AQUARES
Interreg Europe

European Union
European Regional Development Fund

A3.2: Input study for the organisation of the Interregional Workshop on water reuse technologies

Fondazione Lombardia per l'Ambiente

November 2018

Table of Contents

1 Introduction

This document is one of the firsts two input studies of AQUARES Activity A3.2, which foresees the organisation of an interregional workshop on the application of appropriate technologies to water reuse across the agricultural, industrial, urban and recreational sectors. The aim of the input paper is to be used as the primary source of knowledge for the capacity building and interregional learning processes of the policy workshop.

The input paper will present to the workshop delegates the most relevant needs & challenges to be addressed through regional policies. It will also specify the organisatonal details of the workshop to be hosted by FLA and provide guidelines on how to prepare the workshop summary report in order to facilitate the integration of its results/findings into the AQUARES action plans.

The report is structured as follows: section 2 outlines the key activities of the AQUARES project; section 3 defines the scope of the interregional workshop; section 4 provides the thematic background, and section 5 presents the research conducted for the collection of cases of application of water reuse technologies. Section 6 provides recommendations in the form of topics to be presented and discussed in the workshop, while section 7 illustrates past events and projects. Section 8 defines the scope and objectives of the workshop, presenting organisational details such as date, duration, participants, format, and agenda. Section 8 also shows how to build upon the conclusions of the workshop.

2 The AQUARES project

The "Water reuse policies advancement for resource efficient European regions – AQUARES" is an Interreg - Europe project that aims to promote the efficient use and management of water in EU regions and to encourage sustainable development and eco-innovation adoption across the agricultural, industrial, urban and recreational sectors. The project will support the improvement of policy instruments through sharing practices and exchanging of experiences between partners and actors relevant to water reuse management, integrating lessons learned into national, regional and local policies as well as action plans.

2.1 AQUARES activities

AQUARES brings together 10 partners from 9 countries, involving managing authorities and regional bodies influencing regional and national policy instruments, to exchange experiences and practices, and to improve their capacity on implementing policies targeting water reuse and to strengthen efficient water management and green growth. To boost efficient water management through water reuse, the project includes a wide range of activities, focusing on promoting the interregional learning process and the exchange of experience among regional authorities. Project activities include:

- Identify viable strategies to utilise water reuse to confront inefficient uses of water.
- Promote public dialogue to address conflicting interests.
- Increase capacity for policies that promote innovative water reuse technologies and business models.
- Raise awareness on the benefits of water reuse & water efficiency solutions.
- Facilitate the integration of water reuse when producing or consuming goods, services and works.
- Unlock investments for water reuse projects.
- Promote and support the harmonisation of policies and quality standards about water reuse.
- Promote water efficient use & management and support sustainable development & eco-innovation through the integration of water reuse in policies.
- Support the utilisation of untapped water resources, promote adoption of water reuse technological and managerial innovations, support compliance with water quality standards.
- Increase the capacity of public authorities to implement the proposals of the Water Framework and Drinking Water Directives.

2.2 AQUARES expected results

AQUARES will improve the addressed policy instruments, relevant to the abovementioned policy areas, with the target to achieve:

- Increased capacity of 200 staff of public administrations to effectively support water reuse.
- 10+ million € investments unlocked to support projects on water efficiency and to improve the management of water bodies.
- Increased awareness and consensus building among water providers, the workforce, and citizens, to support measures for water reuse (over 1000 individuals).

3 Added value and strategic orientation of AQUARES workshops

Fondazione Lombardia per l'Ambiente (FLA) will organise and host a two-day workshop for regional authorities on how to apply the appropriate technologies to water reuse across the agricultural, industrial, urban and recreational sector of each region. The purpose of the workshop is to facilitate the exchange of ideas and experiences, and the acquisition of operational and technical knowledge on this topic.

Three thematic axes will be covered in the workshop: 1) Technical challenges and scientific uncertainties; 2) Identification and optimization of appropriate technologies; 3) Specific barriers to water reuse in irrigation.

All partners will participate with members of their stakeholder groups and external experts, to discuss regional strategies, advancing interregional learning and capacity building. During the workshop, regional authorities' representatives will have the opportunity to exchange views with their peers, familiarise themselves with existing technical measures and strategies, and co-shape a common approach to improve their knowledge on technological applications in water reuse sectors.

The AQUARES project includes the organization of 3 interregional workshops to promote interregional learning and capacity building, as presented in the following table:

Table 1: AQUARES Workshops

#	Title	Host	Country	Date
A3.1	Interregional workshop on how to plan and unlock public and private investments	EWA	Malta	Semester 2
A3.2(a)	Interregional workshop on water reuse technology	FLA	Italy	Semester 2
A3.2(b)	Interregional workshop on water Reuse standards	OOWV	Germany	Semester 4
A3.5	Interregional workshop on water reuse policy	MURCIA-GDW	Spain	Semester 5

Figure 1: Diagram presenting the structure of AQUARES workshop

4 Thematic Background

4.1 Wastewater treatment plants

Wastewater treatment plants (WWTPs) produce waste that contains many potential contaminants. Regenerated wastewater is usually safe enough to be used for irrigation, but usually contains higher concentrations (~ 1.5 times) of dissolved solids than source water.

