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REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA



My Autobiography

*Anxiously waiting to make my
physical appearance*



February 2022

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Preface

Reclaimed municipal wastewater is considered as a valuable non-conventional water resource (NCWR). Unfortunately, a substantial number of wastewater treatment plants installed in the Mediterranean region have proven unsuccessful copies of western-based treatment system concepts. Besides their high operational and maintenance costs, these systems are often unsuited to address the local challenges of wastewater treatment. As a result, treated municipal water is commonly underexploited throughout the region. To address these challenges, AQUACYCLE is set to bring an eco-innovative wastewater treatment technology that will consist of anaerobic digestion, constructed wetlands and solar treatment for the cost-effective treatment of urban wastewater with minimal costs of operation and maximum environmental benefits.



Anaerobic digester



Constructed Wetland



Solar Raceway Pond

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By way of introducing myself

AQUACYCLE Log November 2019

My name is **AQUACYCLE** which you may mistakenly interpret as a means to cycle across water, although I will indeed be criss-crossing the Mediterranean Region, as my creators hail from Greece, Lebanon, Malta, Spain and Tunisia.

So, I rush to explain that my envisaged destiny is a rather more noble one, as shown in this graphic illustration.

In my physical appearance that is foreseen in Lebanon, Spain and Tunisia, I will be able to showcase how to deliver more water than that which is brought by the natural hydrological cycle. The acute water shortage in our region is well-known, and the vagaries brought by climate change make for a rather gloomy future ahead.



Figure 1: Poster announcing my mission

So, my timing to bring an additional source of fresh water through the treatment of domestic wastewater could not have been more urgent.

You may be thinking – hold on, what’s new about all this?

You will soon be able to read up more on how I will be taking advantage of the abundance of solar energy, not least to make such treatment more cost-effective compared with other technologies, and through my functioning also as a new biodiversity habitat that remains not only respectful of the natural environment but brings maximum environmental benefits.

Landed in Thessaloniki

AQUACYCLE Log December 2019

My very first journey took me to Thessaloniki which is considered the cultural capital of Greece for its festivals, events and vibrant cultural life in general.

Yet, before I had the chance to explore the city I was rushed to the Centre for Research and Technology Hellas, better known as CERTH, where I was to be officially launched.

In his welcome address, Mr. Vasilis Gavrielides, representing the National Contact Point (NCP) of the ENI CBC MED programme in Greece, congratulated my creators from Greece, Lebanon, Malta, Spain and Tunisia, and went on to augur that I would bring:

“a real opportunity to bring as much as possible added value towards environmental protection and sustainability, not only for the benefit of the 5 partner countries directly involved in the project but also for the Mediterranean area as a whole.” Mr. Vasilis Gavrielides

Prof. Anastasios Karabelas (CERTH), my Coordinator, concurred that I had been conceived to address key economic, social and environmental sustainability concerns that are indeed relevant across the Mediterranean Region as a whole:

“We are faced with a general economic slowdown which is driven, among other, by a reduction in investment and is leading to a lack of sufficient employment opportunities.” Prof. Anastasios Karabelas

Prof. Karabelas went on to explain that the investment in wastewater treatment infrastructure continues to be sorely lacking with as many as 40% of cities with 2,000 to 10,000 inhabitants not connected to any wastewater treatment plant in the Mediterranean area, and reiterated:

“If we are to succeed, we need to prepare the ground for investment in the new technology AQUACYCLE brings along, as a means to increase employment opportunities and stimulate the long-term endogenous economic growth”. Prof. Anastasios Karabelas

Of course, I felt proud to be introduced with such noble intentions, but at the same time, it crossed my mind whether I was really going to be up to fulfilling all of these truly ambitious expectations?

Listening in to what each of my creators will be able to bring to my further development in terms of expertise and resources, as well as a visit to the fascinating research that is being conducted at the CERTH laboratory facilities did a lot to restore my confidence. I invite you to watch this brief compilation¹!

I was overjoyed when I learned that I would be leaving for Rome to meet other members of my extended family already on the very next day.

That left very little time to explore Thessaloniki, but an evening stroll along the waterfront was not to be missed!



Figure 2: Celebrating my launch in Thessaloniki

¹ <https://youtu.be/c7Jt8vgWGF8>

Meeting my family in Rome

AQUACYCLE Log January 2020

I was overjoyed to meet so many of my family members on the occasion of a Training for Lead Beneficiaries event organized over two days in Rome.

It was still dark when we had left Thessaloniki on our way to Rome via Athens, and yet, we only made it on time for the ice-breaking session... by skipping lunch.

To begin with, all my family members that had gathered at the Angelicum Congress Centre in the very heart of Rome were asked to be introduced to one another in just 30 seconds!

My project manager, Dr. Konstantinos Plakas from CERTH was among the very first to step under the clock in which these 30 seconds ticked away mercilessly, but as I was holding my breath, I must admit he did a rather brilliant job at introducing me!



Figure 3: My project manager introducing me to my family in 30 seconds

In the interactive weaving session that followed, it came as no surprise that I was firmly bonded with the closest of my family members: **MEDISS**, **MENAWARA**, **NAWAMED** and **PROSIM**. We proudly have in common the emblem that shows **a water drop in emerald colour** to signify we have water efficiency at heart.



Yet, by the end of the weaving session, not a single member of my family present for the event was left out. This was weaving at its best, and a great opportunity for networking among all our respective creators!



Figure 4: Getting to know each other through an interactive weaving session

Among the trainers at the event, a clearly widely travelled journalist in the Mediterranean Region and beyond, delivered an emphatic plea on the importance of adopting a story telling approach when communicating... so I can safely admit that it gave me the idea to take her message literally ... I am bringing my story here to share it with everyone!

