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Project funded by the EUROPEAN UNION
REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

FEMISE

White Paper No. 3

Water-Energy-Food Nexus: Unexplored potentials for Tunisia

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Abstract

Tunisia is known as "Tunis Elkhadraa" (Tunisia the green), thanks to its historical wide green lands of olives and grapes, however in recent years, the country has been grappling with the effects of climate change. Population growth, economic development and urbanisation have also increased pressure on energy, food and water, thus undermining the sustainable use of resources. These pressing challenges require the development of a comprehensive national Water-Energy-Food Nexus (WEFN) strategy in light of the mandate and targets of both the Sustainable Development Goals (SDGs) and the 2015 Paris climate summit. The WEFN strategy would aim to implement integrated planning and management that reduces trade-offs and creates synergies across the three sectors, ensuring that the environmental and social needs of future generations are reflected in policies and practices.

This White paper calls for the establishment of a WEFN committee under the aegis of the National Environmental Protection Agency (ANPE) in Tunisia that will be in charge of increasing policy coherence among the three sectors and climate change policies to provide integrated solutions aimed at mitigating nexus-related risks (integrated policies, non-siloes thinking, linking up across sectors and ministries). In support of the country's overall goals of achieving long-term sustainable economic development and reducing its vulnerability, this committee will also contribute to building understanding of the overall scope of WEFN as an integrated approach to drive sustainable development in Tunisia, ensuring the development of natural resource management while promoting the circular economy through ad hoc economic measures and social instruments, and stimulating creative thinking and the development of a culture of innovation and technology adoption in the field of WEFN among young people and the community.

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1. Introduction

Tunisia has been committed for several years to reducing its greenhouse gas emissions by placing the crucial issue of climate change at the top of its political and economic agenda in line with its efforts to achieve the Sustainable Development Goals (SDGs) and the mandates of the Paris Agreement. In fact, Tunisia is the first country in the MENA region to recognize in its new Constitution the importance of contributing to "the safety of the climate by all available means"[4].

While the country is ranked 69th out of 185 countries in the 2021 ND-GAIN Index[5] - which means that, despite its high vulnerability, the country is well positioned to adapt - the country is currently facing a severe climate change crisis due to a number of political, geographic, and social factors. In a survey conducted by the European Investment Bank (EIB)[6], 84% of Tunisians say that climate change is already affecting their daily life, with 52% believing that it has affected their income and source of living, while 83% are in support of further investment in renewable energy. The country is expected to experience further adverse effects of rising temperatures, increased aridity, reduced rainfall and rising sea levels. This will be exacerbated by the social and development needs of the population resulting in an increased demand for water, energy and food which leads to the sustainable use of resources while triggering a stagnation in their renewal. According to the United Nations Population Fund, Tunisia has a population of 12.5 million people (2023)[7], with an average annual population growth rate of 1.1% and is projected to reach 13.8 million people by 2050[8]. It is estimated that 69% of the current population resides in urban areas, which is expected to reach 80% in 2050[9]. Moreover, the coastal region hosts most of the country's activities and 2/3 of the population, making more people vulnerable to threats due to sea level rise. Beach erosion has already been observed, which could have both a social and economic impact on the country which relies heavily on beach tourism as a vital source of income and employment (contributing almost 5% to the country's GDP)[10].

As such, the Tunisian government is receiving support from a number of international organisations to help implement a climate strategy that would help the country overcome the current crisis, such as the United Nations, the World Bank and GIZ.

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[4] Chibani, 2021

[5] The ND-GAIN Index ranks 185 countries using a score which measures a country's climate vulnerability and adaptation readiness based upon compiled indicators to improve resilience. Tunisia is the 119th most vulnerable country and the 86th most ready country. The low vulnerability score and high readiness score of Tunisia places it in the lower-right quadrant of the ND-GAIN Matrix. This means that although adaptation challenges remain, Tunisia is well positioned to adapt.

[6] European Investment Bank (EIB), 2022. Climate Survey https://www.eib.org/en/surveys/climate-survey/5th-climate-survey/africa

[7] United Nations Population Fund. 2023, World Population Dashboard: Tunisia. https://www.unfpa.org/

[8] The World Bank Group, 2021. Climate Risk Country Profile: Tunisia. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-04/15727-WB_Tunisia%20Country%20Profile-WEB.pdf

[9] Ibid.

