AQUARES - WATER REUSE POLICIES ADVANCEMENT FOR RESOURCE EFFICIENT EUROPEAN REGIONS

MARCH 2020

A3.3 Final report

Site visits Exchange to match make desired water reuse iniciatives with appropiate technologies and business models

Regional Goverment of Murcia, Ministry of Water, Agriculture, Livestock, Fisheries and Environment.

General Directorate of Water

Region de Murcia
Consejería de Agua, Agricultura, Ganadería, Pesca y Medio Ambiente.
Dirección General del Agua

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1 INTRODUCTION

AQUARES aims at strengthening efficient water management and green growth by improving the capacity of public administrations and regional bodies to promote innovative technologies and business models for water reuse.

So far, the tasks developed by the project can be summed up as following:

1) To prepare methodologies where general aspects of reused water are studied from a theoretical approach and with the only goal of introducing the topic to the partners.

At this stage, the working procedures for the project were defined and aspects of the water reuse field like the legal framework, the needs of the sector, special features in every territory and necessary technologies were studied.

2) Peer review among partners. This is precisely the task that is being shown in these guidelines and which consists of the process in which the partners show their effective solutions to the found problems related to the water reuse issues.

"Peer Review" is the pillar on which the INTERREG EUROPE methodology is based, since the main goal is the exchange of knowledge among partners and to transfer solutions to others countries with similar problems.

In the development of the project, the accumulated delays could endanger the execution of the program. In order to avoid that, this methodology substitutes the task identified in the Application Form (from now on, AF) to the task with the title A3.3 "Site visits Exchange to match make desired water reuse initiatives with appropriate technologies and business models".

The main reason for this substitution regarding to the initial plan is that no partner would not carry out any of the ten site visits exchange foreseen in the Application Form, as this is the stem task on which all of them depend.

Apart from that, the substitution of the task might bring some advantages, for example:

- It has led Lead Partner (from now on LP) to make a diagnosis about if AQUARES has identified enough best practices before starting to draft the Action Plans, and we must not forget that there are really the ultimate goal of the project.
- Instead of the task be carried out by an external expert, it is always better a coordination with the partners conducted by the Lead Partner, because it promotes and forces the dialogue between partners, indeed, the future steps of the project depend on the quality of the results elicited in this task.

3) Site visits exchange. Ten visits are foreseen from the fourth to the sixth semester, in which the main goal consists in showing the Good Practices identified in each territory to the partners. This stage helps to check the applicability of the Good Practice in the territory of the partner, being led by their stakeholders.

4) Drafting of the Action Plan. In this stage, with the results obtained in the previous stages, every partner tidies the lessons learnt in a document, that will have to implement in the second phase of the project.

Each stage influences the subsequent ones, although in some of them are easier to correct the mistakes than the other. Unfortunately the inaccuracies implications of the "peer review" can be dragged until the end of the project, so we need to pay special attention at this step.

2 BASIC DEFINITIONS

This section provides basic definitions and acronyms so as to make the text more understandable and easier to use, especially considering that vocabulary used may not be known to those not familiar to INTERREG EUROPE methodology and water reuse field.

One of the objectives of this guideline is to be able to be used for organizing site visits exchange without a previous knowledge about these topics.

Table 1: Definitions for site visit terminology

Term	ACRONYM	Definition
Application Form	**AF**	It is the document approved by INTERREG EUROPE in which the project is based, including all the actions of the project and the program for implementing it.
Good Practice	**BP**	According to the Interreg Europe program manual, a good practice is defined as "an initiative (e.g. project, process, technique) undertaken in one of the programme's priority axes which has proved to be successful in a region and which is of potential interest to other regions. Proved successful means that the good practice has already provided tangible and measurable results in achieving a specific objective." Since Interreg Europe is dedicated to regional development policy improvements, a good practice is usually related a public intervention. A private initiative may be considered as a good practice only if there is evidence that this initiative has inspired public policies.
Matching	--	It consists of the process of exchanging knowledge between the partners so as to improve their weak points with practices carried out in foreign countries or territories.
Peer review		It means to compare a same situation in two countries regard the same issue.

Term	ACRONYM	Definition
Site visit exchange		It is a meeting at a partner's place in which it shows its identified best practices in its territory to those partners who have previously been interested in them.
Water reuse		The use of reclaimed water for a direct beneficial purpose.

3 IDENTIFICATION PROCEDURE OF THE BEST PRACTICES

In order to sum up briefly all what we have been doing so far at AQUARES, it could be said that firstly, the theoretical issues on water reuse have been addressed through several methodologies and international workshops on issues of legislation, technologies applied to reuse in each of the countries, as well as the study of the reuse sector and their needs.

Secondly, the exchange of best practices identified in the influence area of AQUARES, and the exchange among partners has been carried out, in the way that is described in this point.

In future tasks, the partners will study through the site visits exchange the identified best practices, showed by who is really carrying them out, and they will be the base of a final document called Action Plan, which will collect all the lessons learnt in the project.

There are great differences among the member countries of AQUARES, especially in their governance of water reused, for this reason it is necessary to organize the dialogue between partners and, in this way, we can focus mainly on the weaknesses and strengths of everyone and how to exchange the knowledge, maximizing the results of this procedure.

Due to unforeseen circumstances, this task was delayed one semester, being necessary to take measures to bring it up to date. One of them consisted of advancing the identification process of best practices for the project partners before drafting these guidelines. The advancement of this assignment has meant recovering 4 months of work as well as reducing the impact of the initial delay in its performance.

The prior steps were driven by the Lead Partner, which assumed the task, with the contribution of the rest of the partners. Such steps are shown hereafter:

1. Identification of the Best Practices.

In the last week of October 2019, Lead Partner asked the partners for the best practices in every territory through the monthly Skype meeting, defining what a Good Practice is and giving some recommendations on how to search them, after that every partner consulted with their stakeholders. The target was 5 Best Practices by every partner and to reach 45 for the whole project (F-IEA does not have to search any Good Practice because of its role as advisory partner).

At the end of November every partner submitted to the Lead Partner a brief draft of 3 pages, describing their possible Best Practices, then Lead Partner with the contribution of the Advisory Partner suggested some improvements about what was submitted. Most of the suggestions were addressed to the countries which were right at the beginning of the water reuse implementation, and that had problems to identify which best practices could be considered like a water reuse practice.

In the first week of December, LP collected the results of the consultation in a spreadsheet, which was uploaded to the Google Drive of AQUARES so that every partner can consult what the rest had submitted. The collection of all Best Practices in one only file, served so as to globally estimate whether the partners had identified enough of them in order to tackle successfully the Action Plan drafting.

2. Completing the Best Practices in the official Interreg Europe template.

In January, 2020, every partner collected all the necessary information about their Best Practices to fill in the official template of Interreg Europe, which can be downloaded in the following link:

https://www.interregeurope.eu/news-and-events/news/2494/how-to-submit-good-practices-explained/

This guide makes sure that the partners collect the same information for each practice. The points referred are:

1) Data of the institution in charge of the Good Practice.
2) Detailed description.
3) Resources needed for implementing it. The rest of the partners have to know if it requires a high investment, or special conditions.
4) Timescale (start/end date). The practice is more reliable if it is longer.
5) Evidence of success (results achieved). It is logical that the practice has to be absolutely proved.
6) Challenges encountered. At this point, the partners have to describe all the problems and especial difficulties that they found when implemented it.
7) Potential for learning or transfer. At this point, it must be explained the method of transfer the knowledge, especially in the case of site visits exchange.

All the BPs identified were uploaded to a Google Drive Platform of AQUARES for being shown to the rest of the partners until the 15th February 2020.

3. Selection of the Best Practices by every partner.

In the second half of February, Lead Partner applied to the partners to select those Best practices that are interested in, mainly thinking about their future action plans. Some recommendations were given for that selection like:

- Talk to their stakeholders before choosing them.
- In case of doubt, choose the practice, because there is enough time to discard it.
- If there are repeated practices, deal to select them in the least countries as it is possible.
- Consider the researching lines of your stakeholder at the time of choosing the best practices.

The partners submitted their selections at the end of February.

4 RESULTS OF THE IDENTIFICATION PROCESS

The partners identified 54 Good Practices of water reuse, which is a bit more than the target of the project (45, that means 5 per partner). The partners located in the North of Europe had special difficulties to find them, since their water reuse governance is currently in the very early beginning.

As far as the classification of the Good practices identified is concerned, the category most identified was about specific Applications of the water reuse with 19 best practices, although it is surprising that regarding the agricultural uses (which according to FAO is the most water consumer in the world, reaching a 70 % of the water resources), partners only found 4 good practices, as shown in the following table.

CLASIFICATION OF THE IDENTIFIED BEST PRACTICES

Category	GPs
Methods & Technologies of treatment	15
Applications of water reused	19
Agricultural applications	4
Recharging aquifers	2
Industrial uses	6
Leisure uses	1
Domestic applications	6
Governance Measures	7
Restoration of landscapes + wetlands	7
Valorization of wastes and recovery of N and P	3
Harvesting rain reuses	1
TOTAL	**55**

The second most important category is Methods and Technologies of treatment with 15 best practices. It is logical considering that for the most of the partners, their main stakeholder is usually the entity in charge of the treatment of the wastewater.

Despite that AQUARES is a project dedicated to the water reuse governance, partners have only identified 7 best practices of this category. That can be explained by two reasons; the first one is that except for Germany, the partners countries are still at an early stage of the implementation of water reus and for them it is also more difficult to find measures taken by their administrations. And the second one, in the phase of the dialogue among the partners, after submitting the first draft of the best practices, these kind of measures did not generate any interest and who had examples did not make an effort to search more than the found ones.

In particular, hereafter you can find best practices identified so far in AQUARES, distributed by partner. In each one of them, it is specified the way of teaching it. You can find a wider explanation of them in the Annex 1 of this report.

1 LP GDW GENERAL DIRECTORATE OF WATER – MURCIA

GP1: Anaerobic treatment as a first step in a wastewater treatment process

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP2: Disinfection in every WWTP independently of the treated water destiny

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP3: Dry anaerobic digestion of sewage sludge

Way of teaching it: Visit at the place, many WWTPs in Murcia have developed this practice, so this visit could combine with other good practice (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP4: Model of sanitation collection canon with a delimited taxable event

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP5: Exemption the sanitation levy to the farmers

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP6: Wastewater sludge reuse programs

Way of teaching it: Visit at the place, many WWTPs in Murcia are involved in these programs, so this visit could combine with other good practice (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP7: Grants for connecting the WWTP with the facilities of the Irrigator Communities.

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP8: To Inventory the water treated as water source available in the hydrographic basin

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP9: Reduction of the applied fertilizers for the crops, controlling the compounds in the water in every step

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP10: The Smart Irrigation lets the users a complete management of the water reused in every step of the process

Way of teaching it: Visit at the place (priority, it can be combined with other visits to see other good practices), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP11: Co-digestion WWTP sludge with other wastes

Way of teaching it: Visit at the place (priority, it can be combined with other visits to see other good practices), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

G12: Co-digestion of crop wastes for biogas production and use of digestate as fertilizer.