Alas, there was again little time for proper goodbyes. Instead, I found myself rushed off to Fiumicino airport where I was to board the early evening flight to Malta. I could vouch another activity must be taking place on the archipelago in the centre of the Mediterranean which is calling for my presence, but for sure it was kept a secret from me for the time being.

In the meantime, most welcome if you wish to share my Rome photo album² with colleagues and friends!

² https://youtu.be/59UzrK_lwTo

Meeting my extended family in Malta

AQUACYCLE Log January 2020

Having arrived in Malta from the Training event in Rome, I learned that I was brought here to now also meet members of my extended family.

Indeed, aside from my nearest kin that are being funded under ENI CBC Med Programme, I was to meet up with relatives that receive funding from the Interreg Europe as well as the Interreg Italia-Malta Programme.

The event was organized in celebration of projects that involve Maltese entities under these respective EU funding programmes.

In his introductory address, the Hon. Dr. Aaron Farrugia, Parliamentary Secretary for European Funds, stated that:

“The territorial cooperation programmes on a European and Mediterranean level will in the future assist the country in the ongoing ecological transition.” Hon. Dr. Aaron Farrugia

I could not agree more with this aspiration. As you can observe from the poster announcing my mission in the first entry of my log, I am firmly rooted to bring along much needed eco-innovation, driven by a process a participatory water governance, and which are jointly destined to deliver sustainable development and economic growth to the Mediterranean Region.

Then the time arrived for the presentation of the award certificates to each of us. There must be something about my name starting with an ‘**A**’, as my name was called out first, just like my name appears first among my relatives on this ENI CBC Med website.

During the coffee break I sneaked out for a rest by the poolside of the resort where the event was held, and left my Maltese representative to follow the training event that followed. The topics of ‘First Level Control system in Malta’ and ‘Quality checks held by the Financial Control Unit’ sounded too daunting a challenge, not least after my several back-to-back journeys criss-crossing the Region.

I much enjoyed watching the presentation of the award certificates again as part of the day’s news broadcast on TVM, Malta’s national television station.

Keen to hear how the Maltese language sounds? Here is the link to the write-up in English and short video clip of the event³!



Figure 5: Joining the awards presentation in Malta



Figure 6: My award certificate to my co-creators in Malta

³ <https://www.tvm.com.mt/en/news/maltese-entities-presented-with-certificates-on-successful-european-funds/>

Listening in to interviews with water stakeholders in Lebanon

AQUACYCLE Log April 2020

Listening in to stakeholders' needs and expectations in Lebanon's wastewater treatment sector brought into focus stark realities on the ground and the real needs my creators will be expected to integrate into my physical design in the coming months.

I invite you to watch this short video clip⁴, and to read the transcript of the interviews that were conducted by my promoters in Lebanon, Prof. Mohamad Khalil and Prof. Ahmad EL Moll from the Faculty of Engineering at the Lebanese University in Tripoli.



Figure 7: Listening in to stakeholder interviews in Lebanon

A colleague Professor and researcher at the Lebanese University, Dr. Imad Kasaa, points to the challenges faced in Lebanon's water and sanitation sector:

⁴ <https://youtu.be/uFZTHTcWFvY>



“The reality of the water situation in Lebanon is very painful. Here in Lebanon, waste streams from sanitary facilities, laboratories and factories, go directly to the sea, without any treatment, and this hurts a lot.”

Dr. Imad Kassaa, Professor and researcher at the Lebanese University, director of the Francophone Agency for the AUF in the Middle East and the Francophone Digital Center in the north.

Dr. Kassaa further explains that aside from the microbial diseases this brings, there is a much greater problem with heavy metals and chemicals which go into the sea. Animal health is in danger and even any water that is drunk in Lebanon may be contaminated with these substances, whose symptoms do not appear but later like in the form of cancerous and chronic diseases.

Prof. Monzer Hamze reiterates to having conducted studies over many years in the Akkar plain, which is one of the most important agricultural plains in Lebanon, from which he draws a sobering conclusion:

“We can say that 100% of the water sources used in the irrigation process are highly bacterial contaminated.”

Prof. Monzer Hamze, Head of the Microbiology Laboratory for Health and Environment and a member of the Administrative Board of the Tanmiya association.



Eng. Mohamed Nour Al-Ayoubi informs that the (sewerage) network in Lebanon is under ongoing construction:



“Here in Tripoli, we have one of the largest wastewater treatment stations in Lebanon but it is not working at full capacity because of the lack of connected (sewer) lines.”

Eng. Mohamed Nour Al-Ayoubi, Member of Tripoli Municipal Council and Chairman of the Environmental Committee in Tripoli Municipality.

Eng. Hussam Hawa considers that my eco-innovative technology, which consists of an anaerobic digester, constructed wetlands and a raceway pond for solar disinfection, aims to put development projects in the context of the circular economy, meaning that nothing is wasted, and (instead) waste becomes a resource:

“We are very excited to engage in a project of this nature, especially since it looks at treatment in a decentralized way and we believe that this is the most appropriate solution for Lebanon as its societies are very small and spread throughout its territory. Unfortunately, this sector (sanitation) is new to the Lebanon State which has been trying for a while to restructure the sector.”

Eng. Hussam Hawa, CEO of Defaf Company.



Prof. Monzer Hamze concurs:

“We are in urgent need of such projects and I hope that this project will succeed in scientific and technical terms and it will see the light until we enter the stage of solutions to the intractable problems in Lebanon.”

These testimonies from stakeholders together with desk reviews of the national legislation in force, the country’s institutional and regulatory framework and of available reports and assessment studies, will form the basis for an in-depth analysis of the wastewater treatment and reuse governance framework in Lebanon.

In rolestorming mode to shift paradigm on wastewater reuse

AQUACYCLE Log April 2020

The idea of rolestorming as a means to come up with novel, out of the box ideas, fascinated me, and I recorded the whole event, so as to be able to share this transcript together with snippets collected in this short video clip⁵.



