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Innovative Solutions in the Process Industry for next generation Resource Efficient Water Management

Collaborative project

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INSPIREWATER cross-cutting issue workshop

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When	Who	Comments
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1. Executive Summary

Two workshops were organised to facilitate and promote the exchange of knowledge and results between the different technology and application communities involved in the integrated INSPIREWATER approach as well as between different research projects. The aim was to support the dissemination and exploitation of the project results for possible future implementation in other demonstrations and industrial applications. Therefore, stakeholders and other projects were identified and contacted through the support of several stakeholder groups and initiatives by e-mail, phone calls, newsletters and social media.

The first workshop was broader in scope and aimed in particular at the process industry on the topic of integrated water management, current needs and innovative approaches. As there are three water-related projects currently running in SPIRE under Horizon2020, the idea was to use the knowledge of the three projects also for cooperation, exchange, synergies and stimulation of new ideas as well as the exchange with interest groups outside the projects. Apart from INSPIREWATER the other two projects are SPOTVIEW and REWACEM. Three experts from the chemical, steel and paper industry together with partners from all three projects filled the workshop with content. The event was complemented by pitches in the form of poster presentations and plenty of time for networking and discussion during the breaks.

The second workshop focused on water and energy efficiency measures in relation to process and cooling water in industrial water circuits. This workshop was organised in collaboration with the EU project WaterWatt. The workshop was part of the “Industrial Water 2018” conference in Frankfurt/Main Germany at DECHEMA. Specific demo case studies from the steel and chemical industries on water and energy efficiency measures were presented. The group then divided into three subgroups according to the demo cases and each subgroup discussed challenges, solutions and drivers for the implementation of water and energy efficiency measures. These were collected and discussed with the whole group. Finally, possible technical and digital solutions from the projects were presented and an online tool for energy efficiency could be tested.

The cross-cutting issue workshops were very successful and led to new ideas and cooperation. They have brought all participants and the participating projects and project partners significantly forward with regard to considerations and implementation of water management as well as energy and water efficiency measures. The cooperation was facilitated so that the new concepts, instruments and research results can be implemented later and supported by further exchange. This cooperation will also contribute to making the final conference of INSPIREWATER a success, and the follow-up points from the workshops are a good starting point for the final presentations and the groups of stakeholders to be invited.

2. Introduction: Cross-cutting issue workshop

Cross-cutting issue workshops are intended to help support the implementation of project results in demonstrations and industrial applications. The aim of the workshops was to achieve demand-oriented developments that are oriented to market needs beyond INSPIREWATER and a solid linkage of synergies from the various development paths. Two workshops were organised to facilitate and promote the exchange of knowledge and results between the different technology and application communities and stakeholders as well as between different research projects. Parties interested in developing initiatives related to INSPIREWATER or the other projects have been identified through their respective networks, in particular also outside the steel and chemical industries. The concept of the workshop on cross-cutting topics has already been successfully implemented in the cooperation of networks such as SusChem and WssTP as well as the ChemWater and E4Water FP7 projects.

3. Content of the workshops

Both workshops dealt with the topic of water efficiency in the process industry. The first workshop emphasised current needs and innovative approaches in water management, while the second workshop focused on the relationship between water and energy and the concomitant challenges and drivers.

3.1 First workshop

The first of the two workshops took place on 8 February 2018 in Frankfurt/Main Germany. The title of the workshop was “Water efficiency in process industry – current needs and innovative approaches”. The workshop was organised by DECHEMA with support by the two other SPIRE projects SPOTVIEW and ReWaCEM from the call “Water Management Systems – SPIRE01-2016”. The Executive Director of SPIRE was present for a presentation.

The ReWaCEM project aims at reducing water use, wastewater production, energy use and water footprint by between 30-90% as well as increasing valuable metal resource recovery in the metal plating, galvanizing and printed circuit board industry.

The objective of the SPOTVIEW project is to develop and demonstrate innovative, sustainable and efficient processes and technology components, in order to optimize the use of natural resources, especially water, in three industrial sectors (Dairy, Pulp and Paper and Steel) contributing to 44% of industrial water usage in EU.