Way of teaching it: Visit at the place (priority, it can be combined with other visits to see other good practices), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

G13: Enhanced nitrogen and phosphorus recovery from wastewater

Way of teaching it: Visit at the place (priority) In this case it will not be possible to combine this visit with other best practices because the WWTPs in which this practice has been identified, do not have tertiary treatment and consequently other good practice identified. Through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

G14: Denitrifying woodchips bioreactor

Way of teaching it: Visit at the place (priority, it can be combined with other visits to see other good practices), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

G15: Program to teach the benefits of reused water in schools

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

2 PP SPECIAL SECRETARIAL FOR ENVIRONMENT - GREECE

GP16: Sewer Mining for Urban Water Reuse

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP 17: Expansion and upgrading of a wastewater treatment plant

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP18: Telemetry system for sewage pumping stations in Municipality of Trikala

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP 19: Combination of rainwater network and stormwater storage tanks

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

It must be considered the long distances between the places in Greece when the visit is organized.

3 PP LODKIE REGION LODZKIE REGION - POLAND

GP20: Ecohydrologic rehabilitation of recreational reservoirs "Arturowek" as a model approach to rehabilitation of urban reservoirs.

Way of teaching it: This practice was already shown in the Study Visit in Lodz (16-17 Oct 2019)

GP21: Integrated chemical-biological textile sewage treatment plant in Biliński Textile Factory

Way of teaching it: This practice was already shown in the Study Visit in Lodz (16-17 Oct 2019)

GP22: Use of DynaSand filters for iron and manganese removal.

Way of teaching it: This practice was already shown in the Study Visit in Lodz (16-17 Oct 2019)

GP23: Closed-cycled water overflow in Sports Bay

Way of teaching it: This practice was already shown in the Study Visit in Lodz (16-17 Oct 2019)

GP24: Digital Water

Way of teaching it: This practice was already shown in the Study Visit in Lodz (16-17 Oct 2019)

4PP RRAPK – CZECH REPUBLIC

GP25: Botanica K – system of grey waste water management

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP26: Reuse of water in a food company for cooling system at vinegar production

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP27: Dry Polder, dry protective or retention tank is made for flood protection called Žichlínek
Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP28: Nano filtration unit in the regime stand–by on water treatment in Domašov nad Bystřicí
Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP29:Lanškoun city – best practice – innovation city
Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP30: Hydrogeopark Pátek
Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

5PP EWA – MALTA

GP32: Sewer Discharge Control Unit
Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP33: New Water - Highly Polished Treated Effluent
Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP34: New Water – Automated Distribution System
Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP35: Sant Antnin- Moving Bed Biofilm Reactor
Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP36: Pwales – MAR Managed Aquifer Recharge
Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

6PP FLA - LOMBARDY

GP37 CSO-CW for Carimate WWTP

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP38 Water reuse at the building level – Condminio di via Sassetti

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP39 Milano-San Rocco WWTP

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP 40 Milano-Nosedo WWTP a European Best Practice

Way of teaching it: This practice was already shown in the workshop in Milano (March 2019)

GP 41 Constructed Wetlands Gorla Maggiore

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

7PP OOWV – GERMANY

GP42 Alternative resources for agricultural irrigation

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP43: Indirect water reuse in a partly closed water cycle (Hessisches Ried)

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP44:MULTI-ReUse 1 – Technologies for Water ReUse

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP45: MULTI-ReUse 2 – Monitoring in Water ReUse

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP46: MULTI-ReUse 3 – Communication in Water ReUse

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

AP8 F-IEA – SPAIN

They collaborate in the development of the identification and practical implementation process of the best practices.

PP9 BALTIC COAST - LATVIA

GP47 Water protection measures in forest management

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP48 Rainwater reuse for car washing

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP49: Bioswale at the SPICE Home shopping center parking lot

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP50: Green and blue corridor in Skanste neighborhood of Riga city

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

GP51: Water reuse in plastic pipe manufacturing process

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

PP10 MUNICIPALITY OF TREBNJE - SLOVENIA

GP52: Nanoremediation of water from small wastewater treatment plants and reuse of water and solid remains for local needs – LIFE RusaLCA

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP53: Degradation of pharmaceuticals in wastewaters from nursing homes and hospitals– LIFE PhramDegrade

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP54: Adding sustainability to the fruit and vegetable processing industry through solar-powered algal wastewater treatment – LIFE PhramDegrade

Way of teaching it: Through a discussion with interested partners, a presentation or even through reports of the activity.

GP55: AquaLink monitoring system for water network efficient

Way of teaching it: Visit at the place (priority), and through a discussion with interested partners, and just in case that both ones are not possible, through a presentation.

5 RESULTS OF THE MATCHING AMONG THE PARTNERS

In this section, best practices chosen by every partner will be shown, so that the organisers of the site visits exchange are able to know about the possible target audience.

In the fist column of the following table, the holders of the good practices can check the partners who could attend their future site visits exchange.

HOLDERS	PARTNERS INTERESTED								
	GDW	SSW	LODZKIE	RRAPK	EWA	FLA	OOWV	B. COAST	TREBNJE
1-GDW		Yes		Yes	Yes		Yes	Yes	Yes
2-SSW	Yes							Yes	Yes
3-LODZKIE				Yes			Yes	Yes	Yes
4-RRAPK		Yes	Yes			Yes		Yes	Yes
5-EWA	Yes	Yes		Yes			Yes	Yes	
6-FLA	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
7-OOWV	Yes	Yes						Yes	Yes
9-B. COAST	Yes	Yes		Yes					Yes
9-TREBNJE	Yes	Yes	Yes	Yes	Yes			Yes	

In any case, this is only theory because even the partners had chosen a good practice it does not imply that they have to attend the site visit.

However, this table can serve as a guide so as to know which partner has to address in order to organize their site visits, not having to contact all the partners of the project.

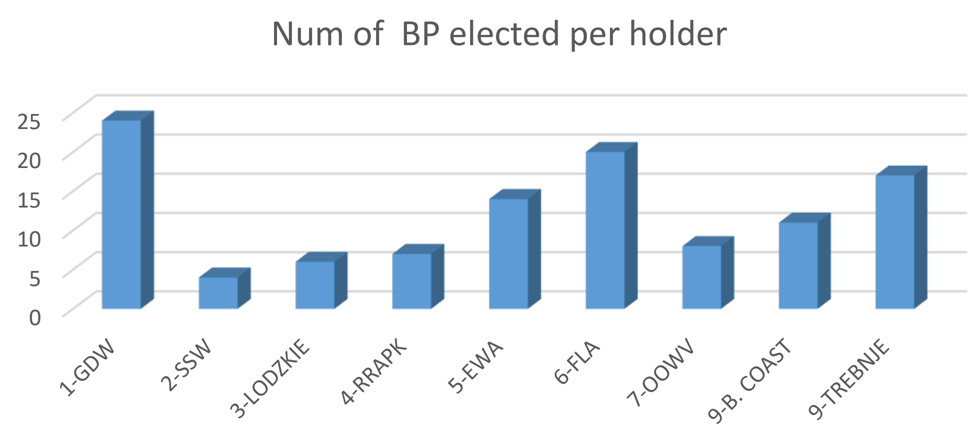
As far as the elections of the partners is concerned, the BP most chosen are the hereafter shown:

HOLDER	GOOD PRACTICES	GDW	SSW	LR	RPK	EWA	FLA	OWV	BC	TRB
FLA3	System to collect, treat and reuse of grey (from bathroom sinks and showers) and meteoric waters for toilet flushing, domestic laundry washing, car washing, irrigation, external pavement cleaning.	Yes	Yes	Yes		Yes		Yes	Yes	Yes
FLA4	Construction a wetland for removing the pollutant with biofiltration as well as a buffer for flood events, maintaining the biodiversity and with recreation goal.	Yes	Yes	Yes					Yes	Yes
RK2	Using "grey waters" in residential houses - company SKANSKA Botanica K		Yes	Yes			Yes		Yes	Yes

The results of this table are a bit striking, since two of these three best practices are applied for domestic uses, despite of the fact that the highest consume of water worldwide is agricultural activity.

All best practices related to action of recovering or implementation of wetlands have been accepted among the partners, although some of them have been rejected considering that if the wetland does not over an aquifer and there is not infiltration, therefore that cannot be considered a water reuse practice.

The following graphic shows the number of elections, which every holder has, with the only goal to foresee which site visits will have a higher number of attendees:



Murcia GDW had the highest number of chosen good practices, mainly because GDW have identified 15 best practices, together with FLA, this is merit considering that they have identified only 5 BPs.

The FLA Lombardy's five good practices have been chosen almost 20 times.

It is also necessary to add, that in the case of Lodzkie, although they have been elected 5 times, all their best practices have been shown in the last Study visit celebrated there.

To sum up, this is a fixed picture of the conditions in which the partners will have to start preparing their site visits exchange, although as you will see in point 8, it will be given freedom to the partners to make changes, during this semester and the next one.

6 GUIDELINES FOR ORGANIZING THE SITE VISITS

In the previous points, we have pointed out the tasks carried out so far, before the organization process. From now on, we are going to focus on how to prepare a site visit. Before the planification, it is necessary to tackle some aspects to consider, the first one is to define the responsibility of the organisers and the participants:

Responsibilities of the organisers:

<u>Before the visit, the organisers might:</u>

- Discuss a proposal with its interested partners;
- Prepare a draft preliminary program of the visit and update it periodically;
- Find and recommend accommodation;
- Identify the stakeholders to be visited and get in touch with them;
- Identify speakers and get in touch with them;

<u>During the visit, the organizers might:</u>

- Indicate precisely the objectives of the visit, explain to the group the structure of the program;
- Guide the group throughout the visit, be “part of the group”, be available and be a source of information;
- Offer attendees the opportunity to participate in the debates, ensuring that everyone contributes to them;
- Show flexibility and try to adapt to the interests and needs of the participants in the contents of the site visit and adapt the program throughout the visit to ensure its quality.

<u>Responsibilities of the participants:</u>

- Play an active role in all activities scheduled in the program throughout the visit;
- Try to establish professional contacts that can be used to develop the process of implementation of best practices and create networks;
- Disseminate the knowledge acquired in their organisation;
- Confirm your participation to the organisers;
- Manage your trip (reservation and payment of tickets), as well as, assumes expenses related to the site visit, such as meals, accommodation and local travel;
- Take out accident and / or illness insurance that covers it for the duration of the site visit;
- Inform the organiser immediately in case of cancellation.

Preparation of the draft agenda:

The first step of the process consists of sending an email from the organiser to the partners interested in their best practices. The email will be proposing an online meeting to discuss the expectations of this particular site visit.

The organiser must identify the most relevant points of each BP offered and will appoint a person responsible for the communication with the partners.

Secondly the organiser must contact stakeholders related to those best practices, in order to discuss how to present them. The stakeholders will make a first proposal of the pre-selected speakers, following the hereafter recommendations:

- Managers or operators who are directly handling that good practice, are preferred to other kind of experts.
- The selected speakers must provide practical information to the audience, in particular the most important drawbacks and challenges of implementing the measure. In the same way, they should be ready to exchange experimental data about the BP or to teach the audience about how to implement it.

After selecting, contacting the speakers, the potential host organizations, and exploring the availability of accommodation and local transportation and social, a draft provisional program must be developed. It is advisable to have done a draft program at least one month before the visit.

A realistic program should consider the following aspects:

- In the opening of the visit, the organizer should contextualize briefly, the good practices regarding to the country and the region where they are carrying out.
- Avoid the theoretical presentations and encourage the exchange of opinions between participants and speakers.
- The number of visits to the facilities or institutions programmed must be suitable and give some flexibility to the schedule. It is not advisable to overload the program.