Figure 8: My creators in rolestorming mode

My communication manager, Ms Anna Spiteri invited my creators in the first project progress meeting in Malta to step outside their usual role and assume a different one. She asked to first spend a few moments to reflect on what each of us would come up with in this assumed role so as to bring about a much-needed paradigm shift on wastewater reuse.

Enjoy the read and especially look out for the out-of-the-box ideas each of the personas came up with!

⁵ <https://youtu.be/3ZmKoZxYoRg>

Editor's note: AQUACYCLE's eco-innovative technology is referred to as the APOC technology by the participants in the rolestorming session.

Housewife

"I live in a country where the practice of irrigating with untreated wastewater is common. I wish to buy vegetables that are free from pesticides and have been irrigated with properly treated wastewater."

NGO representative

"We should also be asking from where the vegetables are coming."

Investor

"Before taking the decision whether to invest, I would expect detailed information to be available, for example through the news media."

Journalist

"Yes, you are right, but my problem as a journalist is that I never know whether the person in front of me is telling me the truth. For example, a mayor of a council confirmed what a researcher had told me earlier, but actually there is no evidence of the new technology being in use. So, whom can I trust?"

Minister for Agriculture

"Yes, this is true. The previous government did not care about this. We are working on a national plan. It will involve farmers, NGOs and all interested parties to build a master plan for agriculture. This will define ways on how we are going to ensure that the quality of the crops produced will meet standards and will be safe for human consumption."

NGO representative

"Yes, but we have been carrying out our own analysis and found a lot of problems with the quality of the water that was used."

Farmer

"We have been checking on our crops and find that crops irrigated with treated effluent are of a higher quality than others, so this suggests that there must be other sources of contamination. Among all the operators in the market chain – we are the ones that are being checked upon but there

is no control in place of others! In the end, we have a situation where shoppers are not buying from vendors who they know are selling crops which have been irrigated with treated wastewater.”

Consumer

“I am willing to pay more for good quality produce, but it may backfire if a product is labelled ‘cultivated with treated effluent’. We need the government to study this in more detail.”

Traveller

“In my country I can know whether the vegetables and fruits are irrigated with treated effluent or not. But when I travel to another country how will I know which crops have has been irrigated with natural water or with treated water?”

Treatment plant operator

“We take the monitoring of water quality very seriously so that we are in line with the standards set by the government. We also have a contractual agreement with farmer associations to whom we are providing the treated effluent as a product. Moreover, environmental NGOs are telling us people are ready to pay extra for eco-labelled products.”

Supermarket owner

“This is fine, but government should give us some form of subsidy so we can support the idea of promoting products produced by an eco-innovative wastewater treatment technology.”

Minister for Agriculture

“We have to gain the trust of the consumer, but we are faced with a situation where the news provided by journalists cannot be trusted.”

Journalist

“We have been following up on scientific research findings and our articles make full references to the sources of our information.”

Minister for Agriculture

“As a government we have invested in several in-depth studies but we are still in need to have these translated so as to raise awareness and

confidence among consumers. I have asked the Minister for Economic Affairs to finance this type of actions.”

Treatment plant operator

“We should be mindful that there is a major difference in all this between countries that permit irrigation with untreated effluent and countries that do not allow this.”

Moderator of rolestorming session

“This project is planning to draw up a Charter on Wastewater Reuse. I understand there are existing Charters on Wastewater Reuse already. How do each of you see a ‘niche’ for the promotion of the APOC technology?”

Farmer

“As we are faced with a situation of our natural, fresh water resources becoming ever scarcer, and a growing demand for water from other sectors, we see the new technology as an opportunity to invite our government to invest in decentralized wastewater treatment plants that cater for smaller communities.”

Consumer

“I would suggest we look at how to reduce on the pollution we generate, because I am pretty sure the cost of wastewater treatment would then also be reduced. For example, we should avoid pharmaceutical waste to enter into the domestic wastewater stream. And the recovery of biogas through the use of the eco-innovative APOC technology could be used to provide electricity to the local community.”

NGO representative

“Yes, valid considerations, but aside from those, we should also take into consideration the type of cultivation. Could the minister provide us with information on the quality of the treated effluent?”

Minister for Agriculture

“I would like to invite you to consider alternative treated wastewater reuse applications, such as existing golf courses, industrial use and managed aquifer recharge.”

Journalist

“Yes, but with a growing population, we should be concerned about security when it comes to food production.”

Teenager

“As a teenager I just do not believe anyone. Nobody is teaching us about these things at school. The only thing I know is that I cannot buy some products because my mother says ‘don’t eat this’. I cannot swim in the sea or play near the river. I think that the government has contracts with the journalists. The minister is paying for the research and controls the media.”

Supermarket owner

“My supermarket is in a small village of 2000 people. So, the important people are the village priest and the teacher, and if they were to raise awareness on all these issues, they would be the local trusted champions.”

Treatment Plant Operator

“Like Greta Thunberg you are surely aware that eco-innovative technologies, such as this novel water treatment technology, provide the opportunity to be showcased as a climate change impact mitigation measure. My experience of taking schoolchildren around our plant is very positive. They take a great interest and ask me a lot of questions.”

Supermarket owner

“If teenagers are interested in trends, we can introduce a new fashion: ‘APOC Style’!”

I eagerly admit that I am looking forward to more rolestorming in the coming months. I very much encourage you to try it out with friends and colleagues, and thanks for watching the video clip⁵!”

Sharing outcomes of virtual meetings

AQUACYCLE Log July 2020

Since my last appearance on the occasion of the rolestorming session in Malta in February, the outbreak of the COVID-19 pandemic changed my travel plans rather abruptly. However, as my creators quickly took to organizing virtual online meetings on a weekly basis, I owe you quite a few updates by now.

For starters, I listened in to an interview with one of my Team Leaders in Spain. I was all ears as Pedro shared the outcomes of monitoring for the prevalence of virus RNA in municipal wastewater.



