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Accelerating Progress on the Water-energy-food-ecosystems (WEFE) Nexus in Sub-Saharan Africa

Inter-Agency Policy Brief – December 2025

The Water-Energy-Food-Ecosystems Nexus – Opportunity and Catalyst for Accelerated SDG Progress in Sub-Saharan Africa

The year 2025 marks a decade since adopting the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs). For many African countries, progress in implementing the 2030 Agenda and AU Agenda 2063 has been slow, requiring more efficient approaches to accelerate progress on the SDGs.[i]

*In Africa, **55%** of the population lives on less than US **$2.15** a day, while nearly **600 million** people lack access to electricity.*

According to the 2024 Africa Sustainable Development Report, only 6% of SDG targets are currently on track in the region[1], compared to 16-17% globally[2,3]. In addition, 55% of people living on less than US$2.15 a day, live in an African country, with most living in countries facing fragility, conflict and violence. The 2025 Sustainable Development Goals Report notes an alarming increase in the number of people facing hunger, undernourishment, and stunting, with 22.3 per cent of people in Sub-Saharan Africa affected by hunger as of 2024.[4]

Africa's growth is constrained by immense and competing demands for water, energy, and food, which are degrading critical ecosystems and intensifying the impact of climate change. This challenge is exemplified by the energy sector, where, despite the electricity access rate rising from 44% to 59% since 2010, rapid population growth has left the absolute number of people without access to power static at about 600 million[5]. Africa's electricity demand is projected to triple by 2040[6]. Since the continent relies heavily on hydropower[7], this surge will significantly strain water resources in a region where agriculture already accounts for 80% of all water withdrawals[8].

The Water-Energy-Food-Ecosystems (WEFE) Nexus is a multiplier for SDG Progress

Additionally, Africa is highly vulnerable to the impacts of climate change, even though it remains the lowest per capita contributor of global carbon emissions, accounting for less than 4%[9]. The siloed nature of government ministries in Sub-Saharan Africa creates significant barriers to addressing the interconnected water, energy, food,

[1] African Union, African Development Bank, UNDP, and UNECA (2024)
[2] United Nations (2024)
[3] Sachs et al. (2024)
[4] United Nations (2025)
[5] IEA, IRENA, UNSD, World Bank, WHO (2025)
[6] AUDA-NEPAD (2019)
[7] SEforALL (2024)
[8] AQUASTAT
[9] World Meteorological Organization (2024)

and ecosystem challenges.[10] This fragmentation results in policy conflicts, resource waste, and a failure to develop coherent, integrated strategies that harness opportunities for synergy.[11] In this context, advancing sustainable development in Africa will require a well-coordinated, cross-cutting approach that is anchored in reducing climate vulnerability and achieving water, energy, and food security.

The Sustainable Development Goals (SDGs) are inextricably linked, especially SDGs 6 (Water) and 7 (Energy). An integrated "whole-of-government" approach is required to navigate and achieve the interconnected multiple SDGs and their targets, as progress in one area is often dependent on another. Echoing calls from the Pact for the Future and the 2023 Global Sustainable Development Report, a nexus approach can create the "multiplier effects" needed to accelerate SDG progress by ensuring coordinated action where it is most needed.[12,13] One such approach is the water-energy-food-ecosystems (WEFE) nexus, which can be used to strengthen governance and integrated progress to ensure sustainable access to natural resources. The WEFE nexus is rooted in sustainable development, transboundary governance, integration, and systems thinking. The objective of the WEFE Nexus Project is to document high-impact case studies where the nexus approach has tangibly improved community well-being. These examples will serve as a blueprint to guide implementation in other regions.

