusive information to the end-users. Moreover, UNIVPM contributes to the development of a match-making tool between water supply and demand, remote detection of water stress for real-time monitoring of soil-plant-atmosphere system. UNIVPM will develop a Demo of Web-based serious game for the water reuse – carbon – energy – food – climatic nexus, to raise awareness and engage public to overcome social and economic barriers to water reuse. UNIVPM supports intra-project CoP, communication activities, scientific coordination of project and quality and risk management.

Expected impacts

DWC innovations and solutions will bring interoperability of decision support systems through the identification and use of ICT/water vocabularies and ontologies in view of developing or improving ICT/water standards; improved decision making on water management, related risks and resource efficiency through increased real-time accuracy of knowledge; maximising return on investments through reduced operational costs for water utilities, including reduced costs for water monitoring, improved performance of water infrastructures, and enhanced access to and interoperability of data; enhanced public awareness on water consumption and usage savings; market development of integrated and cyber-resilient ICT solutions and systems for smart water management; reduction in the environmental footprint of the main water-dependant activities and improve their resilience to climate changes and other environmental changes.

https://www.digital-water.city/

ENERWATER - Standard method and online tool for assessing and improving the energy efficiency of wastewater treatment plants (H2020)



Grant agreement ID: 649819
Status: Closed project
Start date: March 2015
End date: October 2018
Funded under: H2020-EU.3.3.7.
Overall budget: € 1,731,087
EU contribution: € 1,731,087
Coordinator: Universidad De Santiago De Compostela (Spain)

General concept

The main objective of ENERWATER was to develop, validate and disseminate an innovative standard methodology for continuously assessing, labelling and improving the overall energy performance of WWTPs. For that purpose, a collaboration framework in the wastewater treatment sector including research groups, SMEs, utilities, city councils, authorities and industry were be set up. ENERWATER devoted important efforts to ensure that the method was widely adopted. Subsequent objectives were to impulse dialogue towards the creation of a specific European legislation following the example of recently approved EU directives, to achieve EU energy reductions objectives for 2020, ensuring effluent water quality, environmental protection and compliance with the WFD. These actions brought European Water Industry a competitive advantage in new products development and a faster access to markets by facilitating evidence of reduction therefore fostering adoption on new technologies.

The role of UNIVPM in ENERWATER

The main role of UNIVPM in ENERWATER was related to the supervision of monitoring activities in n.15 Italian WWTPs where energy monitoring systems were installed, with the purpose to get an updated public benchmark database with energy data from all plants.
UNIVPM participated in the creation of the ENERWATER methodology, for the calculation of the energy index and energy classes (A, B, C, D, E, F) and carried out energy audits on Italian WWTPs to test and evaluate the Methodology, even in terms of socio-economic impact.
UNIVPM has also been in charge of the engagement of italian stakeholders (research groups, WWTP builders and designers, water authorities, WWTP operators, ESCOS, equipment providers and other WWTP stakeholders), through a Joint Standardisation Stakeholders Workshop and the elaboration of a Report on standardisation activity. A full set of recommendations for a future directive about energy performance of WWTPs was delivered to EC.

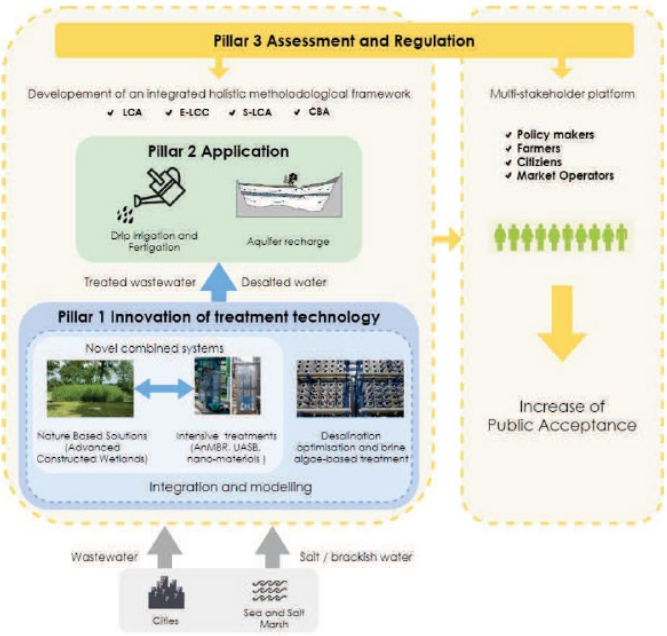
Impacts and Results

ENERWATER created an organized structure of collaboration to yield a methodology based on previous works and experiences. The methodology was tested to reach an 11to 30% energy reduction in 65 WWTPs (15-20) WWTPs per country (preliminary selection has been done of total), and it was also offered as an online tool to facilitate the work to WWTPs managers. ENERWATER created an open benchmarking database to share energy data results. Discussion and networking with European stakeholders were promoted. Finally, contribution of the project to the European standardisation system proposed and fostered the elaboration of a new standardisation document. The main result of the coordinated action was a methodology, which was suitably, assessed and tested in real case scenarios. Other results included: An automated tool reflecting the developed methodology, an energy benchmarking database, a guideline document on water treatment technologies and best practices for energy efficiency, proposal and contribution to a new standard and a set of recommendations to the EU commission towards a future directive.

http://www.enerwater.eu/

FIT4REUSE PRIMA IN THE MEDITERRANEAN AREA

FIT4REUSE - Safe and sustainable solutions for the integrated use of non-conventional water resources in the Mediterranean agricultural sector (PRIMA)



Grant agreement ID: [1823] [FIT4REUSE] [Call 2018 Section 1 Water]
Status: Ongoing project
Start date: June 2019
End date: June 2022
Funded under: EU PRIMA
Overall budget: € 2.020.000,00
EU contribution: € 2.020.000,00
Coordinator: University of Bologna (Italy)

General concept

The overall concept and rationale of FIT4REUSE are identified with the three main pillars of the project: i) innovation of treatment technologies, ii) application of non-conventional water resources in simulated/relevant environment, and iii) assessment and regulation, followed with the engagement of research, governmental and industrial partners from different parts of the Mediterranean region. The innovation pillar will concentrate on wastewater treatment and desalination technologies in order to optimise the water-energy-carbon-food nexus and offer new knowledge through novel and sustainable solutions. In particular, nature-based solutions (optimised constructed wetlands), advanced treatment systems (mainly based on anaerobic processes, as UASB and AnMBR) and nano-materials will be innovatively combined; FIT4REUSE will develop innovative solutions tailored for maintaining nutrients only when needed (crop irrigation seasons), while removing pathogens and emerging compounds for a safe wastewater reuse. The use of non-conventional water resources will also be considered for aquifer recharge after soil aquifer treatment and FIT4REUSE will provide a basis for a novel modelling tool that links meteorological conditions and infiltration rate. The data obtained for both wastewater treatment and desalination will be used to provide a simple and easy-to-use modelling platform in order to cover a wider range of scenarios and conditions than those relative to the experimental part. Once a suitable water quality is achieved, the application pillar will study its use in irrigation, fertigation and aquifer recharge, as direct and indirect water reuse schemes.

