



# Water in the Circular Economy policy development

Workshop report with findings from demo cases of  
Horizon 2020 projects

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# **Water in the Circular Economy policy development**

Workshop report with findings from demo cases of  
Horizon 2020 projects





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## Abbreviations

ABP	Animal By-Products
AnMBR	Anaerobic Membrane Bioreactor
AP	Agronomic Products
BAT	Best Available Techniques
BREF	BAT reference document
CE	Circular Economy
DAF	Dissolved Air Filtration
DG ENV	Directorate-General for the Environment
DG GROW	Directorate-General Internal Market, Industry, Entrepreneurship and SMEs
DG RTD	Directorate-General Research and Innovation
EASME	Executive Agency for Small and Medium-sized Enterprises
ELO	European Landowners Organization
GAC	Granulated Activated Carbon
IAS	Individual or Appropriate Systems
iWWTP	industrial Wastewater Treatment Plant
KPI	Key Performance Indicators
KWR	KWR Water Research Institute
MBR	Membrane Bioreactor
MF	Membrane Filtration
MMP	Municipal Master Plan
NTUA	National Technical University of Athens
nZLD	near Zero Liquid Discharge
p.e.	population equivalent
RBMP	River Basin Management Plans
REACH	Registration, Evaluation, Authorization and restriction of Chemicals
RO	Reversed Osmosis
SLU	Swedish University of Agricultural Sciences
SRM	Slaughterhouse Raw Materials
SWO	Storm Water Overflow
UASB	Upflow Anaerobic Sludge Blanket
UCRAN	Cranfield University
WE	Water Europe
WRP	Water Reclamation Plant
WSIS	Water Smart Industrial Symbiosis
WWTP	Wastewater Treatment Plant



## Relevant EU Policy, Strategies and Regulations

Biodiversity Strategy

[https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030\\_en](https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030_en)

Climate Adaptation Strategy

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:82:FIN>

CEAP            Circular Economy Action Plan

<https://op.europa.eu/en/publication-detail/-/publication/6e6be661-6414-11ea-b735-01aa75ed71a1/language-en/format-PDF/source-search>

DWD            Drinking Water Directive (EU) 2020/2184

<https://eur-lex.europa.eu/eli/dir/2020/2184/oj>

EED            Energy Efficiency Directive 2012/27/EU

<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1399375464230&uri=CELEX:32012L0027>

IED            Industrial Emissions Directive 2010/75/EU

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0075>

FR            Fertilising Products Regulation (EU) 2019/1009

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R1009>

European Green Deal

<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2>

RWRA          Water Reuse Regulation (EU) 2020/741

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0741>

SSD            Sewage Sludge Directive 86/278/EEC

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31986L0278>

UWWTD        Urban Waste Water Treatment Directive 91/271/EEC

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31991L0271>

WFD            Water Framework Directive 2000/60/EC

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060>

ZPAP          Zero Pollution Action Plan

[https://ec.europa.eu/environment/strategy/zero-pollution-action-plan\\_en](https://ec.europa.eu/environment/strategy/zero-pollution-action-plan_en)

## 1. Introduction

The workshop on 'Water in the Circular Economy policy development' is a joint event of Water Europe (WE), EASME and NextGen organised in the frame of Water Knowledge Europe 2021 (WKE2021), side event Water Projects Europe (WPE2021).

The workshop session took place on 26 March 2021 and was hosted by Andrea Rubini (WE) in collaboration with Violeta Kuzmickaite (EASME) and Jos Frijns (NextGen).

The EU Circular Economy Action Plan provides the basis for a regulatory framework that is streamlined and made fit for a sustainable future. In this report, we reflect on the policy implications for the implementation and transferability of initiatives to further close water cycles, reuse water, and recover energy and nutrients from wastewater, based on real-life experience from water in the Circular Economy (CE) demonstration cases across Europe.

In Water Projects Europe 3rd edition water experts and policy makers discussed the governance challenges in the transition towards circular water solutions. Experts from a number of EU Horizon 2020-projects on Water in the context of the Circular Economy reviewed with EU policy-makers relevant regulations, such as the Urban Waste Water Treatment Directive and Sewage Sludge Directive.

The programme consisted of brief presentations from the projects, each highlighting relevant directive topics, and showing results from a demo case on the policy implications for the circular water solutions. Each presentation finalized with a discussion statement. After two sessions with three presentations, the EC policy officers reflected on the statements.

The participating Horizon 2020-projects were:

- Water2Return (<https://water2return.eu/>)
- Run4Life (<https://run4life-project.eu/>)
- NextGen (<https://nextgenwater.eu/>)
- HYDROUSA (<https://www.hydrousa.org/>)
- Project Ô (<http://eu-project-o.eu/>)
- ULTIMATE (<https://ultimatewater.eu/>)

Organisers: Jos Frijns (NextGen), Loïc Charpentier (WE), Simos Malamis (HYDROUSA), Daniel Monteleone (Water2Return), Christos Makropoulos (Ultimate), Stef Koop (Ultimate), Heather Smith (NextGen), Chiara Iurlaro (Project Ô), Annika Nordin (Run4Life), Andrea Rubini (WE), Evdokia Achilleos (EASME), Violeta Kuzmickaite (EASME).

The panellists: Ana-Lucia Crisan (DG GROW), Avelino Gonzalez Gonzalez (DG RTD), Nele-Frederike Rosenstock (DG ENV C2), Michal Chedozko (DG ENV C4), Keir McAndrew (wood), Gonzalo Delacamara (IMDEA Water Institute).