The Water-Energy-Food-Ecosystems Nexus Framework

The Water-Energy-Food-Ecosystems (WEFE) nexus framework is critical for addressing resource interdependencies in Sub-Saharan Africa, a region facing significant challenges, including water scarcity, food insecurity, limited energy access, and ecosystem degradation. These issues are exacerbated by climate change, rapid population growth, and economic pressures.[14,15] By adopting a nexus approach, policymakers and practitioners can create and strengthen synergies across sectors, optimize resource use, and enhance sustainable development outcomes.[16]

The Water-Energy-Food-Ecosystems (WEFE) Nexus is a governance framework

The Water-Energy-Food-Ecosystems (WEFE) Nexus is a governance framework that addresses the inherent interconnections and interdependencies among these four domains. Adopting this approach enables integrated policymaking that systematically manages cross-sectoral trade-offs and synergies, thereby enhancing resource security and achieving sustainable development. The WEFE nexus is

[10] SADC (2023)
[11] Lah (2025)
[12] SEforALL (2024)
[13] United Nations (2023)
[14] FAO (2014)
[15] Hoff (2011)
[16] Ringler et al. (2013)

interconnected with the majority of the 17 SDGs, with direct linkages to SDGs 2 (zero hunger), 6 (clean water and sanitation), 7 (affordable and clean energy), 13 (climate action), and 15 (life on land).[17]

The WEFE Nexus is grounded in the following well-established approaches:

1. Integrated Resource Management: Addressing the interconnections between water, energy, food, and ecosystems enables integrated planning and decision-making to maximize synergies and minimize trade-offs. For example, improving water use efficiency in agriculture (a sector consuming 70% of freshwater globally) helps conserve water for energy production and ecosystem maintenance.[18, 19]
2. Policy and Governance Alignment: The nexus approach promotes cross-sectoral collaboration among ministries responsible for water, energy, agriculture, and the environment. Such collaboration is essential for harmonizing and integrating policies, such as aligning renewable energy targets with agricultural water management strategies.[20]
3. Technology Deployment: The nexus approach emphasizes adopting technologies that address multiple sectors simultaneously, such as solar-powered irrigation or wastewater reuse systems that support agriculture while preserving ecosystems.[21]

Sub-Saharan Africa's deeply interconnected, climate-vulnerable challenges make an integrated WEFE nexus approach essential for ensuring that resource policies are coherent, sustainable, and support long-term development.

[17] Carmona-Moreno et al. (2021)
[18] FAO (2017)
[19] UN-Water (2021)
[20] Albrecht et al. (2018)
[21] Biggs et al. (2015)

The need for integrated and coordinated planning - Fragmentation in Regional Water, Energy, Food and Ecosystems strategies

Africa is making tremendous progress on various regional plans and strategies; however, the fragmented nature of these strategies impedes overall progress toward achieving the SDGs. With separate strategies for water, energy, agriculture, and ecosystems, Sub-Saharan African states and economies lack the necessary resources to achieve accelerated progress. This is why the WEFE Nexus approach provides opportunities for optimised, efficient, and integrated implementation.

Below is an accounting of the fragmented programmes and plans currently in place across Sub-Saharan Africa:

Water - The Continental Africa Water Investment Programme (AIP)[22], endorsed by the African Union Assembly in 2021, is a flagship initiative aimed at closing Africa's water investment gap. At the 2023 Water Conference and COP28, the Africa Water Investment Action Plan was launched with a goal of mobilizing at least USD 30 billion and creating over 5 million jobs by 2030. It aims to fast-track climate-resilient water investments across national, regional, and transboundary levels, but technical and capacity constraints are hindering progress.

Energy - The Continental Master Plan for Electricity in Africa (CMP) aligns regional and national energy initiatives with the African Union's Agenda 2063 vision of an Africa Single Electricity Market (AfSEM).[23] However, the Continental Master Plan does not include an assessment of electricity investments in water resources or food, despite it being an opportunity to advance integrated solutions such as agrivoltaics and more.

"By integrating the WEFE nexus into policy frameworks and regional initiatives such as the AU Agenda 2063 Continental Master Plan for Electricity (CMP) and the Comprehensive Africa Agriculture Development Plan (CAADP), Africa can unlock multiplier effects that drive inclusive and resilient growth." (WEFE Nexus March 2025 Workshop Report)

Agriculture – The Comprehensive African Agricultural Development Programme (CAADP) is an AU Agenda 2063 initiative designed to increase investment in agriculture to drive economic growth and achieve SDG 1 (No Poverty) and SDG 2 (Zero Hunger)[24]. Through its new 10-year action plan (2026-2035) and the recent Kampala Declaration, AU member states have committed to strengthening Africa's agri-food systems by focusing on key areas, including industrialisation, productivity, and trade.

