



FIT4REUSE

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

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Brief Description	According to the Grant Agreement, Water Reuse Days have been planned once per year. The meetings (a total number of 3) should have been held in the countries where pilot plants are located (Greece, Italy and Tunisia), which was not possible for the 1 st and 2 nd Water Reuse Days due to the COVID-19 restrictions and limitations. Water Reuse Days aim at reaching the wider public and expanding the size of the local reuse forums by bringing additional stakeholders in contact with the project and further developing its results. This report summarizes the contents and the main results of the 3 rd Water Reuse Day, held in Bologna (Italy) on the 23 rd and 24 th of November 2022.		
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EXECUTIVE SUMMARY

This document is a deliverable of the FIT4REUSE project, presenting the key results of the third Water Reuse Day, that took place on the 23rd and 24th of November 2022 in Palazzo Pepoli - Bologna (Italy). In order to reach the wide public, the event was also live streamed on the YouTube channel of the University of Bologna.

The third and last Water Reuse Day, which coincided with the final event of FIT4REUSE, has included the presentation of the main project results and the involvement of relevant stakeholders through keynote speeches, video-messages, round tables and panel discussions. This document aims to show the contents and the results achieved by the event, which was organized thanks to the collaboration of all the partners involved.

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ABBREVIATIONS

CECs	Contaminants of emerging concern
NBS	Nature Based Solutions
SAT	Soil aquifer Treatment
WP	Work Package

1. INTRODUCTION

Fostering knowledge sharing and co-production among experts and information dissemination to other relevant stakeholders, including citizens, is one of the objectives of the project FIT4REUSE. To this aim, the project includes a Work Package dedicated to Communication and Dissemination (WP9), which is highly important to inform and raise awareness on sustainable water management to a wide range of stakeholders and to share results and knowledge produced by the Project. One of the core actions of WP9 is the organization of Water Reuse Days (Task 9.5), one per each of the 3 years of the project. These events were planned to be held in the countries where pilot plants are located (Greece, Italy and Tunisia). Unfortunately, due to the COVID-19 restrictions and limitations, this was not possible for the 1st and 2nd Water Reuse Day. On the other hand, given the improvement of the pandemic situation, it has been possible to organize the 3rd Water Reuse Day in Italy (Bologna), with the participation of project partners and relevant stakeholders.

Besides their role in fostering knowledge sharing among experts and information dissemination to other relevant stakeholders, Water Reuse Days also aim at expanding the size of the local Reuse Forums by bringing additional stakeholders in contact with the project. In fact, Water Reuse Forums were established in each participating country as a result of Task 8.4 of FIT4REUSE, to promote the idea that democratic governance and collaborative working between a range of societal actors such as researchers, citizens, civil society organizations and businesses can develop outcomes that are aligned with societal values and needs.

2. WATER REUSE DAY ORGANIZATION

The 3rd FIT4REUSE Water Reuse Day was held on the 23rd and 24th of November 2022 in a hybrid mode: in presence in Bologna (Italy) and in live streaming on the YouTube channel of the University of Bologna. The objective of the event was to reach the widest public and to bring additional stakeholders in contact with the project, to present and further develop the project results and to allow knowledge sharing and dissemination.

The event started in the afternoon of the 23rd of November with an opening session followed by a roundtable discussion dedicated to the challenge of water scarcity in agriculture, featuring experts from relevant organizations. To follow, the 3 Pillars of FIT4REUSE have been explored, thanks to the presentation of the achieved results and to the contributions of stakeholders and experts from the water sector. In particular, three subsequent sessions have been dedicated to:

- Innovative solutions for wastewater treatment and desalination for water reuse (23rd of November);

- The use of non-conventional water resources for irrigation and aquifer recharge (24th of November);
- Assessment and regulation of the treatment and use of non-conventional water resources (24th of November).

Following these sessions, the project partners took part in a roundtable discussion about the challenges and the main achievements obtained during FIT4REUSE, including also some perspectives on future activities. To follow, a panel discussion has been focused on the Italian experience on the use of non-conventional water resources, with the participation of local stakeholders.

The closing speech has been dedicated to the PRIMA Programme and its support to address relevant challenges in the Mediterranean area.