The role of UNIVPM in FIT4REUSE

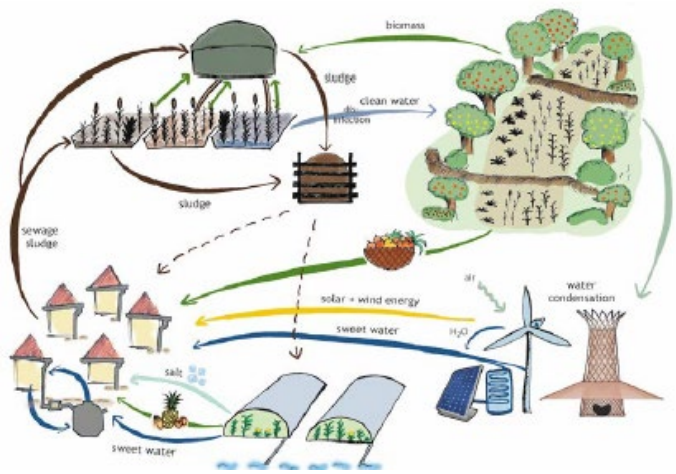
UNIVPM is operating a pilot scale UASB coupled with AnMBR in the demonstrative hall of Falconara Marittima WWTP (Ancona, Italy) for high-rate innovative municipal wastewater treatment. The integration of molecularly imprinted polymer (MIP) column to the UASB+AnMBR configuration is being tested for enhanced pharmaceuticals removal to enable safe reclaimed water reuse. In parallel, an intensive pilot system is being operated in the Falconara Marittima WWTP to enable wider use of desalted water in agriculture through evaporation, chemical precipitation (selective Mg and Ca precipitation) and forward osmosis (FO) steps. The recovered Mg is to be used as an external source to enhance the struvite precipitation in the effluent of the AnMBR. In addition to lab and pilot-scale achievements, water reuse safety plans are also under preparation by UNIVPM to consider multi-dimensional risk interactions involved with water reuse schemes.

Expected impacts

The expected impacts of the FIT4REUSE include: - increasing the quantity, quality and safety of non-conventional water use for agriculture and food processing (direct use and indirect use of reclaimed water, i.e. artificial recharge, aquifer storage recovery approach) - increasing the efficiency of water management systems with particular regard to energy and water smart infrastructures - decreasing the cost of treating wastewater and, particularly, desalination by using more energy-efficient processes - obtaining socio-economic, environmental (soil conservation and nutrient pollution in particular) and technical information to influence Mediterranean countries policies in terms of wastewater use - Deriving new solutions for brine disposal considering a holistic approach for desalination water.

https://fit4reuse.org/

HYDROUSA - Demonstration of water loops with innovative regenerative business models for the Mediterranean region (H2020)



Grant agreement ID: 776643
Status: Ongoing project
Start date: July 2018
End date: December 2022
Funded under: H2020-EU.3.5.2.3., H2020-EU.3.5.4., H2020-EU.3.5.2.2.
Overall budget: € 12,015,448
EU contribution: € 9,958,706,88
Coordinator: National Technical University of Athens (Greece)

General concept

HYDROUSA aims to setup and demonstrate on-site nature-based solutions for the management of a variety of water streams including rainwater, sewage, groundwater and seawater to produce valuable resources, which can then be valorised to increase agricultural production and boost the economic activities of Mediterranean areas. The demonstration systems will be applied at full scale on two Greek islands (Mykonos and Tinos). The implemented solutions will be complemented with innovative services, based on the formation of new value chains, involving farmer associations and water producers. The transferability of the solutions will then be demonstrated in 10 other Mediterranean and water stressed places. HYDROUSA will advance technologies from TRL5 or 6 (already validated in relevant environment independently) to TRL7 (system prototype demonstration in operational environment) or even 8 corresponding to advances to be achieved during the 2 years full-scale demonstration.

The role of UNIVPM in HYDROUSA

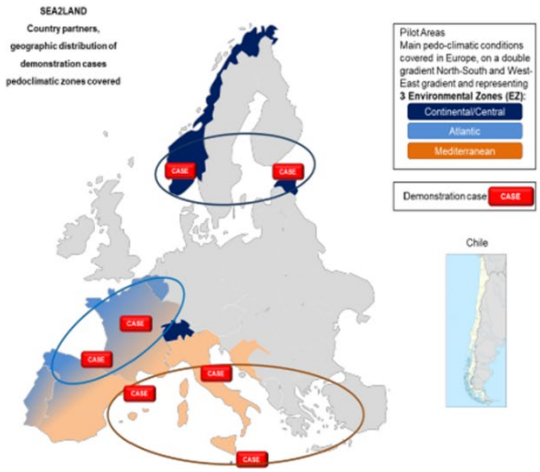
UNIVPM is evaluating transferability and replication of HYDROUSA services in different replication sites world-wide. To achieve this goal, legislative and institutional analysis at European level have been assessed for identification of possible gaps within the policy framework which could hinder the implementation of HYDROUSA innovative solutions.
Specifically, EU legislation in the field of Water Framework Directive, Urban Waste Water Treatment Directive, Fertiliser Regulation, Food safety legislation as well as links to other EU policy initiatives (e.g. EC policy framework on phosphorus; resource-efficient Europe initiative; EU biodiversity strategy; EU climate change adaptation and disaster prevention; Thematic Strategy for Soil Protection) and policy proposals and measures have been analysed. A guidance methodology for replicability assessment in different replication sites has been developed in order to provide criteria for replicability of HYDROUSA solutions within the different local contexts. Feasibility studies for all the replication sites will be further reported with focus on the identification of social, legislative, financial and economic instruments for enabling environment analysis at local level.

Expected impacts

The whole water value chain will benefit from this disruptive approach of turning a problem into a solution within HYDROUSA. With a plethora of application possibilities a variety of additional services can be created: e.g. new standardisation procedures for technical equipment or organic farming, new methods for decentralised urban farming with wastewater, new business models with leasing of biogas equipment, , new open data citizen science activities, farmers utilising and commercialising new systems, new types of community farming with shared toilets, community supported agriculture with closed nutrient cycles, etc.

https://www.hydrousa.org/

SEA2LAND - Producing advanced bio-based fertilisers from fisheries wastes (H2020)



Grant agreement ID: 101000402
Status: Ongoing project
Start date: January 2021
End date: December 2024
Funded under: H2020-EU.3.2.1.1.
Overall budget: € 8,853,401,54
EU contribution: € 7 748 383,50
Coordinator: NEIKER (Spain)

General concept

The SEA2LAND project brings together 26 multidisciplinary actors from 10 different European countries (9 companies, 2 social actors, 9 technological centres and 5 universities), to implement 9 processes for the recovery of nutrients from the by-products and side-streams of the aquaculture and fishing industry. SEA2LAND will optimise near-to-market (TRL7) technologies some of them combined (advanced compost, biodrying, frozen concentration, algae production, pyrolysis, membrane technology, chitin extraction, frozen extraction, thermo-mechanical fractionation, enzymatic hydrolysis) that will generate at least 12 bio-based or tailor-made fertilisers. SEA2LAND aims to develop solutions that connect the problem of the wasted nutrients from fisheries with the need of nutrients for agricultural purposes. Thus, by-products waste producers and managers will identify and quantify the waste flows while agricultural research institutions will assess the soil needs. Technological centres will provide solutions for the transformation of wastes into bio-based fertilisers, while fertiliser companies will produce and tests the fertilisers and will give the point of view of business and market. Besides, advisory services and associations of farmers will interact to optimize the final product. Their contribution, in the final formulations, will affect to the production process design.