[22] AIP
[23] AUDA-NEPAD (2019)
[24] CAADP

Ecosystems - The African Union has launched several strategies to build resilience and protect ecosystems. The AU's Climate Change and Resilient Development Strategy and Action Plan (2022-2032) aims to create a unified, continent-wide response to climate impacts and plan for a low-emission future.[25] Similarly, the AU Biodiversity Strategy and Action Plan (ABSAP: 2023-2030) guides the implementation of the Kunming-Montreal Global Biodiversity Framework across the continent.[26]

While these and other WEFE-related strategies are both innovative and comprehensive, structural and operational challenges (such as institutional fragmentation, lack of resources, incoherent policies, and technical capacity gaps) are limiting the implementation of these strategies. This is where an integrated Water-Energy-Food-Ecosystems Nexus approach can ensure resource optimisation and operational efficiencies, facilitating accelerated progress.

Understanding Sectoral Silos: Mapping Ministerial Mandates to Improve WEFE Coordination

Implementing the WEFE nexus approach requires gaining an understanding of current governance and institutional structures in Sub-Saharan Africa. Efforts to map mandates are currently underway, as there is no integrated database mapping ministries and their functions at the country level. This is a key data gap, as ministries can also change mandates, with many not having websites or online presence to map government functions for recommendations on coordination. The research process for the purposes of this policy brief involved detailed data collection and analysis, as outlined in the following sections.

Data Collection

To map the ministerial and inter-ministerial mandates across Sub-Saharan African countries, data on ministries in these countries were collected primarily from the corresponding government websites, documents, and news agencies. When websites were unavailable or unreachable, alternative sources from the UN or social media websites were used, which were found to be actively updated by government agencies.

Data Analysis

The ministry names for each country were scanned to classify them according to nexus areas, namely water-related, energy-related, food-related, and ecosystems-related. Such identification and classification served as the basis for establishing the nature of integration and ministerial and inter-ministerial mandates, i.e., distinguishing between standalone ministries addressing a single nexus component versus integrated ministries combining multiple nexus elements under one roof.

To map the ministerial and inter-ministerial mandates across Sub-Saharan African countries, the level of integration for the WEFE-related ministries was categorised and assessed as very low,

[25] African Union (2022)
[26] African Union (2024)

moderately low, moderately high, and very high, based on the combination of sectoral ministries (Table 1).

Table 1 Categories for the level of integration for the WEFE-related ministries in Sub-Saharan African countries

Category for the level of integration	Number of interconnections between WEFE-related ministries
Very low	No combination of ministries
Moderately low	One combination of or interconnection between ministries
Moderately high	Two combinations of or interconnections between ministries
Very high	At least three combinations of or interconnections between ministries

Results

The minimum, median, mean, and maximum numbers of ministries per country in Sub-Saharan Africa were 12, 23, 24, and 39, respectively. While a minority of Sub-Saharan African countries have at least three combinations or interconnections between ministries, it was found that the majority (44%) have only one combination, and 19% have two combinations. A quarter of Sub-Saharan Africa countries completely lack a combination of WEFE-related ministries, with all existing along sectoral lines (Figure 1a).