- All presentations are available from Water Europe website:

[WPE2021 - ALL Presentations](#)

## Workshop agenda



Welcome by Water Europe – Andrea Rubini (WE)

Introduction by EASME – Violeta Kuzmickaite (EASME)

Circular Economy (CE) nexus and policy directives: introduction – Jos Frijns (KWR) & Loïc Charpentier (WE)

### *Session 1*

HYDROUSA – Simos Malamis (NTUA)

- Lesbos Island case on decentral small-scale sewage treatment and effluent reuse in agroforestry – Urban Waste Water Treatment Directive

Water2Return – Daniel Monteleone (ELO)

- Salteras case slaughterhouse bio-refinery – CE action plan (Integrated Nutrient Management Plan)

ULTIMATE – Christos Makropoulos (KWR)

- Tarragona case on water reclamation for industrial reuse - Industrial Emissions Directive

*Q&A between the 3 projects and the EC policy officers*

### *Session 2*

NextGen – Heather Smith (UCRAN)

- Sperral case on AnMBR and biosolids recycling – Sewage Sludge Directive and Energy Efficiency Directive

Project Ô – Chiara Iurlaro (IRIS)

- Puglia case on emerging pollutants - Urban Waste Water Treatment Directive and Zero Pollution Action Plan

Run4Life – Annika Nordin (SLU)

- Helsingborg case on fertilizer production from organic waste - fertilizer regulation

*Q&A between the 3 projects and the EC policy officers*

Wrap up and conclusions – Jos Frijns (KWR) & Violeta Kuzmickaite (EASME)

Closing by WE – Andrea Rubini

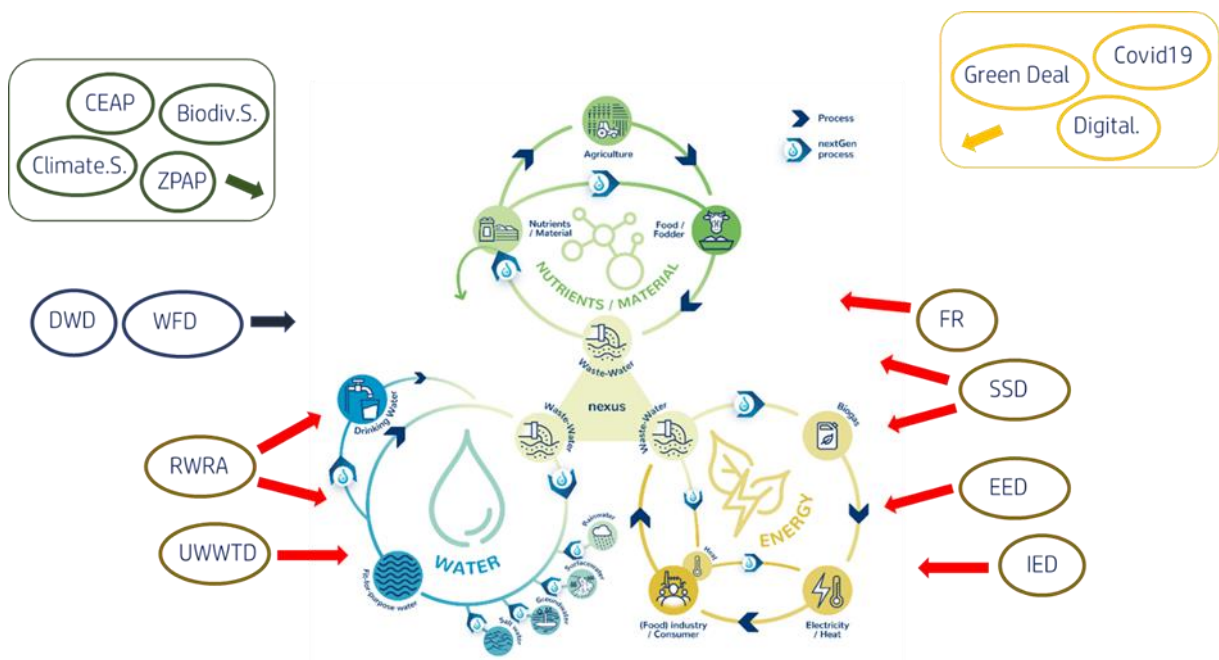
## 2. CE nexus and policy directives

- Jos Frijns (KWR) & Loïc Charpentier (WE)

The new EU Circular Economy Action Plan (CEAP) aims to streamline regulations made fit for a sustainable future. With relevance to the water sector, the EU CE Action Plan will facilitate water reuse and efficiency (including in industrial processes), and announces the review of directives on wastewater treatment and sewage sludge, and the development of an Integrated Nutrient Management Plan to ensure more sustainable application of nutrients and stimulate the markets for recovered nutrients. Among the CE Action Plan priorities is the new Water Reuse Regulation to encourage circular approaches to water reuse in agriculture.

The CE challenges embedded thinking beyond traditional sectoral governance paths. Indeed the CE brings together a number of policy and regulatory regimes resulting in potential gaps and overlaps that affect the feasibility of circular water solutions. Tensions between different regulatory frameworks need to be resolved as the CE is very much a transition from waste management and disposal towards value creation within and between sectors.

The figure below (<https://nextgenwater.eu/unlocking-hidden-potential/>) shows the policy directives related to the water-energy-materials nexus.