Solid waste from wastewater treatment plants, called biosolids, is typically polluted by common fertilizers and may also contain heavy metals and synthetic organic compounds.

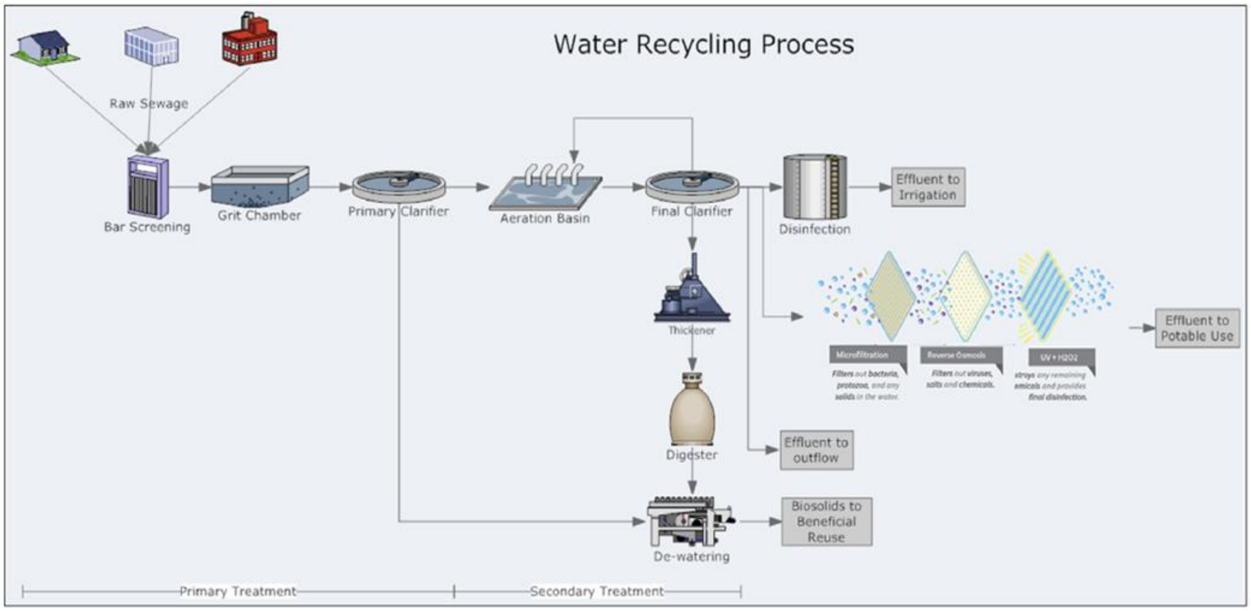
Wastewater treatment plants can be divided into two main categories:

- Biological waste treatment plants ustilise biological matter and bacteria to break down waste. These treatment systems are the best option for treating wastewater from households and business premises.
- Physical waste treatment plants use chemical reactions as well as physical processes to treat wastewater. These plants are mostly used to treat wastewater from industries and factories.

4.2 Step by Step Wastewater Treatment Process

Conventional sewage treatment (Fig. 2) starts with preliminary screening and grit removal, intended to remove the larger floating and suspended materials that could affect the treatment process.

Figure 2: Water recycling process



Primary sedimentation follows, eliminating most of the suspended materials and, if some of these solids are biodegradable, the biochemical oxygen demand (BOD) is typically reduced. Then, secondary treatment usually involves a biological process. Microorganisms in suspension (in the "activated sludge" process), are used to remove biodegradable organic material.

Secondary treatment processes can remove up to 95% of the BOD, as well as significant amounts of heavy metals and certain organic compounds. However, conventional wastewater treatment usually ends with secondary treatment which cannot efficiently remove all the different compounds found in sewage and therefore treated effluents are one of the main sources of persistent micropollutants in the environment.

For water reuse, tertiary or even quaternary treatment is necessary to ensure additional removal of contaminants such as microbial pathogens, particulates, or nutrients, and advanced treatment processes are employed when wastewater is to be reclaimed for reuse, depending on the type of use and quality requirements.

4.3 Advanced treatment technologies

WWTPs can utilise a wide range of applications, depending on different factors, such as the source water and delivered water qualities and volumes. While the most manageable wastewater contaminants, such as degradable matter, are removed by conventional treatment methods, compounds that persist even in the treated effluent are unaffected and hence flow to the receiving compartments, producing environmental and health problems. For example, activated sludge and trickling filters are some of the most widespread processes used for biological treatments. Nevertheless, these methods are not effective to remove some dangerous persistent substances. Therefore, advanced treatment methods need to be employed during the main treatment steps for the efficient removal of persistent pollutants from the effluent.

The following pages provide an overview of the advantages and disadvantages of the major control and treatment options, which are used during the main wastewater treatment process.