A total of three industry representatives from the chemical, steel and paper sectors gave an introductory lecture on the current situation and the future challenges in water management for their respective sectors. A panel discussion complemented the general presentations. After speed poster presentations in the form of 3 min pitches the focus turned to the specific outcomes and goals of the three projects, again with a concluding panel discussion. Enough time for discussions was given during the lunch and coffee brakes (Figure 1).

Figure 1: Participants discussing and networking at the first joint cross-cutting issue workshop in Frankfurt at DECHEMA.

To facilitate discussion and networking, a photo wall with pictures and associated business cards of the participants was installed (Figure 2).

Figure 2: One of the photo walls of participants of the workshop to facilitate networking and discussions.

The workshop was very well attended with more than 100 registrations. The participants came from all over Europe from different fields, especially the industry was well represented, besides people from science and research as well as authorities.

The Agenda of the first cross-cutting issue workshop was as follows:

Water Efficiency in Process Industry – current needs and innovative approaches
(8th February 2018 at DECHEMA, Frankfurt a.M., Germany)

09:30 Registration and welcome coffee

10:30 Start of the Workshop program

Moderation: Thomas Track, DECHEMA

10:30 **Welcome and introduction**
DECHEMA, SPIRE (Àngels Orduña Cao)

10:50 **Keynote lecture: Water and Waste Water in the Chemical Industry: Management, Challenges and Future Developments**
Andree Blesgen, Evonik Technology & Infrastructure GmbH, Head of Environmental Technology, Process Technology and Engineering, Technology & Infrastructure

11:10 **Keynote lecture: Water management in steel Industry - state of the art and challenges**
Thorsten Thörner, German Steel Federation, Sustainability

11:30 **Keynote lecture: Water Efficiency in the Pulp and Paper Industry: situation and new challenges**
Serge Andres (R&D Manager, Emin Leydier Company) and
Eric Fourest (Team Manager Water - Energy - Environment; Centre Technique du Papier)

11:50 **Panel discussion**

12:25 **Speed presentation of posters**

12:45 Networking Lunch – Poster presentation

14:30 **Improved water efficiency in the process industry by intelligent water management and technology solutions (INSPIREWATER)**
Uwe Fortkamp, IVL

14:45 **Efficient water use in steel industry by innovative and sustainable solutions (INSPIREWATER/SPOTVIEW)**
Martin Hubrich, VDEh-Betriebsforschungsinstitut (BFI), Beatrice Padilla Vivas, Patricia Gomez Leiva, Elena Piedra Fernandez (ArcelorMittal)

15:00 **Sustainable Processes and Optimized Technologies for Industrially Efficient Water Usage (SPOTVIEW) – New strategies for the Pulp and Paper Industry**
Eric Fourest (Centre Technique du Papier), Antti Grönroos (VTT)

15:15 **Ressource recovery from industrial waste water by cutting edge membrane technologies (ReWaCEM)**
Joachim Koschikowski, Fraunhofer-Institute for Solar Energy Systems ISE

15:30 **Discussion and Conclusions on current needs and innovative approaches in water efficiency in process industry**

16:00 Networking coffee and official end of the workshop (~17:00 end)

After the workshop experts were asked to fill out a questionnaire with information about their background and their opinions regarding innovation in water treatment, integrated water management and digitization (see Annex). The outcomes of the questionnaire were used specifically for discussion rounds in stakeholder meetings, in presentations to stimulate discussion and in individual conversations with important target groups. As each project has a different focus on different process industries the cross-sectoral exchange contributed to solutions for the process industry as a whole. Furthermore, experiences from cases and technologies were used regarding the water management framework conceivably leading to synergies to boost the outcomes of each project.

