Water Europe
Technology & Innovation

NUTRIENT MANAGEMENT

Create a Water-Smart Action Plan for Closing Nutrients Cycles

August 2022

Water Europe (WE) is the voice and promoter of water-related innovation and RTD in Europe. WE is a multi-stakeholder association representing over 250 members from academia, industry, technology providers, water users, water service providers, civil society, and public authorities. WE activities and positions are guided by its Water Vision "The Value of Water: Towards a Future-Proof European Water-Smart Society".

Water Europe

POLICY RELATED PAPER

Table

Nutrients Management in Europe

CREATE A WATER-SMART ACTION PLAN FOR CLOSING NUTRIENTS CYCLES

Water Europe has set out a blueprint for a Water-Smart Society in which the true value of water is recognized and realized, and all available water sources are managed in such a way that water scarcity and pollution of water are avoided, water and resource loops are largely closed to foster a circular economy and optimal resource efficiency, while the water system is resilient against the impact of climate change events, and all relevant stakeholders are involved in the governance of our water system.

Introduction

Water Europe welcomes the initiative for a Nutrients Action Plan for better management[1], aiming to avoid nutrient loss which can lead to air, soil and water pollution, loss of biodiversity and a wide range of climate-change impacts. It is an opportunity to contribute to a Water-Smart Society in Europe with several benefits in terms of biodiversity protection, circular and sustainable solutions, and competitiveness. **It is our societal responsibility to improve our environmental legacy for the future generations.**

Mismanagement of nutrients constitutes a financial surcharge for the economic actors particularly for the European agriculture which is mainly responsible of nutrients leakages [2] . Excess of nutrients leads to eutrophication which impacts several sectors such as tourism, beyond the direct environmental damages. Lastly, it can lead to financial surcharge for water utilities as regard to drinking water production while the Nitrate Directive (91/676/EEC) is directly considered in the EU water legislation under the Water Framework Directive (2000/60/EC).

In line with the objective to limit industrial emissions, it is also important to consider the CO2 and greenhouse gasses associated with the nutrient cycle and the technologies used. Both recovering and recycling nutrient in a way that generates a large amount of CO2 is not a sustainable solution and hence technologies that are able to abate emissions should be prioritized.

Therefore, an ambitious, clear and holistic approach linking all the different strategies is mandatory to reduce this environmental and financial costs, strengthen our strategic autonomy and the polluter pays principle. The EU is largely (more than 90%)[3] dependent on phosphorus imports from outside Europe. It is one of the listed critical raw materials (CRM)[4] for that Europe shall secure its provision by recycling and recovering processes.

Wastewater from households and industries contain massive amounts of both Phosphorous (P) and Nitrogen (N). Therefore, we need to exploit this asset. Wastewater treatment plants (WWTPs) can be a source of phosphorous and nitrogen recovery and recycling. Several solutions exist to extract N and P from wastewater flows or to use wastewater for crops irrigation and agricultural fertilisation while contributing to tackle water scarcity.

The European Commission already recognises that the water ecosystem and particularly the utilities are key actors for an integrated and ambitious nutrient management plan for Europe[5]. It also supports a reduction of "nutrient losses by at least 50%, the overall use and risk of chemical pesticides by 50% and the use of more hazardous pesticides by 50% by 2030"[6].

The overall environmental costs of all nutrient pollution in Europe are estimated at €70–€320 billion per year[7].

Therefore, the integrated nutrient management action plan (INMAP) shall support better awareness of nutrients challenges and strengthen circular opportunities within the water ecosystem, and particularly through the revision of the Urban Wastewater Treatment Directive (91/271/EEC).

[1] Have your say, *Nutrients – action plan for better management*, European Commission

[2] RISE, *Nutrient Recovery and Reuse (NRR) in European agriculture, A review of the issues, opportunities, and actions*, 2016

