COORDINATOR OF THE EUROPEAN DARROW PROJECT

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From waste to resource: how Artificial Intelligence will transform water treatment in the EU

Water passing through treatment plants used to be considered waste to be discharged into rivers and seas. Its organic matter was a residue, and the nitrogen and phosphorus it contained were pollutants. Perceptions have shifted. With the right technology and infrastructure, it is possible to turn these elements into energy (biogas) and fertilisers for agriculture, in line with the European Union's commitment to a circular economy.

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According to Eurostat data, components of wastewater could supply 13% of the demand for fertilisers and generate electricity for 25 million households per year in the European Union.

To drive that transformation, the European DARROW project is developing artificial intelligence (AI) tools to reduce the energy cost of water treatment plants and to help the people who operate them make decisions. For World Water Day we spoke to Ion Irizar, project coordinator and CEIT researcher, about how people-centred AI will transform water treatment and resource recovery in Europe over the next decade.

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Wastewater is no longer perceived as waste but as a resource, yet few European facilities are applying this circular economy concept. Why?

The European Union is committed to aligning its industrial sectors with circular economy principles, decoupling economic growth from the use of more and more resources and the waste production. However, water treatment infrastructure is meant to last several decades, so transforming existing facilities into resource recovery plants is neither quick nor easy.

So how can Europe accelerate the evolution of water treatment plants into water resource recovery plants?

Plants must undergo two major transformations. They must harness new infrastructure, technologies, and microorganisms to recover nutrients such as nitrogen and phosphorus from water and reuse them in agriculture That means redesigning existing facilities, and it will take time. But plants have been trying to reduce their energy consumption for years. Their operative costs are paid by taxpayers, so reducing energy consumption will benefit everybody. The latter point can be achieved faster than the former, and that is where data and AI come in.

How can Artificial Intelligence help to reduce plant costs and improve plant autonomy?

Large water treatment plants will never be 100% autonomous, and technological tools are not there to replace the plant's operating staff, but to help them. Having said this: in the last decade, automatic corrective control systems have been introduced that have helped to reduce energy consumption, but machine learning or AI tools will go much further. For example, by incorporating predictive aspects to help anticipate decision-making.

Why is it important to improve aeration control?

Aeration accounts for most of the energy consumption of treatment plants.

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The composition of the water changes throughout the day — there are many more people and industries using water in the morning than in the middle of the night — so plant operators must frequently adjust the amount of air supplied to water tanks. That is a tricky business: too much air, and energy costs soar; too little, and you kill the bacteria, which are essential for the entire process.

The DARROW project is developing systems that learn to identify the right amount of air depending on the composition of the water, so it can be treated using as little energy as possible before being discharged into rivers or the sea. Those systems will be able to recommend the right level of aeration based on data about the quality of the water.

What are the other applications of AI in water treatment?

AI can help detect problems on sensors that are essential for critical control systems. Water treatment plants are harsh environments for sensors and cause them to fail more often than usual. One way to address the problem is through redundant sensors — if one fails, you have backups — but this is not cost-effective in that type of facility. AI offers an alternative: we can train the system to detect when a sensor is giving erroneous readings, so that control systems go into safe operation mode. Our project is also working on that.

A central focus of your project is to build trust in the AI tools you are going to develop. Why is trust important?
Artificial Intelligence is like an automatic gearbox: it makes driving easier, but there is always a person behind the wheel. Our goal is to develop AI solutions that help plant operators and allow them to spend more of their time on tasks with a higher added value, such as supervising controllers. But we can only implement AI tools if operators understand how we have designed them, how they work, and what underpins their recommendations.

And how will you build trust in your AI solutions?
The idea is to develop AI tools in a very transparent way, clearly explaining to operators how we are designing the solutions and checking whether they meet their needs. In addition, our AI tools will not only make recommendations, but will also try to justify them.

Your experience in the water treatment industry spans more than 20 years. How do you see the future of water

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DARROW consortium visiting Rioolwaterzuivering Tilburg, the wastewater treatment plant that will be used for the demonstration of the project's technologies.

treatment and resource recovery plants in Europe in the next decade?

Advancing towards plants with high levels of digitisation and AI calls for technological advances and cheaper sensors, which only large treatment plants can currently afford. That would also help to reduce the technological gap between urban and rural treatment plants. In European countries, around 5% of the plants treat 80% of the water: it makes sense to start implementing the principles of circular economy in these large plants, but we mustn't forget the small ones. In fact, we are working to ensure that some of our AI developments can also be applied to small plants in the future.

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