3.2 Second workshop

The second workshop took place on 30 November 2018 in Frankfurt/Main and was a collaboration between the EU projects WaterWatt and INSPIREWATER. WaterWatt is an EU funded project which addresses the improvement of energy efficiency in industrial water circuits. It aims to remove market barriers for energy efficient solutions, in particular the lack of expertise and information on energy management and saving potential in industrial water circuits. The main objective of the project is the development of an Energy Efficiency Evaluation Platform (E3 Platform) to offer stakeholders the expert knowledge on improving energy efficiency. The workshop was part of the “Industrial Water 2018” conference. The conference is the information hub for all experts in industrial water management, from applied research, technology development, application - solution providers and industrial water users. The title of the workshop was “Increasing water and energy efficiency in process industry – tools, technologies and concepts“. In this context, a holistic view of water and energy efficiency measures in relation to process and cooling water was to be taken and discussed with stakeholders from the process industry. Specific case studies from the steel and the chemical industry regarding water and energy efficiency measures were presented. Participants were also introduced to the recently developed online tool for evaluating energy efficiency (E^3 Platform) and had the opportunity to test the tool during the workshop. After a welcome and introduction to the water-energy interaction in industrial circuits, a short presentation of each project was given, followed by insights into 3 demo sites dealing with energy and water efficiency (2 INSPIREWATER cases and 1 WaterWatt Case). Then the group divided into three subgroups according to the demo cases and each subgroup discussed challenges, solutions and drivers for the implementation of water and energy efficiency measures (Figure 3).

Figure 3: Participants discussing in subgroups at the second joint cross-cutting issue workshop in Frankfurt during the Industrial Water conference at DECHEMA.

Finally, possible solutions were presented, Lex van Dijk from Blue-Tec (forward osmosis and ammonia membrane stripping), Jan Koppe from MOL Katalysatortechnik (MOLLIK catalyst) and the E^3 platform developed in WaterWatt by Jochen Michels (DECHEMA). 55 persons registered for the workshop, the participants attending the workshop came from Portugal, Germany, China, Netherlands, Switzerland, Singapore, India, Italy, Belgium, Sweden, Belgium, United Kingdom and Egypt.

The Agenda of the second cross-cutting issue workshop was as follows:

Increasing water and energy efficiency in process industry – tools, technologies and concepts

Moderation: Pavel Ivashechkin/BFI, Jochen Michels/DECHEMA

09:00 – 10:00 Welcome and introduction

Why is the link between energy and water efficiency important for the industry?
(Pavel Ivashechkin, VDEh-Betriebsforschungsinstitut GmbH, Düsseldorf/D)

How to prioritize your work with energy and water?
(Thomas Track, DECHEMA e.V., Frankfurt/D; Fredy Dinkel, FH Nordwestschweiz, Basel/CH)

How to increase water and energy efficiency in process industry?
(Staffan Filipsson, IVL, Stockholm/S; Jochen Michels, DECHEMA e.V., Frankfurt/D)

Case study experiences:

- **DEW case: Monitoring energy demand of industrial water circuits**
  (Pavel Ivashechkin, VDEh-Betriebsforschungsinstitut GmbH, Düsseldorf/D)
- **ArcelorMittal case: How to save energy and water in cooling water circuits in steel industry?**
  (Martin Hubrich, VDEh-Betriebsforschungsinstitut GmbH, Düsseldorf/D)
- **Clariant case: Towards zero-liquid discharge in European chemical industry?**
  (Mateo Pastur Romay, Clariant Ibérica Producción S.A., Tarragona/ES)

10:00 – 11:00 Three break-out sessions: Challenges and solutions for each of the case studies

Questions to be discussed:

1) Challenges in the implementation of water and energy efficiency measures
2) Solutions and drivers for the implementation

11:00 – 11:30 Coffee break and networking

11:30 – 13:00 Solutions and tools for improved energy and water efficiency:

- **Technical solutions**
  (Lex van Dijk, BLUE-tec bv, Renkum/NL; Jan Koppe, MOL Katalysatortechnik GmbH, Schkopau/D)
- **WaterWatt E^3 platform**
  (Jochen Michels, DECHEMA e.V., Frankfurt/D)

Open discussion (starts with results of the break-out sessions)

13:00 – 14:00 Lunch snack, networking and opportunity to test the E^3 platform

After the workshop, a summary of the challenges and drivers collected in the sub-groups in relation to water and energy efficiency was disseminated.