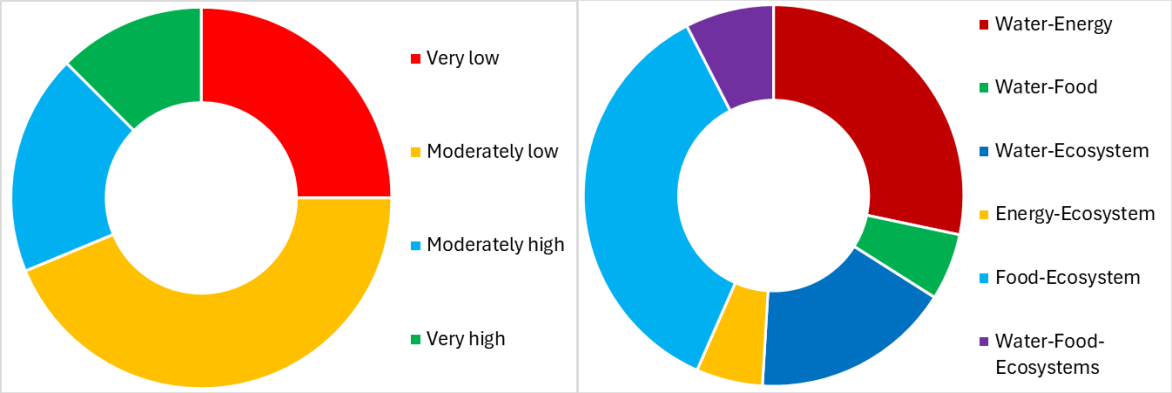

Figure 1: (a) Level of integration for the WEFE-related ministries in Sub-Saharan Africa countries (Very low: no combination of ministries; moderately low: one combination of or interconnection between ministries; moderately high: two combinations of or interconnections between ministries; very high: at least three combinations of or interconnections between ministries), *(b) Combinations of ministries in integration* (Water = water affairs, sanitation, water resources, hydraulics, water supply, dams; Energy = electricity, hydrocarbons, power; Food = agriculture, livestock, fisheries, agro-industry, food security; Ecosystem = land, environment, forests, forestry, natural resources, blue economy, marine, climate change, environmental preservation, wildlife).

Such sectoral ministries are signs and symptoms of fragmented policy and decision-making.[27] They fall short of addressing cross-cutting nexus challenges and present more complex coordination challenges. The countries with sectoral WEFE-related ministries include Ghana,

[27] Lah (2025)

Lesotho, Rwanda and São Tomé and Príncipe. They may require capacity building through training and workshops focusing on cross-ministerial coordination. They can benefit from cross-sectoral collaboration through inter-ministerial committees and coordination bodies, including formal committees, task forces, and councils across various government levels, such as those established by the Southern African Development Community (SADC).[28]

For the integrated ministries, the pairs are mainly related to food-ecosystem (36%), water-energy (28%), water-ecosystem (17%), water-food (6%), and energy-ecosystem (6%). Approximately one-tenth (8%) of integrated ministries are trios, which exist as water-food-ecosystems in the Central African Republic, Djibouti, Namibia, and Zimbabwe. If properly coordinated, such integrated ministries could foster holistic policy planning and harmonised implementation across the WEFE sectors.[29,30]

Countries with integrated WEFE-related ministries may be more likely to adopt comprehensive nexus-based policies.[31] Hence, their capacity-building needs to focus on technical knowledge exchange, advanced policy frameworks, and the implementation of integrated planning. They can benefit from internal collaboration, sub-departmental coordination and capacity building to design coherent policies and harmonised strategies.

It is also important to note the presence of gaps and duplications within WEFE-related ministries. None of the Sub-Saharan African countries has a ministry that explicitly mentions ecosystems or biodiversity. However, some implicit consideration is given through sub-sectors such as forestry, land management, natural resources, and wildlife conservation. This gap suggests that ecosystem services are not always prioritised in policies, despite ecosystems underpinning the security of water, energy, and food resources.[32].

Ministerial gaps and duplications in WEFE-related sectors create conflicts, waste resources, and hinder integrated policymaking.

Ministerial gaps and duplications in WEFE-related sectors create conflicts, waste resources, and hinder integrated policymaking.[33] It is therefore essential to close these gaps and harmonize mandates — for instance, by combining agriculture, livestock, and fisheries into a single ministry — to create more coherent policies and promote sustainable food systems. By transitioning from fragmented governance to an integrated WEFE nexus framework, Sub-Saharan Africa can unlock the synergies necessary to accelerate progress on the SDGs and achieve sustainable water, energy, and food security without compromising

[28] Kabeya et al. (2022)
[29] Mperejekumana et al. (2024)
[30] Nhamo et al. (2018)
[31] Ibid.
[32] Carmona-Moreno et al. (2021)
[33] Nhamo et al. (2018)

ecosystem health. However, further research is needed on how institutional arrangements or national-level governance influence the nexus and its outcomes.