The figure shows the green recovery plan for Europe after Covid19 with Green Deals and Digitalisation strategy. Key CE policies and strategies: CEAP Circular Economy Action Plan, Biodiversity Strategy, Climate Adaptation Strategy, ZPAP Zero Pollution Action Plan.

Relevant directives: DWD Drinking Water Directive, WFD Water Framework Directive, RWRA Water Reuse Regulation (for agricultural irrigation), UWWTD Urban Wastewater Treatment Directive, FR Fertilising Products Regulation, SSD Sewage Sludge Directive, EED Energy Efficiency Directive, IED Industrial Emissions Directive (links provided on p.7).

### 3. Policy implications from demo cases

#### 3.1. HYDROUSA



- Simos Malamis (NTUA)
- Lesbos Island case on decentral small-scale sewage treatment and effluent reuse in agroforestry – Urban Waste Water Treatment Directive

HYDROUSA project demonstrates the implementation of low-cost, nature-based and other engineered solutions for the recovery of non-conventional water sources (wastewater, seawater, rainwater and vapour water) to be used in agriculture and for domestic use in the Mediterranean region.

The demo case called HYDRO1&2 for decentralized wastewater treatment plants (WWTP) in Lesbos Greece, shows that energy production in the main treatment line make sense even at small scale (with the capacity of WWTP < 2000 p.e.). It is possible to reduce energy consumption by 15% for plants with < 2000 p.e.; further energy reduction is expected by at least 20% due to optimized operation and energy recovery.

HYDROUSA analysed the current policy and legislations related to water supply, wastewater treatment, water reuse and resource valorisation within the context of decentralized state-of-the-art technologies applied in rural areas. It is concluded that the current EU legislative framework does not provide ad-hoc guidelines to close the water loops for a small decentralized system. The table below shows a summary of the parameters to be considered and the link to the relevant EU legislation for different types of wastewater application fields.

Inputs (I)/Outputs (O)	Parameters to consider	Reference documents	Relevant information
I = Domestic wastewater O = Reclaimed water	Crop categories allowed for irrigation	Water Reuse Regulation 2020/741, ISO/TC 282	-
	Treatment required to reach quality standards	Regulation 2020/741, UWWTD Directive 91/271/EEC, ISO/TC 282	-
	Influence of quality on final intended use	Regulation 2020/741, Directive 91/271/EEC, ISO/TC 282	-
I = sewage sludge O = Compost	CE Labelling for the fertilizer	Regulation 2019/1009 market of EU fertilizing products	BARRIER
	Agricultural uses of sewage sludge	SSD Directive 86/278/EEC	-
	Use of sewage sludge for organic farming	Regulation 889/2008 organic production and labelling	BARRIER
	Compost parameters	ENV.A.2./ETU/2001/0024 Compost Quality Definition;	-
	Agricultural purposes	Digestate and compost as fertilizers report; JRC Report EoW	-
I = Reclaimed Water O = Agroforestry system	Categories of crops allowed	Regulation 2020/741	-
	Treatment required to reach quality standards	Regulation 2020/741, Directive 91/271/EEC	-
	Types of food regulated	1881/2006 Setting maximum levels for certain contaminants in foodstuffs	-
	Limits for compliance in foodstuffs		-
	Amount of water required by crops	FAO Manual	Not considered

Discussion statements / needs indicated by the project related to small-scale wastewater treatment systems:

- Define technical standards for Individual or Appropriate Systems (IAS) and other small WWTPs (e.g., making reference to technological examples including Nature Based Solutions)
- Introduce energy metering and appropriate key performance indicators (KPIs) for all WWTPs (for wastewater and sewage sludge) including small-scale WWTPs (with the capacity of < 10000 p.e.). Define for each size category of WWTPs specific energy thresholds (kWh/m<sup>3</sup>).
- Challenge for small wastewater systems (with the capacity of < 2000 p.e.) to consider recovery/use of safe treated wastewater, sewage sludge and raw materials. Follow an ad-hoc, risk-based approach rather than having to monitor an endless list of contaminants.
- Local stakeholders (including end-users of technologies and products recovered from wastewater) can have a pronounced impact on shaping local, decentralized solutions facilitating social and market acceptance and price for higher circularity.

*Key messages from Q&A with panellists*

Q: Nele-Frederike Rosenstock (DG ENV C2): what is needed to improve the EU 2005 requirements on IAS, and better integrate decentralized systems in the CE?

A: Simos Malamis: The evaluation of the UWWTD showed that some Member States introduced better monitoring and control and specifying standards for small-scale wastewater systems. These experiences can be grouped into a unified approach, taking into account aspects of the integration of CE and Nature Based Solution and can help to shape future EC legislation.

Q: Are the operators of small WWTPs interested to invest in energy efficiency or is the initial investment perceived as too high (knowing that the benefits come later)?