“Our most recent studies have corroborated how the monitoring of municipal wastewater can serve both as an early indicator of the virus prevalence in a community and help authorities to coordinate the exit strategy to gradually lift coronavirus lock-down measures.”

Pedro Simón Andreu, my Team Leader at ESAMUR (*left*) reviews outcomes with Amalia García del Real, Operation Manager of the Blanca Wastewater Treatment Plant in Spain.

Next was an interview in which my Innovation Manager from the Centre of Research and Technology, Hellas (CERTH), which informed that several of the originally planned research activities in my foreseen work plan had been updated in response to the pandemic.

“The knowledge that aside from Greece and Spain, also our research partners in Lebanon and Tunisia bring expert staff and laboratory facilities, has indeed motivated us to update several of our planned activities, which are now more strongly focused on microbiological quality aspects”.

Dr. Vasilios Takavakoglou, my Innovation Manager



Delivering on my Key Message: All water is too precious to waste!

AQUACYCLE Log November 2020

Ever since my ceremonious launch in September 2019 in Thessaloniki my creators have been keeping my wheels turning at full speed. Alas, the third project meeting which was scheduled to be held in Tunis could not be organized as a physical get-together of my co-creators. Yet, the atmosphere of the virtual meeting organized by CERTH on 23 and 24 September 2020 captivated me from the very start.

Dr. Konstantinos Plakas, my project manager, was clearly beaming when he ticked off the outputs that were on the to-be-achieved list for the first twelve months since my launch.



Bonjour, Sabah al-khejr, Kaliméra to everyone!

Dr. Konstantinos Plakas, my Project Manager welcomes my co-creators to the third project meeting.

Conscious of the urgency to change the paradigm on wastewater treatment and reuse, my co-creators drew up strategies aimed at decision-makers and public entities involved with the use of non-conventional water resources.

These strategies draw on a multitude of inputs which include an in-depth review of the regulatory framework, published studies and reports, as well as 15 one-to-one interviews with high-level actors in the water and sanitation sector in Lebanon, Spain and Tunisia. This achievement was facilitated through the adoption of a SWOT analysis.

In this approach, inputs are organized as depicting either **Strengths**, **Weaknesses**, **Opportunities** or **Threats** (SWOT).

Consequently, the proposed strategies are formulated in a manner which duly:





These distinct outcomes for Lebanon, Tunisia and Spain, were then presented for feedback in a first series of stakeholder workshops. A target was set of having 25 water stakeholders in each of the three events.

“AQUACYCLE shining in the news in Lebanon” was the well-deserved achievement of my team at the Lebanese University (UL) which succeeded in attracting an impressive media coverage of their event in Tripoli which took place on 25 July 2020⁹.

As evidenced by the testimonies of the participants during the event, as well as the earlier interviews, Lebanon’s water and sanitation situation is in dire straits.

A big thumbs up to my Team Leader Dr. Ahmad ElMoll, and my team members Dr. Tawfik Al-Nabulsi and Dr. Fatima Yahya at UL for already having seized this feedback to make a further, emphatic call on all public entities in Lebanon to come together and draw up standards and guidelines for the safe reuse of treated wastewater in agriculture¹⁰!

⁹ <https://www.enicbcmmed.eu/aquacycle-my-autobiography-shining-news-media-lebanon>

¹⁰ <https://www.enicbcmmed.eu/aquacycle-calling-new-vision-lebanons-water-and-sanitation-sector>



The use of treated wastewater as a solution to address the impacts of climate change in Lebanon and MENA region

Whereas in Lebanon, the proposed strategy calls for a radically new vision, a revised strategy is called for in Tunisia's water and sanitation sector. Despite extensive expertise and a long tradition of wastewater treatment, the actual use of treated domestic effluent in Tunisia remains limited.

Congratulations to my teams at the Water Research and Technologies Centre (CERTE) and at the Tunis International Centre for Environmental Technologies (CITET) for attracting representatives from no less than 5 ministries and 6 entities involved with the use of non-conventional resources to the event which took place on 22 September 2020¹¹.

My Team Leaders, Dr. Hamadi Kallali at CERTE and Mr. Fadhel M'Hiri at CITET, conveyed the need for a revised strategy on respectively the RTCI¹² and RTC¹³ radio channels. I definitely recommend to watch the video clip¹⁴ that brings interviews (in Arabic) also with Ms Khitem Mensi, my project manager on behalf of CITET. This clip fascinated me as it brought glimpses of the thematic gardens which are expertly maintained by the Ecological Group for Sustainable Development (Groupement de Développement Agricole, GDA Sidi Amor). Among other, the site boasts a medicinal garden, a forest garden, a cultural garden and a rose garden.

Regretfully unable to organize a physical get-together, my teams in Spain, the Plataforma Solar de Almeria - Energy Department - Solar Treatment of Water Unit (PSA-CIEMAT) and the Regional Entity for Wastewater Sanitation and

¹¹ <https://www.enicbcmed.eu/aquacycle-workshop-joined-28-water-stakeholders-tunisia>

¹² <https://www.youtube.com/watch?v=qWr3rij41BM&feature=youtu.be>

¹³ <http://www.enicbcmed.eu/aquacycle-radio-waves-tunisia>

¹⁴ https://youtu.be/Sm4cNEX_VM0

Treatment in Murcia (ESAMUR) organized a webinar. For sure, online meetings do not offer the same opportunity to exchange views as those brought by a coffee break or a light lunch as were served in Tripoli and Tunis. But then again, the organizers made it into a truly memorable event. No less than 70 water stakeholders in Spain joined the webinar on 8 October 2020¹⁵. I hear you ask me what would have been the reason for this amazing achievement? The hosts, my Team Leaders Dr. Isabel Oller at PSA-CIEMAT and Pedro Simón at ESAMUR had invited keynote presentations on the latest advances in each of the 3 components that make up my eco-innovative **APOC** technology: **A**naerobic digestion, **P**hotocatalytic **O**xidation and **C**onstructed wetland.