Ways to transfer Best Practices' knowledge:

The explanation of the every good practice must contain the following aspects:

(1) A brief summary of the organization in charge of the good practice so as to study in which kind of organization is applicable this good practice.
(2) Scope of the practice
(3) The problem faced with this Good Practice, adding all the relevant data of its backgrounds,

(4) Resources needed
(5) Pros and cons, and especial found drawbacks when the good practice was implemented.
(6) Evidences of the success (results achieved)

Regarding how to show the good practice, there are three possibilities:

A. Checking how it works in situ. This one is the preferable, although, it is necessary to consider the money availability to carry out the site visit. Consider the commuting costs in the case there are many partners interested.
B. Through meetings with the managers and operators that are handling the good practice so as to discuss them.
C. Through presentations. When there are not any other posibilities to teach it. In all the cases, there must be a discussion after the presentation, otherwise it would not be logical to travel so long when presentation could be done digitally. This discusión should be conducted by a moderator, who previously will have contacted both parties so as to prepare it.

In the case B and C, it is necessary to organize a discussion. When a group is made of four or five people, there is no need for a moderator to control the discussion, however, in case the group reaches the number of eight people, it would be helpful as to ensure an effective discussion, the organizer will appoint a moderator whose responsibilities would be:

- Contribute to maintain concentration in the group, to achieve goals in a short period of time,
- Have knowledge about the good practice to be discussed.
- Control the time, trying to keep the comments reasonably short and get to the point, so that others have the opportunity to respond.
- Provide materials that help the discussion, ensuring that everyone receives the necessary information, reading or other material in advance.
- Do not interrupt unless it is absolutely necessary and avoid that a person or small group dominate the discussion
- Summarize or clarify important points, arguments or ideas. The most important thing is to make sure everyone understands the good practice.

Organization of the place

When the draft of the agenda becomes final, it is time to book the meeting room, the commutings to the places and specially everything related to the attendant needs. The organisers must check that everyting concerning the place is properly prepared:

As far as the attendants accommodation is concerned, the organiser must consider the following elements:

- The participants are responsible for their trips and accommodation, however the organizer should find at least two options of hotels, well located, easily accessible to public transport and adequate restaurants nearby.
- The availability of hotel accommodation for the dates of the visit, even trying to negotiate group rates if the participants ask for it, nevertheless the reservation must be done directly by the attendants.
- For local or regional trips, the organizers must rent a minibus or bus and the cost shall be covered by the organizer.
- The organizer must choose and prepare the spaces where the visit will take place, including the place where the guests will wait while the rest arrive.
- The organizer should plan an easy, comfortable travel itinerary when the place of best practices is visited.

Preparing of the definitive agenda

The organizer when preparing the definitive agenda, must keep in mind the main objective of the site visits is to know the results of best practices and learn ways of implementing them in their countries, so it is necessary to promote the exchange of ideas, through a flexible program which make possible the "empty" periods, for discussion and exchange of ideas.

A program with many consecutive presentations can exhaust the attendees, which for sure will probably loose their attention to the visit.

The final agenda will be completed when all its items are closed, included the room, the commuting and the hotels and restaurants which will be offered to the attendants. In that case, the agenda will able to be sent to the partners. It is convenient to prepare an alternative list of speakers and places to visit in case of last minute annulment.

When final agenda is sent, practical information about how to get to and from the airport, the offered hotels, the room and the commuting, should be attached, so that the participants start to search their trips and hotels. For that reason it is recommendable to close all these details, at least one month before the visit.

On Friday (or the last working day) of the previous week of the visit, the organizer will send the last version of the agenda, including information on the national currency, local time, weather, expected expenses and contact persons (in case of emergency).

Matters related to the attendees

The advisable number of attendees is between 6 and 27, that is why, these guidelines recommend to avoid site visits with more than 30 people. In case this occurs, the organiser will ask for members of the partners, not to attend the program, waiting out of the rooms, until number of attendants will be reduced to 30. The partners will be able to do shift between them to avoid that the same partners are always waiting out of the rooms .

To avoid last-minute surprises or that strategic guests do not attend, it is essential that the organizer confirms attendance 7 days before the scheduled date. Once the hoster has all the confirmations, a final list will be made with the information of each guest so that on the day of the visit you can easily identify each of the visitors.

Despite English is the official language of AQUARES, it should be considered that for the most of the partners, is not their mother tongue, so the organizer will ask for to the speakers to speak clearly and slowly if necessary to facilitate understanding.

During the visit

First of all, the organizer must appoint a responsible for the organization that will be in charge of checking the composition of the group especially before, during of after the commuting.

Hereafter, the organizer also must check previously, that the following issues are in running order:

- The state of cleanliness
- Remove architectural barriers, if exist.
- The material and equipment necessary for the development of the visit and hire all the services needed for that day.
- The microphones and stage if necessary.

The organizer might also control attendance of the participants, and prepare a template lists which after being filled in, will be submitted to Lead Partner through the Google Drive platform.

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7 COVID 19 INFLUENCE ON THE SITE VISITS ORGANISATION

These guidelines have been drafted during the worst sanitary crisis of Europe of the last 75 years. Because of the epidemic of COVID we cannot know exactly how long it will take us to overcome it.

The current situation is that there are restrictions to travel to the most of the countries of the European Union, thus, the site visits exchange cannot be carried out until everything goes back to normality.

If the situation persists after summer, the Steering Group, with the support of the Joint Secretariat of Interreg Europe will take the necessary measures so as to avoid endangering the project. So far the guidelines from Interreg Europe to face this problem are the hereafter:

- To assess the situation based on World Health Organization (WHO), your embassies', national health organizations and partner organizations' recommendations. At present, the World Health Organisation (WHO) "…continues to advise against the application of travel or trade restrictions to countries experiencing COVID-19 outbreaks" (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/).
- to cancel meetings or avoid travelling if there is an official travel ban or travel warning for the region or if a partner organisation restricts travels and/or meetings or for other justified medical conditions.
- to apply preventive measures as suggested by the WHO and similar organisations and to discuss them also with meeting places (e.g. to make hand sanitizers available at the meeting rooms and to carry out a careful daily alcohol-based disinfection).

Should the event have to be cancelled, postponed or if partners/stakeholders could not attend for the reasons as mentioned above or other justified medical conditions, we recommend you

- to consider together with the partners involved whether carrying out the meeting by other means such as videoconferences is a suitable option in order to minimize the impact on the workplan.
- to seek reimbursement (e.g. for venue, catering, travel tickets) timely and in line with contractual terms. For any costs that you had to incur already to date and that are not recoverable by any means, we would suggest you to consult the first level control. In our experience irrecoverable costs could be declared eligible by the first level control if this situation is considered a result of unforeseen external circumstance and justification is documented.

If you have further questions, please get in touch with your Lead Parner.

8 PROTOCOL FOR CHANGING THE BEST PRACTICES SELECTED OR IDENTIFIED

Since from the beginning of the project, the Lead Partner has tried to make the process of matching among the partners, as open as possible, thus if new consults between the partners and their stakeholders produce different results about their best practices identified than their ones selected, the procedure ables the partners make changes in their preferences, based on the new found circunstances.

On one hand, the changes of partners preferences about the already selected Good Practices, influence the organization of the site visits, so they must not be accepted directly, without any justification.

On the other hand, the key point of the project consists on selecting properly the good practices of the rest of the partners for our Action Plan, and it is also important so as to shorten the time to the two weeks given in February, to the partners to consult their stakeholders.

For the mentioned reasons, it is convenient to prepare a protocol, just in case one partner decides to change the good practices selected in the procedure of identification and matching among the partners caried out during the last five months in AQUARES.

Hence, if a partner wants to change their good practices selected in the general matching process, must follow the hereafter steps:

1. Communicate the new good practice selected by email addresed to the owner with copy to the Lead Partner.
2. Update the spreadsheet which contains the summary of all of them in Google Drive.
3. If the site visit which shows the good practice, has not been celebrated yet, the organizer will include the partner in it.
4. If the site visit has already been carried out, the organizer should be able to provide them the information given to the attendants of the visit, as well as a contact to give information about that good practice.

It is necessary to clarify, that the responsabilty of the organizer regarding the site visit and the shown good practices, is to end up when the visit is celebrated so this task is volunteer for them.

In the opposite case, if a new good practice is identified, the owner must follow the hereafter steps:

1. Communicate the new good practice by email addresed to all the partners.
2. Update the spreadsheet which contains the summary of all of them in Google Drive.
3. The Lead Partner will send an email addresed to all the partners, offering this new good practice.
4. In some partner wants to choose that new practice, must follow the protocol described in this point.

The project will be more successful if more good practices are able to be identified. Therefore, the Lead Partner will promote that the rest of the partners keep searching their best practices, succesful cases, as well as examples of good management in their territories.

9 BIBLIOGRAPHY

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The most important sources were the direct contribution of the partners.

ANNEX 1: BEST PRACTICES IDENTIFIED IN AQUARES PROJECT

LP1 GDW GENERAL DIRECTORATE OF WATER - MURCIA

GP1:Anaerobic treatment as a first step in a wastewater treatment process

Energy consumption reduction is, currently, one of the main goals in the wastewater treatment system of the Murcia Region. Pollutant removal efficiencies are really high (99 % is the average efficiency in BOD5) in the most of WWTPs (wastewater treatment plants) and now we are looking for treatment systems more eco-efficient. In regions with a warm temperature, anaerobic treatment can become a good system to remove a lot of organic matter of the wastewater with a very low consumption of energy, due to characteristics of anaerobic processes and, moreover, the production of sludge is low. Unfortunately the efficiencies you can get are depending on temperature. Regarding temperatures of Murcia Region, COD removal efficiencies of 50 % are being got in winter and 75 % at least in summer. Moreover the sludge production is really low compared with traditional systems. Of course, we´ll need a second step, usually with conventional treatment processes to get very good efficiencies, but the costs will be much lower because we have removed a lot of pollution before.

We decide to set this technology after several tests on pilot plants in different WWTPs in the region. Then, taking advantage of a LIFE project (RAMSES), a large -scale anaerobic reactor was built in the WWTP of Blanca, using an empty tank we had there and we are working with this system for more than three years. After this treatment we have an extended aeration system to get the highest efficiencies

GP2: Disinfection in every WWTP independently of the treated water destiny

Segura River has a very low flow rate. It means that any WWTP discharge in bad conditions can produce a huge problem for the environment and many uses in the river. On the river, the water is taken for many uses, mainly for agricultural irrigation. This practice doesn´t require any control by the authorities. If we discharge treated water without disinfection, the low dilution will make that the amount of pathogens in the river is very high, jeopardizing the safety of the agricultural products irrigated with river water. Therefore, in Murcia Region, all the plants have disinfection treatment to be sure there won´t be any risk for this practice.

Moreover, according with the principle “who pollutes, pays “this cost is paid by the citizens by the sanitation levy, because they have polluted this water.

Really the main interested in this practice are the environment and the citizens, because river water can be used safely for any application or it´s not harmful for the environment.

GP3: Dry anaerobic digestion of sewage sludge

Good sludge management is a relevant part of the wastewater treatment process. Huge amounts of sludge are produced and it´s necessary to find a good solution to deal with it. Usual systems are composting, thermal dry, incineration, landfill or soil application, and the main drivers to choose the technology are the destiny requirements, viability and the safety, moreover environmental issues.