Innovations, Integrated Resource Management and the WEFE Nexus - Success Cases in Sub-Saharan Africa

Despite persistent ministerial silos, successful WEFE nexus-related projects across Sub-Saharan Africa offer a powerful blueprint for integrated resource management. These initiatives demonstrate tangible co-benefits and provide scalable models for replication across the continent.

1. Kenya's Green Hydrogen: Kenya's green hydrogen roadmap aims to counter food insecurity and decrease dependence on fertiliser imports by 2032. Green hydrogen is derived from renewable energy sources through the electrolysis of water, producing hydrogen molecules.[34] In the first phase, Kenya plans to have the first commercial-scale green hydrogen projects operational by 2027, supporting the production of 100,000 tons of nitrogen fertilisers, which will replace a large share of fertiliser imports. Kenyan President William Ruto believes a green hydrogen economy will decarbonize industry and "enhance food security, including expansion of green production of Kenyan tea, coffee, horticulture, floriculture and grains." Kenya is utilising green hydrogen investments to ensure a positive impact across the water-energy-food nexus.[35] However, hydrogen production requires water, and this emphasises the need for integrated nexus planning, especially in areas facing water scarcity.[36]

2. Namibia's Southern Corridor Development Initiative: Namibia's green hydrogen project utilizes desalinated water for green hydrogen production and will supply local communities, thus enhancing water security and management.[37]

3. Ethiopia's Tana-Beles Project: Ethiopia's Tana-Beles Integrated Water Resources Development Project combines hydropower, irrigation, and ecosystem conservation. By building dams for energy generation and irrigation and implementing watershed management practices, the project has improved agricultural productivity, energy generation, and ecological health.[38]

4. Kenya's Turkana Wind Farm: While primarily focused on energy, the Lake Turkana Wind Power project has positively influenced local water and food systems. Solar-powered

[34] AbouSeada and Hatem (2022)
[35] UNDESA (2024)
[36] IRENA and Bluerisk (2023)
[37] UNDESA (2024).
[38] World Bank (2010)

boreholes financed by the project have improved water availability for communities, while job creation has enhanced food security in the region.[39]

5. Integrated Watershed Management in Rwanda: Rwanda's integrated watershed management programs include terracing, rainwater harvesting, and small hydropower projects. These initiatives address soil erosion, water scarcity, and energy access in rural areas, contributing to food security and renewable energy generation.[40]

6. Renewable Energy Independent Power Producers Procurement Programme (REIPPPP): The REIPPPP programme in South Africa has, to date, installed 90 operational projects of installed capacity 6,180 MW, which have cumulatively generated 126,201 GWh of energy, enough to provide power to more than 38.0million households. To date, these projects have (i) accrued water savings of 151.4 million kiloliters, (ii) contributed ZAR4.3 billion to socio-economic and enterprise development, (iii) created 86,531 job years, and (iv) offset greenhouse gas emissions of 128.1Mton CO_2.[41]

7. The SADC Nexus Regional Dialogue (NRD) Project "Fostering Water, Energy and Food Security Nexus Dialogue and Multi-Sector Investment in the SADC Region" (supported by the European Commission as part of the global 'Nexus Regional Dialogues Programme"): Successfully (i) embedded the nexus approach in the SADC RSAP IV (2016-2020) and V (2021-2025), (ii) (a) co-established and co-validated the SADC Regional WEF Nexus Governance and Operational Frameworks, (b) co-identified 15 investment projects that have potential for applying WEF nexus approach, and (c) developed a WEF nexus investment project screening and appraisal tool.[42]

8. Ethiopia's Ministry of Water and Energy: In 2021, Ethiopia created the unified Ministry of Water and Energy. In 2024, the Ministry of Water and Energy reported that 69.52% of the population had access to clean drinking water, with over 4 million people gaining access that year, amid a population growth of 3 million.[43] The State Minister noted that "Fragmented efforts in water well drilling and pipeline construction are now being coordinated for faster service delivery.[44]

Opportunities for Action – Capacity and Data partnerships

The successful case studies, capacity-building partnerships, and analytical tools highlighted herein prove that this transition is not merely theoretical but is already delivering tangible co-benefits on the ground.