4. Conclusion

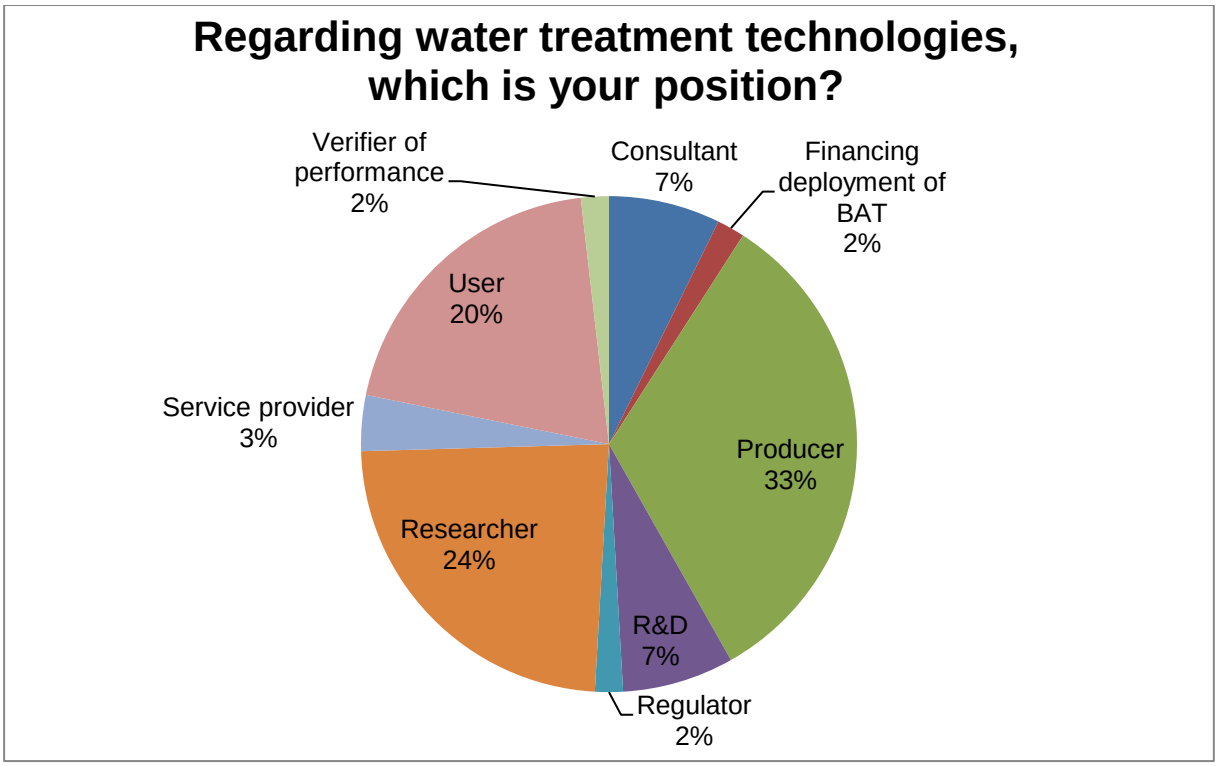
The cross-cutting issue workshops were very successful leading in new ideas and cooperation. They have brought all stakeholders and the involved projects and project partners a good deal further in terms of considerations and implementations on water management as well as energy and water efficiency measures. Cooperation has been facilitated so that the new concepts, tools and research results can be implemented subsequently and supported by further exchange.

This cooperation will also contribute to making the final conference of INSPIREWATER a success and the follow-up points from the workshops are a good starting point for the final presentations and the groups of stakeholders to be invited.

5. Annex

Questionnaire of the first Workshop „Water efficiency in process industry – current needs and innovative approaches