Dry anaerobic management is a promising system when we want to improve the quality of the product, to use as amendment, reducing the pathogenic load, stabilizing the sludge and, at the same time, to produce biogas. It could be used for small and medium plants, with non-digested sludge.

The process consists of a digestion treatment in a tank, where we introduce dehydrated sludge (12- 14 % dryness). We have the sludge in mesophilic conditions for 40 days and the volatile organic matter of the sludge is transformed into biogas and the sludge is disinfected. Using the biogas in an engine we can produce electricity and heat to maintain the mesophilic conditions (sometimes is necessary to apply more energy, depending on the outdoor temperature). The energy to mix the sludge is very low.

At the end of the process we get a stabilized sludge, without pathogens and with a high capacity to use as an amendment and fertilizer in agriculture.

GP4: Model of sanitation collection canon with a delimited taxable event

The taxable event of the fee is only used to recover the cost of the wastewater sanitation process and the agent in charge of the collection is a public company whose function is precisely this. The problem addressed by this system is guarantee the works are done and are paid by who generates the pollutant loan, applying incentives for who properly uses their water resources and penalizing the wasters.

This practice was set by the Law 3/2000, July 12stof sanitation and treatment of wastewater and implementation of the sanitation levy in which ESAMUR was created, assigning it the function of collecting the sanitation levy and its position in the Regional Administration of Murcia.

The specific taxable event of the sanitation levy is to be connect to a public net, and the cost paid by the consumers depends on the water consumed.

The money collected is only used to maintain the operation costs of the treatment facilities.

To also highlight the inclusion of binomial tariffs that penalize the most wasteful and pollutants hardest.

The main stakeholders of Murcia have been benefitted from this way of collecting the fee, because the system has always been controlled by a sole organization that furthermore was controlled by the General Directorate of Water which in turn is an organism interested in fostering the water rushing.

GP5: Exemption the sanitation levy to the farmers

Despite of their advantages, the reusing currently has a very low rate of implementation in Europe for several reasons, and one of them, is the lack of economic incentives.

In Murcia Region, there is a levy to pay the water sanitation costs, which is paid by the users. In the case of water reuse the requirements are higher than for discharging into the river, especially in crops which require a high quality of the treatment. This practice consists of exempting the farmers to pay for the tertiary treatment of the waste water. This way we are giving to the waste an added value against the rest of the water sources.

This exemption is considered like a grant for promoting the reusing which helps to reduce the overexploitation of the groundwater and allows to prioritize this sustainable water source above the rest more polluting.

GP6: Wastewater sludge reuse programs

Programs for reusing the sludge produced in the process of the water treatment, using GIS for its control and monitoring its application.

In Murcia Region WWTPs are producing 135.000 tons of sludge yearly. This is a huge source of organic matter and nutrients, very appreciated in an agricultural region as Murcia. But this practice could be the origin of many problems if we don´t manage it properly. Problems as odors, insects or pollution of soil and aquifers could be caused by a bad management of this product. Due to these circumstances the control of the use is strong in the region.

A strong control of the sludge, from the production in WWTP until the use to amend and fertilize the soil and crops should be carried out. A third of the total produced sludge is composted and two thirds are applied directly in agricultural soil. To avoid any problem with this application there is a control system to know the track of the transport trucks, the moment in which the sludge is unloaded and when it´s foreseen the application on the soil. Of course also the characteristics of the sludge and the plot in which the sludge will be applied are known previously, to control the tons could be applied in the plots, regarding environmental and agricultural issues. A random control is carried out to check if the application on soil is correct.

GP7: Grants for connecting the WWTP with the facilities of the Irrigator Communities.

Thanks to the Rural Development Programs, WWTPs are connected with the facilities of the Irrigator Communities. This way, it is avoided discharging the water treated into the water bodies The region of Murcia is a deficit in hydraulic resources and the first measure of offset it is the under-resourced for the crops and through the overexploitation of the rest of the water sources.

The practice is carried out in Irrigator Communities with a water concession, but under-resourced, this way, with the addition of the water reclaimed the irrigation is steadier in the time and there is a slower rural depopulation due to there are many municipalities in Murcia Region in which the agricultural activity is currently producing a lot of jobs.

In the specific case of Murcia Region, that almost the whole water resources proceed from the river Segura basin, which in turn, is usually underneath the theoretical resources conceded, that is why, in some years, the most of the users cannot cover their needs despite of having an enough water concession.

In all those cases, it is offset the difference between theoretical and real resources with the indirect reusing, it means the water discharged into the river, the flow of the river increase and which in turn, increase its real resources, and the agricultural activity takes an equivalent amount of the water treated from the water bodies.

This is like that, because of the necessary high investment for connecting the WWTP to the Irrigators facilities, which the users cannot offset because they have available other water sources that not require any investment for their use.

This practice is mainly addressed to the traditional irrigation, without a guarantee of supply, since the water reclaimed has a higher stability than others water sources, like for example the superficial sources or groundwater.

There are also environmental reasons which support this good practice as reducing the exploitation of the groundwater, which in turn, reduces the energy consumption for its extraction and the pressure on the aquifers.

As an additional support, so far, the farmers are free of paying the additional cost of the necessary tertiary treatment for being able to use this water.

GP8: To Inventory the water treated as water source available in the hydrographic basin

The watersheds which include the water reused resources in their concessionaires catalogues are a rare exception and this only happens in arid areas which barely cover their needs.

With this practice the water deficit is reduced, the resources increased and the exploitation of water sources, environmentally more vulnerable is reduced as for example the groundwater, due to these kind of regions usually also has problems of the high rate of exploitation of their water sources so as to offset the lack of water.

This measure can be useful to prioritize in the future, some water sources more sustainable over the less ones.

Apart from that, due to the demands of the users, the quality of the water treated increases, as well as, a minimization of the waste produced.

Another point is that an optimization of the resources is carried out, letting a better management for the users' scarcity of water.

The following step of this practice consists of giving the rights to the users for utilizing this water and set their conditions in any case. The guidelines which rule the concession are the Basin Plans, approved by Law (or Royal Decree in its absence).

The organism in charge of the control of the concessions and authorizations of the water resources for the users is the Watershed Authority.

<u>GP9 Reduction of the applied fertilizers for the crops controlling the compounds in the water in every step</u>

The practice consists of controlling the chemical composition of the water from the WWTP, the resulting mix after being blended with other water sources (especially the groundwater) and to consider the contained of Nitrates, Phosphates when the fertilization of the crops is carried out.

The problems addressed with this practice are:

1. To reduce the pollution by Nitrates, Phosphates, and others in the soil.
2. To reduce the intensity of treatment of denitrification and removing the Phosphates and other compounds, and then, they are applied through fertilizers to the crops.
3. To add to the water resources the groundwater with high salinity due to the resulting mix with the reclaimed water is considerably less salty.
4. Offset the deficit between the need for water and the real resources.

The control implemented at each step allows to streamline all the factors in the process of reusing, especially reducing the polluting by an excess of fertilization.

Apart from this, one of the worst problems of the region in which Jumilla is placed, is precisely the overexploitation of the aquifers, which in turn, has caused a decreasing of its quality and increasing of its salinity. With this measure, it is possible to make the most of this groundwater, and reduce the exploitation.

Another point is that the Irrigator Community of Miraflores (an organization which manages the water for agricultural use) has a real need of 7.765.000 m3/year and its concession for groundwater of the Watershed Authority of the River Segura barely reaches 4 million m3 per year. This practice helps to reduce the deficit.

<u>GP10: The Smart Irrigation lets the users a complete management of the water reused in every step of the process</u>

This practice is based on the volume control at any point and specifically at the supply point of the farmers.

Water is transported through pressured tubes from the dams to the supply point, being automated by electro-valves which allow the pass or it is cut.

This practice is very suitable in regions with lack of water because allows a water saving very important for 2 reasons, the rate of use by the crops is much higher, and the water losses in the system are drastically reduced in relation to the traditional irrigation since the losses by infiltration and for evaporation are lower.

This system is also very useful at the time of mixing the water reused with the rest of water sources, due to it lets a higher control of the resulting mixture and traceability of the water compounds.

This practice allows the use of waters with less quality in relation to the salinity and to adjust the resulting mix between the different sources so that the quality is suitable for every crop.

This is an advantage for the farmers since helped to reduce the cessation of agricultural activity.

GP11: Co-digestion WWTP sludge with other wastes

The mixture of sludge from WWTP process, with other wastes is a good way to get the increase of biogas production and, therefore, a higher production of electricity that will reduce the energy consumption of the plant and make the treatment process more sustainable.

Another advantage could be the mixture of sludge and waste could get a final product with better properties for the digestate as fertilizer.

Anaerobic digestion is a part of the treatment process where microorganisms break down the volatile matter of the sludge in the absence of oxygen and biogas is generated. This biogas is burned in an engine to produce electricity for the needs of the plant and with the produced heat in the exhaust gases we can maintain the digester temperature in mesophilic conditions. If we mix the sludge with other products (usually wastes) with a high carbons matter, we can increase dramatically the produced biogas. If usually we can get between 40 and 50 % of the plant energy from the combustion of digestion, biogas, if we mix the sludge with other products, the energy consumed will be much higher. Of course we need that disaster has capacity excess. In Molina de Segura WWTP we have been mixing sludge with molasses from factory candies, with a high load of sugar, and the production of biogas increased significantly. The sludge will be increased obviously, but, if the management price of sludge is not very high, the process will be very profitable.
Other experience has been a pilot plant included in a LIFE project (LIFE STO3RE) in which the sludge was mixed with pig slurry. The mixture was treated with cavitation and ozone to improve the hydrolysis stage of digestion.

GP12: Co-digestion of crops wastes for biogas production and use of digestate as fertilizer.

The company KERNEL EXPORT has built a digester to treat anaerobically their wastes. KERNEL EXPORT is a big company that produces, packages and distributes fruits and vegetables from the Murcia Region for all the Europe.

This process needs the application of a cold treatment which requires a high energy consumption, indeed this is the most costly production factor.

On the other hand, in the process, there is a big quantity of wastes that can be recovered. This company takes these wastes and makes a digestion with them, obtaining biogas. They have installed an engine of 370 KW that supplies more of the 40 % electrical consumption in the factory.

Moreover the digestato is concentrated and they get a compost of good qualities as fertilizer and which is applied in their own farmlands. As far as we know the practice is very suitable and sustainable environmentally, being a clear example of circular economy.

Apart from this, according to responsible staff of the company, they are reducing the 40 % of the energy consumption.

GP13: Enhanced nitrogen and phosphorus recovery from wastewater

In wastewater treatment plants Nitrogen and Phosphorus must be biologically and/or chemically removed before the effluent is discharged in order to protect the aquatic environment from eutrophication phenomena. Part of the nutrients removed from the water, remain concentrated in the sewage sludge.

Apart from this, the conventional treatment processes require a huge amount of energy, which represents a negative impact on the environment.

This practice proposes an efficient recovery of nitrogen and phosphorus contained in the wastewater as ammonium salts and struvite.

P is a limited and non-renewable natural resource, and the existing reserves are concentrated outside Europe

The industrial production of N through the Haber- Bosch process has a very negative impact on the environment due to its huge energy consumption

The goal is to recover 40 % of the phosphorus as Struvite and 15 % of the nitrogen as ammonium salts by membrane Contactors. At the same time the OPEX costs of the WWTP will be decreased by 10 % and the reduction in 25 % of the N2O emissions. Part of the project will be to evaluate the agronomical properties of the obtained fertilizers for the target crop due to Phosphorus and Nitrogen are essential elements in the production of fertilizers for agriculture

It´s being developed by a life project (LIFE ENRICH).