These advances have since been taken up in the design specifications for the three pilot installations that are foreseen in Lebanon, Spain and Tunisia.

Yes, I feel confident my wish to make a physical appearance around the Mediterranean in 2021 will come true!!!



Figure 9: Where I wish to be making my physical appearance in 2021!

¹⁵ <https://www.enicbcmed.eu/aquacycle-webinar-joined-70-water-stakeholders-spain>

On a rollercoaster during the month of February 2021

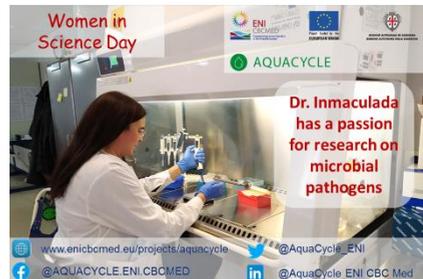
AQUACYCLE Log March 2021

Somehow, my creators have adopted the custom of putting me in the limelight on the occasion of World Days.



World Wetlands Day on 2nd February was not to be missed of course, and Roman Lopez (ESAMUR) duly took to the radio waves in Murcia¹⁶.

Next in line was Dr. Inmaculada Polo (PSA-CIEMAT). Her passion for research on microbial pathogens was given the limelight on **World Women in Science Day** on 11 February¹⁷.



An opinion article penned by Anna Spiteri and Dirk De Ketelaere (IRMCo) on democratizing spatial decision making in the water and sanitation sector was brought to mark **World Social Justice Day** on 20th February¹⁸.

¹⁶ <https://www.enicbmed.eu/aquacycle-radio-waves-spain-occasion-world-wetlands-day>

¹⁷ <https://www.enicbmed.eu/aquacycle-celebrates-women-science-day>

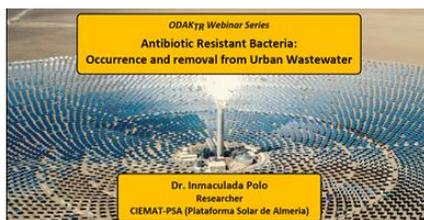
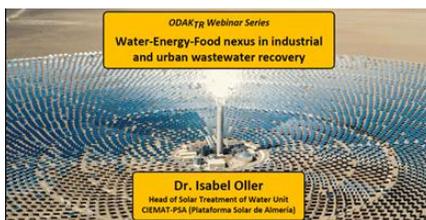
¹⁸ <https://www.enicbmed.eu/aquacycle-targets-democratization-spatial-planning-water-and-sanitation-sector>

February 2021 also saw a stepped-up effort of building synergies with my ever-growing family who benefit from EU funded research.

Dr. Isabel Oller and Dr. Inmaculada Polo (PSA-CIEMAT), both served as invited speakers in a series of webinars organized by the Centre for Solar Energy Research and Applications (METU-GÜNAM) in Turkey in the framework of the EU funded Horizon 2020 SolarTwins project.



I very much recommend you to watch their presentations on You Tube, focusing on respectively the **Water-Energy-Food nexus in industrial and urban wastewater recovery**¹⁹ and **Antibiotic Resistant Bacteria: Occurrence and removal from Urban Wastewater**²⁰.



Meanwhile, the Lebanese University team decided it was time to organize a second national seminar on wastewater treatment and reuse in Lebanon. Representatives from the Ministry of Agriculture, the Ministry of Energy and Water, and the Ministry of Environment, were joined by the director and the head of the Lebanese Agricultural Research Institute (LARI) and the manager of Lebanon's Irrigation, Water, Sewage & Infrastructure Department. Still, my foremost interest was always going to be about the progress being made to enable me to make a physical appearance in Lebanon, Spain and Tunisia in 2021.



¹⁹ <https://youtu.be/1UJ6WS3c63s>

²⁰ <https://www.youtube.com/AnQu523uspU>

Organized as a 2-day online meeting among my creators and their associated partners, it was clear from the outset that my rallying wish for 2021 was indeed being heeded with the utmost priority.



Figure 10: My creators in mid-term review meeting

Albeit for different reasons, the process of launching the respective tenders clearly witnessed some otherwise quite unforeseeable challenges. It was heartening to hear how everyone actively took part in brainstorming fashion to come up with solutions. As special thumbs up to Ms Angeliki Fotiadou, architect in the CERTH team, who guided my creators in a highly expert fashion to foresee any potential risks the proposed solutions might bring.

There was a light moment too, when Eleanna Pana – you will no doubt remember she acted the role of a teenager in the rolestorming session that took place in Malta – invited feedback on her latest cartoon.

To me, it looked like someone who had just finished reading up on the 800-page tender that was launched by ESAMUR. The aim of the tender is to construct a wetland, or rather 2 wetlands, as a further component to the existing anaerobic digester at the Blanca wastewater treatment plant in Murcia, Spain.



Still there was more to celebrate as the Malta Council for Science and Technology awarded me as their research project for the month of February 2021 in their plumtri newsletter!

Yes, am truly feeling in rollercoaster mode!



Figure 11: Feeling in rollercoaster mode!