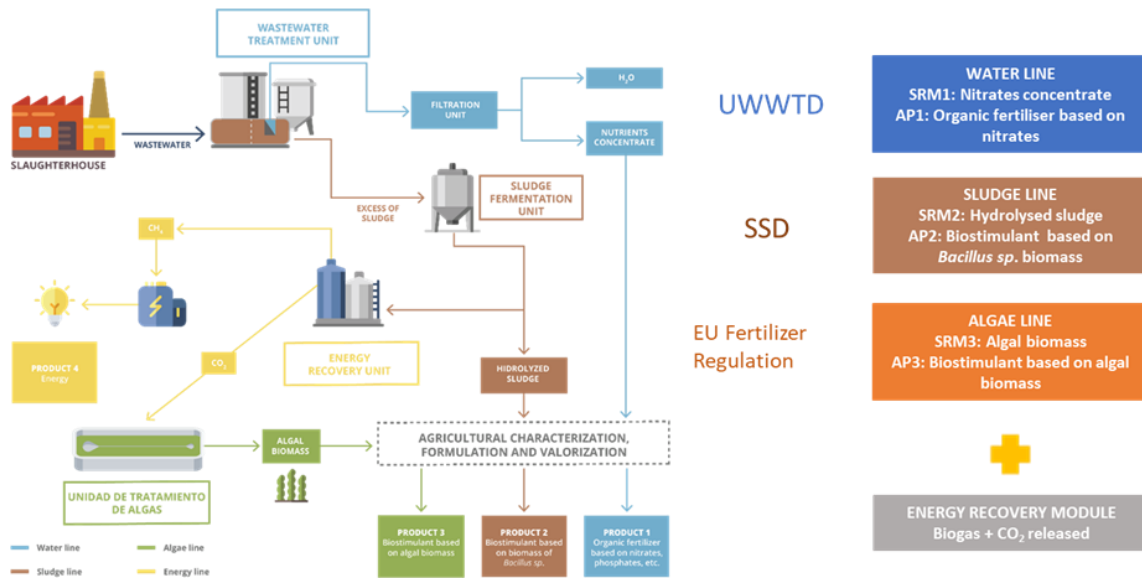
A: Simos Malamis (HYDROUSA): It is indeed difficult for utilities to go for innovative solutions for new treatment systems that have a payback period of some years. Water utilities would be more comfortable to keep an existing small treatment system and to introduce energy metering and, step-by-step, try to have small interventions that decrease energy costs.

## 3.2. Water2Return



- Daniel Monteleone (ELO)
- Salteras case slaughterhouse bio-refinery – CE action plan (Integrated Nutrient Management Plan)

Water2REturn project aims to promote the recovery and recycling of nutrients present in the slaughterhouse wastewater by turning the treatment plants into bio-refineries and producing high added value products for agricultural use. The figure below shows the different treatment steps and its relation to EU regulations.



Agronomic products manufactured from organic waste of animal origin can only enter the market if they are registered at the national level, and each country has different standards. Ideally the Integrated Nutrient Management Plan, planned to be introduced by the EC in the new Circular Economy Action Plan, would help to create strong harmonized standards at EU level.

Discussion statements indicated by the project to ensure market uptake for extracted materials:

- Should the project focus on attempting to bring the product to the consumer showing that it is less expensive and better for the environment than existing methods? ('carrot')
- or
- Should the project encourage EU legislation to create guidelines that advocate or even require consumers to use methods like Water2REturn to create clean water/low cost extracted materials? ('stick')

#### Key messages from Q&A with panelists

Ana-Lucia Crisan (DG GROW): Although the Fertilising Products Regulation is more about placing on the market of fertilising products and not about educating the choice of users, the best way forward would be to combine the 'carrot & stick'. Developing the guidelines (stick) takes time and it would be good if we could already move in the right direction using the 'carrot'.



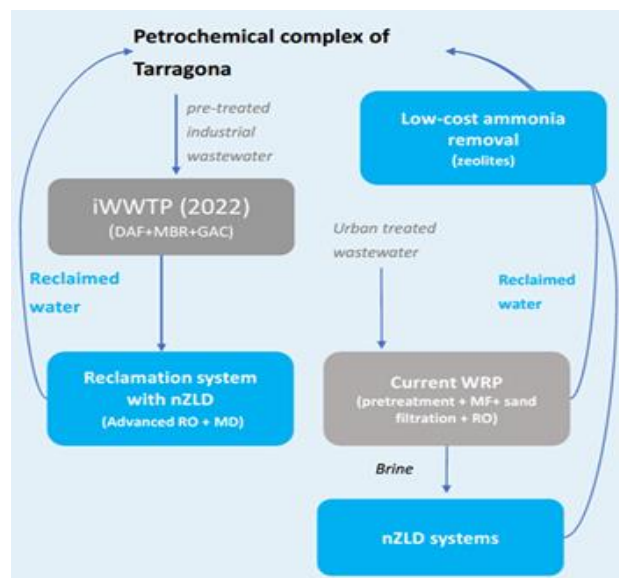
### 3.3. ULTIMATE



- Christos Makropoulos / Stef Koop (KWR)
- Tarragona case on water reclamation for industrial reuse - Industrial Emissions Directive

ULTIMATE project aims to be a catalyst of Water Smart Industrial Symbiosis (WSIS) in which water plays a key role as a reusable resource, and as a vector for energy and materials to be extracted and reused.

In the Tarragona demo case, ULTIMATE is accessing the regulatory barriers in the symbiosis (reuse and exchange) between industrial and urban wastewater treatment systems. The figure below presents the treatment and reclamation system at Tarragona.



Water Europe (partner in ULTIMATE) suggests five objectives to update the Industrial Emissions Directive (IED) to achieve a water-smart society. Those are:

1. leveraging water-related standards in each BREF
2. setting-up a horizontal BREF on water efficiency
3. including mandatory systems assessment for water usage
4. incentivizing industrial water efficiency, cascading and reuse water through subsidies
5. deploying digital water solutions for water-energy efficiencies.

Discussion statements relevant to industrial symbiosis indicated by the project:

- The current BAT emphasizes the reduction of volume and pollution load of wastewater streams.
- More emphasis needed on the reuse of wastewater within the production processes of process industries and the recovery and reuse of raw materials.
- A policy requirements shift from means to goals/targets would give more opportunities for innovation procurement.