[39] ADB (2018)
[40] Gasore et al. (2018)
[41] DMRE Republic of South Africa (2025)
[42] Kabeya et al. (2022)
[43] ENA (2024)
[44] Ibid.

Additionally, programmes and tools exist that can help Sub-Saharan African countries implement a WEFE Nexus approach.

Capacity Building Partnerships: A partnership between the Water Research Commission (WRC, South Africa), Centre for Transformative Agricultural and Food Systems - University of KwaZulu-Natal (CTAFS, UKZN), Centre on Climate Change & Planetary Health - London School of Hygiene & Tropical Medicine (LSHTM), Global Water Partnership Southern Africa (GWP-SA), WaterNet, IHE Delft Institute for Water Education, and Consortium of International Agricultural Research Centers (CGIAR) has hosted several capacity building programs on the WEFE nexus. These include multiple cohorts of the WEF Nexus Masterclass, the In-person Advanced School, and the WEF Nexus Regional Summit. At a regional level, nexus regional dialogues have been conducted in Southern and Western Africa.

Water-Energy-Food (WEF) Nexus Index: This composite tool measures a country's performance in managing the water, energy, and food nexus, providing essential data to support evidence-based policymaking. It brings together indicators across resource availability, access, sustainability, and efficiency to provide a holistic picture of nexus performance. By quantifying and visualising trade-offs and synergies, the WEF Nexus Index enables policymakers to move beyond siloed approaches and align sectoral strategies with integrated sustainability objectives.

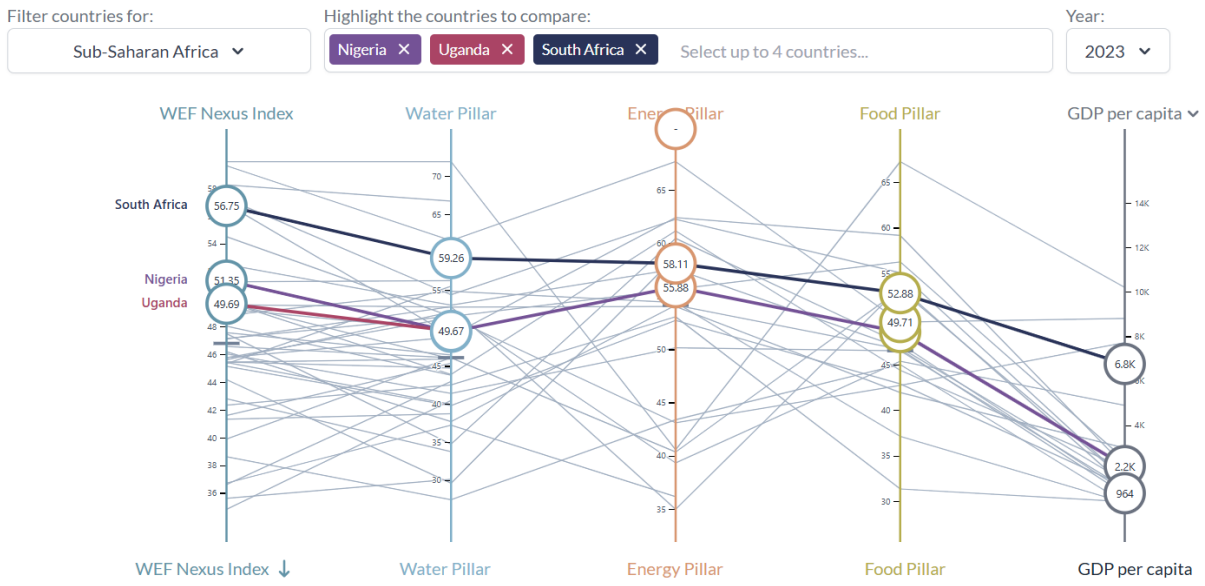

Figure 2: The Water-Energy-Food Nexus Index and pillars in 2023 for Nigeria, Uganda and South Africa[45]