Figure 2.1: Group photo at the Third Water Reuse Day

The detailed agenda of the 3rd Water Reuse Day is reported in the next Figure:

Figure 2.2: Agenda of the Water Reuse Day

23 rd of November 2022	
14:00	Check-in of the participants
14:30	Welcome and opening to the 3rd Water Reuse Day Attilio Toscano, <i>University of Bologna, FIT4REUSE project coordinator</i> Angelo Riccaboni, <i>Chair of the PRIMA Foundation</i> Francesco Tomatore, <i>Regione Emilia-Romagna</i> Luca Fontanesi, <i>University of Bologna, Delegate on competitive research projects</i>
14:50	Round Table: The challenge of water scarcity in agriculture Moderator: Rafael Casielles, <i>BIOAZUL</i> Carmen Galindo, <i>EIT Food – Adriano Battilani, Irrigants d'Europe –</i> Marco Orlando, <i>PRIMA Programme – Faycel Chenini, FIT4REUSE External Advisory Board member</i>
15:40	Coffee break
16:00	The 3 pillars of FIT4REUSE: Innovation, application, assessment and regulation Attilio Toscano, <i>University of Bologna</i>
16:10	Pillar 1: Innovative solutions for wastewater treatment and desalination – Introduction Moderator: Alessia Foglia, <i>Marche Polytechnic University</i>
16:15	Keynote speech: Tertiary treatment of municipal wastewater by solar photo Fenton - a sustainable solution for a safe water reuse Luigi Rizzo, <i>Salerno University</i>
16:30	A stakeholder's video message
16:35	Survey on innovations for water reuse
16:40	Innovation in municipal wastewater treatment for safe agricultural reuse Nature based solutions for municipal wastewater treatment Atef Jaouani, <i>University of Tunis El Manar, Higher Institute for Applied Biological Sciences of Tunis</i> Intensive solutions for municipal wastewater treatment Evidiki Barka, <i>National Technical University of Athens</i> Integration of treatment solutions Francesco Fatone, <i>Marche Polytechnic University</i>
17:25	Environmental improvements in the desalination process Sarit Bason, <i>MEKOROT</i>
17:40	The Simulation Platform: a modelling tool to predict the behaviour of the developed treatment technologies Özlem Karahan Özgün, <i>ITUNOVA</i>
17:55	Pillar 1: Q&A
18:05	Conclusions and closure of the first day Attilio Toscano, <i>University of Bologna</i>

24th of November 2022

- 09:30 Check-in of the participants
- 10:00 **Welcome and summary of the outcomes of the first day**
Attilio Toscano, University of Bologna
- 10:10 **Pillar 2: Use of treated municipal wastewater and desalinated water for irrigation and aquifer recharge – Introduction**
Moderator: Stevo Lavmić, University of Bologna
- 10:15 **Keynote speech: Seven steps towards an efficient and sustainable use of reclaimed water in agriculture**
Adriano Battilani, Irrigants d'Europe, FIT4REUSE External Advisory Board member
- 10:30 **A stakeholder's video message**
- 10:35 **Survey on the use of reclaimed water**
- 10:40 **The use of reclaimed water for irrigation, fertigation and aquifer recharge: project outcomes and support tools**
 - Aquifer recharge and Soil Aquifer Treatment (SAT): process optimization for higher infiltration rates**
Roy Elkayam, MEKOROT
 - Towards sustainable irrigation and water reuse agronomic practices**
Rémi Declercq, ECOFILAE
 - The irrigation and aquifer recharge guidelines: a support for practitioner**
Rafael Casielles, BIOAZUL
 - Towards the water reuse risk management plan**
Francesco Fatone, Marche Polytechnic University
- 11:20 **Pillar 2: Q&A**
- 11:30 Coffee break
- 11:50 **Pillar 3: Assessment and regulation of water reuse - Introduction**
Moderator: Viola Benedetti, Italian National Institute for Environmental Protection and Research
- 11:55 **Keynote speech: Innovative approach for unlocking the potential of non-conventional water for agricultural development**
Faycel Chenini, FIT4REUSE External Advisory Board member
- 12:10 **A stakeholder's video message**
- 12:15 **Survey on assessment and regulation**
- 12:20 **Sustainability and profitability assessment of reuse and desalination solutions**
Rémi Declercq, ECOFILAE