The role of UNIVPM in SEA2LAND

UNIVPM creates a “shell biorefinery” concept using the leftovers from a seafood processing industry (CO.PE.MO) in Ancona (Marche, Italy). CO.PE.MO produces 1-3 tons/day seafood wastes and by-products. Process leftovers are mainly composed of mussel shells and little contribution of organic fraction of the seafood (i.e. remaining mussels’ meat, seaweed as well as other crustacean shell wastes). This type of waste contains three primary chemicals that have many industrial uses: calcium carbonate, chitin and protein. Accordingly, raw seafood processing wastes will be separated between shells and remaining organic fraction. Two different innovative routes will be followed to recover valuable materials. In the first route, chitin and protein hydrolysates will be recovered from seafood processing wastes at the lab-scale by UNIVPM to obtain chitin-protein derivative as a slow-release N-fertiliser. In the second route, biochar-compost composite fertiliser will be achieved at pilot-scale using several batches of real seafood processing wastes by UNIVPM. Biochar will be obtained by the pyrolysis of shells and/or co-pyrolysis with other relevant wastes. Organic fraction of the wastes will be latter composted and/or co-composted using other aquaculture and/or forestry wastes such as macroalgae and softwood. Processes optimization will be carried out in each step and characterization of resulting products will be assessed for each recipe to obtain ready-to-use high-quality biofertilisers.

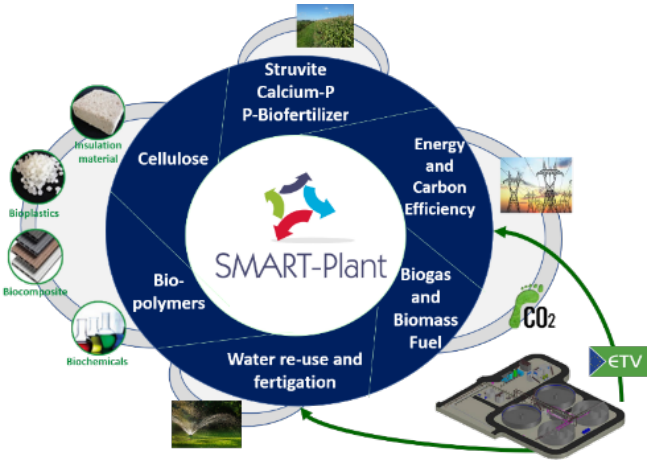
Expected impacts

The long-term impact of SEA2LAND is the supply of biological and renewable nutrients to European agriculture through the recovery of nutrients present in by-products from the fisheries and aquaculture industries. Around 50 MT of by-products are generated and only a part is used to produce fish meal. It is expected to implement and optimize 9 technological solutions that could lead to the recovery of about 5.2 million tons wastes that means 620,000 ton of nutrients (N and P) for agricultural use, which means more than 20% of the nutrients imported into Europe (3 million tons annually). That means that around 6.8 million ha that could benefit from the use of those fertilisers. In this way SEA2LAND will contribute to reduce European dependence of external inputs of nutrients, and at the same time, will contribute to reduce GHG emissions and to boost local economy.

SMART-Plant

HORIZON 2020

SMART-Plant - Scale-up of low-carbon footprint material recovery techniques in existing wastewater treatment plants (H2020)



Grant agreement ID: 958396
Status: Closed project
Start date: June 2016
End date: May 2020
Funded under: H2020-EU.3.5.4.
Overall budget: € 9,768,806,09
EU contribution: € 7,536,300,02
Coordinator: Università Politecnica delle Marche (Italy)

General concept

SMART-Plant aimed to scale-up in real environment eco-innovative and energy-efficient solutions to renovate existing WWTPs and close the circular value chain by applying low-carbon techniques to recover materials that are otherwise lost. 7+2 pilot systems were optimized for > 2 years in real environment in 5 municipal water treatment plants, including also 2 post-processing facilities. The systems were automatized with the aim of optimizing wastewater treatment, resource recovery, energy-efficiency and reduction of greenhouse emissions. A comprehensive SMART portfolio comprising biopolymers, cellulose, fertilizers and intermediates were recovered and processed up to the final commercializable end-products. The integration of resource recovery assets to system-wide asset management programs were evaluated in each site following the resource recovery paradigm for the wastewater treatment plant of the future, enabled through SMART-Plant solutions. The project proved the feasibility of circular management of urban wastewater and environmental sustainability of the systems and demonstrated through Life Cycle Assessment and Life Cycle Costing approaches to prove the global benefit of the scaled-up water solutions. Dynamic modelling and superstructure framework for decision support were developed and validated to identify the optimum SMART-Plant system integration options for recovered resources and technologies. Global market deployment was achieved as right fit solution for water utilities and relevant industrial stakeholders, considering the strategic implications of the resource recovery paradigm in case of both public and private water management. New public-private partnership models were explored connecting the water sector to the chemical industry and its downstream segments such as the construction and agricultural sector, thus generated new opportunities for funding.

The role of UNIVPM in SMART-Plant

UNIVPM has been the SMART-Plant Coordinator, responsible for the scientific, financial and administrative coordination of the project and in charge of the interaction with the EC and the large project Consortium. UNIVPM has been in charge of the engineering senior supervision in the design, construction, validation and optimization of the 2 SMARTechs (4a and 5) installed in a WWTP near Treviso (Italy). The data obtained from the long-term operation of the SMARTechs were used for the assessment, data-processing, modeling and decision support system. UNIVPM was the promoter and main organizer of several stakeholders workshops and events, including the organization of the 3rd IWA Resource Recovery Conference (www.iwarr2019.org ,Venice, 2019) as final project event. UNIVPM provided support to local, national and EU policy makers, having an active role in the main EU stakeholders platforms and as a member of technical boards and committees. UNIVPM is responsible for the italian local Hub for the exploitation of the SMART-Plant solutions.