GP14: Denitrifying woodchips bioreactor

Drainage of agricultural irrigation has a high load of nitrates proceeding of the fertilizer that the crops do not uptake. Likewise, that high load of nitrates (which in some cases reaches a concentration around 250 mg/l) goes to the deeper layers of the ground, producing eutrophication in water sources.

The high concentration nitrates or its pollution concerns all the Authorities as Local, Regional, National or even European which are in Murcia Region, indeed there is an Action Plan in vulnerable areas so as to limit polluting potential activities as the agriculture.

Especially this is a strong problem in a salty lagoon in Murcia called Mar Menor, where a higher concentration of nitrates in aquifer and lagoon water jeopardizes the environmental health of the lagoon and also the tourism and fishery.

Removes nitrates is not an easy and cheap task, for it some organizations are trying to find viable and efficient systems to reduce the discharged nitrates without negative effects in the environment. Chipwoods bioreactors is a very promising system to get it. Some pilot plants have been installed both in an experimental field of UPCT and Los Alcázares WWTP to study the removal of nitrates from the brine of desalination plants and agricultural drainages. Studies of retention time, type of woodchips, practice design, organic matter in the effluent and so on are being studied and the results are really promising.

GP15: Program to teach the benefits of reused water in schools

The professionals dedicated to water reusings visit the schools to show the children the benefit of reusing the water. Children can play and participate in activities addressed to them so as to learn the importance of the recycling.

PP2 SPECIAL SECRETARIAL FOR ENVIRONMENT - GREECE

GP16: Sewer Mining for Urban Water Reuse

Present water treatment systems are very robust, but do not have the flexibility to deal with changes in climate, demography, water demand, etc. Therefore, wastewater reuse depends highly on the development of new distributed modular and compact systems with the flexibility to quickly react to quality requirements on demand. EYDAP through its participation in two European programs (one FP7 and one HORIZON 2020) applies sewer mining technology. Sewer Mining is a concept that is gaining traction, the end is considered an innovative way to address water scarcity. It extracts wastewater directly from the sewer network treats it on- site and produces water for on-site use.

EYDAP applies the technology by the installation and testing of a sewer mining modular unit for urban green irrigation at the point of demand, which is clearly of direct benefit for the sustainability of urban water management. To address resource efficiency issues in e circular economy context, compost-based eco-engineered growing media are also produced and reused as on-site fertilizers and thermal energy recovery schemes are investigated to minimize the pilot's environmental footprint.

These technologies are applied and tested for the first time in Greece in a real-world application, and the results aim to serve as a significant step towards transferable, modular, scalable and circular solutions.

The main stakeholders and beneficiaries of the practice are water companies, industry, specialized SMEs, applied research institutes, city and regional authorities.

GP17: Expansion and upgrading of a wastewater treatment plant

Expansion and upgrading of a wastewater treatment plant in Crete (Heraklion city) by installing an ultra-filtration membrane system (Membrane Bioreactor - MBR) as well as a UV system to achieve an effluent quality that will allow irrigation of a variety of crops and urban areas, according to national legislation provisions. The main advantages of this practice are the utilization of water coming from the tertiary treatment of the WWTP as well as saving on drinking water.

GP18: Telemetry system for sewage pumping stations in Municipality of Trikala

Planning and installation of a telemetry system for sewage pumping stations in Municipality of Trikala. Technology Internet of Things was used to control basic functions of pumping stations and have a real time information. Helps control the pumping stations remotely.

This technology reduces damage and maintenance costs, avoids unnecessary on-the-spot checks, reduces damage, prevents environmental pollution from overflowing of wastewater. Tt can be expanded to other types of pumping stations, such as those for drinking water.

GP19: Combination of rainwater network and stormwater storage tanks

The project consists of rainwater networks as well as a storage tank of a total volume of 8000m3, with a pumping station for the discharge of storm water to surface waters. The tank is a flood retention tank and the collected water currently discharges to a nearby stream, but future planning is that the collected storm water is used for the irrigation of urban areas. The tank is divided into two compartments; the second one is used during heavy rainfall. The project succeeds concentration of flooding, flood retention time and storage of water of suitable quality for irrigation of nearby urban areas and other uses (street washing, fire extinguishment etc.) as there is a mechanism for the removal of solids in the storage tank. The existence of a separate compartment allows for the preservation of a quantity of rainwater during the summer months. By the end of August the pumps will be able to enter the winter program by fully discharging the tank so that its volume is fully exploited for the flood retention.

PP3 LODZKIE REGION - POLAND

GP20: Ecohydrologic rehabilitation of recreational reservoirs "Arturowek" (Lodz) as a model approach to rehabilitation of urban reservoirs.

The practice implements comprehensive activities based on a complex system approach using the concept of ecohydrology for the restoration of one of the main recreational areas in the city of Lodz. The water reservoirs in the Arturowek place are among the most popular rest and recreation areas of the citizens of Lodz. Not unlike other water reservoirs in urban settings, they are exposed to considerable contamination which significantly reduces the quality of water. Under an EU LIFE+ innovative ecohydrological measures were tested to improve water quality in Arturowek recreational reservoirs. In the period 2010-2011 project implementation included measures to identify the sources of pollution based on an analysis of threats and opportunities. Based on this information a mathematical model was used to develop and then used in 2012 to create a concept of the reservoirs' rehabilitation. This documentation enabled implementation of investment works, which took place between January and June 2013. The work included:

- Construction of buffer zones and floating vegetation mats in 3 of the water reservoirs to reduce the inflow of nutrients from the catchment;
- An Ecohydrological adaptation of upper reservoir in Arturowek to intensify the sedimentation and self purification of water in the reservoir;
- Construction of a Sequential Sedimentation Biofiltration System (SBSS) for retention and pretreatment of stormwater received from Wycieczkowa Street;
- An Ecohydrological adaptation of low-volume water reservoirs to intensify self purification processes of water in the upstream river section;
- Hydrotechnical adaptation of damming structures to reduce the risk of flooding;
- Removal of bottom sediments to reduce the reservoirs' internal supply with nutrients.

In the mid of 2013, the reservoirs in Arturowek were made available for recreational functions. In the period 2014-2015, in the framework of monitoring system the optimization of implementing biotechnical systems was applied to improve their efficiency in elimination of nutrients.

GP21: Integrated chemical-biological textile sewage treatment plant in Biliński Textile Factory

The sewage treatment and closed water cycle project for Fabian Bilińscy was completed in compliance with BAT (Best Available Techniques) for the textile industry (European Commission, 2003).

The BAT guidelines determine the following stages of project work:

1. Characterization and classification of sewage into streams by biodegradability;

2. Design of a treatment system for the relevant sewage streams;

3. Investigation into the feasibility of treated water use in manufacturing processes. The wastewater treatment and recycling system based on BAT implementation (based on BREF TXT) assumes its division into streams with respect to biodegradability. First stream (about 50% of the sewage generated by the plant) is low-loaded sewage with mineral pollution; it is subject to biological treatment. The second stream consists of wastewater whose components could adversely affect the operation of the activated sludge; it is pre-treated with coagulation-flocculation and sent to the municipal sewerage system. The third stream consists of highly salinated waste water from the dyeing process, after being treated by means of electrocoagulation, a brine is created, which is used again in the same process.

The chemical-biological sewage treatment plant has been designed as a system of sequenced treatment stages: filtration, heat exchange, pH adjustment, coagulation, biological treatment and ultra-filtration, and ozone treatment. The sewage treatment plant was also equipped with an oxygen stabilization system for excess sludge. The first stages of processing in the treatment are mechanical filtration and heat recovery. The raw sewage enters an expansion tank with a service capacity of 10 m3, in which irregular sewage discharges are contained and averaged. Next, the sewage is pumped to a self-cleaning filter screen, called a drum interceptor. The drum interceptor separates solids up to 0.2 mm in diameter, which reduces approximately 75% of solid contaminants, approx. 10% of suspended organic contaminants and approx. 10% of BOD5, with removal of grease, sand particulates, and fibers (which are a major pain point for dyeing operations). The downstream module is a 60 m3 tank in which the quality of sewage is averaged and sewage temperature is equalized before discharge to the heat exchanger. This tank is operated in cycles of filling and discharge to achieve optimum mixing of sewage.

The reclaimed water is subject to ongoing manual quality monitoring by laboratory workers who test the water parameters and monitor the performance of biological and chemical sewage treatment plant, which includes testing of pH, redox, oxygen levels and miscibility. An array of probes and meters is operating in an automatic water measurement system.

<u>GP22: Use of DynaSand filters for iron and manganese removal.</u>

The technology applied at the water treatment stations purify the backwash water by separation and densification of sediments. Supernatant water is recycled to the filters. Hence, the backwash water is stripped of heavy pollutants, and a part of the water reclaimed in the process is recycled for treatment. It is estimated that the technology will reduce the consumption of backwash water by approximately 10%. At Męka Water Treatment Station, the water losses from the formation of backwash water during water intake treatment were minimized to 1.5%. At Górka Kłodzka Water Treatment Station, the loss of backwash water were estimated at approximately 5%. The remaining backwash water that cannot be reclaimed are discharged to a combined sewer system. A future objective of MPWiK Sieradz is to further minimize the loss of water in intake treatment and increase the water reclamation rate of the backwash water.

The reclaimed water is recycled back to the water intake treatment process, so its biochemical quality is not separately monitored. Monitoring the quality of reclaimed water is a part of an online quality control of the treated water supply distributed to consumers via the pipeline network.

GP23: Closed-cycled water overflow in Sports Bay

Both pools reuse water by operation of closed-cycled water overflow. Each pool has overflow gutters by which the water splashed out of the pool volume is returned to a tank in the pool basement. The pool basement tanks are covered to prevent evaporation of the contents. The water in this closed cycle is disinfected and filtered with positive-pressure auger filters that comprise a total of approximately 200 cartridges. The water is fed into the filters under positive pressure and treated while passing layers of diatomic earth deposited on the fabric which surrounds the filter auger part. Downstream of the filters, the water is chlorinated with a chlorine compound produced on site with an electrolyser, which forms a salt bridge and chlorine gas from NaCl; this form of delivery is much more efficient than liquid chlorine compounds. Next, the chlorinated water is passed under a UV lamp. The UV lamp provides photo-oxidation-driven disinfection, which efficiently neutralizes and inhibits the growth of bacteria, viruses and other microbes. Finally, the water is recycled back to the pool via a system of piping and pool bottom inlet nozzles (with a total number of approximately 100 units). A pool with a total service capacity of 3,300 m3 has 3 to 4 full water changes a day.

The water lost by evaporation, carried out on the bodies and splashing amounts to approx. 100 m3 a day is replenished from the district mains; this make-up water is already treated (pursuant to the Polish Regulation of the Minister of Health concerning the water supply for indoor pools). The district mains water is not additionally tested. The Łódź Sports Bay pool systems test the water at later stages.

The swimming pool water quality is monitored online.

GP24: Digital Water

The proof of concept (POC) of a solution for detection of conditions favorable to infestation of water with e.coli.

The PoC project for an online monitoring of water conditions was developed in response to a request from an STP (sewage treatment plant). The problem defined by the STP in the request was a missing ongoing source of information about the quality of network water. The turnaround time for the output of water quality data from manual testing was long (an average of one day of sampling to test report) and a small number of quality testing locations. The STP defined a goal of having an online monitoring and assessment of the actual network water conditions, determined by multi-point testing and providing a continuous stream of data about the potential presence of conditions favorable to infestation of water with E. coli.

