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Sustainable Energy Week: The Water-Energy Nexus

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Opinion

Managing the relationship between the water used for energy production and the energy used to deliver that water is key to increasing water sector energy efficiency, explains Charlina Vitcheva.

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There are strong interdependencies between water and energy.

The energy industry uses water for producing fuels, cooling of power plants and for generating - and storing - electricity in hydropower plants.

Europe’s water systems also need their own energy for the collecting, pumping, treating and desalinating seawater.

The interoperability of water and energy systems depends on the availability of water resources.

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The energy sector in the EU requires significant amounts of fresh water, around 74bn cubic metres a year, the equivalent of 30 million Olympic swimming pools.

Water availability is a key operational constraint for the energy sector: during the hot summer of 2018, high water temperatures meant that nuclear power plants in France, Finland, Germany and Sweden were shut down due to the reduced cooling efficiency - and also to avoid the overheating of rivers.

In addition, the EU currently uses 50 billion cubic metres a year for its public water supplies.

Making this quantity of water, including waste-treated and desalinated water, available through public networks consumes 80 TWh.

This corresponds to 2.6 percent of the EU's total electricity consumption, equivalent to the annual electricity generation of Belgium.

Decarbonising the energy system will lead to an overall reduction in the amount of water the energy sector needs.

Water availability will also play an essential role in the path to achieving climate neutrality by 2050.

> "Decarbonisation of the energy system will lead to an overall reduction in the amount of water needed by the energy sector. Water availability will also play an essential role in the path towards achieving climate neutrality by 2050"

The European Commission's Long-Term Strategic vision "A Clean Planet for All" states that: "A switch to a low-carbon energy system will have to be managed with care, since some low-carbon energy systems could use water more intensively than the system they replace."

This means that the climate-neutrality transition should be designed to take account of the important role of fresh water and sectorial water requirements.

Furthermore, reducing water availability and simultaneously increasing demand may create issues at regional level.

Water resources will become more stressed in the future and water scarcity will be felt across Europe, affecting at least 90 million people.

Mediterranean regions will be most affected, with an expected 30 percent decrease in water availability, but other countries, such as Poland, Czechia, Bulgaria, Germany, France and Romania will

also be affected.

This may lead to increasing energy supply concerns in regions where fresh water is crucial for cooling thermal power plants or where hydroelectric capacity plays a significant role in the power system.

The water-energy nexus (the relationship between the water used for energy production and the energy used to deliver that water) has yet to be reflected in any regulatory frameworks.

These remain largely disconnected and unconcerned with issues of reciprocal impact and opportunity.

There would indeed be significant added value in developing an integrated policy model to bridge this gap and feed into future policy developments.

The European Commission's Joint Research Centre established the Water-Energy-Food-Ecosystems Nexus project to address common issues, such as water and energy and their interdependencies.

Its objective is to systematically inform the design and implementation of European policies and strategies that depend on water and to identify options for policy convergence, coordination and integration.

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This work is timely, as it coincides with the evaluation of the Water Framework Directive and the Energy Efficiency Directive, while EU Member States are also developing their national and energy climate plans for 2030 and their 2050 climate Strategies.

The results to date will be presented at this year's EU European Sustainable Energy Week conference.

The "Water-Energy Nexus in Europe" report will set out the outcomes of analysis, based on the combined use of water and power system models with energy scenarios, how water is used by the energy system; how water and energy are interconnected; estimated expected changes in water availability in the future; and possible solutions to avoid water scarcity and increase energy efficiency, while preventing power generation from not meeting the demand issues.

Operational and strategic considerations are also outlined.

These can have an immediate impact, such as achieving a 50 percent energy savings through implementing energy efficiency measures in the water sector.

A strategic, longer-term view considers promoting water-based criteria for energy policies and looking at the sustainability of the energy system in 20 EU regions that may become vulnerable to water scarcity in the not too distant future.

These are just some examples of how the Joint Research Centre's research can help design and implement better and more cohesive policies.

Only through a holistic "nexus" approach will it be possible to take full advantage of the opportunities to increase energy efficiency in the water sector; to exploit the possibilities of the water as a source of flexibility for the energy system and to reduce the water footprint of the energy sector.

This is essential, as today’s challenges no longer present themselves in neat and clearly-defined silos.

About the author

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