- 12:35 Fostering knowledge sharing and the exploitation of FIT4REUSE results to support the implementation of water reuse practices**
Exploitation and transferability of FIT4REUSE results beyond the life of the project
Antonia Lorenzo, BIOAZUL
Knowledge sharing and stakeholder engagement: the Multi-Stakeholder Platform, the webinars and the Water Reuse Days
Viola Benedetti, Italian National Institute for Environmental Protection and Research
Future scenarios for the diffusion of water reuse: the foresight exercise
Matteo Vittuari, University of Bologna
- 13:05 Pillar 3: Q&A**
- 13:15 Launch break**
- 14:30 Round table: the experience of FIT4REUSE – Main outcomes, challenges and insights for the future**
Moderator: Marco Orlando, PRIMA Programme
Simos Malamis, National Technical University of Athens – Özlem Karahan Özgün, ITUNOVA – Rémi Declercq, ECOFILAE – Atef Jaouani, University of Tunis El Manar, Higher Institute for Applied Biological Sciences of Tunis – Antonia Lorenzo, BIOAZUL
- 15:30 Coffee break**
- 15:50 Panel discussion: water reuse, the Italian experience**
Moderator: Attilio Toscano, University of Bologna
Francesco Fatone, Marche Polytechnic University – Michele Solmi, Consorzio della Bonifica Renana – Maurizia Brunetti, HERA SpA – Francesco Tomatore, Regione Emilia-Romagna
- 16:40 The PRIMA Programme and its support to sustainable water management**
Marco Orlando, PRIMA Programme
- 17:00 Presentation of the main outcomes of the 3rd Water Reuse day**
Attilio Toscano and Stevo Lavrić, University of Bologna
- 17:10 Closure of the event**

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3. OUTCOMES OF THE THIRD WATER REUSE DAY

3.1 OPENING SESSION AND ROUND TABLE “THE CHALLENGE OF WATER SCARCITY IN AGRICULTURE”

The third Water Reuse Day took place in Bologna (Italy), at Palazzo Pepoli and started on the afternoon of the 23rd of November 2022.

In the opening session, Prof. Attilio Toscano (UNIBO), the project coordinator, introduced FIT4REUSE and the objectives of the event. Angelo Riccaboni – Chair of the PRIMA Foundation and Luca Fontanesi – Delegate on competitive research projects (UNIBO) took part to the initial greetings, underlying the relevant role of research and innovation for a more sustainable water management and the importance of the transfer of the results towards the community.



Figure 3.1: Attilio Toscano (UNIBO) during the third Water Reuse Day



Figure 3.2: The Round Table “The challenge of water scarcity in agriculture”

challenges that agriculture is facing in coping with water scarcity and on the potential of water reuse in this context.

After the round table, Attilio Toscano presented an overview on FIT4REUSE, describing its objectives, partners involved and the project’s concept, based on 3 pillars:

- innovation of treatment technologies;
- application of non-conventional water resources in simulated/relevant environment;

- assessment and regulation.

The pillars of FIT4REUSE have been explored during 3 dedicated sessions, details of which are described in the next chapters.

3.2 PILLAR 1: INNOVATIVE SOLUTIONS FOR WASTEWATER TREATMENT AND DESALINATION

The first pillar of FIT4REUSE is focused on the development of innovative, sustainable and low cost technologies for municipal wastewater treatment for agricultural reuse and for the improvement of the desalination process.

After a brief introduction on the objectives of the Pillar by Tadej Stepisnik Perdih (NTUA), Prof. Luigi Rizzo from University of Salerno, delivered a keynote speech in which he presented the experience developed within the project DSWAP, with particular reference to the tertiary treatment of municipal wastewater by solar photo Fenton process as a sustainable solution for a safe water reuse. The speaker discussed the challenges in tertiary treatment of urban wastewater, also in relation to the requirements of the EU wastewater reuse regulation (EU 2020/741), describing the state of the art and the potentials of the photo driven advanced oxidation processes.

To follow, two video-messages from relevant stakeholders that may benefit from the solutions developed by FIT4REUSE have been presented. Sharon Sason, the CEO of ProBeauty company (Israel), presented the experience in the implementation of the Photobioreactor (PBR) technology, also tested within FIT4REUSE. Georgia Stefanakou, executive director of mayor projects of Athens Water Supply and Sewerage Company SA (Greece), discussed about the ongoing water reuse projects of the company, that have been developed in response to water scarcity issues, to provide reclaimed water in compliance with Greek National standards for irrigation, urban reuse and aquifer recharge.