The processing solution designed by Cybercom in response to the request by the STP is based on an array of sensors which test temperature, pH, water turbidity, flow rate and odor (the water odor is tested by application of ultrasonic detection; no sensors exist which would enable any assessment of the odor of liquids). The PoC system solution features a Wi-Fi module which outputs all water quality test results to the cloud (AWS). A pump delivers water to the array of sensors.

Cybercom based its solution on a predictive maintenance approach: to detect the conditions which are likely to favor infestation of water by undesired bacteria.

PP4 RRAPK – CZECH REPUBLIC

GP25: Botanica K – system of grey waste water management

This best practice describes the system of gray waste water management in an apartment building.

SKANSKA reality is thinking about the future and way how to use water more gently in the residential house area. The first and pilot project Botanica K with the system of gray waste water management was developed by SKANSKA company. SKANSKA is the first company who developed the residential house, where substituted drinking water to treat grey waste water and they used the system for the place, where it made the most economic and ecologic sense – for flushing toilets.

Botanica K residents can be satisfied. They saved 550 m3 in 6 months compared to other residents. Results of research are Botanica K residents happy and more than 75% residents seems that the grey waste water system is very positive and suitable.

Residential house Botanica K was groundbreaking in many ways, because company prepared the project to aim also a high rating for the project from environmental certification BREEAM. The big part of the project was how to reduce drinking water consumption in general. The goals they achieved by installation of economical amateurs that consumption of water was reduced to around 14% and part of the grey waste water from the sinks and showers they recycle and reduce consumption for another 26%. These data had been listed by Petr Dušta, project manager Skanska reality, who was in charge with Botanica K.

The system of gray waste water management – purified bathroom water (mostly from wash basins, bathtubs and showers) is reused for flushing toilets. If gray water from these sources is not enough, the system will supplement it with captured rain of drinking water.

GP26: Reuse of water in a food company for cooling system at vinegar production

Kávoviny a. s. is the regional food company with a long tradition in the Pardubice region. The company´s production is huge and they use systems on one hand with long tradition and on the other one with new technologies.

They started approximately 15 years ago with production of vinegar. During production, one of the phases is the cooling the product. Cooling is carried out by means of so – called cooling towers. A large amount of water is used in cooling, so they close the water cycle and reuse the water to cool the product. They reuse water 20-30 times, that depends on analyze on water quality in the cycle. They use a simple system to treat the water. In the process, they pump water from well, then the water goes to the water treatment reservoir and then into the reservoir. At this moment is water ready to use for cooling. The water circulates in a closed pipe system where it changes its temperature as it moves in the system. For treating water they use water softening salt, UV lamp a sand filtration with hypermangan.

Reuse of water is know-how developed with vinegar production. The idea is to save the water and it is unnecessary to drain the water to the waste system and it is also cost saving.

GP27: Dry Polder, dry protective or retention tank is made for flood protection called Žichlínek

Dry polder Žichlínek is on the biggest in the middle Europe. It was constructed at the confluence of river Sázava and Lukovský stream. The institution in charge is Povodí Moravy and older have been put into operation in 2008.

The tank corridor Česká Třebová - Olomouc passes through the tank. The railway embankment and dams create a barrier that divides the reservoir into two areas, the southern and the northern. However, the levels of the retention space are loosely interconnected over the railway bridge profiles.

Simultaneously with the construction of the dam, both streams were revitalized. Along with the formation of meanders, wetlands and permanent bodies of water were formed at the bottom of the polder. The whole polder area has landscaping and ecological importance.

What is dry polder good for?

It is water work which is more often dry and without water. The polder is filled with water only when it is horrible that the watercourse spills from the banks. The spout is usually set that the water works leaves the so-called harmless flow. This polder is made for "twenty year water". But if the capacity of the polder is full, the water will overflow with the so-called safety spillway. If there will be more water, the worst scenario it can delay the flood.

GP28: Nano filtration unit in the regime stand–by on water treatment in Domašov nad Bystřicí

Nano-filtration unit is in the regime standby to be ready for emergency worsening water quality of raw water, that means it is not working on a daily basis. This unit was installed in Domašov nad Bystřivcí where the river Bystřice make big problem with water quality. Quality of water had been so bad in the river that there had been situated temporary tanks with drinkable water in the villages in the past. Thanks to the nano-filtration technology, we can remove and treat all pollution and supply drinkable and clean water to the residents every day. This nano-filtration treat water from all types of pollution, impurities, color, microplastic and increase the efficiency of removal of drug and pesticide residues. On the other hand, this technology keeps the calcium, magnesium and other beneficial substances in the water. Company Veolia developed this technology in the Czech Republic.

GP29: Lanškoun city – best practice – innovation city

Lanškroun is the city in Pardubcie region, where the mayor – Mgr. Radim Vetchý leads the city and municipality to the circular economy Mayor Mgr. Radim Vetchý leads the city and municipality use the system and ideology of the circular economy. He is very innovative and he focuses on the environment, people and harmony.

In the city they know how to reuse the water, for example rain water.

The more information I will upload soon.

GP30: Hydrogeopark Pátek

Hydrogeologic centrum Pátek was developed to reclaim and restore contaminated groundwater, and to educate, to research and to inform for students, professionals and public Field hydrogeological center is located in the northeastern part of the village Pátek at Poděbrady. Recently, there was a pollution of the rock environment and groundwater by chlorinated hydrocarbons at this locality. This old environmental burden originated in the second half of the twentieth century, when the company STYL, producing degreasing agents and gasoline for lighters, prospered there. The site underwent several stages of surveys, risk analyzes and subsequently decontamination work.

The former contaminated site, which by its existence threatened not only groundwater, but also surface water and was located near mineral water sources, has been successfully undergoing remediation works in recent years. The result is a current situation that complies with demanding legislation and remediation limits for chlorinated ethylene pollution. During the realization of the rehabilitation project, more than twenty hydrogeological objects were created for sampling, monitoring, as well as the actual remediation. In parallel, an extensive and time-lapse collection of hydrogeological, chemical and physical data characterizing the transformation of the site was created. These assumptions led to the emergence of a unique infrastructure for research (Hydrogeopark Pátek, HGP), development and innovation in environmental engineering, with particular emphasis on the management and management of water resources. The extensive network of hydrogeological objects has been supplemented by other, suitably selected for the purposes of simulation of specific processes, their control and monitoring.

PP5 EWA MALTA

GP32: Sewer Discharge Control Unit

Regulatory framework managing effluent discharge into the sewer system.

The "Sewer Discharge Control Unit" focuses on the implementation of a national legislation which regulates the discharge of trade effluents into the wastewater network. Prohibited effluents under the legislation include saline water, fats, animal parts, solvents, materials with a high oxygen demand, heavy metals and other toxic compounds. Hence the unit adopts an upstream approach, aimed at eliminating the entry of hazardous substances in the wastewater stream. This will decrease the total amount of pollution at the wastewater treatment plant, which will reduce pressures during the treatment of the wastewater.

The Unit issues wastewater discharge permits to industrial entities and undertakes direct monitoring to assess adherence to the permit conditions. The capacity of this unit is currently being augmented with the development of automated monitoring points along the wastewater network which will facilitate the upstream detection of pollutants hence ensuring a more effective regulation of the sector.

GP33: New Water - Highly Polished Treated Effluent

A water polishing process using a four-barrier treatment which converts treated water into crop-safe water to be used by the agriculture industry. This proposed best practice gives the agriculture sector a new source of water which is safe to be used for irrigating crops without jeopardizing the health of the consumer or negatively impacting the environment.

The three polishing plants built for the "New Water" project, have the capacity to produce up to 7 million m3 of highly- polished reclaimed water using a four-barrier treatment process entailing ultra-filtration, membrane desalination and advanced oxidation stages, in addition to the activated sludge treatment process in the primary treatment plant.

Water produced from the polishing plants can address around 35% of the water demand of the agriculture sector in the Maltese Islands. This will reduce the dependence the sector has on natural water resources whilst also ensuring a constant supply of irrigation water for crop production throughout the year.

GP34: New Water – Automated Distribution System

An easy to use automated distribution system for the use of New Water (reclaimed water) An innovative water distribution system has been incorporated within the "New Water Project" to facilitate the distribution of reclaimed water for irrigation use. These water distribution hydrants are distributed across the local agricultural land in such a manner that the need of pumping is minimized as distribution is mostly done by the use of gravity which aids in reducing the energy required to maintain this practice.

Access to New Water from these hydrants is enabled by using an electronic card which the users are registered to. The card registers the volume used by the single user, enabling the application of a tariff system aimed at ensuring efficient use of water. The distribution network is being further extended to reach further agricultural land in the proximity of the respective New Water plants.

GP35: Sant Antnin- Moving Bed Biofilm Reactor

A Moving Bed Biofilm reactor (MBBR) allows the treatment of wastewater to be done with a reduced energy consumption.

A Moving Bed Biofilm Reactor (MBBR) utilizes bio media within the bioreactor with a very large surface area to allow microorganisms to attach to the media for the removal of dissolved organic matter and nutrients. This system is more compact and is able to increase the capacity for nutrient removal in traditional plants. The implementation of the MBBR will require less space when compared to the activated sludge system while also increasing the effectiveness of the sludge retention time and a decrease in cost from energy consumption.

GP36: Pwales – MAR Managed Aquifer Recharge

The Managed Aquifer Recharge (MAR) scheme will involve the intentional recharge of the Pwales coastal aquifer located in the north of Malta. The Pwales aquifer is an aquifer with a low-qualitative status due to high salinity and nutrient concentration, which makes the water unsuitable for most irrigation purposes. The initial step of the MAR scheme involves the investigation of the hydro-geological characteristics of the area. This is followed by the design and installation of the MAR scheme. An important component of the project is the monitoring of the water quality and level before and after the implementation of the MAR scheme. Recharge will be carried out using high-quality reclaimed water (New Water) obtained from the Polishing plant during periods of low demand for this water. The objective of this project is to improve the status of the Pwales groundwater body and make it available for the agriculture sector.

PP6 FLA ITALY

GP37: CSO-CW for Carimate WWTP

The centralized WWTP of Carimate treats the wastewater from the combined sewer serving 11 towns in Como province (70,040 inhabitants). The Water Utiliy (Sud Seveso Servizi spa) wants to further reduce the pollutant load discharged in the Seveso River by treating also the combined sewer overflow (CSO) upstream the WWTP. To this aim, a constructed wetland for treatment of combined sewer overflow (CSO-CW) was designed by IRIDRA. The CSO-CW is a two-stage system. The first stage comprises two VF CW beds, each one further divided into 2 separated hydraulic sectors for a total area of 8500 m2. The second stage is a free water surface (FWS) CW of 4500 m2. The system is fed by a pumping system and automatically regulated by a PLC to properly treat the first more polluted fraction of the CSO events. The CSO-CW is able to intercept up to 500.000 m3/year (about 58% of the total estimated average CSO volume per year) and a COD load of 60 tCOD/year (about 60% of the total estimated CSO COD load per year). In other words, the CSO-CW is planned to intercept a pollutant load of 7700 p.e. (expressed in terms of COD), which were previously discharged untreated in the Seveso River. The maximum exploitation of CW ecosystem services is planned thanks to the FWS stage, which also aims to increase biodiversity and to recreate an area suitable for environmental educational activities. The riparian area along the left side of the Seveso river is planned to be involved in river restoration activities, with plantation of vegetation more suitable for riparian environments.