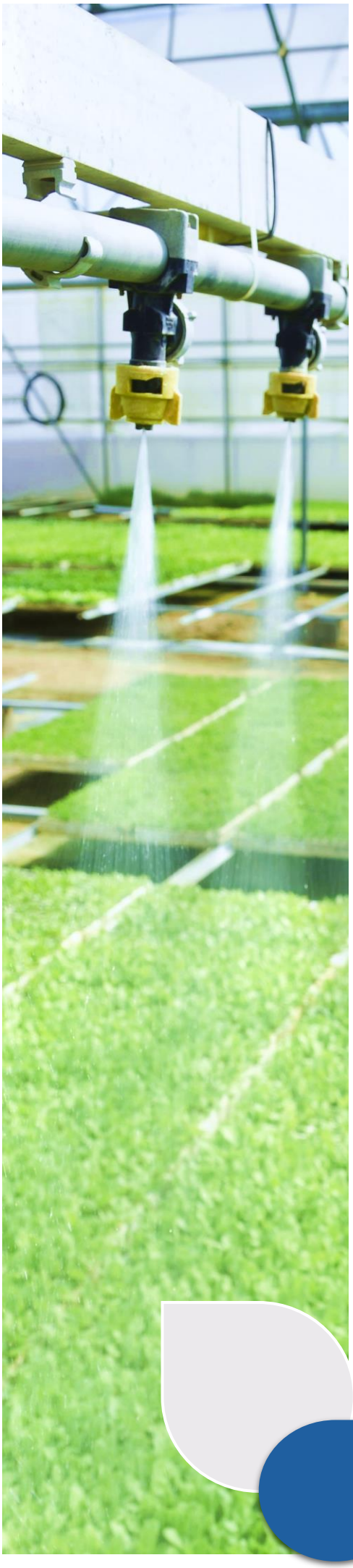
[3] NUTRIMAN, *Sustainable use of Phosphorus*, 24 May 2022

[4] COM(2020) 474 from the Commission of 3 September 2020 on Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability

[5] COM(2021) 699 final from the Commission of 17 November 2021 on the EU Soil Strategy for 2030

[6] Ibidem.

[7] Sutton, et al. (2011). Summary for policy makers. In M. Sutton et al. (Eds.), *The European Nitrogen Assessment: Sources, Effects and Policy Perspectives* (pp. XXIV-XXXIV). Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511976988.002



Awareness

STARTS WITH EFFICIENT MONITORING

Digital Water is essential to create a safe and closed nutrient cycle. The presence of nutrients in water should be monitored in real time or near real time, and not only once per month, to take the right actions immediately.

Building awareness will help not only understanding the impact of nutrients for water, soils, and the environment, but also informing citizens and advising farmers to better consider nutrient management in their actions.

Reduction

OF NUTRIENTS WITH TARGETS NEEDS A CLEAR FRAMEWORK

The Action Plan must emphasise legislative clarity. It will not be a sustainable nutrient action plan if efficient use and recycling of safe nutrients is not a target with clear goals and actions. The INMAP should not be limited to water policy, climate change and CRM policies. INMAP should include goals to create safe and sustainable loops when closing nutrients cycles with clear criteria which will open the market to those high-quality materials:

CLOSE THE NUTRIENT CYCLE

The plan should aim at closing nutrient cycles, pushing for the missing piece in the value chain:

- Deploy preventing techniques to avoid nutrient loss (eg. Nature based solution such as a crop-free zone along ditches, no manure application when it rains)
- Strengthen the recycling of good quality nutrients to reduce EU dependence.
- Adapt the solutions to the local context. The magnitude of water scarcity and the economic activities in some European regions should be considered deploying the solution to recycle and/or recover nutrient.

REDUCE THE EXPLOITATION OF NATURAL (VIRGIN) RESOURCES

To reduce the exploitation of natural, virgin resources, the INMAP needs to include a high demand on recovery of phosphorus from sewage sludge (in line with the new Sewage Sludge Directive (SSD) and Urban Wastewater Treatment Directive) of at least 80%, to close the phosphorus cycle and reduce the dependency of imported mined P that also often contain contaminants. A technology neutrality will keep all methods accessible to adapt to environmental circumstances. To effectively reduce the exploitation of natural resources, the polluter-pays-principle should avoid putting the burden on the end-consumer.

ENABLE RECOVERY & RECYCLING OF MATERIALS WITH GOOD QUALITY AND EFFICIENT FUNCTION SUITABLE FOR THEIR APPLICATIONS

High quality, clear scientifically based limit values and function demands for all recovered products and end-use applications to both prevent contaminating the food cycle and the environment should be the INMAP's core element, to achieve a level playing field for all types of products and markets. It will lead to the market focusing on high quality demands and *not origin*, which including stimulating the markets for recovered nutrients.

At Glance

Recycle nutrients & unlock the potential of a circular nutrients management plan

Monitor pollution by deploying digital water technology

Phosphorus

70% Globally, it is the expected growth of phosphorus demand between 2015 and 2050 (JRC).

