



TRANS-SAHARA

POLICY BRIEF

Institutionalizing the Water–Energy–Food– Ecosystem (WEFE) Nexus in Africa



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Executive Overview

Africa faces mounting water, energy, food, and ecosystem (WEFE) pressures, particularly in arid and semi-arid regions, where climate change and growing demand are intensifying resource scarcity and fragility. Groundwater is a strategic yet under-governed asset. Africa hosts more than 100 transboundary aquifers supporting hundreds of millions of people, but most remain weakly monitored and lack formal cooperation frameworks, increasing risks to water security, food production, and regional stability. Building on the TRANS-SAHARA WEFE Workshop, this policy brief highlights how an institutionalized WEFE Nexus approach can strengthen groundwater governance through regulatory harmonization, innovation and Nature-based Solutions, and inclusive transboundary cooperation, in line with Agenda 2063 and the AfCFTA.

Global Wastewater Reuse and the Nexus Opportunity

Globally, approximately 359 billion m³ of wastewater are generated each year (*Jones et al., 2021*). However, only 11% is intentionally reused, while nearly 80% is discharged into the environment without adequate treatment, posing serious risks to public health and ecosystems (*UNESCO & UN-Water, 2023*).

Regional disparities are pronounced. In Sub-Saharan Africa, wastewater reuse remains below 5%, largely informal and constrained by limited treatment infrastructure and regulatory frameworks (*UN-Water, 2024*). In contrast, several countries in the MENA region reuse more than 80% of treated wastewater and account for nearly 27.8% of global reuse volumes, demonstrating the feasibility of large-scale reuse under appropriate governance and investment conditions (*FAO AQUASTAT, 2025*). Europe and North America achieve high treatment rates, yet reuse remains limited except in water-stressed contexts (*Oadiri et al., 2023*).

For Africa, treated wastewater reuse, rainwater harvesting, and managed aquifer recharge represent high-impact WEFE levers. When embedded in integrated basin and aquifer management frameworks, these solutions can simultaneously enhance water availability, reduce energy intensity, improve agricultural productivity, and protect ecosystems (*UN-Water, 2023; Chaibi et al., 2024*).

Key Insight

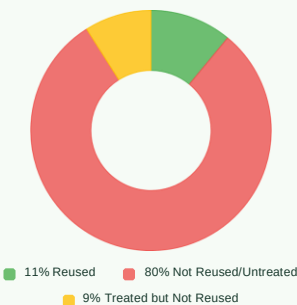
Wastewater is a largely untapped resource. While hundreds of billions of cubic meters are generated annually, less than a small fraction is safely treated and reused, resulting in environmental degradation and missed opportunities for water, energy, and food security.

In Africa, wastewater reuse remains below 5%, constrained by limited infrastructure, weak regulation, and fragmented governance. By contrast, several MENA countries have demonstrated that large-scale reuse is achievable when supported by clear policies, investment, and integrated planning.

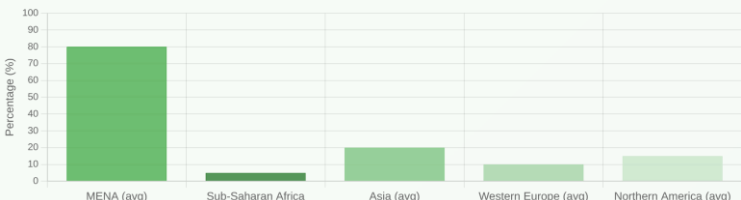
For Africa, treated wastewater reuse—combined with rainwater harvesting and managed aquifer recharge—represents a high-impact WEFE Nexus opportunity. When embedded in basin- and aquifer-level governance frameworks, these solutions can simultaneously improve water availability, reduce energy demand, enhance agricultural productivity, and protect ecosystems.

Global Wastewater Statistics

Global Wastewater Treatment & Reuse



Regional Disparities in Wastewater Reuse Rates



Workshop Findings

The workshop confirmed that institutionalizing the WEFE Nexus in Africa requires coordinated action across governance, regulation, innovation, and stakeholder engagement.

Sustainable and equitable management of natural resources emerged as a core priority for resilience and long-term development. Discussions emphasized integrated basin and aquifer management, recognition of transboundary aquifers as strategic assets in arid regions, improved energy efficiency across water and food systems, enhanced soil health through circular use of organic waste, and a regenerative approach to ecosystem services to strengthen food security and climate adaptation.

Regulatory harmonization and standardization were identified as key enablers of effective WEFE implementation. Fragmented governance continues to hinder transboundary cooperation, particularly for shared groundwater resources. Priority actions include harmonizing groundwater regulations, addressing governance gaps in shared aquifers, aligning technical standards under the AfCFTA, and promoting mutual recognition of certifications to facilitate the deployment of WEFE-related technologies across African markets.