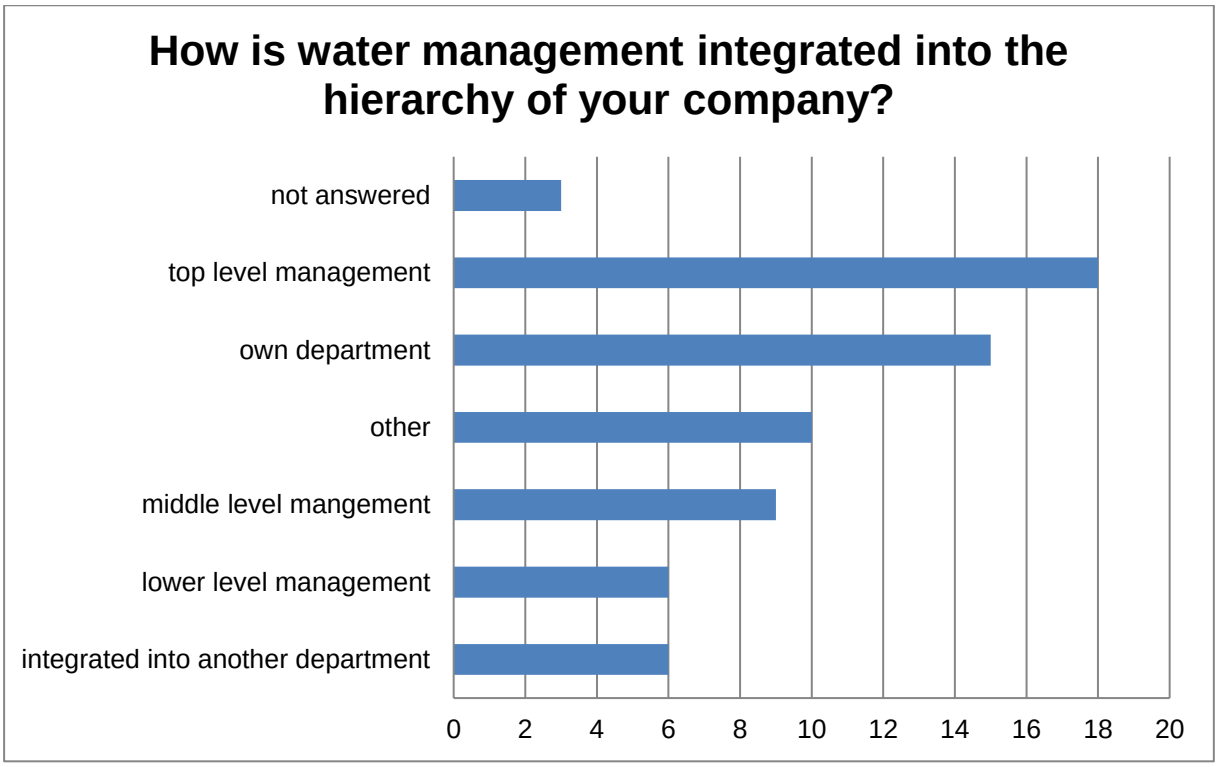
55 Persons answered the following questions in our questionnaire