The session continued with the presentation of the results of the implementation of the technologies developed by FIT4REUSE, starting from the innovations in municipal wastewater treatment for agricultural reuse.

Atef Jaouani (ISSBAT), presented the outcomes of WP2 that was oriented to the design, setup, improvement and optimization of nature-based solutions (NBS), focusing on single stage and hybrid constructed wetlands systems for municipal wastewater treatment and safe reuse in agriculture. In particular, the characteristics, main objectives and results obtained by NBS pilot plants - located in Granarolo dell'Emilia (Italy), El Manzah (Tunisia) and Antissa (Lesvos Island, Greece) - were discussed and indications for future research activities were provided.

Evridiki Barka (NTUA), described the configuration, the operational conditions and the performances obtained by the intensive solutions for municipal wastewater treatment developed

within WP3, for the optimization of intensive anaerobic treatment, nutrient recovery and the removal of contaminants of emerging concern (CECs) and heavy metals, tested as single operation units or combinations in larger treatment trains in order to achieve high quality of reclaimed water for irrigational purposes.

The integration of nature-based and intensive solutions for municipal wastewater treatment, developed under WP5, was the topic of the presentation of Francesco Fatone (UNIVPM), who discussed the results obtained by the integrated treatment train implemented in the pilot plants installed in Imola (Italy), Antissa (Greece) and Chotrana (Tunisia).

After the first group of presentations dedicated to wastewater treatment for agricultural reuse, Sarit Bason (MEKOROT) discussed about the characteristics and the results obtained by the 4 pilot plants included in WP4, focused on the environmental improvement of the desalination process, with particular reference to the reduction of desalination energy consumption and the improvement of desalination brine management.

In conclusion of the session dedicated to Pillar I, Özlem Karahan Özgün, (ITUNOVA) presented the Simulation Platform, a modelling tool developed under WP5 in order to predict the behavior of the technologies developed in WP2, WP3 and WP4, individually or as integrated systems. The Simulation Platform has been designed as a tool for decision making, in order to predict the best treatment configuration according to specific purposes, considering the required treatment performance (conventional parameters, micropollutants and pathogens) and treatment cost in terms of energy consumption and CO₂ production.

After the last presentation, Attilio Toscano closed the first day of the event.

3.3 PILLAR 2: USE OF TREATED MUNICIPAL WASTEWATER AND DESALINATED WATER FOR IRRIGATION AND AQUIFER RECHARGE

The session dedicated to Pillar 2 was opened on the 24th of November 2022.

Stevo Lavrnić (UNIBO), introduced the second Pillar of FIT4REUSE, whose objective is to assess the use of the reclaimed water produced by the innovative technologies developed under Pillar I.

The session started with the keynote speech of Adriano Battilani, General Secretary of Irrigators d'Europe. The speaker underlined how the new European Regulation has completely changed the approach to water reuse, that now needs to take into consideration a complex system, the water reuse schema, in which different actors are involved: the water agencies, the agricultural water managers and the farmers. The management of each single water reuse scheme needs to take into consideration the intersectoral conflicts that may arise between all the involved parties. Starting from these premises, the speaker illustrated seven steps towards an efficient and sustainable use of reclaimed water in agriculture.

To follow, another contribution from the end-user sector has been presented, through a video-message from Kais Oueslati, a farmer and member of important Tunisian agricultural associations, who described the challenge that farmers in North Africa face when dealing with increasing water scarcity. In this context, the speaker stressed how non-conventional water resources represent a precious alternative for the agricultural sector.

After the stakeholders' contributions, the session continued with the presentation of the results of the different activities performed under Pillar II and focused on the use of reclaimed water for irrigation, fertigation and aquifer recharge.

Roy Elkayam (MEKOROT) presented the research activity focused on the improvement of aquifer recharge and soil aquifer treatment (SAT). The study has been focused on the Shafdan Wastewater Treatment Plant, located in the center of Israel, which secondary effluent flows into an operational reservoir and then towards a SAT system. The speaker discussed the methodology applied for the development of a modelling study aimed at the prediction of the infiltration rate during flooding events, basing on environmental and operational parameters, as well as the obtained results.