Going in poetry mode to mark World Water Day

AQUACYCLE Log March 2021

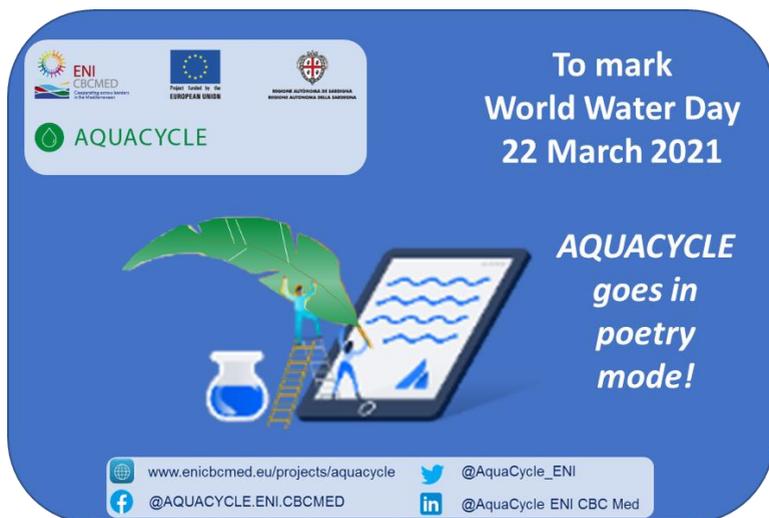


Figure 12: Going in poetry mode!

Still feeling exhilarated from the rollercoaster ride I was on in February 2021 and in the midst of reciting one of my obviously favourite poems:

**Twinkle, twinkle, little star
How I wonder what you are**

I heard a voice from a water stakeholder in the region of the World you call the Med in short, which sounded rather desperate:

***AQUACYCLE, AQUACYCLE please come in haste
For all water is too precious to waste!***

Before realizing I had gone into poetry mode, my response was loud and clear:

***Rest assured I shall be making my way
For today is World Water Day
I appreciate your trust
But calling on my siblings is a must.***

It made perfect sense not to take on this huge challenge by myself, so I first called on my ENI CBC Med sponsored sister projects **MEDISS**, **MENAWARA**, **NAWAMED** and **PROSIM**.

*Dearest ENI CBC Med siblings,
Let me bring you good tidings*

*You will wish to heed my call,
it is of the highest importance to all*

*Let me start by reaching out to MEDISS,
for sure this is not an opportunity you will wish to miss!*

*MENAWARA and PROSIM, greetings to you!
Let us build forces by joining this effort too.*

*And with the added help of NAWAMED
We shall bring lasting solutions to the water issues in the Med*

I thought best to now also bring my manager, Dr. Konstantinos Plakas (CERTH) up to date on these developments. As usual over these past months, I found him at the lab where he was still busy checking on the tiniest details of my 'prototype' laboratory version. Kostas was clearly upbeat and launched this motto to celebrate World Water Day:



Figure 13: My project manager's motto to mark World Water Day in 2021

AQUACYCLE Log November 2021

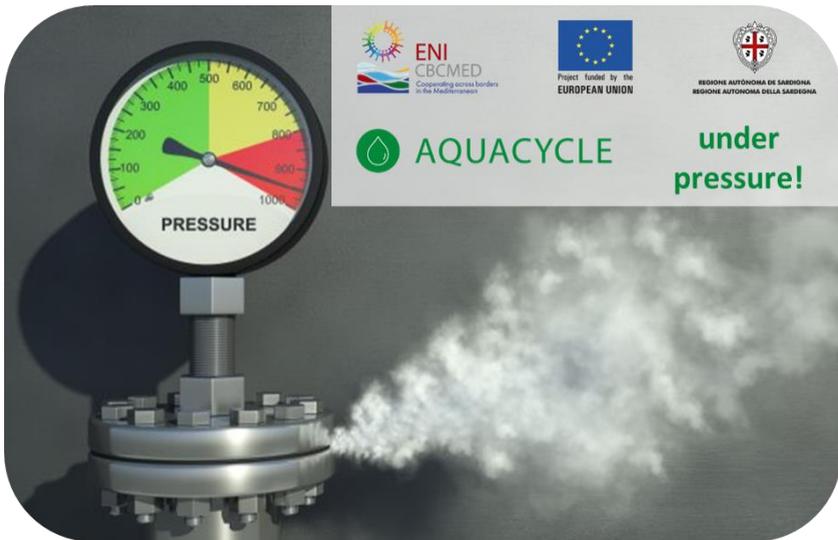


Figure 14: Am feeling under pressure!

(Editor's note: to fully appreciate AQUACYCLE's sentiments I do recommend to read this latest diary entry to the accompaniment of this music²¹).

It's been quite a while since I put pen to paper. You will have been wondering what I have been up to since calling on my ENI CBC Med siblings to come to the rescue of a rather desperate-for-water call from a stakeholder in the Med on World Water Day on 22nd March 2021.

Making my physical appearance was never going to be an easy challenge, but to be perfectly honest, some unexpected hurdles did catch me off-guard.

In Spain, the award of tenders for two constructed wetlands and for a raceway pond reactor, which will further treat the effluent delivered by the existing anaerobic digester at the Blanca wastewater treatment facility, was obviously most encouraging news.

²¹ https://www.youtube.com/watch?v=YoDh_gHDvkk

Alas, it turned out that the originally earmarked site for their construction proved to be of ecological interest, thus requiring a new environmental impact assessment (EIA) for an alternative site.



Figure 15: Site earmarked for my physical construction in Spain

And although the EIA for a new location was then accepted, an on-site inspection by the environmental authorities resulted in the requirement to transplant some of the trees from this site to an alternative location since a permit to cut the trees was not going to be granted.

Even if I could not but feel admiration that the authorities in Murcia do consider the protection of trees a serious matter – which rather unfortunately is not a given in each and every country of the Mediterranean Region, the transplanting of a tree does require time if it is to be carried out professionally.

Just the other day I was seeing a highly professionally executed transplanting of four mature orange trees and one lemon tree of a local variety in Malta which was quite awesome to watch. It required a mini-excavator to be hauled over a garage into a back garden of a dwelling that is set to be demolished and is located a highly congested road.

But let me return to the subject of my much-awaited physical appearance. Also in Tunisia, the news of the launch just before World Water Day of the tender for a complete pilot demonstration replica of myself in a real environment was most encouraging. A one-month extension of the deadline for the submission of offers, i.e. until 19th May 2021, was of no immediate concern.