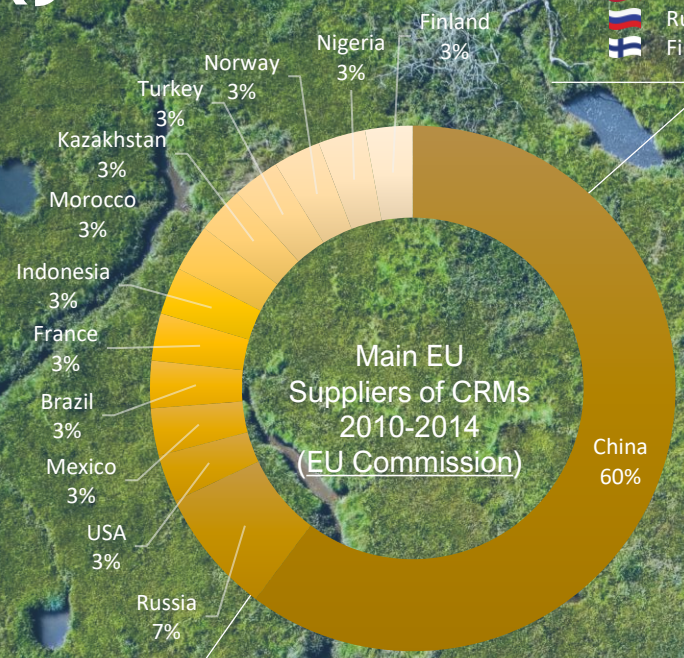
92% It is the dependence rate of the EU in 2011 for phosphorus according to the European Union (European Commission).

0% It is the recycling rate of phosphate between 2010-2014 in Europe (European Commission).

17% It is the recycling rate of phosphorus rock between 2010-2014 in Europe. (European Commission)

Main EU suppliers for phosphorus rocks between 2010-2014

- Morocco – 28%
- Russia – 16%
- Finland – 12%



Main EU suppliers for phosphate between 2010-2014

- Kazakhstan – 77%
- China – 14%
- Vietnam – 8%

Cadmium

A pollutant diffused through phosphorus rocks importation that can be reduced by recycling phosphate from wastewater.

Nitrogen

NH3 emission
Most emission coming from agriculture (French ministry)

Eutrophication
with potential emission of H2S mainly in coastal areas and economic impact for several sectors (French ministry)

60%
EU rivers not reaching good chemical and ecological status (EEA)

N2O emission
In 2018, 89% of French N2O emission came from agriculture (French ministry)

-30%
Share of reduced economic growth due to lack of clean water (World Bank)

70-320
Estimated environment costs due to nutrient pollution in Europe in billion euro per year (Sutton)

Water Europe
Technology & Innovation

Best Practice

Investing in research and development to find and deploy technological solutions is key. Below four examples of EU Research projects that demonstrate the feasibility and limits of circular nutrient management.

NEXTGEN PROJECT

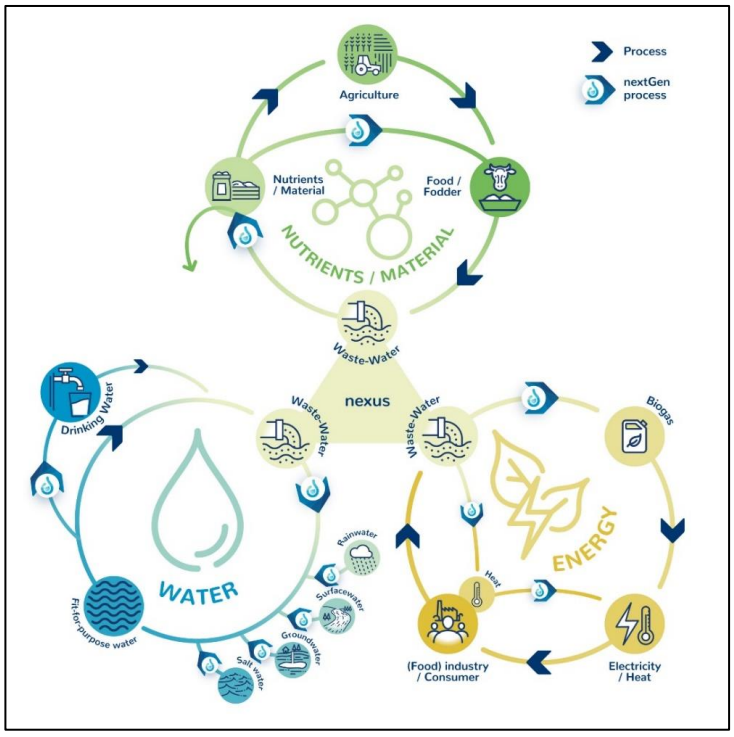
NextGen[1] is a project financed by the European Union's Horizon 2020 research and innovation programme (agreement No. 776541) which aims to boost sustainability and bring new market dynamics throughout the water cycle in its 10 demo cases and beyond. The project will assess, design and demonstrate a wide range of water-embedded resources, including energy, raw material and water reuse. The NextGen deployment is paired with the definition and cultivation of a successful framework for involving and engaging citizens or other stakeholders, and also addressing social and governance challenges.