4.4 Secondary treatment

Over one-third of the water reuse plants depend on secondary treatment. This level of treatment is distinctive for specific agricultural irrigation applications (for example cooked food crops) and for some industrial applications like industrial cooling (except for the food industry). Membrane Bioreactors (MBRs) represent the main technology employed during this stage.

Membrane Bioreactors (MBRs)	
Advantages	Disadvantages
High effluent quality, low concentration of nutrients; high capability to collect microbial contaminants; decoupled control of sludge and hydraulic retention times; low sludge production; low footprint; easy automation/simple process control.	Membrane fouling; capital costs associated with membranes; maintenance costs (cleaning, membrane replacement every 5-10 years); energy consumption and associated costs.

4.5 Tertiary treatment

In order to meet the standards for unrestricted irrigation, secondary treatment must involve supplemental treatment (mainly filtration and/or disinfection). These standards are particularly significant for agricultural and landscape irrigation, recreational and environmental application as well as for process water in some industrial uses. The main technologies employed during this stage are Advanced Oxidation Processes (AOPs) (such as ultraviolet irradiation or UV and ozone), chemical non-membrane processes (such as nitrifying and denitrifying systems, activated carbon) and the less employed Natural Systems (constructed wetlands, soil aquifer treatment, and lagooning).

Advanced Oxidation Processes (AOPs)	
Advantages	Disadvantages
No waste production; fast reaction rates; easy automation and control.	Chemicals and/or energy consumption; possible generation of hazardous products; expensive operating costs.

Chemical non-membrane processes	
Advantages	Disadvantages
Natural filter media; low-cost & easy maintenance; excellent for enhancing the smell of tap water; good at filtering out other carbon-based, organic chemicals and chemical disinfectants like chlorine as well as some microorganisms.	Short service life; not effective against some pathogenic bacteria and viruses; time-depending.

Natural Systems	
Advantages	Disadvantages
Simple to design and manage, tolerant; recharge by percolation/soil filtration through unsaturated soils in combination with underground storage delivers extra water treatment; elevated underground storage capacity that can buffer seasonal changes in water supply and demand; holds microbial contaminants; low maintenance and operation; aesthetic benefits; attractive for rural applications	Considerable land constraints; clogging of systems, demanding regular maintenance; possible irreversible clogging of subsurface soils; possible impacts on groundwater; performance closely linked to soil properties; smell release.

4.6 Quaternary treatment

The quaternary treatment step is capable to generate drinking or ultrapure process water quality. Membranes are the most used technologies during this stage. Semipermeable membranes are utilised to remove ions, molecules or larger particles from water in a process called reverse osmosis (RO) while microbial retention can be achieved by membranes microfiltration and ultrafiltration.

Membranes	
Advantages	Disadvantages
Efficient removal of organics and microorganisms; high quality of water produced; reliable and predictable; low footprint; suitable for a wide range of reuse applications, (agricultural, industrial, commercial and environmental).	Expensive; high energy consumption; maintenance costs associated with cleaning and replacement; regular maintenance (chemical cleaning of the membranes); production of concentrated wastes.

4.7 Prospective for the future

●***Forward Osmosis (FO) and Combinations:*** This technology is getting attention in the field of membrane desalination/reuse. The concentration differences across the membrane naturally create the driving force in the FO process, using significantly less energy than conventional RO. FO membranes are also being investigated in combination with other technologies, such as use within MBRs, particularly for distillation purposes.

●***Analytical Online Tools and Rapid Screening:*** Online monitoring for management of water reuse plants is vital and the improvement of tools and techniques is still a priority. Fluorescence-based technologies can offer substantial advantages. Rapid biological screening assays are seen as a way to rapidly and comprehensively assess the complex mixtures of chemicals in water.

5 Case studies

5.1 Water reuse for irrigation at Fasano Forcatella (Italy – Agricultural sector).

Overexploitation of groundwater is very common in Southern Italy, due to the region's lack of water resources and its economic reliance on irrigated agriculture such as olive trees and vineyards. Coastal areas are particularly affected leading to groundwater salinization as a result of seawater intrusion. Therefore, treated wastewater represents a safe and valid alternative resource for irrigated agriculture.

Until 2005, the WWTP of the municipality of Fasano (Puglia), discharged secondary effluents to the sea. This was true until the company Aquasoil s.r.l. installed a first tertiary treatment system which has been used for 10 years. In 2016, a new plant was launched based on an innovative technology (MITO3X®) that simultaneously injects aluminum chloride (clariflocculation), sodium hypochlorite or peracetic acid (disinfection), and powdered activated carbon (adsorption) in the suction line of a centrifugal pump. Subsequently, lamellar settling delivers separation of the sludge and the powdered activated carbon from the clarified effluents. These are then stored into a basin of 40,000 m^3 to compensate for the changes in demand from farmers. The benefits of the Fasano tertiary treatment and reclamation plant involve the development of chemical and microbiological quality of the secondary effluents to irrigation standards and the reinstatement of the biodiversity of the area. In addition, during periods of lower water demand for irrigation, the overflow from the storage basin is infiltrated in the ground in order to reload the aquifer and combat seawater intrusion.