[10] World bank data, 2023

However, the country remains constrained by political fragmentation and tensions and the lack of consensus on pivotal economic reforms amid diminishing job prospect, in addition to the ongoing Russian-Ukrainian war which has further hampered economic recovery from the COVID-19 pandemic, amplifying the country's vulnerability to shocks and threatening the country's ability to ensure food and energy security.

Therefore, there is an urgent need for the implementation of an integrated approach that addresses the challenges of the three sectors together rather than individually, given the interconnection between those three sectors, which will be crucial to reduce trade-offs and build synergies. A Water-Energy-Food Nexus (WEFN) integrated approach in Tunisia, in support of the country's efforts to accomplish its economic development goals, will reinforce its efforts towards environmental sustainability and enhance its capacity to adapt to climate change, in order to respond more effectively and sustainably to these critical challenges.

2. The Water-Energy-Food Challenges in Tunisia: An overview

Tunisia is ranked second among SMCs (after Algeria) in the WEF Nexus index[11], which makes it in a favourable position compared to other countries of the region, however, it is still ranked relatively low compared to the rest of the world with an overall ranking of 109 (over 177 countries)[12].. While the food pillar is ranked the highest among the SMCs (56th), water and energy indices are alarming (119th and 128th respectively).

In fact, the country's water resources are characterized by scarcity. Tunisia faced its 5th year of drought leading to a reduction in water levels in the 30 Tunisian Damns to less than a third. According to the National Water Sector Report 2021, the total rainfall for the 2020-2021 hydrological year is largely in deficit. A national average of 172 mm was recorded this year compared to an inter-annual average of 232 mm. The situation will worsen as climate projections signal that the scarce water resources will be exposed to increased demand for water and conflicts of use, overexploitation of groundwater, declining water reserves, and degradation of water quality including salinization of coastal aquifers. In fact, an estimated 50% of coastal aquifers are expected to be salinized by 2030 due to sea-level rise[13]. In fact, the country is facing a decline in renewable water resources per capita, being 303.54 m3/capita/year in

[11] The Water-Energy-Food (WEF) Nexus Index is a national-level composite indicator founded on 21 relevant indicators for 3 pillars: Water, Energy and Food with regards to their access and availability: https://wefnexusindex.org/
[12] Louis, Maryse & Dahdouh, Sophie, 2022
[13] Ghezal, Abdelkarim, Keskes, Tarek & Zahar, Hakim, 2019

2020[14] and expected to decrease sharply to 300 m3/capita/year by 2030 and 220 m3/capita/year by 2050[15] (which represents about 75% of the total coastal water resources), bringing the country closer to the threshold of severe water scarcity. Not to mention that most of the exploitable renewable surface water is mobilized in dams and hilly dams and subject to a loss of storage capacity of up to 43% of their initial capacity[16]. In a survey conducted in the context of the WEF-CAP project, Tunisian respondents highlighted the fact that water stress and sea level rise are the most threatening externalities of climate change in their country as well as in the Mediterranean and Africa[17].

Although the country has made notable progress in improving water supply, sanitation and water-related health services, significant imbalances and lack of access remain high, especially across different geographies and between urban and rural populations. In fact, the increasing deployment of non-conventional water resources and the need to pump water across large distances and vertical gradients make the Tunisian water system very energy-intensive. Similarly, underground water resources mainly deployed for irrigation generate additional energy demand due essentially to the increased depth of the water, through overexploitation and increased number of pits. This is further aggravated by an inconsistent institutional framework to ensure the sustainability of groundwater use and unauthorized drilling for aquifer exploitation. In addition, uncontrolled land use practices are contaminating aquifers, and inefficient agricultural techniques contribute to the overexploitation of water resources in the country, with farmers tending to achieve higher levels of productivity through an overall simplification of agricultural practices, resulting in the disruption of traditional hydraulic systems and associated organizational configurations within oases.

[14] FAO AQUASTAT database, 2020
[15] Tunisia. 2021. "Updated Nationally Determined Contribution".". https://unfccc.int/sites/default/files/NDC/2022-08/CDN%20-%20Updated%20-english%20version.pdf
[16] Ministry of Higher Education and Scientific Research. 2019
[17] Egypt Today, 2023. Egypt has 90 universities serving 3.6M students: Higher Education Minister. https://www.egypttoday.com/Article/1/121838/Egypt-has-90-universities-serving-3-6M-students-Higher-Education.