Impacts and Results

SMART-Plant validated n.9 SMARTechs able to considerably reduce the operational costs of WWTPs (energy savings up to 68%, GHG emission reduction up to 70%, sludge reduction up to 30%) while at the same time resulting in energy, nutrients and other materials recovery (n.3 SMARTechs were certified through Evironmental Technology Verification). The materials recovered by the SMARTechs were used to develop new valuable SMART-Products (such as biocomposites, fertilizers, additives) that were tested to comply with law and market requirements. Results in terms of chemical safety, concentration of pesticides and heavy metals, agronomic value, quality and performances were encouraging, so the portfolio of SMART-Products was presented to the attention of the water, chemical, agricultural and construction sector to start creating new-value chains. The project developed n.2 digital support tools/systems for real-time monitoring of energy demand and greenhouse gas emissions and support decision on the optimal configuration of a WWTP.
SMART-Plant results have been published in high-impact scientific ISI journals, achieving a total Impact Factor 89.

http://www.smart-plant.eu/

ULTIMATE WATER SMART INDUSTRIAL SYMBIOSIS
HORIZON 2020

ULTIMATE - Industry water-utility symbiosis for a smarter water society (H2020)

Grant agreement ID: 869318
Status: Ongoing project
Start date: June 2020
End date: May 2024
Funded under: H2020-EU.3.5.4., H2020-EU.3.5.2.2.
Overall budget: € 16,614,813.75
EU contribution: € 13 527 116.27
Coordinator: KWR (The Netherlands)

General concept

The project brings together 9 Water Smart Industrial Symbiosis (WSIS) cases (8 in the EU and 1 in IL) where it develops, tests and demonstrates multi-layered water-energy-materials reuse approaches, complying with strict health and safety requirements while showcasing novel governance arrangements and business models. All cases build on direct industrial interest and investment, with ULTIMATE providing added-value through additional expertise, novel technological ideas, software (process models and control optimisation analytics, whole system models, IS matchmaking algorithms and digital marketplaces), hardware (e.g. advanced treatment technologies, sensors), as well as business intelligence and market analysis. We facilitate the design, deployment, monitoring and control of these symbiotic systems and co-develop with the main stakeholders (from the industry and water service provision sides of the symbiosis) the business models required to make them profitable - ensuring wide transferability and uptake. The project also leverages years of experience and millions in investment in industrial symbiosis, by learning from additional mature high-profile cases (incl. cases in the UK and China). All demonstrations place emphasis on the valorisation of resources, addressing key challenges in scale of production, quality and costs.

The role of UNIVPM in ULTIMATE

As the Innovation Manager in ULTIMATE, UNIVPM brings new approaches and best practices for closing materials cycles within symbiosis cluster and increased yield of provision of fit-for-purpose water quality in Rosignano (Tuscany, Italy) in collaboration with ARETUSA. A real-time data driven monitoring and process control system for seawater intrusion and infiltration in the sub-catchment and sewers sub-system will be established to overcome salinity peaks in the influent to the WWRP. Therefore, flow splitting and equalization of the secondary WWTP effluents will be tested to achieve the contracted water quality. The ICT tool will integrate real-time flow data from the two WWTPs and the upstream sewer system as well as online conductivity data at the WWTP outlets and at strategic points of the sewer systems. An early warning system for the intrusion of seawater and salinity management will be developed, using a model-based approach with hydrometeorological forecasts (wind speed + direction, rainfall) combined with hydrogeological data (groundwater level) to predict saltwater intrusions and impacts from sea spray. To allow for water reuse during periods of very high salinity, the potential for others water uses outside of SOLVAY will be screened regarding the highest admissible chloride content. These potential uses will be integrated in a data-driven matchmaking platform for water reuse to manage the industrial and agricultural demand and supply of water from various sources (water reuse, wells, surface water). This platform incorporates a fit-for-purpose water quality approach based on online parameters (e.g. salinity, turbidity, COD) and will improve the local management of water sources.

Expected impacts

ULTIMATE demonstrates innovative solutions for symbiosis between industry and water service providers, contributing to the challenges of water scarcity, raw materials depletion and climate change. Efficient use and recovery of resource and energy, together with water reuse, are main pillars of ULTIMATE. In ULTIMATE, energy recovery reducing almost 15% of process energy demands will be demonstrated. ULTIMATE proposes reuse and recovery schemes to drastically reduce demands for freshwater of European industries, while providing CE business opportunities for new products. Solutions will allow preparing both Industries and Utilities for the CC challenges (e.g. water scarcity), while also reducing CO_2 emissions through energy demand reductions. Considering the project lifetime plus three years, the ULTIMATE partners have an anticipated investment planning focussing circular economy and symbiosis activities of in total 270 M€. Furthermore, ULTIMATE will propose new business models and services based on the cases, improve on current practices by facilitating knowledge-co-creation and when applicable, propose new business models, partnership and services around circular symbiotic opportunities between industries and water service providers with active participation of SMEs.

https://ultimatewater.eu/

eit Climate-KIC

PROSUMER - Techno-economic and environmental feasibility study of Phosphorus recovery and reuse in fertilizers (EIT CLIMATE-KIC)

Task ID: EIT_2.2.2_200103_P456_1A
Status: Ongoing project
Start date: January 2020
End date: December 202

Funded under: EIT CLIMATE-KIC
Overall budget: € 93.803,00
EU contribution: € 73.172,00
Coordinator: University of Bologna (Italy)

General concept

Prosumer aims to explore the potential of P loop closing in Italian food industry. A techno-economic feasibility study will be conducted to: (i) identify the main barriers and the necessary concrete interventions to implement drivers of change in this field; (ii) estimate the economic impact for a single Company and for EU economy reducing P imports; (iii) the environmental impact in terms of CO_2 emissions comparing the actual and the potential scenarios; (iv) identify requirements for successful activities, tested during following practical applications. Italian food industries and fertilizer producers, which own and use P, will be engaged to provide data for the feasibility study.

The role of UNIVPM in PROSUMER

UNIVPM is responsible for the analysis of the regulatory framework and of the available technological solutions for P recovery as struvite (and other forms of P). The regulatory framework at several levels (Regional, National and European) will be deeply analyzed to identify the boundaries in which the technological solutions should be implemented. UNIVPM will also conduct techno-economic and environmental feasibility study of P recovery in Italian agro-food industry 'waste' streams and reuse of struvite (and other forms of P) for P fertilizer production.

Expected impacts

The main expected impact is the awareness that new valuable opportunities exist rethinking what now is considered waste, generalizing an effective circular economy. In addition, other expected impacts and/or results include (i) increase awareness about phosphorus and disseminate information; (ii) evaluate business risks and opportunities (iii) deliver decision support tools for financial instruments and regulatory framework.

INTCATCH - Development and application of Novel, Integrated Tools for monitoring and managing Catchments (H2020) (UNIVPM as third party)

Grant agreement ID: 689341
Status: Closed project
Start date: June 2016
End date: January 2020

Funded under: H2020-EU.3.5.4.
Overall budget: € 8,770,935
EU contribution: € 7,570,335
Coordinator: Brunel University London (UK)

General concept

INTCATCH instigated a paradigm shift in the monitoring and management of surface water quality that is fit for global waters in the period 2020-2050. INTCATCH did this by developing efficient, user-friendly water monitoring strategies and systems based on innovative technologies that provided real time data for important parameters, moving towards SMART Rivers.