Rémi Declercq (ECOFILAE) discussed the study on the application of non-conventional water resources in agriculture, aimed at assessing the agronomic, environmental and sanitary impacts and at identifying adapted and sustainable practices in different soil, climate and crops conditions.

To follow, Rafael Casielles (BIOAZUL), illustrated the irrigation and aquifer recharge guidelines, which are intended to be an advisory document for farmers and water reuse practitioners. The guidelines aim to provide practical management advises in order to minimize the adverse effects may occur in the soil, the crop or the irrigation system and to maximize the benefits of the use of reclaimed water, included those related to its nutrients content.

In the last presentation, Francesco Fatone (UNIVPM), presented the approach applied towards water reuse risk management planning developed in FIT4REUSE, that aims to adapt the European methodology, according to EU Regulation 741/2020 and to the recent published guidelines 2022/C298/01, to the Mediterranean basin. The starting point has been the harmonization of worldwide standards, national standards and the most advanced case studies. The risk-based management approach, which has been updated and upgraded according to the most recent literature, starts from the risk characterization, followed by the integration and prioritization of risks and then by the technological performances' evaluation. Finally, it is very important to ensure the right communication. To follow, the speaker discussed the key elements of the approach implemented in FIT4REUSE, applied to the integrated wastewater and reuse system, which include preliminary information, the system description, the risk assessment, the consideration of additional requirements and the monitoring step.

After the presentations, the question-and-answer session allowed to discuss some additional topics of interest related to the use of non-conventional water resources, as the valorization of the fertilizer savings achieved using reclaimed water.

3.4 PILLAR 3: ASSESSMENT AND REGULATION OF WATER REUSE

The session dedicated to Pillar 3 has been held on the 24th of November 2022, following the session dedicated to Pillar 2.

Viola Benedetti (ISPRA), introduced the objectives of Pillar 3, focused on assessment and regulation, that builds on outcomes of the previous two pillars to provide a holistic assessment of the use of non-conventional water resources and to increase the diffusion and the public acceptance of water reuse practices.

An Innovative approach for unlocking the potential of non-conventional water for agricultural development was discussed during the keynote speech delivered by Faycel Chenini, FIT4REUSE External Advisory Board member. The speaker stressed the need to develop a clear vision for water reuse development, in which non-conventional water resources should be at the heart of Integrated Water Resource Management (IWRM) and should be seen as a sustainable alternative to improve water and food security.

In the following video-message, Olcay Unver, Professor of Practice at Environmental and Resource Management Program at Arizona State University, shared his considerations on the topic of water reuse, which brings together many mayor components of the 21st century water management paradigm. In the context of the transition from a linear to a circular economy, it is stressed the great potential of water reuse to turn what we have called so far “a waste” into a valuable resource.

Focusing on the outcomes of FIT4REUSE activities developed under Pillar 3, Rémi Declercq (ECOFILAE) presented the approach and the outcomes of the sustainability and profitability assessment of reuse and desalination solutions. The assessment, based on Cost-Benefit Analysis and Life Cycle Analysis, has been focused on the economic and financial profitability, on the environmental impacts and on the social impacts of FIT4REUSE solutions. Five case studies have been analyzed in 4 of the countries of the consortium with the objective to assess the profitability and sustainability of the technological solutions in a logic of eco-conception and to compare them with business-as-usual solutions.

In the following presentation, Antonia Lorenzo (BIOAZUL), discussed the work performed regarding the exploitation and transferability of FIT4REUSE results beyond the life of the project. The activities performed included the identification of key exploitable results within FIT4REUSE and the selection of 4 of them, for which a business plan is being developed. An important support in this sense has been the Business Plan Development Service of Horizon Results Booster (HRB), an

initiative of the European Commission and PRIMA to assist beneficiaries to bring their results closer to the market by developing effective business plans.