GP38: Water reuse at the building level – Condminio di via Sassetti

Renovation of the condominium in Via Sassetti in Milan, in front of the new building of the Region and next to the registry office of the municipality of Milan. The condominium has been renovated following the philosophy of energy saving.

To reduce water consumption, a gray water and white water recovery system has been installed: water from the shower, washbasins and bidets, and rainwater.

Through different levels of filtration and sterilization, it is cleaned of pollutants, returning to a state suitable for subsequent re-use, for example for garden irrigation, cleaning of areas around the building and toilet flushing.

The biological-mechanical filtration process does not require impacting chemical additives.

With the system for reusing both white and gray waters, there is a 50% reduction in drinking water consumption.

The treatment system is characterized by its compactness, and because it is pre-assembled in the factory, installation in this way is easier and safer. The machine is designed for low maintenance and low operating costs, thanks to the automatic counter-washing system and easy access for maintenance.

The technology used for fine filtration (ultrafiltration, in vessels with filtering microtubule filters) allows a longer duration of filtering capacity and maintenance of flow rates. The positioning of the parts subject to maintenance is accessible and easy to check. The pumping systems are managed with inverters, to improve performance and lower consumption. All this to guarantee a constant supply of recycled water without complicated operations and performance losses, as happens with other types of plant.

GP39: Milano-San Rocco WWTP

The Milano San Rocco municipal wastewater treatment plant, which handles wastewater for a population equivalent of 1,050,000 is a facility of prime importance in Milan, improving the city's environmental quality and conserving its water resources. Located in a protected agricultural estate south of Milan, between the districts of Rozzano and Opera, the plant is fully compliant with the principles of sustainable development. Its versatile structures can accommodate exceptional storm water loads and practically all the treated water can be reused for farm irrigation

The plant's strongest point is the simple design of its treatment process. The activated sludge technology adopted is a tried and tested method already used in many facilities. In this specific application, it is further optimized by a biological treatment stage (step feed and alternating zone processes). With this solution, treated water not only significantly exceeds the requirements of current regulations but is also in line with foreseeable legislative changes. The final step in the treatment chain, disinfection by ultraviolet radiation, produces water suitable for agricultural irrigation at a rate of 14,400 m3 /h in the dry season, making a significant contribution to water resource conservation. Treating the water to higher quality levels allows the WWTPs to discharge in the water bodies connected to the irrigation network without compromising the agricultural practices or forcing the farmers to adopt different water sources (drinking water or groundwater).

Therefore the farmers located in this area can continue the local tradition of using water coming from the widely spread and well-maintained channel network without risking to use polluted water and saving costs. With this solution, treated water not only significantly exceeds the requirements of current regulations, but is also in line with foreseeable legislative changes. The final step in the treatment chain, disinfection by ultraviolet radiation, produces water suitable for agricultural irrigation at a rate of 14,400 m3/hr in the dry season, making a significant contribution to water resource conservation.

GP40: Milano-Nosedo WWTP a European Best Practice

The Nosedo municipal WWTP is the first and the biggest plant serving the city of Milan (Italy), it purifies about 50% of the total urban sewage, corresponding to a treatment capacity 1,250,000 p.e. and an average flow of 5 m3/s. Since the design stage of this plant, a great attention has been paid to some aspects of energy efficiency as, for example, choosing equipment with inverters, installing a fine bubble aeration system with high efficiency in oxygen transfer and dO2 probes, to monitor and control the oxygen concentration in each biological treatment line. In 2012 the Nosedo WWTP recorded an average consumption of energy corresponding to 0.266 kWh/m3 of treated wastewater, this value can be placed in the low range of similar data reported in literature (Campanelli M. et al., 2013) also if the values available from different publications indicate a quite variable specific energy consumption for WWTPs, depending on the plant size, the geographical location, the characteristics of the incoming water and the type of treatments. From this side, it's also worth noticing that the WWTP of Nosedo has biological steps of oxidation – nitrification with high sludge age, tertiary treatments of sand filtration and high level disinfection (bacteriological limits for the discharge are those imposed by the Italian D.M. 185/2003), that are considered notoriously more energy demanding compared to less advanced treatments (Metcalf & Eddy, 2006). In addition to this very good starting condition, in the year 2012 the company in charge of the plant's operation & maintenance, the Vettabbia S.c.a r.l. (which has among its contractual obligations a rational use of energy) has started a virtuous process for improving energy efficiency.

GP41: Constructed Wetlands Gorla Maggiore

Gorla Maggiore is a municipality of ca. 5000 inhabitants in the Lombardy Region, northern Italy. The mean household annual income is around 29,120 €; and the population economically active is 54%. The green infrastructure consists of a set of constructed wetlands (CW), surrounded by a park on the shore of the Olona River in an area previously used for poplar plantation. It includes a) a pollutant removal area with a grid, a sedimentation tank and 4 vertical sub-surface flow CW; b) a surface flow CW with multiple roles, such as pollution retention, buffer for flood events, maintenance of biodiversity and recreation; and c) a recreational park with restored riparian trees, green open space, information panels, walking and cycling paths and other services. The whole surface area is 6.5 ha.

The experimental case study is located in Gorla Maggiore, Italy (46◦N, 9◦E). The CSO-CW has been designed for different multidisciplinary goals: (i) treating first flush according to Lombardia Region law (50 m3 per hectare of impervious surface of catchment served by sewer network); (ii) partially treating the second flush; (iii) storing the second flush for hydraulic protection of the receiving stream (Olona river); (iv) increasing biodiversity; (v) provide a recreational area. The impervious surface interested by the sewer (2017 person equivalents served) and the first flush volume in this case has been estimated at 20 ha and 987 m3, respectively

PP7 OOWV – GERMANY

GP42: Alternative resources for agricultural irrigation

Uelzen is a region with an intensive agricultural use and a high demand of irrigation water. For the stabilization of the groundwater balance in the Uelzen region, the following basic measures have been examined and implemented in large parts:

- Increase in groundwater recharge, especially through forest conversion, storage of elevated runoff (floods, heavy rainfall) in the area.
- Use of clear water from sewage treatment plants (350.000 m³/a): a monitoring well is build, all authorities and stakeholders participate in an annual round table.
- Use of production (waste) water from a sugar factory (> 1 million m³/a): In 2002/2003, the Uelzen sugar factory and the Uelzen water and soil association set up the first of 4 water reservoirs in the Uelzen district to collect the water quantities produced during the beet campaign. The water is warm, rich in nutrients (especially potassium) and hygienically safe (controlled by the Lower Saxony Office for Plant Protection regarding phytosanitary pathogens).

These reservoirs enable the reuse of 1,4 Mio m³ per Year. The reservoirs are filled up during the campaign with pre-cleaned with water and this is then used for field irrigation in the following year.

Since the water surface is an attractive attraction for waterbirds, the water reservoir has developed over the years into a magnet for many species.

GP43: Indirect water reuse in a partly closed water cycle (Hessisches Ried)

The Hessian Ried is of great importance for the production of drinking water in the Frankfurt Rhine-Main and Rhine-Neckar metropolitan regions. Although the Ried only covers around 5 % of the state's surface area, almost 25 % of the drinking water in Hesse is extracted from the groundwater of the Hessian Ried - due to the hydrogeological conditions. The Hessischer Ried has a special water management and hydrogeological situation. This is characterized by cover layers with a high permeability and by low-runoff and heavily polluted watercourses, some of which infiltrate the groundwater. Trace substances such as pharmaceuticals, household and industrial chemicals, pesticides and biocides enter the flowing waters of the reed via the wastewater. These trace substances are only partially retained by the cover layers and thus enter the groundwater.

Due to the use of the groundwater for drinking water production and agricultural irrigation, the water management situation can be described as a regional water cycle closure. For this reason, the state government has initiated a strategy to reduce the material pollution of the flowing waters in the fen, by means of suitable measures and thus, in accordance with the Water Resources Act (WHG), to ensure both the manifold functions and uses of the water bodies in the future and to protect the groundwater resources in the fen in the long term. Central elements are the system-wide optimization of the sewer networks as well as the equipment of selected sewage treatment plants with more extensive wastewater treatment in order to minimize the input of trace substances via the watercourse - groundwater path in a targeted manner.

GP44: MULTI-ReUse 1 – Technologies for Water ReUse

The main task of MULTI-ReUse was the development, demonstration and evaluation of a modular water treatment system, in order to offer service water in different qualities and volumes for the different purposes and to competitive prices.

The following process chains were tested in the pilot plant:

1) Ultrafiltration – Desinfection
- Water quality: free of undissolved substances and pathogenic germs; still contains dissolved nutrients and organic trace substances.
- Uses: industrially for washing processes (e. g. street cleaning) or for cooling processes with little requirements (e. g. regarding the concentration of dissolved salts).

2) Ultrafiltration – activated Carbon filtration – Desinfection
- Water quality: free of undissolved substances and pathogenic germs; concentrations of nutrients and organic trace substances are considerably reduced compared to water quality 1. This increases the microbiological stability of the water (lower growth potential during storage and distribution
- Uses: Industry: cleaning or cooling processes with higher quality requirements; urban or agricultural irrigation purposes; MAR.

3) Ultrafiltration – Reverse Osmosis – Desinfection/Stabilization
- Water quality: free of undissolved substances and pathogenic germs; minimum in the concentration of salts and organic trace; a maximum of microbiological stability
- Uses: MAR; process water for a broad spectrum, e. g. for the production of ultrapure water or as mixed water for dilution purposes

GP45: MULTI-ReUse 2 – Monitoring in Water ReUse

Risk management and monitoring are central issues for water reuse. In MULTI-ReUse we tested online and offline analysis methods as well as conventional analysis and innovative methods. The flow cytometry allows to measure both total and intact cell populations online and offline. Flow cytometry offers fast and reliable determination of bacterial cell numbers in the field of monitoring water reuse processes. Based on the fact that the detection isn't based on the cultivation of the bacteria, the entire bacterial population in the water is measured independently of their growth requirements. While traditional hygienic indicator bacteria, such as Coliforms, intestinal enterococci or Clostridium perfringens are typically not detectable after membrane filtration and total colony counts are only available after 2–3 days, flow cytometry offers a sound database for the microbiological assessment of the efficiency of different water treatment steps. Information about the actual microbiological status of a water sample, i.e. about the total and intact cell concentration, is supplemented by information about the microbiological growth potential and therefore indirectly about the assimilable organic nutrients contained in the water.

"Reverse Isotope Labeling" (RIL) is a new method to determine the biodegradable dissolved organic carbon (BDOC). The new RIL method provides a sensible and easy to handle method for the determination of the BDOC and delivers comparable results with precise specifications of concentrations. The RIL procedure measures the degradation of carbon sources, i. e. DOC in the water and therefore indicates the BDOC. Hence, it measures the biological stability of the treated water and indicates when the BDOC reaches levels where measures for risk minimization need to be taken.