The majority of these demo case are considering solutions to recover resources such as nitrogen and phosphorous. The project focus on the water-energy-nutrients nexus (see figure below), demonstrating different solutions across Europe to recover nutrients with high quality while ensuring that the solutions deployed does not increase CO2 and greenhouse gas emissions.

In the case of Spernal, the infrastructure is energy positive. The process not only recovers nutrients but also produces biogas and use dewatering sludge as fertilizer.

The different benefits and recommendations of the project are also available in the of workshop report of the European Commission - *Water in the circular Economy policy development*[2] – which gathers findings from demo cases of six Horizon 2020 projects.

Figure – *energy-water-nutrients nexus*[3]



ULTIMATE PROJECT

Ultimate[1] is a project financed by the European Union's Horizon 2020 research and innovation programme (agreement No. 869318). The aim is to create economic value and increase sustainability by valorising resources within the water cycle.

In the demo case 5, partners are comparing the performance of two bioreactor prototypes. Both prototypes have the potential to establish new industry benchmarks for water reuse, energy and material recovery.

Brewery wastewater is also rich in nutrients that can help produce fertiliser. A concept study is being conducted to assess materials recovery strategies from compounds in brewery wastewater and to find suitable value chains.

By setting goals to create safe and sustainable loops when closing nutrients cycles with clear criteria, the INMP will encourage this type of assessment to accelerate nutrients recovery and identify suitable local markets.

[1] Nextgen, NextGen website , July 2022.
[2] European Commission, *Water in the circular Economy policy development*, June 2021
[3] NextGen, *Results*

Best Practice

WATER MINING PROJECT

Water Mining[4] is a project financed by the European Union's Horizon 2020 research and innovation programme (agreement No. 869474). The project expects to develop innovative technologies for:

- a more energy-efficient and less polluting desalination process,
- more sustainable techniques for extracting valuable products from urban wastewater residues such as phosphates and other bio-based valuables products, and
- producing pollution-free industrial wastewater through a Zero-Liquid-Discharge loop system.

The project also aims to increase public awareness about water management, promote new circular economy business models within the wastewater cycle, attract public and private funding for the upscaling of the methodologies developed, and develop adequate policy and regulatory measures.

The project involved 38 partners around 6 sector specific case studies. The project partners are considering resource recovery in industrial and urban infrastructures but also related to desalination. It demonstrates that a holistic approach in line with the Water-Smart Society vision is valuable for a comprehensive nutrient management action plan in Europe.

B-WATER SMART PROJECT

B-WaterSmart[5] is a project financed by the European Union's Horizon 2020 research and innovation programme (agreement No. 869171) which aims to accelerate the transformation to water-smart economies and societies in coastal Europe and beyond by reducing the use of freshwater resources, improving the recovery and reuse of resources, and increase water use efficiency.

The research therefore is based on specific problems in six European coastal cities and regions which have set up water-oriented Living Labs in Alicante in Spain, Bodø in Norway, Flanders in Belgium, Lisbon in Portugal, East Frisia in Germany and Venice in Italy.

Particularly in Venice and its lagoon zones, there are 1 million citizens and 42 million tourists per year. Resource recovery and circular economy logics will support the environmental equilibrium of the region by:

- boosting water reuse at multiple levels (industrial, urban and agricultural).
- fostering the best practices of nutrients and energy recovery from wastewater treatment and sludge management in a logic of low environmental impact and economic sustainability.
- developing Integrated Evaluation Digital Strategic Platform, to support concerted governance to assess and support reuse & recovery opportunities.

The development of clear goals in the INMAP will support the duplication of this type of initiative with several benefits for the environment, including sensitive areas while the use of digital solutions will strengthen monitoring and awareness.

[4] Water Mining, Water Mining website , July 2022.
[5] B-Water Smart, B-WaterSmart website , July 2022.


Water
Europe
Technology & Innovation