Innovation, technology transfer, and economic assessment were highlighted as essential for scaling WEFE solutions. The workshop stressed the importance of cost–benefit analyses to ensure context-appropriate investments, alongside the promotion of decentralized systems, Nature-based Solutions, and digital tools such as Earth Observation and groundwater monitoring to improve data availability, decision-making, and early warning.

Finally, communication, advocacy, and stakeholder engagement were recognized as cross-cutting drivers of effective WEFE governance. Targeted policy briefs, structured dialogue platforms, and co-creation mechanisms were identified as key to fostering ownership among policymakers and practitioners, while strengthening institutional and human capacities remains essential for the long-term sustainability of WEFE solutions.

Policy Recommendations for Strengthening WEFE Nexus Integration

Sustainable and Equitable Management of Natural Resources

Sustainable management of natural resources is a prerequisite for resilience, stability, and long-term development in Africa (*UNECE, 2021*).

- Promote equitable and sustainable use of water, land, energy, and ecosystems as a foundation for peace, climate adaptation, and socio-economic stability (*UN-Water, 2023*).
- Strengthen water security through integrated basin and aquifer management, including rainwater harvesting, managed aquifer recharge, groundwater protection, and conjunctive use of surface and groundwater resources (*IGRAC et al., 2024*).
- Recognize transboundary aquifers as strategic regional assets, particularly in arid and semi-arid zones where groundwater often represents the main buffer against climate variability (*OSS, 2024*).
- Improve energy efficiency across water and food systems by reducing losses, modernizing infrastructure, and expanding low-carbon, resilient energy solutions (*IEA, 2023*).
- Reinforce food security by enhancing soil health through organic amendments derived from urban and agricultural waste streams, capturing methane emissions while strengthening soils as carbon sinks (*Chaibi et al., 2024*).
- Reframe ecosystem services through a regenerative lens, emphasizing human stewardship of nature as a foundation for long-term ecological and economic value (*IPBES, 2019*).

Regulatory Harmonization and Standardization

Fragmented regulatory frameworks remain a major barrier to effective WEFE implementation and transboundary cooperation (*OECD, 2015*).

- Develop harmonized African regulations for groundwater use, monitoring, protection, and transboundary aquifer governance (*IGRAC et al., 2021*).
- Address the current governance gap whereby only 9 shared aquifer systems worldwide—6 of them in Africa—are covered by formal agreements or consultation mechanisms (*Nijsten et al., 2018*).
- Strengthen alignment of technical regulations, standards, and quality infrastructure to reduce barriers to cross-border cooperation and technology deployment under the AfCFTA (*AU, 2023*).
- Enable mutual recognition of conformity assessments and certifications, facilitating the circulation of WEFE-related technologies and services across African markets (*AfCFTA Secretariat, 2022*).

Innovation, Technology Transfer, and Economic Assessment

Scaling WEFE solutions requires technologies and investments that are economically viable, context-appropriate, and resilient to climate stress (*UNIDO, 2022*).

- Conduct systematic cost–benefit analyses to guide the adaptation of WEFE technologies to African socio-ecological contexts (*OECD, 2019*).
- Promote robust, affordable, and resource-efficient technologies, with a focus on decentralized systems and Nature-based Solutions such as constructed wetlands, biofilters, sand filters, and anaerobic digestion (*UN-Water, 2023*).
- Integrate digital tools, Earth Observation, and groundwater monitoring technologies to improve data availability, decision-making, and early warning systems for drought and water stress (*UNESCO, 2024*).
- Strengthen collaboration with complementary WEFE and Nexus initiatives to enhance knowledge sharing and regional impact (*TRANS-SAHARA Consortium, 2024*).

Communication, Advocacy, and Stakeholder Engagement

Effective WEFE governance depends on informed decision-making and inclusive participation across sectors and scales (*OECD, 2015*).

- Produce targeted policy briefs and communication tools tailored to policymakers and regional institutions (*UNECE, 2021*).
- Establish dialogue platforms and co-creation mechanisms involving ministries, researchers, private sector actors, and civil society (*AMCOW, 2022*).
- Promote cross-regional learning between the Maghreb, Sahel, and other African regions to integrate diverse experiences in WEFE implementation (*AU, 2023*).
- Strengthen institutional and human capacities to ensure long-term operation, maintenance, and ownership of WEFE solutions (*UNESCO, 2024*).

Conclusion: Institutionalizing WEFE for a Resilient Africa

Groundwater-dependent systems sit at the core of Africa's WEFE Nexus. With transboundary aquifers supporting water supply, food production, ecosystem stability, and regional cooperation, their coordinated management represents a high-impact, low-regret investment for climate resilience and peacebuilding (*OSS, 2024*).

Institutionalizing the WEFE Nexus through harmonized policies, integrated surface- and groundwater governance, innovation uptake, and inclusive cooperation provides a concrete pathway to strengthen Africa's resilience to climate change while advancing Agenda 2063 and the AfCFTA (*AU, 2023*).