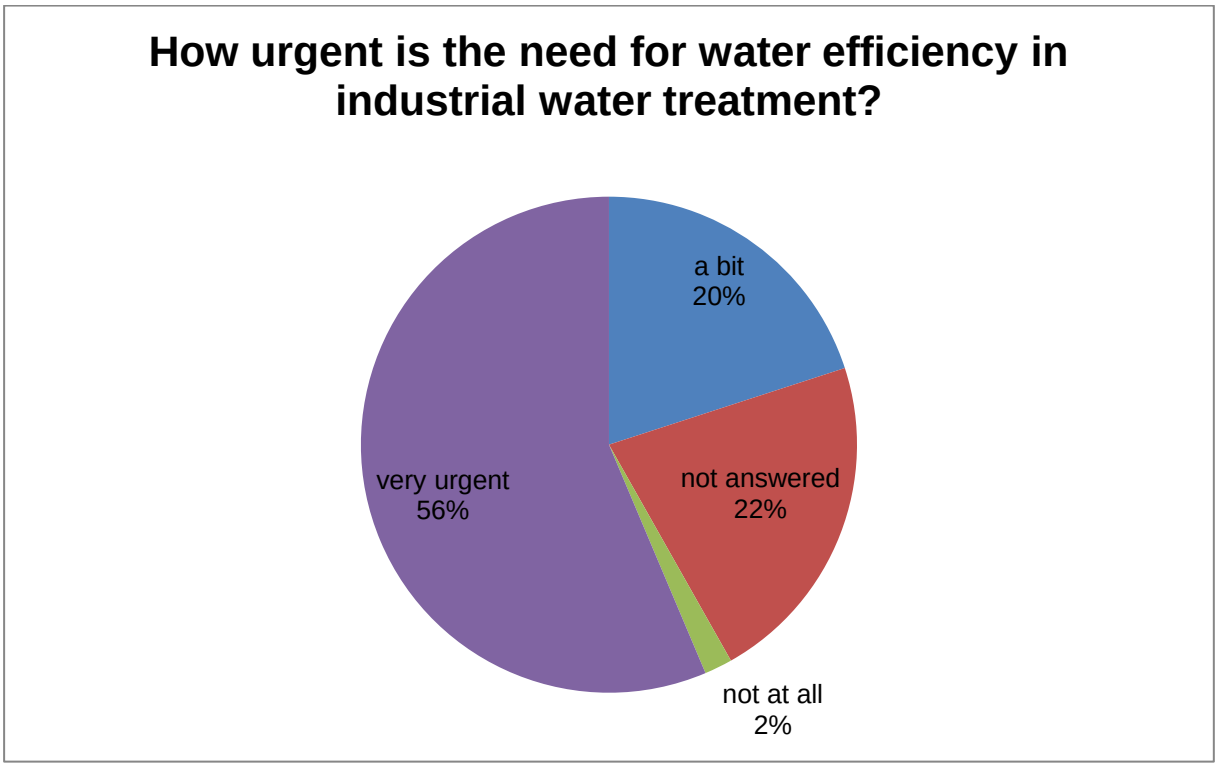


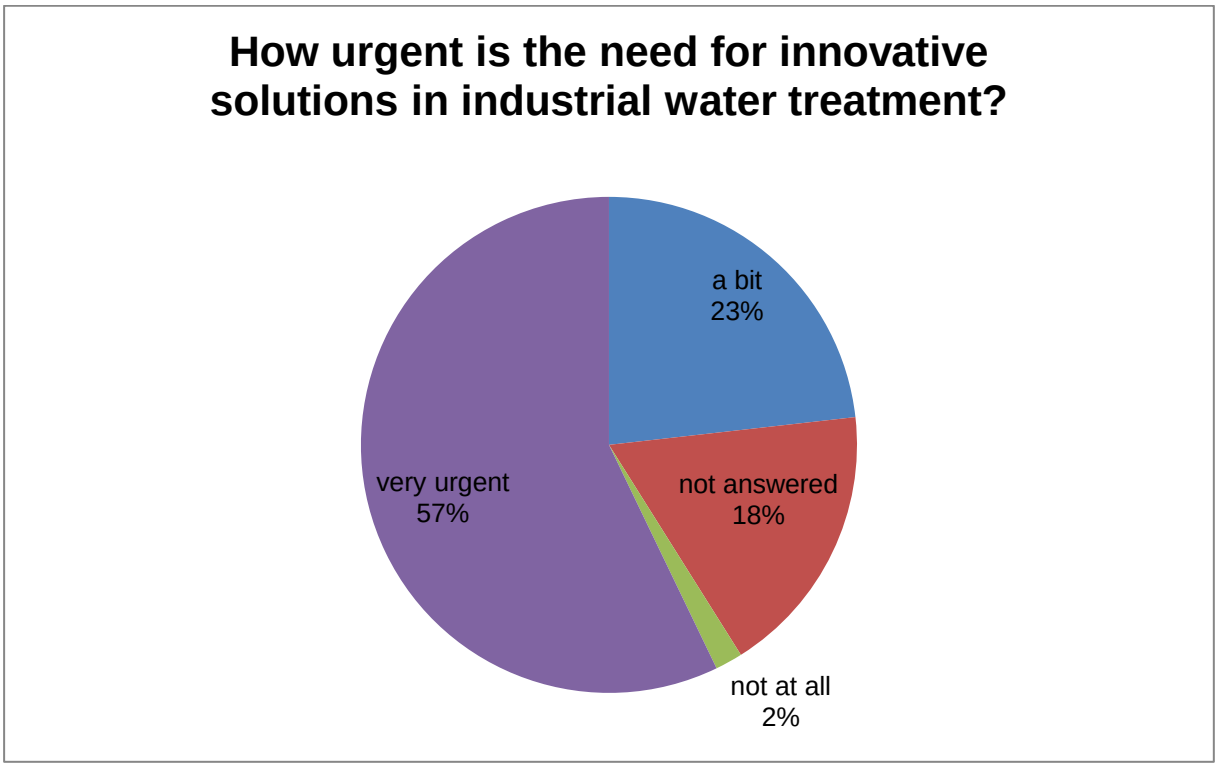
What is your area of expertise?
Separation technology (2)
Water Treatment; sustainable water management
Corporate water management
AOPs, natural systems, membrane technologies
drinking water (from source to tap)
Industrial water
Water Treatment Chemicals
Economics/ Water Resources
membrane separation processes
Membrane technology, Forward Osmosis, Ammonia Membrane Stripping
All type of treatment
environment protection