The cost of the Fasano tertiary treatment is around 0.16-0.25 €/m^3, which is charged to the local residents' water bill. Thanks to their contract with Aquasoil, the local farmers reusing the water do not pay additional fees for the treatment but only for water distribution, based on different factors such as distance or frequency of use. This case is innovative in both the technology and the management since the company Aquasoil also distributes the effluents in accordance to contracts with local farmers.

5.2 Soil aquifer treatment for indirect potable reuse in El Port de la Selva (Spain – Urban sector).

El Port de la Selva is a coastal village with about 1000 permanent residents, and during summer it sees its population grow by more than ten times. The village exploits local groundwater for drinking water production and is not connected to the regional water distribution network. The local WWTP, operated by the company Empresa Mixta d'Aigües de la Costa Brava SA or EMACBSA, has a capacity of 10,500 people (secondary effluent).

After successive drought events in the 2000s, a tertiary treatment, which includes double-step filtration, UV disinfection, and chlorination, was added to the WWTP in order to allow the reuse of non-potable purposes, decreasing the demand for fresh water during the summer season. Notwithstanding, water abstraction volumes for potable purpose in the village remained high (~ 350,000 m^3 / year) and saline intrusion as a result of both drought and over-abstraction in summer was still an issue. Thus, water reclamation by aquifer recharge was included in the water reuse scheme in order to improve groundwater availability and prevent seawater intrusion.

The infiltration area was divided into three infiltration ponds, facilitating management of potential clogging problems through the implementation of wetting and drying cycles and allowing low

maintenance operations. In order to remove organic traces, a granular activated carbon treatment step was added, while chlorine disinfection was halted during infiltration to avoid the creation of disinfection by-products. Coagulant dosing, phosphorus, and ammonia in-line probes were also installed to improve the operation of the biological treatment.
El Port de la Selva scheme is one of the few membrane-free planned indirect potable reuse scheme in Europe. The tertiary treated effluent is recharged, infiltration is stopped in summer as the biological treatment does not have the capacity to reach the required ammonia level. The EU DEMOWARE project confirmed the safety and environmental benefits of the scheme.

5.3 Industrial wastewater reuse for food processing at Bakkavor Group (United Kingdom – Industrial sector).

Bakkavor Group is a UK provider of fresh-prepared food, owner of the facility named "Cucina Sano". The company intended to reduce offsite tankering of trade wastewater and start a recycling scheme that would enable to reuse their water for food processing.

The project was developed by British firm Aquabio in 2016. The wastewater recycling plant is placed next to the food processing facility. Wastewater from the food processing facility is treated to potable water standards for reuse in the factory for all processes.

The effluent is primarily treated using screens and then undergoes chemical treatment using dissolved air flotation, followed by a low energy membrane bioreactor. The treatment is completed by reverse osmosis, UV disinfection, and chlorination/remineralization. Next, the treated water is blended with incoming mains water for being utilised within the facility. This method can deliver more than 85% water recycling back to the factory, allowing the reuse of around 122 million liters of wastewater in 2017. The plant is setting the standards for large-scale wastewater reuse within the food-processing industry. The project has employed innovative technology and know-how in order to reduce resources and costs, setting an example for others to follow. It has received multiple awards, including the Water Reuse Europe Innovation Award in 2017.

5.4 Aerated lagoons for the treatment of municipal wastewater (Germany – Rural sector)

In Nature, the contaminated water is the habitat of microscopic algae which through photosynthesis produce the necessary oxygen for to the bacterial cultures which are used during the biological process of water purification. In this context lagooning is a treatment process which presents the great advantage of not requiring the external input of energy for carrying out wastewater treatment processes, making it very economical. In addition, these wastewater treatment plants are very efficient to remove organic particles and the nutrients from water that is subjected to treatment providing high-quality effluent, that can be discharged without danger to natural ecosystems. It is to be highlighted that these types of wastewater treatment plants have been used in Europe for serving small communities (~500 people).

An example comes from Germany, where the company Fuchs Clean Solutions is operating two aerated lagoons in a small town (~300 people) since 1995, which presents two major mechanisms:

- *the aeration* required to allow the aerobic fermentation process, where the water to be treated comes in contact with the micro-organisms that consume the pollutant loading of organic matter and the nutrients from water;
- *the settling*: the suspended solids are settled forming a biological sludge.

Besides of hydraulic advantages, the technique is ideal for rural settlements. Also, the two-stage design allows bypassing wastewater temporarily. Maintenance is possible without causing a major deficit in treatment performance.

5.5 Reuse of urban wastewater for multiple applications (Spain – Urban, Agricultural & Recreational sector)

Rincón de León WWTP is one of the three treatment facilities operating in the city of Alicante, operated by EMARASA (Joint Venture Corporation for Wastewater Treatment in Alicante). The main users of the effluent at Rincón de León WWTP are the Alicante Irrigation Association (AGRICOOP), which use treated wastewater for agricultural purposes, and the High Vinalopó Irrigation Association (ARALVI), which spans several municipalities and it also waters a golf course, the Alenda Golf Course with a total area of 1,331,617 m^2 and that in summer requires 1,500 m^3 /d of water.

