From Nexus to Action:

Aligning EU Water, Energy & Food Policies for a Resilient Green Deal

Key policy messages

- **Cross-cutting, Nexus-wide**

  -Embed the Nexus explicitly in EU and national law by linking targets and indicators across water, energy and food (e.g., energy per m^3 treated; water intensity per kWh; nutrient circularity), so progress in one domain doesn't undermine another. The paper argues for integrated delivery of EGD files and coherent monitoring across sectors.

  -Operationalize the EU's Zero-Pollution ambition together with Circular Economy actions (reuse, microplastics control, nutrient plans, updates to wastewater and sludge directives) to create consistent incentives across the WEF systems.

- **Water policy & digitalisation**

  -Close the governance gap for digital water by defining common terminology, interoperability standards, cybersecurity, data-sharing rules, and by deploying efficient monitoring and early-warning systems. These gaps hinder the optimal uptake of digital solutions in the water sector.

  -Scale safe water reuse and circular practices in agriculture and industry under Regulation (EU) 2020/741 and the Circular Economy Action Plan, supported by guidance and investment.

  -Aim for an energy-positive/energy-neutral water sector by promoting energy recovery at utilities (e.g., from wastewater treatment) and linking water legislation with energy legislation such as the Energy Performance of Buildings Directive.

  -Manage data-centre water use through standards for efficiency, recycling and discharge, and by considering local scarcity during siting and permitting.

- **Energy policy & the water–energy link**

  -Accelerate digitalisation of the energy system (smart grids/meters, open data interfaces) to integrate distributed renewables and flexible demand while tracking water implications of power systems and electricity intensity of water services.

  -Set and enforce water-reduction targets for energy production and industrial cooling, recognising the water footprint of energy supply.

- **Food policy (Farm-to-Fork) & the water–food/energy–food links**

  -Use CAP Strategic Plans to finance sustainable on-farm energy (biomethane from residues; agro-PV) and energy-efficiency improvements, with safeguards so climate measures don't compromise food security or biodiversity.

-Strengthen Integrated Pest Management and the uptake of safe alternatives to reduce pesticide loads in water bodies while maintaining yields and resilience under climate extremes.

-Advance the Farm-to-Fork framework so its goals on pesticides, antimicrobials, nutrient use, organics, food loss and healthy diets are implemented in ways that align with water and energy objectives.

Preface

The European Green Deal (EGD) offers a unifying compass for climate neutrality, resource efficiency, and social inclusion. Yet its success hinges on how Europe manages the interlocking systems that sustain life and livelihoods: water, energy and food. The paper underlying this brief, positions the Water–Energy–Food (WEF) Nexus not as an abstract framework but as the operational grammar of implementation across EU policies, funding and monitoring. It highlights where regulation and investment are already moving, and where gaps—particularly around digitalisation in the water sector and the integration of cross-sector indicators—still hold back coherent delivery. By synthesising the article's findings, this brief speaks to national administrations, regulators, utilities, and agricultural actors who must translate ambition into aligned, measurable action.

Executive summary

Europe has begun to mainstream the Nexus through the EGD and related initiatives, but fragmented governance risks missed targets and higher costs. The article shows how a water-smart approach, a digitally enabled and consumer-centric energy system, and a Farm-to-Fork food transition can generate joint gains for resilience, affordability and environmental quality—if they are planned and monitored together. The evidence points to three enabling levels. First, embed Nexus-aware metrics and governance in water policy, including a clearer mandate for digital solutions and shared data standards that can cut energy use in utilities and support safe water reuse in agriculture. Second, accelerate digital grids and smart metering to integrate distributed renewables and flexible demand, while tracking the upstream and downstream water implications of power systems. Third, deliver Farm-to-Fork measures that connect pesticide reduction, nutrient circularity, irrigation reuse, and clean on-farm energy, in order to protect ecosystems and consumers while maintaining producer viability. The brief concludes that aligning targets, incentives and data across these domains is the most practical route to make the Green Deal deliverable at pace and at lower cost.