integration/optimisation of water streams
water chemistry, physical/chemical characterization, water pre-treatment
Business Development
Operator models water and wastewater technology municipal and industrial
Waste Water Technology
Reuse technologies
Sewage sludge recycling, in particular drying
Heat exchangers out of heat conductive polymer
Wastewater Technology (anaerobic, aerobic, membrane, physical-chemical)
Process Development / Membrane technology
Pulp and paper making
Hygiene and Legionella
aerobic biological and tertiary (physical/chemical) treatment
Industrial wastewater treatment, membrane distillation
Resource recovery
water technology/water management
Water Treatment Solutions
Industrial waters. Boiler. Legionella. DAF
Suez Water Technologies and Solutions - Global Technology Leader
Water and energy management
Water treatments
Process water reuse
Instrumentation, Sensors
Reverse Osmosis and Ultrafiltration
Papermaking
Treatment technologies and water management
Environmental Technology Verification
Engineering
water treatment research
Process, DI and wastewater treatment
Water treatment and management
Process chemistry
Industrial water treatment
Regulatory and operations
EHS Manager
industrial and municipal water and wastewater treatment

Development membrane processes
water treatments
Catalytic Water Treatment
Membrane Distillation



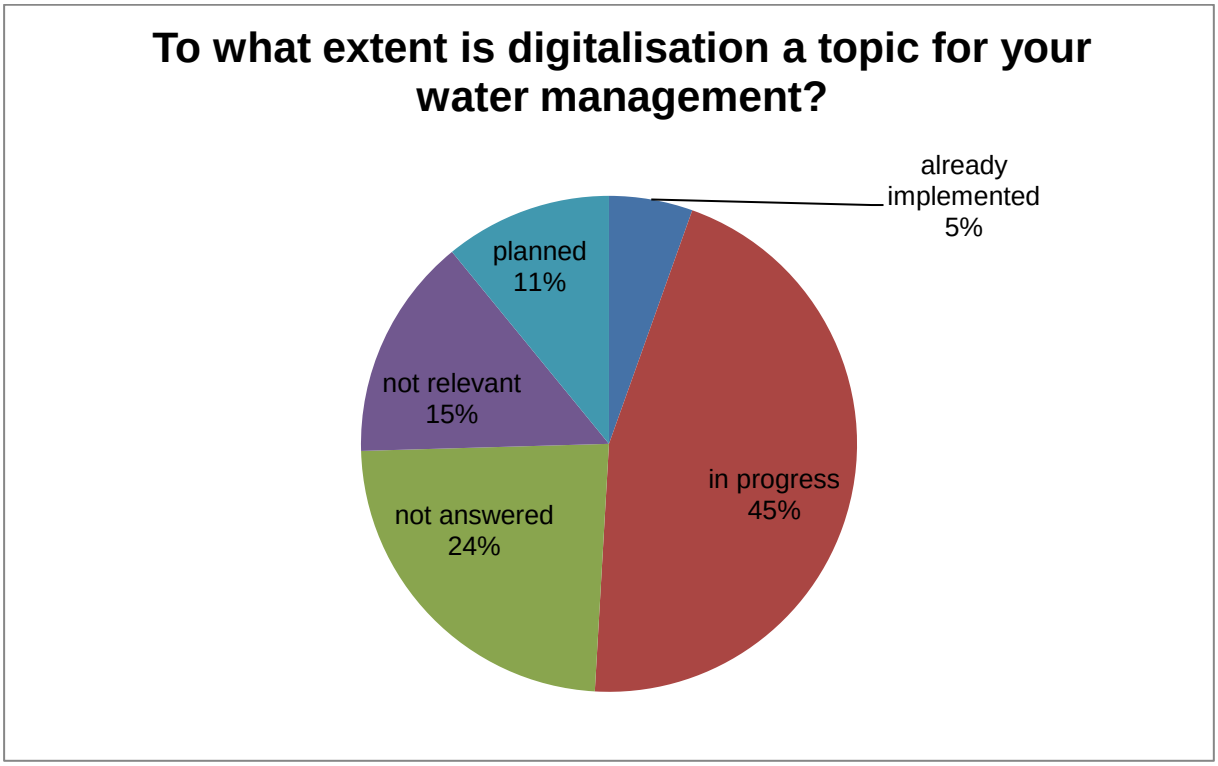




What are the main challenges in introducing a new technology for industrial water treatment?
Time to market, economics (2)
balancing resource efficiency and economics