*Key messages from Q&A with panellists*

Michal Chedozko (DG ENV C4): the ongoing impact assessment of the revision of the IED will drive water efficiency in the industry sector. The targeted stakeholder survey is still open till 9 April 2021. DG Environment is keen to include digital solutions towards CE, for example the idea to establish a chemical management system (similar to environmental management system).

### 3.4. NextGen



- Heather Smith (UCRAN)
- Sernal case on AnMBR and biosolids recycling – Sewage Sludge Directive (SSD) and Energy Efficiency Directive(EED)

NextGen project aims at demonstrating innovative technological, business and governance solutions for water in the circular economy in ten high-profile, large-scale, demonstration cases across Europe. The project is assessing, designing and demonstrating a wide range of water-embedded resources, including water, energy, materials (e.g. nutrients). In particular, NextGen is developing the necessary approaches, tools and partnerships, to transfer and upscale proposed solutions.

The AnMBR demo case at Sernal (UK) shows greatly reduced energy requirements and reduced GHG emissions from treatment processes with the potential to be energy neutral.

NextGen also assessed the policy-related opportunities and challenges, see Table:

Products from wastewater and/or sludge	Policy-related opportunities and challenges
Effluent for reuse (agricultural or industrial use)	<ul style="list-style-type: none"> <li>• Uncertain quality requirements (Water Reuse Regulation)</li> <li>• Uncertain alignment with IED</li> </ul>
Biosolids applied to land * current focus of the SSD	<ul style="list-style-type: none"> <li>• Important as soil conditioner (carbon)</li> <li>• Quality certification can help water companies recognise value from the product (not just as a waste disposal route)</li> <li>• Anaerobic Digestion processes are leaky, and sludge emits gas when drying or applied to land (less attractive for GHG emissions)</li> <li>• Incentives for Anaerobic Digestion plants are ending</li> <li>• Land availability is a challenge</li> <li>• Monitoring (lab-based) is difficult and expensive for micro-pollutants, hard to get accurate results for trace amounts</li> <li>• Might see shift towards thermal processes (pyrolysis, gasification) – this creates air pollutants that need to be scrubbed, but also additional useable products (e.g. biochar, P from burned fraction)</li> <li>• Other alternative would be increased landfilling</li> </ul>

P products – struvite, calcium phosphate	<ul style="list-style-type: none"> <li>• Not clearly covered under current legislative frameworks</li> <li>• Inorganic nutrient products (e.g. struvite) are high purity but may not be of high value to large-scale agriculture (slow release, small quantities)</li> </ul>
N (ammonia) products – many possibilities!	<ul style="list-style-type: none"> <li>• Other markets (small-scale, domestic) haven't really been explored</li> <li>• Recovered products will often have difficulty competing with mainstream products (small quantities, higher cost) – may require bespoke markets that recognise the true added value (not just financial value)</li> </ul>
Volatile fatty acids	<ul style="list-style-type: none"> <li>• Scale of the WWTP is not the key issue - context &amp; stakeholders are key</li> </ul>
Bioplastics (PHA) and polymers	<ul style="list-style-type: none"> <li>• Ownership of wastewater, sludge and associated products can be legally uncertain (important for realising value and making arrangements with other actors) – more of a concern for public utilities</li> </ul>
Cellulose	<ul style="list-style-type: none"> <li>• Route to <b>legal end-of-waste status</b> (under Waste Framework Directive, as no other route currently exists) is slow, burdensome, difficult to navigate and costly – inhibits market exploration and creation, esp. for SMEs <ul style="list-style-type: none"> <li>○ Must be done per product and per country</li> <li>○ Some chemical products also require REACH registration (equally slow, burdensome and costly)</li> </ul> </li> </ul>
Hydrogen	

Discussion statements indicated by the project:

- Can the reporting requirement for CE initiatives be created under the Urban Wastewater Treatment Directive?
- Can the Energy Efficiency Directive support a shift towards anaerobic treatment systems, as a way to reduce energy requirements for WWTPs, by providing meaningful incentives for the production and use of biogas (electricity-to-grid or gas-to-grid)?
- Can the Sewage Sludge Directive clarify ownership of sludge and cover more than just biosolids applied to land (e.g. thermal processes and associated products)?
- Can it be ensured that commercial products derived from urban wastewater and sludge are exempt from the Waste Framework Directive (e.g. by introducing requirements under SSD/UWWTD for the products derived from WWTPs) and an alternative (simpler) route to End-of-Waste status and Quality Assurance under the Sewage Sludge Directive and/or the Urban Wastewater Treatment Directive can be created?

*Key messages from Q&A with panellists*

Avelino Gonzalez Gonzalez (DG RTD) made a statement that in Germany for WWTPs with >50.000 p.e. the phosphate needs to be recovered from sludge and land disposal is not allowed anymore. Q: Is thermal treatment the right choice? A: Heather Smith (NextGen): the shift towards thermal processes can also be seen, e.g., in the UK as an alternative to anaerobic digestion. It can be a good route if the air quality is managed properly (gas scrubbed) and that will create additional opportunities for

products, i.e. it is possible to recover phosphate through the thermal process and other products from the ashes.