GP46: MULTI-ReUse 3 – Communication in Water ReUse

In order to transfer knowledge towards water reuse to the different target groups, MULTI-ReUse used successfully different communication methods:

- Learning Expeditions
- Dialogue Events
- Touch Table
- Fact sheets
- Image film
- Articles in journals

Participants of the events as well as the regional press show a great interest in the project. In addition, these measures also successfully addressed the issue of reuse at national level

Communication is a key issue for reuse projects. Authorities, users and future consumers have to trust in the water quality of reuse water. With this project, future reuse project can learn how to communicate with different stakeholders

PP9 BALTIC COAST – LATVIA

GP47: Water protection measures in forest management

The practice includes a set of measures implemented in forest management to reduce the harmful effects of logging, site preparation and drainage system maintenance. Creation of ponds is important in terms of direct water re-use, as they store water for firefighting purposes. Riparian buffers, overland flow areas and PFC dams contribute to the water re-use indirectly, as they reduce the amount of N, P, suspended solids and Hg enters the water bodies from forest areas.

Surface flow constructed wetland for nutrient retention from agricultural catchment

Constructed wetlands are implemented to improve water quality, to offer a habitat for biological diversity support in simplified, uniform areas and also as water storage for water reuse in dry summers. The pilot object in Latvia was built at intensively used agricultural area to retain nutrients and suspended solids. The main practical benefits are a nutrient amount retained in artificial water bodies and a knowledge based on scientific studies and monitoring data in pilot sites. The stakeholders, including farmers and legal beneficiaries, can use a good practical advice. The pilot site constructed wetland demonstrated a good example in reuse of water recourse as providing irrigation from wetland as a water reservoir during dry periods of a year. Wetland capacity served to reduce flooding risks in adjacent areas during spring flood or heavy rains.

GP48: Rainwater reuse for car washing

The company Latvian Road Maintainer (LAU) manages state roads. Roads are covered with salt and sand in the winter and graded in the summer. The car's equipment is dirty and should be washed regularly. Rainwater is a great resource that can be collected and reused. LAU has installed rainwater treatment plant. Collected rain water is used for car washing. Collected rainwater can be reused several times. Rainwater treatment plants are regularly cleaned. Not just rainwater is reused for washing cars, but also accumulated sand is reused in the winter season for road coverage. Reusing rainwater for car wash also have not just environmental benefits, but also economically - the company savings on drinking water (was used for car washing before rainwater treatment plant installation) are 4089 EUR per six years.

GP48: Bioswale at the SPICE Home shopping center parking lot

Bioswale at the shopping center Spice Home parking lot exemplifies an innovative (in Latvian terms) approach to stormwater management as a successful example of green blue infrastructure. Stormwater collection in Bioswale offers multiple functions/benefits also for water reuse: groundwater recharge, landscaping function, stormwater runoff attenuation before restricting discharge into sewer network, stormwater treatment by plants and soil, space for snow storage during winter.

GP49: Green and blue corridor in Skanste neighborhood of Riga city

Green and blue corridor in the Skanste neighborhood near Riga Centre will be multifunctional green and blue infrastructure servicing the area of total size around 100 ha and offering multiple ecosystem services including stormwater collection, stormwater reuse for purification and use for passive and active purposes.

GP50: Water reuse in plastic pipe manufacturing process

Evopipes is a Modern and innovative producer of piping systems for cable protection and liquids and gas, including water supply and sewerage infrastructure. The company manufactures plastic pipes through an extrusion process. Water used in production processes, in particular cooling is reused multiple times, thus reducing total water use.

Evopipes company manufactures plastic pipes through an extrusion process. The production process, especially cooling of the extrusion equipment, requires a lot of water. The total water consumption for production purposes of the plant is between 500 and 750 cubic meters per day, which is around 200-250 thousand cubic meters per annum. To stay competitive and sustainable, the company needs to keep fresh water abstraction to the minimum. Thus, the company has found and implemented innovative technology allowing reuse of water in the manufacturing process.

The water in the production process is included in the closed cycle. The water is filled into a 25m3 reservoir/tank, from which it is cycled through the production plant and equipment cooling system. The mentioned volume of water is reused/recycled 25-30 times per day, amounting to the total consumption between 500 and 750 cubic meters of water per day. This process is repeated for around 4 months. In such way the single volume of water is recycled between 2500 and 3500 times. In order to make it possible, a special 3D TRASAR™ technology by Nalco company is used that employs a mix of chemical additives to water that limit scaling and corrosion of plant equipment and fouling (microbiological contamination) of water. Water quality is monitored continuously by the automatic process and chemicals are added only in case the water contamination reaches a certain threshold and until the water reaches necessary quality. After use for the mentioned period, the water is changed and the used water is settled for a period of several days, in order for the active chemicals in the water (including biocides) to partly biodegrade and the water to become safe for discharge into the environment. After that the used water (around 90 m3 per year) may be safely discharged into the environment where the remaining chemicals fully biodegrade or the water may be handed over to the municipal wastewater treatment plant.

The main stakeholders are the company that recycles the water. Beneficiaries include all residents of the Jelgava city who use aquifers from which the water is abstracted.

PP10 MUNICIPALITY OF TREBNJE – SLOVENIA

GP51: Nanoremediation of water from small wastewater treatment plants and reuse of water and solid remains for local needs – LIFE RusaLCA

Large-scale communal wastewater cleaning devices, with extensive drainage networks and expensive pumping-stations, are, in the case of small settlements, particularly those which are thinly spread out, financially unfeasible. In such areas a sustainable option is the construction of small-scale wastewater treatment plants, which need to be of the kind which treats water as a renewable resource.

This can be done as follows: Water originating from small, biologically-based treatment plant is not released into surface water channels, but is additionally cleaned by means of an innovative technology which makes use of nanoparticles of zero-valent iron. The first step is nanoremediation, the second step is the oxidation and the third step is ion exchange and filtration. By means of this process water was made available for households and common purposes. This water was brought to local users by means of a reverse loop. Although it satisfies the requirements for drinking water, the water is used for the watering of gardens and similar areas, for the washing of cars, as water for the needs of firefighters, and for similar purposes.

The development and construction of a prototype waste water treatment system in Šentrupert, Slovenia enabled the reuse of treated water for secondary purposes in households and for common public needs. Another important objective of the project was to use the organic sludge from SWTP, and the sediment from nanoremediation tank, in different types of construction composites. The sludge was during project used as a resource for the production of Geotechnical composites, whereas the sediment was used in cementitious composites.

The project also aimed at the dissemination of knowledge and good practice among the technical and lay public. A fully-operative pilot system using a reverse loop is, together with the establishment of a system for the management of zero-waste water, a good example for other thinly-settled areas, as well as for settlements in areas that have similar geographic and climatic characteristics as it is the case of Slovenia.

The water reuse technology was implemented between 2013 and 2016 within a scope of the LIFE RusaLCA project: Nanoremediation of water from small waste treatment plants and reuse of water and solid remains for local needs. After the end of the project, Municipality of Šentrupert and Municiapl Public Services of Trebnje are in charge of it.

GP52: Degradation of pharmaceuticals in wastewaters from nursing homes and hospitals– LIFE PhramDegrade

The systemic control of pharmaceuticals in waters remains unregulated in the EU, despite the European Commission's proposal in 2012 to restrict three most common pharmaceuticals in water. Among the most frequently found chemicals related to medicines such as endocrine disruptors, antibiotics, along with the remains of painkillers and tranquilizers.

Pseudoendocrines are now classified as substances of very high concern and are addressed in the EU REACH Directive. They are also considered as important pollutants, according to the Water Directive. Although the concentration of most drug residues found in water bodies can be considered low, it is known that due to their high biological activity and tendency to bio-accumulate, their continuous and increasing presence represents a new and dangerous type of environmental pollution and health hazard. Common biological wastewater treatment plants are usually insufficiently equipped to treat pharmaceuticals and sometimes produce metabolites that are often more problematic than the pollutant treated.

The LIFE PharmDegrade project's main aim was to introduce an efficient and financially viable technology for the removal of pharmaceuticals (PH) from the effluent of wastewater treatment plants. The project technology was based on the advanced oxidation processes (AOP) associated with electrochemical degradation of PH, using different electrodes (graphite electrodes, mixed metal oxide electrodes and boron-doped diamond electrodes). The project aimed to demonstrate this technology on a sufficiently large scale to fully evaluate its effectiveness and economic viability. The aim was to demonstrate a solution that is applicable to all wastewater containing PH and other persistent substances, which also include wastewater from old people's homes and hospitals in the EU. Furthermore, the technology was shown to be flexible, suitable for different applications, with low maintenance costs and high efficiency.

The LIFE PharmDegrade project created a pilot plant to demonstrate a novel technology using electro-chemical oxidation for the removal of pharmaceutical residuals from the effluents of wastewater treatment plants.

<u>GP53: Adding sustainability to the fruit and vegetable processing industry through solar-powered algal wastewater treatment – LIFE PhramDegrade</u>

The LIFE ALGAECAN project (LIFE16 ENV/ES/000180) promotes the fulfillment of important directives and EU priorities, such as the Water Framework Directive 2000/60/EC, the Directive 1999/31/EC on the landfill of waste, Directive 2008/1/EC on the integrated prevention and pollution control (IPPC) and Directive 2009/28/EC on the promotion of the use of renewable energies in the European Union.

Europe is the world's second largest producer of fruit and vegetables; this fruit and vegetable processing (FVP) industry is one of the largest industrial sectors in Europe in terms of production, growth, consumption, and export. The LIFE ALGAECAN project proposes a sustainable treatment model of high loaded and salty effluents that combines cost-effective heterotrophic algae cultivation with spray drying of the collected microalgae to obtain a product of commercial interest as raw material for the production of biofertilisers, animal feed, bioplastic, etc.

The technology to be applied in the project is an innovative concept for wastewater treatment, reuse and resource recovery to obtain a high quality water stream and reusable. The treatment proposed for high loaded and salty effluents is simple, from a technological point of view, with low costs associated with the treatment (both process and energy) and it would be carried out in-situ. The prototype will be powered by renewable energies (solar energy supported by biomass), which will minimize the carbon footprint and operating costs of the process. The final effluent quality will be very high, allowing reuse for equipment cleaning and irrigation purposes.

During the project execution specific stakeholders from target sectors (FVPI, animal feed and fertilizer industries, policy-makers, etc.) will be engaged to ensure the fulfillment of the above mentioned objectives.

GP54: AquaLink monitoring system for water network efficient

Fresh water is vital to life on Earth and is a human right. Only 2,5% of all water on Earth is potable. Population is continuously growing and because the human impact on the natural environment is increasing, fresh water resources have become essential to human life and to all life on Earth. According to the World Bank only 65-85% of all pumped water reaches the final user.

The remaining 15-35% is lost in the water network inefficiencies. The main mission of water distributors, mainly public utility companies, is to enable their customers to live in a clean and healthy environment, so it is essential that they are acting responsibly in regards to the natural environment and its resources.

AquaLink system is an expandable monitoring platform that enables the public utility companies to gain control over their water network in a simple and effective manner. The system is composed of hardware and software incorporated into three main elements. Am a self-powered device developed to be connected to the third party instrument for measuring flow, consumption, temperature, pH, pressure, moisture,... Integrated communication that transmits data (global SIM card, GPRS and WiFi) and AquaWeb server that includes a wide range of data services and applications (including two way communication, alarm setting, closing the valve). The installation of the field devices is simple and user friendly as it does not require any power or communication infrastructure. It is designed to be easily installed into existing water networks without modification.

Adding different models of AquaLink devices to the system enables the monitoring of districts meters, the pressure in the system, the level of waters in holding tanks, pH and chlorine values, temperature of tank and pipe water, and much more.