Existing structures, process accreditation
I'd like to learn more about this at the workshop
The process from innovation to implementation
Without benefits in terms of cost-in use, water recycling or regulatory pressure rather difficult.
cost effectiveness/ business case/ price for water/ knowledge sharing/ technology supply chains
First full scale application of a industrial project (scale up from pilot to full scale)
Efficiency and reliability
cost-effectiveness
Cost-effective solutions
finding compelling value proposition for our customers
Investment cost focus
A "never change a running system" mentality: too little experience with new technology is typically the main barrier because it is seen as a risk
Acceptance, economy, security
The TRL of the technologies
Corrosion resistance at reasonable price
Reliability, successful proof of concept
robustness, costs, technology readiness level
Reduction of water withdrawal and increase water recycling with compromising quality, and at reasonable cost. Produce tailor made water quality for further recycling into the process (eg partial removal of salts but no need for demineralised water) First steps towards water recycling can be cost effective (energy saving) but further ones need new technologies that require energy and/or chemicals. Overall environmental impact still needs to be kept on positive side
Safety in function
Conservatism, it is easier invest to well-known technology
reuse of treated water for production; minimizing bio sludge
A 'middle' step between piloting and commercialization can be difficult to achieve owing to conservative mindsets, rigidity towards new unknown technologies, which are not so proven, and no availability of clear cut cost figures for the industry.
Economy and dedication from management
Trust & References
Actual water cost is in general low. Water reuse technology only implemented if acute shortage occur or strong legal/permit restrictions.
To convince customers team, that there are no issues with the production after retrofit AND a saving of money at the same time. (Without saving money NO possibility for new technologies in lunching the market.)
Overcome habits and ageing practices
Advanced technologies are usually more complex in terms of operation
We have to start considering the risk of not having water of a right quality as part of the investment calculations in water related projects

Slow decisions and conservative thinking
References, case studies, efficiency, cost
ROI
Short economic payback times
Lack of trust in innovations, trust in well-established and recognised certification schemes only, obstacles due to public procurements, conservative approach of large industries to innovation
Economics and reliability/robustness of technologies
I believe that innovative water management concepts are more important than new technology.
Short ROI, existing infrastructure (linear lock-in), missing design guidelines and insufficient full scale examples
To get the management to invest in the environment fully.
low cost of water, risk averse market
Investment costs, evidence for efficacy
cost / benefit ratio
Conservative market, short ROI
Providing long-term references for each field of application.
Barriers to market such as conservative approaches of large industries towards new solutions; the need of many references to enter into a larger market; long investment cycles but short ROI requirements



Summary of the second workshop "Increasing water and energy efficiency in process industry – tools, technologies and concepts":

Challenges and solutions/drivers for the implementation of energy efficiency measures

Challenges

- Lack of knowledge (authorities, management board, LCA, LCC)
- Legislation (Standards, lack of legislation)
- Investment costs, CAPEX/OPEX (e.g. pipe system, consulting)
- Technical problems (membrane fouling etc.)
- Risk of being out of water
- Bringing the new technology to the market (esp. being the first one to invest a new technology)
- Maintenance (high demand of manpower)
- Water footprint
- Lack of awareness (of water and energy being so interconnected)
- Measurement systems are missing

Solutions and Drivers

- Providing knowledge (integration of water and energy connection in energy management systems or regulations, training, holistic view)
- Development of the E³-platform
- More/better measurement technology
- Legislations (newly implemented ones or the lack of them)
- The risk of lack of water (in proper quality and quantity)
- Introduction of new technologies
- New concepts
- New company guidelines/concepts (sustainability, green labeling)
- Price of the water (freshwater and discharge water)
- Research projects with demonstration sites, pilot testing
- Funding to support new promising technologies
- Public acceptance of water reuse concepts
- Improvement of marketing, communication