The role of UNIVPM in INTCATCH

UNIVPM acted as Third Party of University of Verona for the senior engineering supervision of: (i) the, operation and validation of the sensors on the CSO treatment; (ii) the monitoring of the impact of stormwater and CSO management on the surface water quality; (iii) design, operation, validation of the CSO treatment; (iv) effectiveness of the decision support tool for the best CSO and stormwater management (v) technical, economic and environmental assessment.

Impacts and Results

The INTCATCH project used demonstration activities to showcase eco-innovative autonomous and radio-controlled boats, sensors, DNA test kits and run-off treatment technologies. INTCATCH incentivised stakeholder innovation in monitoring and facilitated new financing for innovation through its innovative franchise business model and empowerment of community groups and NGOs.

https://www.intcatch.eu/

SCIENTIFIC AND TECHNICAL CONSULTING

The WWEELab Research Group, coordinated by Prof. Fatone,manages several applied research projects, commissioned by waste and wastewater utilities and public authorities.

The research fields can be divided into the following 5 macro-areas:

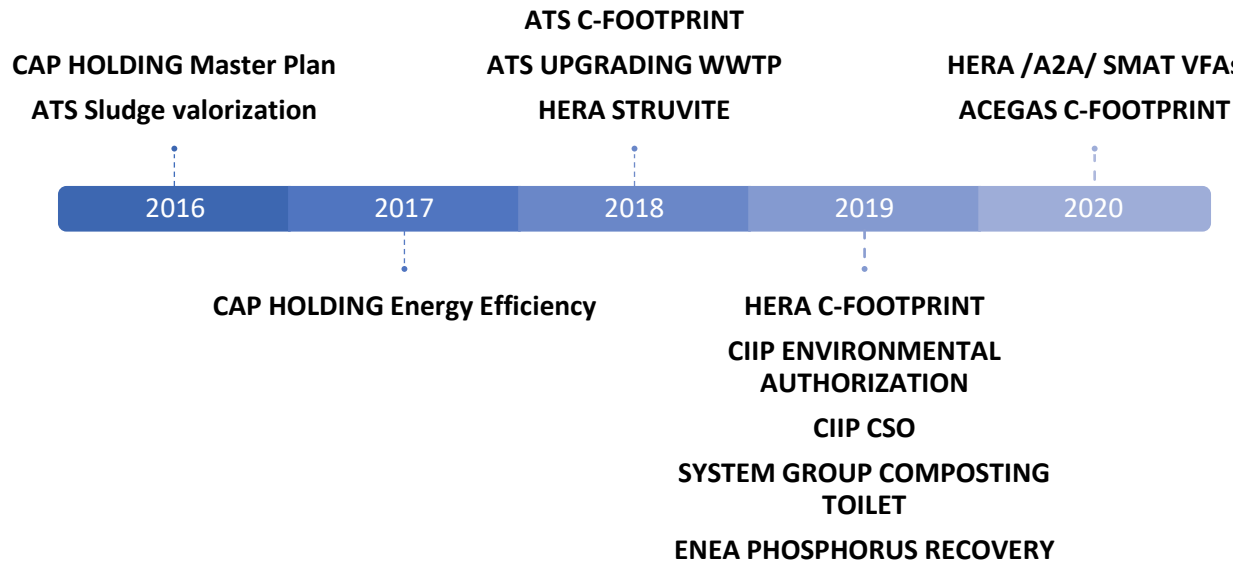
Resource recovery technologies in the urban water cycle

Stormwater treatment and management

Digital solutions for carbon footprinting and environmental/economic assessment

Advanced water and wastewater treatment

Organic waste treatment and valorisation



HERA/SMAT/A2A (2020) - TECHNICAL AND ECONOMIC EVALUATIONS ON THE APPLICATION OF TECHNOLOGIES FOR THE PRODUCTION OF VOLATILE FATTY ACIDS AND BIOPOLYMERS (POLYDROXIALKANOATES) IN URBAN WASTEWATER TREATMENT PLANTS MANAGED BY ITALIAN WATER UTILITIES HERA, SMAT AND A2A - Scientific and technical consulting

VALUTAZIONE TECNICO-ECONOMICA SULL'APPLICAZIONE DI TECNOLOGIE PER LA PRODUZIONE DI ACIDI GRASSI VOLATILI E BIOPOLIMERI (POLYDROXIALKANOATES) NEGLI IMPIANTI DI TRATTAMENTO DELLE ACQUE REFLUE URBANE GESTITI DA HERA, SMAT e A2A

ACEGAS (2020) - CALCULATION OF THE INDICATOR CALLED "CARBON FOOTPRINT OF THE WASTEWATER TREATMENT SERVICE", in accordance with UNI EN ISO 14064-1 (Updated Version - April 2019) for the ITALIAN WATER UTILITY ACEGAS

CALCOLO DELL'INDICATORE DI IMPRONTA DI CARBONIO DEL SERVIZIO DI TRATTAMENTO DELLE ACQUE REFLUE, in accordo alla UNI EN ISO 14064-1 (Versione Aggiornata - Aprile 2019)

CIIP (2019-2020) – CRITICALITIES, IMPACTS AND TECHNICAL SOLUTIONS TO SUPPORT THE UNIQUE ENVIRONMENTAL AUTHORIZATION OF THE WASTEWATER TREATMENT PLANTS MANAGED BY WATER UTILITY CIIP: SANTA MARIA GORETTI in OFFIDA, SAN LEONARDO in GROTTAMMARE, CUPRAMARITTIMA, SAN BENEDETTO DEL TRONTO, ASCOLI PICENO, CAMPOLUNGO and MONTEFIORE (Marche Region)

CRITICITÀ, IMPATTI E SOLUZIONI TECNICHE A SUPPORTO DELL'AUTORIZZAZIONE AMBIENTALE UNICA DEGLI IMPIANTI SANTA MARIA GORETTI a OFFIDA, SAN LEONARDO a GROTTAMMARE, CUPRAMARITTIMA, MONTEFIORE

CIIP (2019)**- PLANTS AND MEASURES FOR MITIGATION OF THE IMPACT OF SEWER OVERFLOWS IN SANTA PETRONILLA AND RIO VALLOSCURA BASIN (PORTO SAN GIORGIO – Marche Region) - Experimental analysis and technical-economic feasibility study**

IMPIANTI E MISURE PER LA MITIGAZIONE DELL'IMPATTO DEGLI SCARICATORI DI PIENA NEL BACINO DI SANTA PETRONILLA E RIO VALLOSCURA (PORTO SAN GIORGIO) - Analisi sperimentale e studio di fattibilità tecnico-economica