Since the WWTPs have to produce treated wastewater for large areas of agricultural, urban and recreational areas, in a region where water is scarce, the operators investigated the best technological alternatives in order to improve the efficiency of the plant. Tertiary treatment in Rincon de León WWTP comprises three alternatives:

-Alternative A = non-membrane process for coagulation + flocculation + filtration (CFF) + Ultraviolet (UV)
-Alternative B = CFF + Ultrafiltration (UF)
-Alternative C = CFF + UF + Reverse Osmosis (RO)

The results are interesting because conclude that the quality of water treated with alternative C is suitable for all uses referred the study, (urban uses, agricultural irrigation, and golf course irrigation), while alternative B is not suitable for residential applications. Finally, water treated with alternative A is suitable for all uses except for residential and irrigation of fresh food for human consumption

6 Suggested topics for discussion

This section provides a very first suggestion on the topics to be presented and discussed during the interregional thematic workshop on water reuse technologies in Italy, based on the research conducted. This list is not final and is subject to changes or updates (if necessary), following the review and feedback from the host organization (FLA).

The term 'thematic areas' refers to a broad theme and the term 'topics' refers to the sub-themes in which the core theme is divided. Three distinct thematic areas have been identified for the interregional workshop on water reuse technologies. Each thematic area is divided into several (indicative) topics, around which the presentations and discussions of the workshops will revolve. Guest speakers are expected to build upon the research findings by extending the scope of analysis and providing new perspectives for the topics under examination.

Thematic Area 1: Technical challenges and scientific uncertainties

This session will present several technical challenges and scientific uncertainties identified in the sector of water reuse, in accordance with the methodology to evaluate water reuse technologies and practices (Activity A1.3). This session will provide valuable insights into how the adoption of different technologies allows achieving any desired level of water quality. Representatives from members of stakeholder groups will be encouraged to participate in the discussion, presenting their experience on the adoption of technological options in terms of their cost and feasibility for use in different environments and scales. The purpose of this session is to highlight the technical and scientific issues and opportunities associated with the adoption of both current and innovative technologies, demonstrating the most relevant needs to be addressed through regional policies.

Indicative topics to be discussed

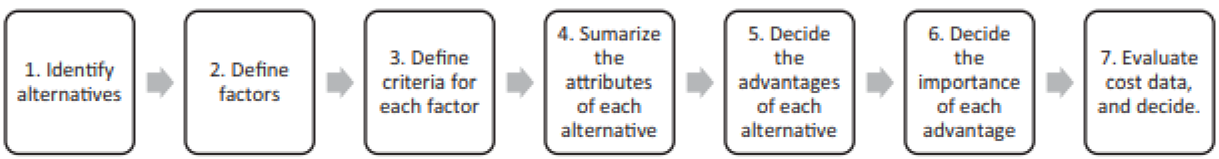
1. Contaminants of emerging concern.
2. Fast monitoring.
3. Complex solutions of the industry sector.
4. Saline intrusion in sewage systems.

5. Obsolete transportation networks.
6. Temporal mismatch between production and demand

Thematic Area 2: Identification and optimization of appropriate technologies.

This session is expected to provide practical insights into how business and local authorities can utilise the most suitable technologies for specific needs, in order to fully exploit their potential. Companies are indeed more than ever ready to invest in water solutions and in that context water reuse technologies are being seen as the way to unlock a potential for growth but also as a way to provide a secure water source for economic activities. However, selecting the most sustainable technology among possible alternatives is a very complex task because the choice must integrate economic, environmental, and social criteria. This session will follow the choosing-by-advantage method described by Arroyo and Molinos-Senante (2017), are summarised below (Fig. 3).

Figure 3: Choosing-by-advantage steps



Indicative topics to be discussed

1. Selection of most suitable technologies for relevant sectors (agricultural, urban/rural and recreational).
2.“Over-engineering” risks and solutions.
3. Carbon emissions.
4. Distribution storage of wastewater.
5. Future trends of key applications.

Thematic Area 3: Specific barriers to water reuse in irrigation

This session will explore the reluctance of the agricultural sector to use treated wastewater in irrigation. Farmers are indeed worried about the potential negative attitudes of consumers towards their products. The risks to health and the environment from pollutants such as bacteria, viruses and emerging pollutants and priority substances such as those already detected occasionally in discharges from water treatment. The key objective of this session is to highlight the regulatory, technological and operational requirements in order to ensure the desired level of water quality, also in accordance with the methodology to collect successful practices in monitoring, assessing and ensuring compliance with water reuse standards (Activity A1.4). The exchange of views among representative from both regional authorities and the agricultural sector will enable to reach a common approach on how appropriate technologies can contribute overcoming such barriers.

Indicative topics to be discussed

1. Environmental and human health safety implications.
2. Economic costs.
3. Fertilizers from wastewaters.
4. Identification of practical technological applications.