© Paul Bow, *The Economist*

Yet, I must admit that I was totally unprepared for the lengthy process to award the tender. I can only be grateful to my co-creators in Tunisia for their patience in dealing with the many due-diligence procedures - which you may call 'red tape' - they face in their day-to-day work.

Still, the award for practicing patience must surely go to my co-creators in Lebanon. A recent spectacular devaluation of the Lebanese pound obviously became a source of major concern. It only made perfect sense to delay the actual launch of the tender for my construction in Lebanon until a sound solution is found to deal with the currency crash.

Despite these challenging circumstances, the team at the Lebanese University kept pushing forward and deftly responded to their national procurement regulations by drawing up incredibly detailed specifications, including a bill of quantities which literally covers every tiniest piece of material that is meant to go into my, so much anticipated, physical appearance in Lebanon.



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Unwrapping my early Christmas present

AQUACYCLE Log December 2021

As I was listening in to a telecon between my Project Manager, Dr. Konstantinos Plakas, and my Innovation Manager, Dr. Vasilis Takavakoglou, I realized they had picked up on my sense of frustration with the delays in making my physical appearance a reality. Vasilis commended Kostas to cheer me up with an early Christmas present. They both understood that only a truly creative present was going to make a difference, hence they came up with the idea to invite also my Graphic Designer, Ms. Eleanna Pana to join in their telecon.

Ever so diplomatic, Kostas started by profusely thanking Eleanna for her inspirational designs that have been accompanying the launch of tenders for my physical construction.



Figure 16: Launch of tenders for my physical construction

Kostas went on to tell Eleanna that he was really impressed that she was producing these cartoons even faster than Lucky Luke could famously draw his colts.

Somehow that appraisal had an unforeseen outcome, as yet another cartoon appeared in the chatline. By this time, Kostas had not yet touched on the purpose of his call on Eleanna. (Editors' note: AQUACYCLE seems to imply that Kostas' narrations can be quite long)

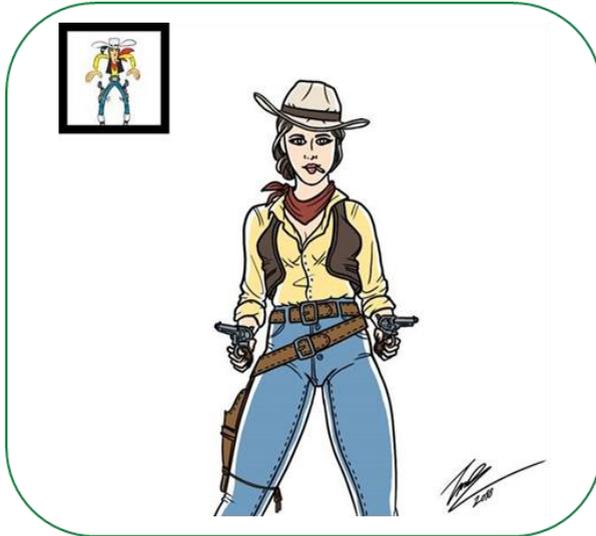


Figure 17: Producing cartoons faster than Lucky Luke could draw his colts

As soon as this latest cartoon appeared, Vasilis jumped back into the conversation and remarked that it perfectly illustrated that “we are not just developing ‘toys for boys’, ladies love the same toys”.

This notion somehow inspired the discussion to reach the understanding that the uptake of any new innovation needs investment, even in the case of what is designed to be a low-cost technology.

Suddenly, Kostas face lit up and he hastened to add: “*dear friends, thank you for your time and guidance, I am confident you both just helped me to come up with the perfect present for AQUACYCLE.*”

You will understand I was now getting really curious what this present was going to be, but Kostas remained tight-lipped and did not share any further details on what he had in mind during that telecon.

Still, Kostas got it right, I was simply over the moon when Kostas invited me to unwrap my present, a few days after that telecon. I invite you to watch this short video clip²² and I am sure you will get the point of the present too.

²² <https://youtu.be/pcPcbVVdLCM>

With only three locations in the Med where my physical appearance is planned, this much smaller replica can easily be stowed in a luggage and showcased at trade fairs and exhibitions.

Yes, the prime motivation is to attract the active interest of investors, but I am pretty sure it will be equally valuable to ‘show me off’ in this miniature way in the upcoming events with local communities in Lebanon, Spain and Tunisia. And the dashboard will help to explain about the details of my functioning even to teenage schoolchildren.

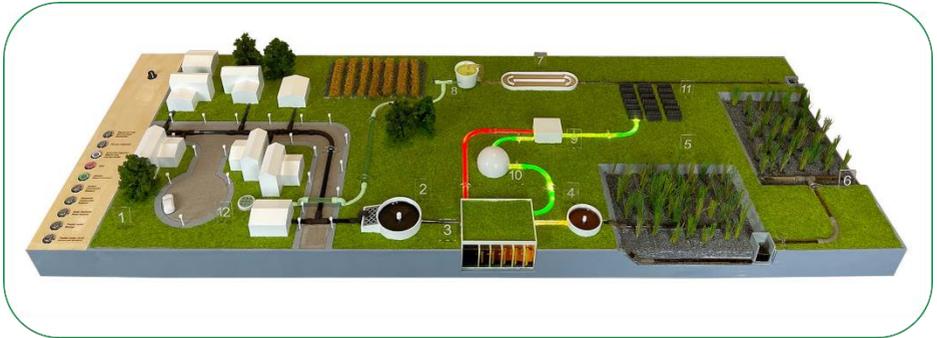
“Thanks Kostas for this truly wonderful present, am even more curious now what my Christmas present will look like!”



Figure 18: What I look like in miniature scale

My components explained

This 3-D Model introduces AQUACYCLE's new "green" technological approach for wastewater treatment and reuse which is particularly suited to small and medium-sized towns and villages in rural areas under Mediterranean climate conditions.