HERA (2019) - CALCULATION OF THE INDICATOR CALLED "CARBON FOOTPRINT OF THE WASTEWATER TREATMENT SERVICE", in accordance with UNI EN ISO 14064-1 (Updated Version - April 2019) for the ITALIAN WATER UTILITY HERA

CALCOLO DELL'INDICATORE DI IMPRONTA DI CARBONIO DEL SERVIZIO DI TRATTAMENTO DELLE ACQUE REFLUE, in accordo alla UNI EN ISO 14064-1 (Versione Aggiornata - Aprile 2019)

ENEA (2019) - ANALYSIS OF THE BEST AVAILABLE (or under development) TECHNOLOGIES FOR PHOSPHORUS RECOVERY FROM NON-CONVENTIONAL SOURCES AND ANALYSIS OF GOOD PRACTICES AT NATIONAL AND INTERNATIONAL LEVEL

ANALISI DELLE MIGLIORI TECNOLOGIE DISPONIBILI (o in fase di sviluppo) PER IL RECUPERO DI FOSFORO DA FONTI NON CONVENZIONALI E ANALISI DI BUONE PRATICHE A LIVELLO NAZIONALE E INTERNAZIONALE

SYSTEM GROUP

SYSTEMGROUP (2019) - SUPPORT TO THE PROJECT FOR A COMPOSTING TOILET PROTOTYPE

SUPPORTO AL PROGETTO DEL PROTOTIPO COMPOSTING TOILET

ALTO TREVIGIANO SERVIZI

ATS (2018) - CALCULATION OF THE INDICATOR CALLED "CARBON FOOTPRINT OF THE WASTEWATER TREATMENT SERVICE", in accordance with UNI EN ISO 14064-1

CALCOLO DELL'INDICATORE DI IMPRONTA DI CARBONIO DEL SERVIZIO DI TRATTAMENTO DELLE ACQUE REFLUE, in accordo alla UNI EN ISO 14064-1

ALTO TREVIGIANO SERVIZI

ATS (2018) - PROCESS ENGINEERING OF THE DEFINITIVE PROJECT OF UPGRADING / EXPANSION OF THE WASTEWATER TREATMENT PLANT OF CASTELFRANCO-SALVATRONDA (TV) MANAGED BY THE ITALIAN WATER UTILITY ATS - Technical and scientific support

SUPPORTO TECNICO-SCIENTIFICO PER L'INGEGNERIA DI PROCESSO RELATIVA AL PROGETTO DEFINITIVO DI UPGRADING/AMPLIAMENTO DELL'IMPIANTO DI DEPURAZIONE DI CASTELFRANCO VENETO LOC. SALVATRONDA

HERA (2018) - TECHNICAL AND ECONOMIC EVALUATIONS ON THE APPLICATION OF TECHNOLOGIES FOR THE PRODUCTION OF STRUVITE IN URBAN WASTEWATER TREATMENT PLANTS MANAGED BY HERA

VALUTAZIONI TECNICHE ED ECONOMICHE SULL'APPLICAZIONE DI TECNOLOGIE PER LA PRODUZIONE DI STRUVITE IN IMPIANTI DI DEPURAZIONE DELLE ACQUE REFLUE URBANE GESTITI DA HERA.

CAP HOLDING (2017) - PRELIMINARY ASSESSMENT OF THE ENERGY EFFICIENCY OF THE MAIN WASTEWATER TREATMENT PLANTS OF THE WATER UTILITY CAP GROUP, USING THE CURRENT ENERWATER DIAGNOSIS METHOD

VALUTAZIONE PRELIMINARE DELL'EFFICIENTAMENTO ENERGETICO DEI PRINCIPALI DEPURATORI DEL GRUPPO CAP UTILIZZANDO L'ATTUALE METODO DI DIAGNOSI ENERWATER

CAP-Holding (2016) - SCIENTIFIC CONSULTANCY ACTIVITIES FOR THE PRELIMINARY MASTER PLAN AND ENERGY EFFICIENCY ACTIVITIES AT THE GROUP'S PLANTS

ATTIVITÀ DI CONSULENZA SCIENTIFICA RELATIVE ALLA REDAZIONE DI MASTER PLAN PRELIMINARE E ATTIVITÀ DI EFFICIENTAMENTO ENERGETICO PRESSO GLI IMPIANTI DEL GRUPPO.

ALTO TREVIGIANO SERVIZI

ATS (2016) - TECHNICAL, ECONOMIC AND ENVIRONMENTAL COMPATIBILITY FOR THE TRANSFER AND VALORISATION OF DRIED SLUDGE FROM URBAN WASTEWATER TO A CEMENT PRODUCTION PLANT.

COMPATIBILITÀ TECNICO, ECONOMICA ED AMBIENTALE AL CONFERIMENTO E VALORIZZAZIONE IN CEMENTIFICIO DI FANGHI ESSICCATI PROVENIENTI DA ACQUE REFLUE URBANE.

PUBLICATIONS

2020

P. Crocetti, A.L. Eusebi, C. Bruni, E. Marinelli, G. Darvini, C.B. Carini, C. Bollettini, V. Recanati, Ç. Akyol, F. Fatone Catchment-wide validated assessment of Combined Sewer Overflows (CSOs) in a Mediterranean coastal area and possible disinfection methods to mitigate microbial contamination
«ENVIRONMENTAL RESEARCH» 110367

G. Mancini, A. Luciano, D. Bolzonella, F. Fatone, P. Viotti, D. Fino A water-waste-energy nexus approach to bridge the sustainability gap in landfill-based waste management regions
«RENEWABLE AND SUSTAINABLE ENERGY REVIEWS» 110441

L. Pittura, A. Foglia, Ç. Akyol, G. Cipolletta, M. Benedetti, F. Regoli, A.L. Eusebi, S. Sabbatini, L.Y. Tseng, E. Katsou, S. Gorbi, F. Fatone Microplastics in real wastewater treatment schemes: comparative assessment and relevant inhibition effects on anaerobic processes
«CHEMOSPHERE » 128415

A Botturi, EG Ozbayram, K Tondera, NI Gilbert, P Rouault, N Caradot, O. Gutierrez, S. Daneshgar, N. Frison, Ç. Akyol, A. Foglia,A.L. Eusebi, F. Fatone Combined sewer overflows: A critical review on best practice and innovative solutions to mitigate impacts on environment and human health
«CRITICAL REVIEWS IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY » 1-34

I. Pikaar, X. Huang, F. Fatone, J.S. Guest Resource recovery from water: From concept to standard practice.
«WATER RESEARCH» Volume 178, 115856

A. Jiménez-Benítez, F.J. Ferrer, S. Greses, A. Ruiz-Martínez, F. Fatone, A.L. Eusebi, N. Mondéjar, J. Ferrer, A. Seco AnMBR, reclaimed water and fertigation: Two case studies in Italy and Spain to assess economic and technological feasibility and CO2 emissions within the EU Innovation Deal
«JOURNAL OF CLEANER PRODUCTION» 122398