7 Past events and projects

This section examines a series of relevant past activities with the aim to identify what kind of topics/issues has already been addressed in conferences and projects across the EU. This will enable to determine the strategic focus and structure of the interregional workshop, avoiding the repletion of information.

IDA International Water Reuse and Recycling Conference (24-27 June 2018) – Valencia (ES). – (http://idadesal.org/water-reuse-conference-2018/)

During the conference, a review of the available technologies has been made, including conventional tertiary treatments, advanced treatment, membranes or soft technologies, contemplating aspects such as efficiency and costs. Case studies have been analyzed for different applications and uses.

Participants: Mr. Antonio Casanas, Key Account Manager, Dow Water and Process Solutions, Spain & Dr. Domingo Zarzo, AEDyR President, Research & Development Manager of Valoriza Agua, Spain

EU-funded AQUAREC project (2002-2006) on 'Integrated Concepts for Reuse of Upgraded Wastewater'- (http://cordis.europa.eu/projects/rcn/69076_en.html)

The project addressed policy guidelines, quality requirements for water reuse, suitable technologies for treatment and monitoring, best management practices including socio-economic aspects and public participatory approaches. The extensive presentation of technological issues, such as treatment processes, disinfection, monitoring and distribution, covers many of the end-use requirements and specifications.

EU-funded DEMOWARE project (2014-2016) on Innovation Demonstration for a Competitive and Innovative European Water Reuse Sector' – (http://demoware.eu/en)

One of the main barriers that hamper the implementation of water reuse schemes is the cost associated with the treatment, storage and distribution of reclaimed wastewater to reuse it. DEMOWARE activities have demonstrated the benefits of several technologies and reuse schemes which should improve the overall feasibility of water reuse and thus, its implementation all over Europe.

EU-funded SAFIR project (2006-2010) on 'Safe and high quality food production using low quality waters and improved irrigation systems and management' – (https://cordis.europa.eu/project/rcn/78629)

The SAFIR project addressed two fundamental concerns of the general public, namely the safety and quality of food and the increasing competition for clean fresh water. The project employed a multidisciplinary approach which integrated the European as well as the global dimension of the EU policy on food quality and safety. Its overall aim was to develop and apply innovative, affordable, easily applicable irrigation technologies using recycled wastewater

8 Organisation of the interregional workshop

Fondazione Lombardia per l'Ambiente (FLA) will host the interregional thematic workshop on "application of the appropriate technologies to water reuse across the agricultural, industrial, urban and recreational sector of each region", in Seveso, Italy. The workshop will last two days (dates to be confirmed) and all AQUARES partners will participate, with members of their stakeholder groups and external experts. The working language of the workshop will be English, which means that participants must have a sufficient knowledge of the language to be able to fully participate in the hands-on activities.

AQUARES – Interregional workshop on water reuse technology	
Thematic focus	Water reuse technologies
Host organisation	FLA
Date	To be confirmed
Venue	FLA Headquarters
Language	English
N° of participants	20 -25 participants
Type of participants	Regional authorities' officials, stakeholders, external experts
Format	Oral presentations, interactive session
Contact details (1)	Mita Lapi E-mail: mita.lapi@flanet.org Telephone: 0039(0)2.806161.12
Contact details (2)	Marco Guzzetti E-mail: Aquares@flanet.org Mobile: 0039.333.88.61.248

8.1 Attendees

At least 2 representatives from partners' organisations, accompanied by 1 regional stakeholder/external expert can attend the interregional thematic workshop, to be held in Seveso, Italy. The target audience includes all those individuals, bodies and organisations that can be impacted by the project outcomes and are interested in utilising project outputs to support the sharing of knowledge and experiences on the application of water reuse technologies. ANNEX A provides a list of key regional stakeholders per project partner as they appear in the Application Form. This is only an indicative pool of regional stakeholders identified at an initial stage (i.e. project development phase). During the project lifecycle, partners have managed to expand their network of contacts, adding new stakeholders and interested institutions from across Europe such as regional development agencies, higher education institutes and research centres, chambers of commerce, professional associations and public authorities.

In any case, AQUARES partners are advised to invite any other organisation or body involved in the decision-making process and/or interested in triggering policy and behavioural changes towards the application of water reuse technologies.

8.2 Work Programme

The interregional workshop may include two different types of activities to facilitate the transfer/exchange of knowledge and capacity building among regional authorities' representatives; namely: a) presentations, b) interactive session with roundtable discussions.

Presentations will provide an opportunity for participants to get a better understanding of a) challenges and opportunities for water reuse technologies and b) how to identify and apply the more appropriate ones. The presentations will be delivered by field experts from various professional backgrounds (e.g. academics, policymakers, business executives, researchers) and both theoretical and empirical knowledge on the topics under examination, in order to cover all the aspects affecting users and policymakers. Roundtable discussions will follow the completion of each presentation. Partners and their stakeholders are invited to discuss the issues under examination with slides or spontaneous conversations interacting with each other, promoting networking and equal participation/contribution, triggering and allowing for faster decisions. The interactive phase will enable participants to come up with new ideas for policy measures to promote the innovation and the application of water reuse technologies, based on priorities, strategies and visions, and moving towards common solutions.