Nele-Frederike Rosenstock (DG ENV C2): under the UWWTD we are considering to set energy efficiency or reduction targets. Q: Should we set a national standard or focus on individual treatment plants? We could also consider setting targets for small-scale systems. A: Heather Smith (NextGen): a national sector approach has as an advantage that a utility can balance the energy performance between large and small systems, e.g. having a kind of hub model where larger treatment facilities support the selection of energy measures at smaller facilities.

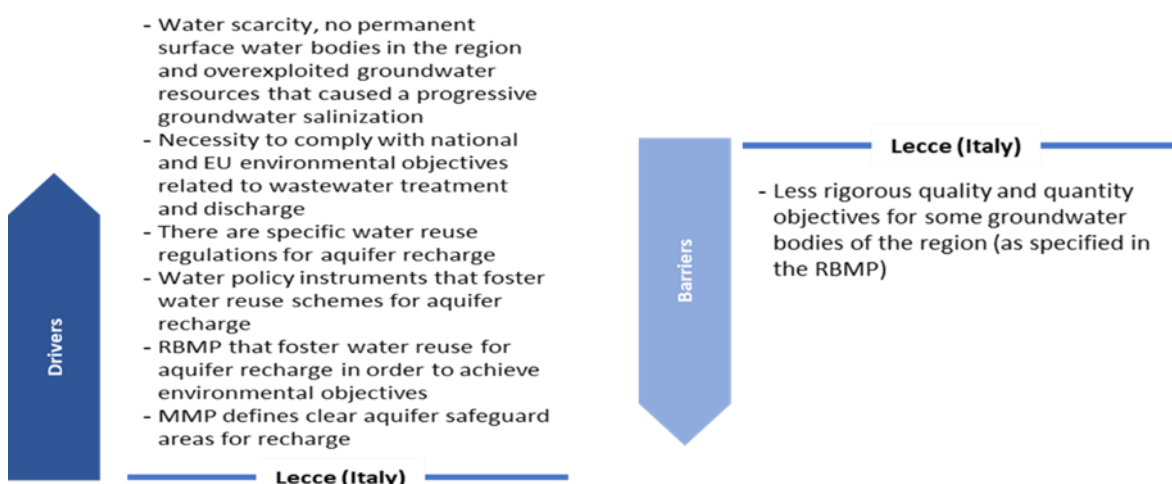
### 3.5. Project Ô



- Chiara Iurlaro (IRIS)
- Puglia case on emerging pollutants - Urban Waste Water Treatment Directive and Zero Pollution Action Plan

The challenge taken up by Project Ô is to provide practical tools for implementing the principles of circular use of water, introducing organized and standardized small loops of water reuse/recycling that distribute the weight of water management over the territory and the users, and releases the pressure over the infrastructure and the ecosystem.

Project Ô analysed the policy dimension of the institutional set-up towards water in the CE in the demo site of Lecce (Italy), constituted by the national CE strategy and the water protection plan. They identified specific water reuse measures (see picture below) that foster the implementation of the new water loop foreseen under Project Ô, including the reduction of discharges in water bodies, in particular through the reuse of treated wastewater, the increase in available water supplies through unconventional resources and priority intervention measures involving specific water reuse loops in the sectors of irrigation, industry and environment.



High Voltage Nano-Second Pulsed Electric Field (advanced oxidation process) technological solution, demonstrated in Lecce demo case area in Italy, has proven effective in the degradation of different emerging pollutants, such as pharmaceuticals and pesticides.

Discussion statement indicated by the project:

- Emerging pollutants in wastewater should be addressed in a systematic manner, remediation actions should be coordinated to take place early in the value chain (before pollutants entering local water cycles) and effectively.

*Key messages from Q&A with panellists*

Avelino Gonzalez Gonzalez (DG RTD) commented that for water in the circular economy context it is important to emphasize pollution prevention and resource efficiency at the first place. To reuse water, micro-pollutants need to be removed, but it would be better to prevent pollution.

Nele-Frederike Rosenstock (DG ENV C2) commented that regarding emerging pollutants, under the UWWTD, we are exploring how we can avoid having yet another list, but instead, to have a number of performance indicator substances, that would trigger the removal of a full set of chemicals.

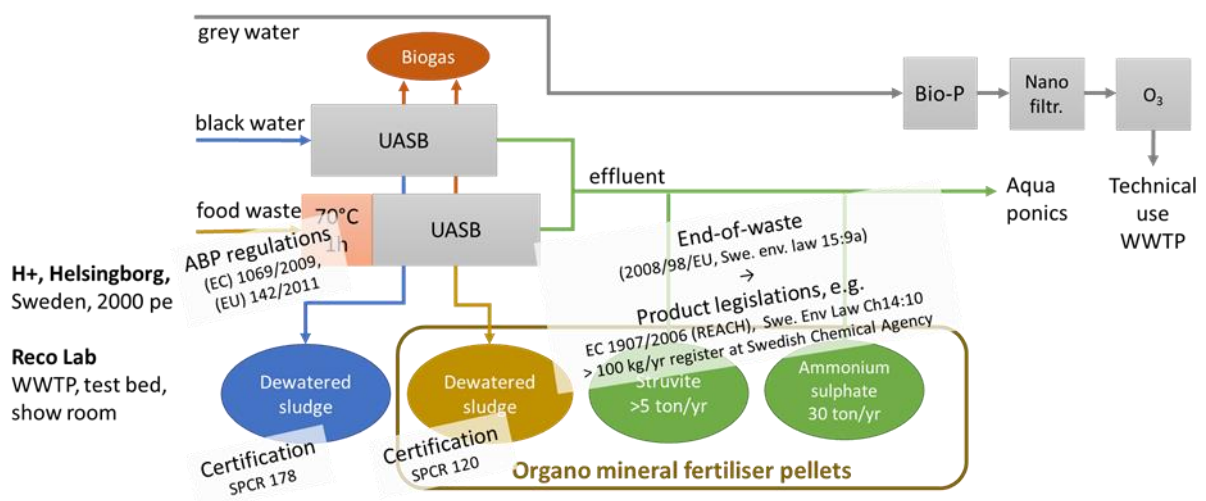
### 3.6. Run4Life



- Annika Nordin (SLU)
- Helsingborg case on fertilizer production from organic waste – fertilising products regulation