A. Botturi, S. Daneshgar, A. Cordioli, A. Foglia, A.L. Eusebi, F. Fatone An innovative compact system for advanced treatment of combined sewer overflows (CSOs) discharged into large lakes: Pilot-scale validation
«JOURNAL OF ENVIRONMENTAL MANAGEMENT» Volume 256, 109937

E. Righetti, S. Nortilli, F. Fatone, N. Frison, D. Bolzonella A Multiproduct Biorefinery Approach for the Production of Hydrogen, Methane and Volatile Fatty Acids from Agricultural Waste
«WASTE AND BIOMASS VALORIZATION» 1-8

A. Foglia, C. Akyol, N. Frison, E. Katsou, A.L. Eusebi, F. Fatone Long-term operation of a pilot-scale anaerobic membrane bioreactor (AnMBR) treating high salinity low loaded municipal wastewater in real environment
«SEPARATION AND PURIFICATION TECHNOLOGY» Volume 236, 116279

C. Bruni, Ç. Akyol, G. Cipolletta, A.L. Eusebi, D. Caniani, S. Masi, J. Colón, F. Fatone Decentralized Community Composting: Past, Present and Future Aspects of Italy
«SUSTAINABILITY» Volume 12 (8), 3319

F. Battista, N. Frison, C. Cavinato, M. Gottardo, A.L. Eusebi, F. Fatone, M. Majone, M. Zeppilli, P. Pavan, D. Bolzonella Food wastes and sewage sludge as feedstock for an urban biorefinery producing biofuels and added value bio-products
«JOURNAL OF CHEMICAL TECHNOLOGY AND BIOTECHNOLOGY» Volume 95, 2, 328-338

B. Benedetti, M. Majone, C. Cavaliere, C. M. Montone, F. Fatone, N. Frison, A. Laganà, A. L. Capriotti Determination of multi-class emerging contaminants in sludge and recovery materials from wastewater treatment plants: Development of a modified QuEChERS method coupled to LC–MS/MS
«MICROCHEMICAL JOURNAL» Volume 155, 104732

V. Conca, C. da Ros, F. Valentino, A.L. Eusebi, N. Frison, F. Fatone Long-term validation of polyhydroxyalkanoates production potential from the sidestream of municipal wastewater treatment plant at pilot scale
«CHEMICAL ENGINEERING JOURNAL» 124627

C. Da Ros, V. Conca, A.L. Eusebi, N. Frison, F. Fatone Sieving of municipal wastewater and recovery of bio-based volatile fatty acids at pilot scale
«WATER RESEARCH» 115633

B. Szeląg, J. Drewnowski, G. Łagód, D. Majerek, E. Dacewicz, F. Fatone Soft Sensor Application in Identification of the Activated Sludge Bulking Considering the Technological and Economical Aspects of Smart Systems Functioning
«SENSORS» Volume 20 (7), 1941

C. Akyol, A. Foglia, E.G. Ozbayram, N. Frison, E. Katsou, A.L. Eusebi, F. Fatone Validated innovative approaches for energy-efficient resource recovery and re-use from municipal wastewater: From anaerobic treatment systems to a biorefinery concept
«CRITICAL REVIEWS IN ENVIRONMENTAL SCIENCE AND TECHNOLOGY» Volume 50(9), 869-902

2019

S. Palmieri, G. Cipolletta, C. Pastore, C. Giosuè, C. Akyol, A.L. Eusebi, N. Frison, F. Tittarelli, F.Fatone Pilot scale cellulose recovery from sewage sludge and reuse in building and construction material
«WASTE MANAGEMENT» 100, 208-218

Longo, S., Mauricio-Iglesias, M., Soares, A., Campo, P., Fatone, F., Eusebi, A.L., Akkersdijk, E., Stefani, L., Hospido, A. ENERWATER – A standard method for assessing and improving the energy efficiency of wastewater treatment plants
«APPLIED ENERGY» 179, 2019, 1251-1268

V. Vasilaki, T.M. Massara, P. Stanchev, F. Fatone, E. Katsou A decade of nitrous oxide (N2O) monitoring in full-scale wastewater treatment processes: A critical review
«WATER RESEARCH» Volume 136, pp. 112-119

Mercer, E., Davey, C.J., Azzini, D., Eusebi, A.L., Tierney, R., Williams, L., Jiang, Y., Parker, A., Kolios, A., Tyrrel, S., Cartmell, E., Pidou, M., McAdam, E.J., Hybrid membrane distillation reverse electrodialysis configuration for water and energy recovery from human urine: An opportunity for off-grid decentralised sanitation.
«JOURNAL OF MEMBRANE SCIENCE», 584, pp. 343-352

2018

D. Crutchik, N. Frison, A. L. Eusebi; F. Fatone Biorefinery of cellulosic primary sludge towards targeted Short Chain Fatty Acids, phosphorus and methane recovery.
«WATER RESEARCH» Volume 136, pp. 112-119

Cingolani, D., Fatone, F., Frison, N., Spinelli, M., Eusebi, A.L., Pilot-scale multi-stage reverse osmosis (DTRO) for water recovery from landfill leachate.
«WASTE MANAGEMENT» Volume 76, pp. 566-574

Lijó, L, Frison, N, Fatone, F, González-García, S, Feijoo, G, Moreira M T Environmental and sustainability evaluation of livestock waste management practices in Cyprus
«SCIENCE OF THE TOTAL ENVIRONMENT» Volume 634, pp. 127-140

Frison N., Malamis S., Katsou E., Bolzonella D., Fatone F. Enhanced retention of deammonification microorganisms for the treatment of psycrophilic anaerobic digestate
«CHEMICAL ENGINEERING JOURNAL» Volume 344, pp. 633-639

D. Bolzonella, F. Fatone, M. Gottardo, N. Frison Nutrients recovery from anaerobic digestate of agro-waste: Techno-economic assessment of full scale applications
«JOURNAL OF ENVIRONMENTAL MANAGEMENT» Volume 216, pp 111-119

Spinelli, M., Eusebi, A.L., Vasilaki, V., Katsou, E., Frison, N., Cingolani, D., Fatone, F. Critical analyses of nitrous oxide emissions in a full scale activated sludge system treating low carbon-to-nitrogen ratio wastewater
«JOURNAL OF CLEANER PRODUCTION» Volume 190, 20 July 2018, Pages 517-524

Wang, K.M., Cingolani, D., Eusebi, A.L., Soares, A., Jefferson, B., McAdam, E.J., 2018, Identification of gas sparging regimes for granular anaerobic membrane bioreactor to enable energy neutral municipal wastewater treatment, «JOURNAL OF MEMBRANE SCIENCE», 555, pp. 125-133

2017

L. Lijó, S. Malamis, S. González-García, F. Fatone, M.T. Moreira, E. Katsou. Technical and environmental evaluation of an integrated scheme for the co-treatment of wastewater and domestic organic waste in small communities
«WATER RESEARCH» Volume 109, 173-185