8.3 Preparing the summary report

The following guidelines have been developed to provide assistance and guidance to the host organization (FLA) on how to summarise and present the main conclusion drawn from the workshop (in the format of a summary paper), in order to facilitate the integration of key policy recommendations into regional action plans. The summary report is considered the key output of activity A3.2 (a). This document will present the final outcomes of the workshop and will be used by project partners as the main input for diffusing the lesson learned within their organisations. The summary report should be drafted as follows:

Step 1: Develop short summaries for each session of the workshop. The summaries should include:
a) the context and objectives of the session, b) the main points from oral presentations c) key argumentation from the interventions of participants, and d) conclusions and findings extracted from the overall discussion and interactive exercises.

Step 2: Review the evaluation forms (if available). The author should summarise the key and ideas (as drawn from the forms completed by workshop participants), with regards to the themes/topics of the workshop.

Step 3: Present the main conclusions with regards the following themes:
-Recognising the challenges/barriers hindering the adoption of innovative water reuse technologies by different sectors.
-Identifying new opportunities for water reuse technologies applications.
-Planning a common strategy for public/private participation.

Step 4: Compair the key arguments/conclusions drawn from the workshop with any relevant results and findings from AQUARES thematic studies and guides on similar policy aspects. Identify convergences and divergences between findings.

Step 5: Provide guidelines (in the form of policy recommendations) on how to utilise the key conclusions drawn to design policy measures and action plans to promote the application of innovative water reuse technologies.

Step 6: Draft the summary report. The workshop summary report should be drafted in a clear and concise way, focusing on the conclusions drawn from knowledge sharing and consultation processes that took place during the workshop sessions.

Indicatively, the workshop summary report can have the **<u>following structure:</u>**

- **1. Introduction**
- **2. Background and objectives of the workshop**
- **3. Summary of sessions**
- **4. Key discussion points**
- **5. Main conclusions**
- **6. Juxtaposition with key findings from project activities**
- **7. Policy recommendations**
- **ANNEX A: Agenda**
- **ANNEX B: Participants list**

8.4 Agenda

“INTERREGIONAL WORKSHOP ON THE APPLICATION OF WATER REUSE TECHNOLOGIES”

Fondazione Lombardia per l’Ambiente – Italy

(Semester 2)

DAY 1

Time/Duration	Description
09:30-10:00	*Arrivals and registration*
10:00-10:15	**Opening speech**
10:15-10:30	**Objectives of the workshop / Overview of the agenda**
10:30-12:30	**Topic 1***
	-Oral presentation of topic 1 (30 minutes)
	-Questions of attendees on speaker’s speech (10 minutes)
	-Answering the attendees’ questions (10 minutes)
	-Interactive session (roundtable discussion): Participants will be split into small groups to discuss specific topics/issues raised during the presentation (45 minutes)
	-Wrap up: The main conclusions and findings from the interactive session will be presented (25 minutes)
12:30-14:00	*Networking lunch*
14:00-16:00	**Topic 2***
	-Oral presentation of topic 1 (30 minutes)
	-Questions of attendees on speaker’s speech (10 minutes)
	-Answering the attendees’ questions (10 minutes)
	-Interactive session (roundtable discussion): Participants will be split into small groups to discuss specific topics or issues raised during the presentation (45 minutes)
	-Wrap up: The main conclusions and findings from the interactive session will be presented (25 minutes)
16:00-16:30	*Coffee break*
16:30-17:30	**Discussion on project activities / Wrap-up**

DAY 2

Time/Duration	Description
09:30-10:00	*Arrivals*
10:00-10:15	**Opening speech**
10:15-12:30	**Topic 3***
	-Oral presentation of topic 1 (30 minutes)
	-Questions of attendees on speaker's speech (10 minutes)
	-Answering the attendees' questions (10 minutes)
	- Coffee break (15 minutes)
	-Interactive session (roundtable discussion): Participants will be split into small groups to discuss specific topics or issues raised during presentation (45 minutes)
	-Wrap up: The main conclusions and findings from the interactive session will be presented (25 minutes)
12:30-13:00	**Final remarks**
13:00-14:30	*Networking lunch*

**** The topics to be discussed during the workshop are presented (in the form of recommendations) in section 6. The host organization can choose more than one topic from each thematic area to present in the workshop.***

9 Bibliography

- Arroyo, P et al. Selecting appropriate wastewater treatment technologies using a choosing-by-advantages approach. Science of The Total Environment, (2018).

-Artiola, J. et al. *Environmental monitoring and characterization*. Elsevier (2004).

- BIO by Deloitte, Optimising water reuse in the EU – Final report prepared for the European Commission (DG ENV), Part I. In collaboration with ICF and Cranfield University, (2015).

-Bixio, Davide, et al. "Wastewater reuse in Europe." *Desalination*187.1-3 (2006).