Run4Life project for “Recovery and Utilization of Nutrients 4 Low Impact Fertiliser”, proposes a radical new concept for wastewater treatment and nutrient recovery. It is based on source-separated collection of domestic wastewaters and kitchen waste, with each flow receiving optimal treatment for resource recovery and subsequent safe reuse.

The Helsingborg demo case (see figure below) reveals that the EU Fertilising Products Regulation does not allow waste, or materials that ceased to be waste, to be included in fertilising products. For market uptake of extracted products from waste water such as struvite and ammonium sulphate they should be allowed to be placed on the market.



Discussion statement indicated by the project:

- How to encourage technology development for nutrient recycling while it is uncertain if fertilising products can be placed on the market?

*Key messages from Q&A with panellists*

Ana-Lucia Crisan (DG GROW): the Joint Research Centre is currently working on a study to support DG GROW in developing safety and agronomic efficiency criteria for the use of by-products within the meaning of the Waste Framework Directive in EU fertilising products. In this context, an idea is to put forward and to develop a new component material category for materials of high purity (be they by-products or simply recovered from waste). These materials, if recovered from waste, would reach an end-of waste status if included into an EU fertilising products. The data collection is open to provide input before 31 March 2021, and projects are very welcome to contribute with the evidence.

## 4. Concluding observations

Avelino Gonzalez Gonzalez (DG RTD): the Horizon 2020-projects should also contribute to the new research needs and knowledge gaps to be included in the future Research & Innovation Work Programmes.

Gonzalo Delacamara (IMDEA Water Institute): the presentations and policy discussion are very relevant but projects need to make an effort **to go from project and demo case specific outcomes to its sectorial policy relevance, to go beyond the project and see what relevant information can feed into policy processes** (e.g. Projects for Policy). This connects to the idea **to focus** on the optimal scale, capitalising on scale and scope economies **not only based on the technologies** and relevant infrastructures **but also through management systems**: plan upfront from a cluster, industrial symbiosis perspective. It also implies for the governance conditions to further upscale project results. Within water governance, issues such as mastering complexity and embracing uncertainty need to be included, looking at enabling conditions for the uptake of (technical, social and financial) innovations.

Violeta Kuzmickaite (EASME): yes, Avelino Gonzalez Gonzalez is right, the Horizon 2020-projects should identify new research needs to contribute in this way to the upcoming Horizon Europe work programmes. Projects should also develop new knowledge to contribute to the implementation of the sectorial policies, such as water and/or water-related policies. And, as Gonzalez Delacamara rightly said, to contribute to policy and to develop new business cases across Europe, all stakeholders/beneficiaries involved in the projects need to go beyond the project itself and its demo cases and address enabling conditions for innovation at local, national and even European scale. It is good to have this type of workshops where projects/beneficiaries and policy-makers connect and try to understand each other and to have bilateral discussions.

All participating projects are further invited to have a look to the questions of DG Environment (see Annex) and to contribute to the EU policy implementation or policy-making by providing evidence from the projects via policy briefs and other reports and/or project deliverables.

Jos Frijns (KWR, NextGen): from this session we can see that there is a good development in supportive policies for the water sector to become more sustainable, e.g. improve energy efficiency in wastewater treatment plants. However, in the Horizon 2020 demo cases where we look into new systems and services connected to other sectors in the circular economy, we still see regulatory challenges, for example, how to deal with recovered products that are considered as waste. The policy discussion in this session is helpful in further upscaling the project innovations.

Andrea Rubini (WE): this systemic view and alignment of project demo cases and the EU policy priorities can be very helpful in supporting the projects in better achieving their innovation goals and facilitate the market and uptake of the projects' outcomes.

## 5. Summarised recommendations

The EU Circular Economy Action Plan facilitates the introduction of circular water solutions such as those demonstrated in Horizon 2020-projects on Water in the Circular Economy. Further upscaling and uptake of innovations, however, requires a shift in the current regulatory framework from sustainable waste management and disposal towards value creation within and between sectors in the CE. Some recommendations derived from the Horizon 2020-projects:

- Introduce **reporting requirements** for circular economy initiatives under the Urban Wastewater Treatment Directive, such as energy metering, energy thresholds and energy efficiency KPIs for WWTPs (including small-scale systems).
- Follow an ad-hoc, **risk-based approach** rather than having to monitor a long list of contaminants, to encourage the water sector to recover and reuse of safe water, sewage sludge and raw materials.
- Ensure that commercial products derived from urban wastewater and sludge are exempt from the Waste Framework Directive, and create an alternative (simpler) route to **End-of-Waste status** and quality assurance (to ensure environmental and health safety of recovered products) under the Sewage Sludge Directive and/or the Urban Wastewater Treatment Directive. Technology development for nutrient recycling will benefit from high purity materials with an end-of-waste status to be used in fertiliser products.
- For the recovery and recycling of nutrients and producing high added value products for **agriculture**, focus should be on both attempting to bring the product to the consumer showing that it is less expensive and better for the environment than existing methods, as well as developing guidelines that advocate or even require consumers to use these recovered products.
- Clarify ownership of sludge and cover more than just biosolids applied to land (e.g. products from thermal processes) in the Sewage Sludge Directive.
- Define technical standards (including quality standards and monitoring requirements) for Individual or Appropriate Systems (IAS) and other **small** WWTPs.
- Support a shift towards anaerobic treatment systems, as a way to reduce energy requirements for WWTPs, by providing meaningful incentives in the Energy Efficiency Directive for the production and use of **biogas**.
- **Emerging pollutants** should be addressed in a systematic manner, remediation actions should be coordinated to take place early in the value chain (before pollutants entering local water cycles) and effectively, and emphasis should be on pollution prevention. Include performance indicator substances for emerging pollutants in the Urban Wastewater Treatment Directive.
- Put emphasis in the Industrial Emissions Directive on the reuse of wastewater within the production process and the recovery and reuse of raw materials, and include **digital** solutions towards circular economy, such as a chemical management system.



## Annex: DG Environment questions

### Workshop on 26 March 2021 policy feedback from CE/nexus projects

Preparatory questions to the participating projects from the policy-team:

Policy area	Ideas for policy measures for the revision of the UWWTD (these are preliminary ideas and may be subject to change)	Questions to projects // request for information if available
SWO and urban runoff	<ul style="list-style-type: none"> <li>• Integrated urban water management plans to initiate better planning, uptake of water retention measures, green urbanisation etc.</li> <li>• Potentially set at EU level minimum targets to be met (could be about % of waste water allowed to spill, dilution rate, storage capacity etc.</li> <li>• Risk-based approach for smaller agglomerations, where action would need to be taken based on WFD data.</li> </ul>	<ol style="list-style-type: none"> <li>1. What kind of continuous (real time) monitoring / digital monitoring practices are well established (in the sense that they do not work only for one project) for SWOs and urban runoff? What exactly do they monitor (e.g. volume, loads, specific pollutants?) Any examples from demo cases?</li> <li>2. Any information on the costs of such monitoring systems? Can they be used everywhere or what would be pre-requisites to consider (e.g. only for large CSOs or for all types of CSOs)? Does project have recommendations to monitor CSOs and urban runoff? Any barriers for implementing monitoring systems?</li> <li>3. Is the project in contact with authorities? How do planning authorities/ MS authorities react to such systems? Are they interested?</li> <li>4. How long does it take to set up such monitoring systems?</li> <li>5. How are monitoring systems are linked to modelling tools to predict overflows?</li> <li>6. What solutions (technical/IT-based, managerial/organisational) exist to detect leakages into urban waste water collection systems? Any demo cases examples from projects?</li> <li>7. Are there monitoring (e.g. real-time) systems for urban runoff?</li> <li>8. What are the best ways (technical, organisational/management) to treat discharges from separate sewers? Any simple treatment methods available? Could projects propose any modular solutions?</li> </ol>
Energy	<ul style="list-style-type: none"> <li>• Energy efficiency requirements: reduce energy use through the use of audits and reduction requirements for the large UWWTPs</li> <li>• GHG emissions requirement: establish current emissions and reduce emissions over time for the large UWWTPs</li> <li>• Energy neutral or energy positive UWWTPs</li> </ul>	<ol style="list-style-type: none"> <li>1. From ENERwater and POWERSTEP projects we know that there are significant energy reduction and production potentials. From your project can you specify for what sizes of UWWTP (in population equivalent) does the cost for reducing energy use and start producing make sense – is only for the large ones or also for the small ones?</li> <li>2. What could be other recommendations from the projects on the energy inventory/balances and energy efficiency / saving potential?</li> <li>3. What are problems with using energy produced from UWWTPs, why isn't it happening already more (e.g. legislation/ regulatory prohibiting to feed it into the grid, technical)?</li> <li>4. What are realistic energy use reduction targets that can be achieved by UWWTPs over a timeframe of X years (specify size of plant in p.e.)?</li> <li>5. What are the initial costs and when do they pay off?</li> </ol>



<p>Sludge</p>	<ul style="list-style-type: none"> <li>• Extract valuable materials, in particular P, where possible</li> <li>• Track and trace pollution at source when sludge is reused in agriculture</li> <li>• Monitoring requirements for micropollutants in sludge used in agriculture</li> <li>• Monitoring requirements for microplastics in urban waste water and sludge</li> </ul>	<ol style="list-style-type: none"> <li>1. Any recommendations to ensure market uptake for extracted materials?</li> <li>2. What is hindering the market uptake of recovered phosphorus products (no stable production? Not the same quality?)?</li> <li>3. What are the technologies to monitor a variety of micropollutants in sludge (if it is reused in agriculture)? Where are they already in use? Do they focus on known pollutants or are there also non-target methods? Any examples from project case studies/demos for monitoring of micropollutants in sludge?</li> <li>4. Based on project demo-cases, which materials can be extracted from wastewater treatment processes separately from waste water/sludge? (what quantities for what UWWT type, size? Which are close /ready to the market (TRL level, business /exploitation plan is ready to go to the market?)</li> <li>5. How would the treatment of micropollutants in wastewater influence the possibility to recover materials from wastewater?</li> </ol>
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Project coordinators and project teams are invited to send evidence and their responses from the project results to the relevant project officers in EASME/REA.

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