Longo, S., Frison, N., Renzi, D., Fatone, F., Hospido, A. Is SCENA a good approach for side-stream integrated treatment from an environmental and economic point of view?
«WATER RESEARCH» Volume 125, 478-489

Lijó, L., Malamis, S., González-García, S., Moreira, M.T., Fatone, F., Katsou, E. Decentralised schemes for integrated management of wastewater and domestic organic waste: the case of a small community.
«JOURNAL OF ENVIRONMENTAL MANAGEMENT» Volume 203, 1 December 2017, Pages 732-740

Eusebi, A.L., Bellezze, T., Chiappini, G., Sasso, M., Battistoni, P., Influence of aeration cycles on mechanical characteristics of elastomeric diffusers in biological intermittent processes: Accelerated tests in real environment, 2017, «WATER RESEARCH» 117, pp. 143-156

Cingolani, D., Eusebi, A.L., Battistoni, P. Osmosis process for leachate treatment in industrial platform: Economic and performances evaluations to zero liquid discharge.
« JOURNAL OF ENVIRONMENTAL MANAGEMENT», 203, pp. 782-790

2016

Castillo; J. Porro; M. Garrido-Baserba; D. Rosso; D. Renzi; F. Fatone; V. Gómez; J. Comas; M. Poch.Validation of a decision support tool for wastewater treatment selection
«JOURNAL OF ENVIRONMENTAL MANAGEMENT» vol. 184 (Part 2), 2016, 409-418

S. Longo; B. M. d'Antoni; M. Bongards; A. Chaparro; A. Cronrath; F. Fatone; J. M. Lema; M. MauricioIglesias; A. Soares; A. Hospido Monitoring and diagnosis of energy consumption in wastewater treatment plants. A state of the art and proposals for improvement
«APPLIED ENERGY» 179, 2016, 1251-1268

E. Katsou, T. Alvarino, S. Malamis, S. Suarez, N. Frison, F. Omil, F. Fatone Effects of selected pharmaceuticals on nitrogen and phosphorus removal bioprocesses
«CHEMICAL ENGINEERING JOURNAL», vol. 295 , 2013 , pp. 509-517

N. Frison, E. Katsou, S. Malamis, F. Fatone A novel scheme for denitrifying biological phosphorus removal via nitrite from nutrient-rich anaerobic effluents in a short-cut sequencing batch reactor
«JOURNAL OF CHEMICAL TECHNOLOGY AND BIOTECHNOLOGY» 91 (1), 2016, pp. 190-197

N. Basset, E. Katsou, N. Frison, S. Malamis, J. Dosta, F. Fatone Integrating the selection of PHA storing biomass and nitrogen removal via nitrite in the main wastewater treatment line
«BIORESOURCE TECHNOLOGY» 200, 2016, pp. 820-829

S. Longo, S. Malamis, E. Katsou, C. Costa, F. Fatone Social aspects of livestock waste management in Cyprus
«WASTE AND BIOMASS VALORIZATION» 7 (4), 2016, 765-777

Anna Laura Eusebi, Diego Cingolani, Matteo Spinelli, Giorgio Passserini, Stefano Carletti, Paolo Battistoni, 2016, Dinitrogen oxide (N2O) emission in the treatment of urban wastewater via nitrite: influence of liquid kinetic rates.
«WATER SCIENCE AND TECHNOLOGY» Volume 75,issue 11

L. Zuliani, N.Frison, A. Jelic, F. Fatone, D. Bolzonella, M. Ballottari, Microalgae cultivation on anaerobic digestate of municipalwastewater, sewage sludge and agro-wast (Open Access)
«INTERNATIONAL JOURNAL OF MOLECULAR SCIENCES» Volume 17, Issue 10, 1 October 2016, Article number 1692

INFRASTRUCTURES

The WWEELab Research Group, coordinated by Prof. Fatone, can count on a 200 m^2-large pilot/demo hall located in the municipal wastewater treatment plant of Falconara Marittima (Ancona), where advanced treatment and reuse/valorization technologies for wastewater, wastes and sludge are validated in real environment.

The Pilot and Demo hall is associated with the Research Laboratory of Water and Waste Environmental Engineering, located in UNIVPM, for analytical and experimental support in urban and industrial wastewater and liquid and solid wastes, with particular reference to organic matrices.

Recently, the group has consolidated new fields of expertise, such as life-cycle assessment, Life Cycle Costing and Cost-benefit analyses, decision support systems, digital water solutions, supported by the use of new softwares such as PYTHON, MATLAB, LABVIEW, R Studio, UMBERTO.

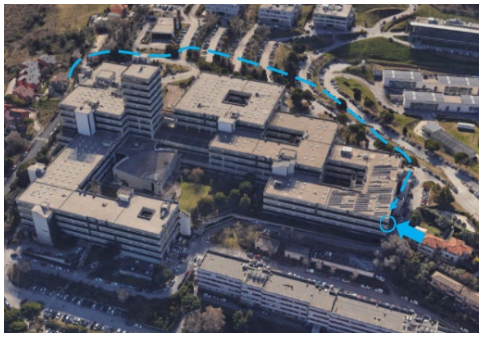
Research Laboratory of Water and Waste Environmental Engineering

Analytical determination of the main organic and inorganic contaminants

The research of the SIMAU Department group conducts experimental and analytical activities from different thematic areas of research in the context of wastewater and wastes, such as Chemical-physical characterization of wastewater and liquid wastes.

In this context, laboratory tests have contributed to the design and validation of various traditional and innovative biological wastewater treatment processes regarding the removal of organic matter and main macro-pollutants. For this purpose, a well-equipped laboratory is provided to carry out physical-chemical characterization of the matrices for the measurement of:

- **Analytical and parametric measurement of pH, alkalinity and electrical conductivity, dissolved oxygen, ammonium or nitrate ion (dedicated ISE sensors) and temperature**
- **Analytical determination of anions, cations and volatile fatty acids (VFA)** carried out by ion chromatography
- **Analysis of nitrogen and phosphate macronutrients**
- **Analysis of the organic substances such as proteins, carbohydrates and organic carbon (COD, BOD)**
- **Analysis of solid fractions and sub-fractions (TVS / TS)**



PILOT AND DEMO HALL

Experimental activity of innovative biological and / or chemical-physical processes at bench-scale

The research centre allows not only to operate and validate eco-innovative solutions in real conditions, but also to carry out research and development activities at the highest level of pre-industrial experimentation and application. The experimental hall is equipped with pilot and demonstrative-scale systems for the advanced treatment of wastewater and / or non-hazardous liquid wastes. It represents a validation center for local, national and international projects in which the research team is involved.

The research topics are studied on a pilot and demonstration scale and validated in a real environment.

The pilot hall hosts demonstrative pilots for:

- Anaerobic valorization of urban wastewater and production of water for reuse
- Landfill lecheate treatment
- Treatment and valorization of seawater
- Monitoring and measurement of green house gases
- Monitoring of emerging compounds and microplatics in collaboration with Ecotoxicology group of UNIVPM

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