-Conserve Energy for the Future, “What is Wastewater Treatment?”, website available: https://www.conserve-energy-future.com/process-of-wastewater-treatment.php (Accessed on November 2018)

- Directorate-General for Environment (European Commission), EU-level instruments on water reuse
Final report to support the Commission’s impact assessment – Study, (2016)

-Gmbh Fuchs Enprotec Aerated lagoons for the treatment of municipal wastewater, FUCHS Enprotec GmbH (2011).

-Gupta, Asmita, and Indu Shekhar Thakur. "Treatment of Organic Recalcitrant Contaminants in Wastewater." Biological Wastewater Treatment and Resource Recovery. InTech, (2017).

-Melgarejo, Joaquín, et al. "A case study of urban wastewater reclamation in Spain: comparison of water quality produced by using alternative processes and related costs." Journal of Water Reuse and Desalination 6.1 (2016).

-Qasim, Syed R. Wastewater treatment plants: planning, design, and operation. Routledge, (2017).

-Uribe, Inmaculada Ortiz, et al. "Advanced technologies for water treatment and reuse." AIChE Journal 61.10 (2015).

- Victor-Viorel Stafa, et al. “LAGOON SYSTEMS FOR EXTENSIVE WASTEWATER TREATMENT PLANTS FROM THE RURAL AGGLOMERATIONS”,Conference: 3rd INTERNATIONAL CONFERENCE ON THERMAL EQUIPMENT, RENEWABLE ENERGY AND RURAL DEVELOPMENT, At Mamaia, Romania (2014)

-Voulvoulis, Nikolaos. "Water reuse from a circular economy perspective and potential risks from an unregulated approach." Current Opinion in Environmental Science & Health (2018).

-Water Reuse Europe Review 2018, Water Reuse Europe, 63p.
Available at: http://www.water-reuse.eu/wre_review2018_final.pdf (Accessed on: November 2018)
ISBN: 978-1-5272-2364-6

- WWAP (United Nations World Water Assessment Programme). The United Nations World Water Development Report 2017. Wastewater: The Untapped Resource. Paris, UNESCO, (2017).

ANNEX A: Regional stakeholder per project partner

PARTNER	COUNTRY	KEY REGIONAL STAKEHOLDERS
Murcia GDW		Regional Entity of Sanitation and Wastewater Treatment-ESAMUR Territorial Information System of the Region of Murcia-SITMURCIA Municipal Company for Water and Sanitation-EMUASA Ecological Agriculture Council of the Region of Murcia-CAERM Murcia Federation of Agricultural Cooperatives-FECOAM Murcia Federation of Municipalities-FMRM
SSW		Ministry of Economy and Development-MED Athens Water Supply and Sewerage Company-EYDAP Central Union of Municipalities of Greece-KEDE Managing Authority of Operational Programme Transport Infrastructure, Environment and Sustainable Development-EPYMEPERAA University of Crete-UoC
ROP of LODZKIE Voivodeship		Technology Transfer Center University of Łódź-UoLTTC Technology Transfer Center Technical University in Łódź-TUoLTTC Łódź Regional Development Agency-LRDA Association of Polish Cities-APC
RRAPK		Ministry of the Environment of the Czech Republic-MECZ Region of Pardubice-RoP University of Pardubice-UoP Water and Sewerage Company of Pardubice-WSCP Agrarian Chamber of the Pardubice Region-ACPR
EWA		Department for Local Government-DLG University of Malta – Department of Earth Systems-UMDES Malta Chamber of Commerce-MCoC Water Services Corporation-WSC Malta Water Association-MWA Malta Enterprise-ME
FLA		Lombardy Region-RoL Italian Ministry of the Environment-IME Italian Institute for Environmental Protection and Research-ISPRA Interregional Agency for the Po river-AIPO Regional Agency for the Environmental Protection-ARPA Regional Agency for Agricultural and Forest Services-ERSAF

OOWV		Lower Saxon State Chancellery-LSSC Lower Saxony Ministry for Environment, Energy and Climate Protection-LSMEECP University of Osnabrück-UoO Jade University for Applied Science-JUAS Metropolregion Nordwest-MRNW Weser-Ems Regional Development Agency-WERDA Lower Saxony Chambers of Commerce and Industry-LSCoC Innovation Network Lower Saxony-INLS
f-IEA		(Advisory partner)
Baltic Coasts		Ministry of Environmental Protection and Regional Development - MEPRD Investment and Development Agency of Latvia - IDAL University of Latvia - UoL Baltic Environmental Forum Group - BEFG Latvian Chamber of Commerce and Industry - LCCI Investment and Development Agency of Latvia Business Incubators - IDALBI Ventspils High Technology Park - VHTP CLEANTECH LATVIA - CTL ALTUM
The Municipality of Trebnje		Ministry of the Environment and Spatial Planning (MESP) Inter-municipal Development Centre of the Municipalities of Grosuplje, Ivančna Gorica and Trebnje (IDC-GIGT) Institute for Water of the Republic of Slovenia (IWRS) National Institute of Chemistry (NIC) Development Centre Novo Mesto - Regional Development Agency for the South East Slovenia Statistical Region (DCNM) Communal Company Trebnje (CCT)