1. Residential area and municipal wastewater
2. Primary treatment
3. Anaerobic Digestion Reactor
4. Clarifier/Settler
5. Vertical Constructed Wetland
6. Horizontal Constructed Wetland
7. Solar Raceway Pond Reactor
8. Treated Water storage
9. Renewable Energy storage
10. Biogas
11. Photovoltaics
12. Treated water reuse (rural and urban applications)

AQUACYCLE Partnership

Centre for Research and Technology,
Hellas, Greece (Lead-partner)
www.certh.gr



Integrated Resources Management
Company Ltd. (IRMCo), Malta
www.environmentalmalta.com



Lebanese University, Doctoral school for
sciences & technology/Azm Center for
Research in Biotechnology & its Applications,
Lebanon
www.ul.edu.lb



Regional Entity for Wastewater Sanitation
and Treatment in Murcia, Spain
www.esamur.com



Plataforma Solar de Almeria (PSA-CIEMAT),
Energy Department, Solar Treatment of
Water Unit, Spain
www.psa.es



Water Research and Technologies Center,
Tunisia
www.certe.rnrt.tn



Tunis International Center for Environmental
Technologies, Tunisia
www.citet.nat.tn



My team of creators

CERTH Greece	Coordinator	Prof. Anastasios Karabelas
	Project Manager	Dr. Konstantinos Plakas
	Innovation Manager	Dr. Vasileios Takavakoglou
	Social Media Manager	Eleanna Pana
	Team members	Ioannis Manakos, Vasilis Chatzis, Angeliki Fotiadou, Rizos-Theodoros Chadoulis, Avgi Karastogiannidou, Sotirios Karavarsamis, Danai-Eleni Aristeridou, Vasilis Sarasidis
IRMCo Malta	Communication Managers	Anna Spiteri, Dirk De Ketelaere
	Team Members	Jean Paul Tabone
LU Lebanon	Team Leader	Prof. Ahmad ElMoll
	Team Members	Prof. Mohamad Khalil, Dr. Tawfik Al Naboulsi, Dr. Fatima Yahya, Eng. Omar Nachar, Khoder Khalil, Maha El Hajj, Jana El Hajj, May Ibrahim
ESAMUR Spain	Team Leader	Pedro José Simón Andreu
	Team Members	Román Francisco López Aragón
PSA-CIEMAT Spain	Team Leader	Dr. Isabel Oller Alberola
	Team Members	Dr. Inmaculada Polo López, Leila Samira Nahim Granados, Alba Hernandez Zanoletty
CERTE Tunisia	Team Leader	Dr. Hamadi Kallali
	Team Members	Dr. Baha Chamam, Dr. Mohamed Ali Wahab, Dr. Samira Melki, Dr. Mariem Ben Said, Dr. Yasmin Cherni, Raja Jomni, Kaouther Bergaoui
CITET Tunisia	Team Leader	Dr. Fadel M'Hiri
	Team Members	Khitem Mensi, Dorra Laater, Dr. Safa Chaabane, Anis Ghattassi, Sonia Jbeli

About the author

Dirk De Ketelaere is Senior Researcher at Integrated Resources Management Company Ltd. (IRMCo), an environmental research company based in Malta, established since 1994. He has been project manager of the EU funded FP6 PLEIADeS (2006-2009) and FP7 SIRIUS (2010-2013) projects which focused on satellite imagery assisted irrigation services. In PLEIADeS, he also led the work package dedicated to the impact of external drivers, i.e. climate change and policies with pilot study areas in Italy, Greece, Portugal, Spain, Morocco, Turkey, Brazil, Mexico and Peru. In the ENPI CBC Med funded project Mare Nostrum (2013-2015), he oversaw field surveys combined with the satellite-derived mapping of the Blue and Green Open Spaces in Malta's Grand Harbour. The use of Participatory GIS (PGIS) enabled the drawing up by the local communities of a new vision for the area in the form of eco-heritage trails, connecting the multitude of historical and cultural heritage sites of the area with the sparse and alarmingly fast disappearing green open spaces. In the ENI CBC Med funded project AQUACYCLE (started in September 2019), Dirk is guiding the partnership on the use of PGIS towards the drawing up of action plans for the reuse of treated wastewater by the local communities around the pilot-demo sites in Lebanon, Spain and Tunisia. Prior to joining IRMCo, Dirk lectured on hydrology related subjects at post-graduate level at the Free University Brussels (1983-1985), where he graduated as a civil engineer with major distinction in 1982, and at the University of Dar es Salaam (1985-1987). Following his participation as a consultant to the Government of Malta in a major study of the Island's fresh water resources (1988-1992), he designed the MSc Water Studies at the University of Malta. His first successful application for EU funded projects enabled him to coordinate the Med Campus Project 355 Network: Water Resources for Future Generations (1993-1994), which provided training on Integrated Water Resources Management to over 100 water professionals from around the Mediterranean. Dirk is co-editor of the Horizon2020 funded NEXT project publication *A Practical Toolkit addressed to Mineral Exploration and Mining Companies*²³, issued in September 2021.



²³ Available for download from www.new-exploration.tech (media section).



AQUACYCLE

Towards Sustainable Treatment and Reuse of Wastewater in the Mediterranean Region

Eco-Innovation



Eco-innovative technology combining:

- anaerobic digestion
- constructed wetlands
- solar treatment

for cost-effective treatment of urban wastewater with maximum environmental benefits.

Demo units in Tunisia, Lebanon and Spain.



Participatory Water Governance

Active stakeholders in planning and decision making processes through participatory GIS.

Action and investment plans targeting the reuse of 900,000 m³ treated effluent.

Sustainable Development and Economic Growth



A cross-border Alliance of decision makers, researchers and private actors for the sustainable use of non conventional water resources in Mediterranean.



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