The activities performed within FIT4REUSE to foster knowledge sharing and stakeholder engagement, presented by Viola Benedetti (ISPRA), include the engagement of local stakeholders through the establishment of Water Reuse Forums in each of the Countries of the Consortium, the development of a Multi-Stakeholder Platform, the organization of Webinars to promote knowledge sharing and co-production and the organization of Water Reuse Days, aimed at reaching the wider public and at bringing additional stakeholders in contact with the project. The Multi-Stakeholder Platform, one of the main outcomes of the activities, is a web tool that has been conceived to reach the widest range of stakeholders in order to to create a community around non-conventional water resources and to act as a supporting service for knowledge co-production and collaborative working thanks to its specific functionalities.

In the following presentation, Valentina Guerrieri (UNIBO) described the work done for the development of the foresight exercise: a first step has been the drafting of an inventory of the current legislative and policy frameworks, about which a perceptions analysis was performed. The following steps were focused on the identification of the drivers that hamper or facilitate the diffusion of non-conventional water resources and the development of future scenarios for water reuse, with the final objective to draft a set of policy interventions and recommendations.

3.5 FIT4REUSE ROUND TABLE AND PANEL DISCUSSION ON THE ITALIAN EXPERIENCE

Following the presentation of the 3 Pillars, a round Table discussion has been dedicated to the experience of FIT4REUSE, with a focus on challenges and lesson learned, the main outcomes and the future perspectives. The round table, moderated by Marco Orlando (PRIMA Foundation, FIT4REUSE Project officer), saw the participation of 5 project partners - Simos Malamis (NTUA), Özlem Karahan Özgün (ITUNOVA), Rémi Declercq (ECOFILAE), Atef Jaouani (ISSBAT) and Antonia Lorenzo (BIOAZUL) – that shared the experience gained during the development of FIT4REUSE activities from different perspectives, including the technological aspects, the modeling of treatment solutions, the use of



Figure 3.3: Round Table "The experience of FIT4REUSE – Main outcomes, challenges and insights for the future"

reclaimed water, the holistic assessment of the developed solutions and the exploitation of the results.



Figure 3.4: Panel Discussion " water reuse, the Italian experience"

To follow, the relevant local Italian stakeholders from different organizations took part in a panel discussion focused on experiences and approaches to water reuse. The Panel discussion, moderated by Attilio Toscano (UNIBO) saw the participation of Francesco Fatone (UNIVPM), Michele Solmi (Consorzio della Bonifica Renana), Maurizia Brunetti (HERA SpA) e Francesco Tornatore (Regione Emilia-Romagna).

The discussion allowed to present the perspective of different local actors that are involved in the water reuse process, already implemented for agricultural

purposes in some areas of the Emilia-Romagna Region in response to water availability issues.

In the following and last presentation, Marco Orlando (PRIMA Foundation, FIT4REUSE Project officer) presented an overview of the PRIMA Programme, aimed at addressing relevant challenges in the Mediterranean Area. The programme is built upon 4 thematic areas: management of water, farming systems, agro-food value chain and water, energy, food and ecosystem nexus.

The speaker illustrated the main features of PRIMA and the expected impacts, together with the overall achievement for the period 2018-2021.

After the last presentation, Attilio Toscano and Stevo Lavrnić (UNIBO) presented a summary of the third Water Reuse Day, thanked all the participants and closed the event.

4. CONCLUSIONS

In conclusion, the third Water Reuse Day met the objective to reach the wider public participation and to bring additional stakeholders in contact with the project: 47 participants attended to the event in Bologna and:

- 275 people connected to the on-line streaming on the 23rd of November;
- 214 people connected to the on-line streaming on the 24th of November.



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Since the end of the 3rd Water Reuse Day, the visualizations of the recording of the event, published on the YouTube channel of the University of Bologna, are continuously increasing, proving the high interest in the project and in the discussed topics. The recordings are available at the following links:

- [FIT4REUSE 3rd Water reuse day - First day – 23/11/2022](#)
- [FIT4REUSE 3rd Water reuse day - Second day – 24/11/2022](#)

Thanks to the large diffusion of the Third Water Reuse Day, stakeholders have been reached in different countries and important results have been collected. Experts and stakeholders have been engaged in knowledge sharing and co-production processes, thanks to different types of contributions (such as keynote speeches and video-message) and roundtables organized during the event.

Therefore, the main goal of the third Water Reuse Day event was achieved: to reach the wider public and bring the stakeholders in contact with FIT4REUSE, in order to develop further the project results and to allow sharing and dissemination.