The art of Nexus under the European Green Deal

The state of play in Europe is defined by a rising policy arc: the Green Deal's headline commitment; a zero-pollution ambition for air, water and soil; the Circular Economy Action Plan; REPowerEU; and sectoral reforms in energy markets, water quality, and food systems. Within this arc, the article portrays the Nexus as the connective tissue for coherent delivery. In water, a "water-smart society" is emerging as a reference vision: a society that recognises water's value, manages all

sources—surface, groundwater, reclaimed and process water—and uses digital tools to anticipate risk, allocate resources, and recover embedded energy and materials. In energy, the turn to digitalisation is increasingly explicit, with smart grids, smart meters, and data governance cast as the means to integrate distributed renewables and empower prosumers. In food, Farm-to-Fork reframes the food economy around health, fairness and environmental limits, while acknowledging that actual delivery depends on clean water, reduced chemical loads, and reliable, affordable energy on farms and along value chains. The state of the art, then, is less about inventing new objectives and more about knitting existing instruments into a Nexus-aware practice of planning, investment and measurement.

Water policy in practice: towards a water-smart, digital-ready Europe

The article situates water policy at the heart of Nexus implementation. It connects the EGD's ecosystem and zero-pollution pillars to concrete measures: tighter monitoring and early-warning, revisiting wastewater and sludge directives, and making safe water reuse a mainstream tool for climate resilience and agricultural productivity. The authors argue that digitalisation is now indispensable but under-specified: EU water policies lack a common terminology, standards for interoperability and cybersecurity, and a clear framework for responsible data sharing. Closing this governance gap can deliver near-term efficiency gains—lower energy per m3 treated, better leakage control, and safer reuse—while equipping utilities to manage shocks. The brief underscores that such progress requires coordinated incentives and mandates across water, energy and agriculture portfolios, not siloed pilots, so that reclaimed water and nutrient recovery become bankable at basin scale.

Energy policy in practice: digital grids for clean, affordable power

On energy, the paper shows a system already in motion. With smart meters in over half of EU households and SMEs, and with a growing policy push for digital energy, the groundwork exists to integrate electric vehicles, heat pumps and rooftop solar while giving consumers and communities more agency. Digital optimisation reduces curtailment and losses, and when viewed through a Nexus lens, it also reduces the water intensity of power systems and the electricity intensity of water services. The authors point to shared metrics and regulator mandates as the hinge for progress: when transmission and distribution operators adopt common smart-grid indicators and open interfaces, it becomes easier to spot and scale cross-sector benefits, from flexible irrigation to energy-positive wastewater treatment. In practice, this means linking energy planning to water availability and quality, especially where cooling needs, drought stress, or data-centre siting risk local trade-offs.

Food policy in practice: making Farm-to-Fork deliver co-benefits

Food is where citizens most viscerally experience the Nexus. The article presents Farm-to-Fork as both an environmental and a social compact: reduce pesticide and

antimicrobial dependence, curb excess fertiliser use, expand organic farming, cut food loss and waste, and still keep food affordable and producers viable. Delivery rests on water quality, water availability, and energy access. Safe reuse for irrigation can stabilise yields under climate extremes; stronger integrated pest management and quicker approvals of biological alternatives can protect aquatic ecosystems; and on-farm renewables—biomethane from residues or agro-photovoltaics—can lower costs and emissions without compromising soils or biodiversity if guardrails are clear. The brief therefore recommends viewing CAP Strategic Plans, reuse regulation, and energy-market reforms not as parallel tracks but as one integrated delivery chain that measures and rewards joint outcomes.

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About the project

This policy brief is part of the portfolio of activities developed by Working Group 3, "Policy Measures" of the COST Action NEXUSNET Network on water-energy-food nexus for a low-carbon economy in Europe and beyond (CA 20138). This Working Group aims to make nexus research meaningful and available to policymakers across different scales in Europe and to strengthen the nexus governance research community. The brief synthesizes findings and recommendations from the paper "Exploring nexus policy insights for water-energy-food resilient communities," Sustainability Nexus Forum (2023) 31:69–82, published online 9 March 2024. It was written by Serena Caucci (UNU-FLORES), Tamara Rađenović (University of Niš), Chrysi Laspidou (University of Thessaly) and Giannis Adamos (Aristotle University of Thessaloniki).

More information on the COST Action NEXUSNET can be found at: https://nexusnet-cost.com/

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