In Sub-Saharan Africa, the WEF Nexus Index has been applied to highlight critical vulnerabilities such as water scarcity, low energy access, and high dependence on rain-fed agriculture.[46] For instance, by broadening its scope through the inclusion of ecosystem-related dimensions, the

[45] Simpson et al. (2022)
[46] Simpson et al. (2023)

WEF Nexus Index can guide governments and regional bodies in prioritising investments that simultaneously address food security and renewable energy expansion, while protecting natural ecosystems. By providing comparable, evidence-based data, the WEF Nexus Index supports cross-sectoral dialogue, enhances regional cooperation, and informs policy frameworks that foster resilience, sustainable resource use, and long-term human security.

Recommendations and next steps for policymakers

The analysis in this brief has demonstrated that fragmented governance, institutions and siloed sectoral planning are significant barriers to achieving sustainable development in Sub-Saharan Africa. The consequence of this ministerial divide is costly, resulting in wasted resources, heightened conflict, and incoherent policymaking. Adopting an integrated Water-Energy-Food-Ecosystems (WEFE) nexus approach is therefore essential to overcome these structural challenges. These cases in this brief offer a powerful and scalable blueprint for progress. The next steps will expand upon these success cases, particularly in areas where implementation of the WEFE Nexus has had a profound positive impact on the daily lives of individuals.

Future activities will focus on strengthening human capital and commitments to ensure policymakers, regional bodies, and development partners collaborate in advancing the WEFE nexus and accelerating progress on the SDGs. To translate the potential of the WEFE Nexus into widespread, transformative action, a concerted effort is now required. To this end, the following recommendations have been outlined as follows:

1. Integrate Regional Water-Energy-Food-Climate plans: Regional plans must steer integrated progress, setting an example for national integration. There is a need to harmonize national policies with regional ones and the SDGs.
2. Enhance Institutional Coordination at the national level: Strengthen cross-sectoral governance to ensure that policies on water, energy, agriculture, and the environment are aligned.[47]
3. Strengthen data and integrated monitoring on Climate Vulnerability for Water-Energy-Food security: Solid scientific knowledge, substantive data, technology transfer, capacity building, and sharing of best practices are needed to support the implementation of the water-energy nexus across the continent. It is also vital to strengthen or establish an integrated monitoring mechanism regarding the water-energy-food nexus at the national level to ensure greater resilience and security in the region.
4. Invest in Capacity Building and Strategic Partnerships: Provide targeted training for policymakers (e.g., systems leadership[48]), engineers, and communities to design and implement nexus-based solutions effectively, while fostering the political dialogue and partnerships essential to mainstreaming the approach in Africa
5. Prioritize the Inclusion of Women and Youth: Nexus planning must be intentionally inclusive to be effective. It is crucial to ensure that the gender dimension is adequately

[47] Weitz et al. (2017)
[48] Mabhaudhi (2025)

reflected in all aspects of the nexus approach to enhance equitable access to productive resources. Furthermore, given that 70% of Sub-Saharan Africa's population is under the age of 30, this new generation must be fully empowered to lead implementation through entrepreneurship and public programmes, which presents a significant opportunity for the continent's growth.

The WEFE nexus offers transformative potential to enhance resilience and foster sustainable development in Sub-Saharan Africa by addressing interconnected challenges related to water and energy access, food security, and ecosystem preservation. Through strategic investments, innovative technologies, and cross-sectoral governance, the nexus approach can significantly contribute to achieving the SDGs in the region.

2026 High-Level Political Forum on sustainable development

Opportunity for policy action: The 2026 High-Level Political Forum on sustainable development will review SDGs 6,7,9,11 and 17 the theme *"Transformative, equitable, innovative and coordinated actions for the 2030 Agenda and its SDGs for a sustainable future for all"*. The review of SDGs 6-7 presents an opportunity for concerted global and regional action to overcome fragmented strategies and ensure more integrated policy commitment to ensure water-energy-food and ecosystems security and access in Africa.

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