Table 1: Water uses for different sectors in Tunisia from 2000 to 2020

Water uses	2000	2010	2020
Agriculture as % of total water withdrawal	85.01	80.18	75.54
Industry as % of total water withdrawal	4.17	4.92	1.73
Municipal as % of total water withdrawal	13.83	14.90	22.73
Total water withdrawal (10^9 m^3/year)	2.64	3.26	3.59
Total water withdrawal per capita (m^3/inhab/year)	271.93	306.48	303.54

Source: FAO AQUASTAT database, 2020

Evidently, the agricultural sector, which is a crucial sector in Tunisia due to its significant contribution to food security and the country's economy representing approximately 14% of GDP, consumes about 75.54% of total water withdrawals for irrigation (Table 1) which is relatively high and could reflect agricultural inefficiency. While the country has one of the highest cultivated areas per capita in Africa, 26% of the total area of the country and 47% of the agricultural and pasturelands are cultivated[18], these areas have been struggling due to droughts in the past few years. Rain-fed agricultural production, which is predominant in the country, has to cope with the arid climate, irregular rainfall and soil degradation. In fact, Tunisia has experienced a significant increase in temperatures over the past 30 years of around 0.37°C per decade as well as a decrease in rainfall of around 3%[19], which is expected to contribute to crop failures and overall yield reductions in the country by the end of the century and further threaten economic viability and sustainability of the agricultural sector. It is clear that the decline in soil productivity and agricultural yields (especially for salt-sensitive crops) which is often offset by illegal extensions of irrigated perimeters and by increased use of fertilizers and phytosanitary products increases water withdrawal while affecting water quality. Studies predict a loss of around 16,000 ha of agricultural land in low coastal areas by 2030 and an indirect loss of irrigable area potential of around 38,000 ha (representing 10% of current irrigated area) by 2050 due to extreme climate

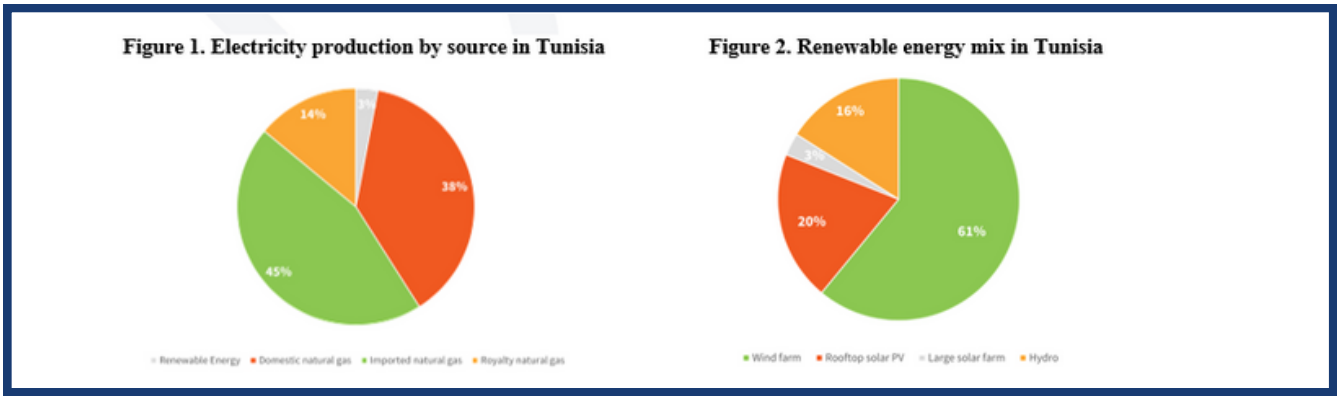
impacts[20]. Cereal crops are expected to decrease by 30% from 1.5 million ha to about 1 million ha in 2030. This is due to the fact that over 97% of the cereal production in Tunisia is grown under rain-fed conditions, making the production highly vulnerable to drought, which is likely to occur more frequently[21]. Olive production, which is one of the most important export crops in Tunisia, will also experience a drop in yield of up to 32%[22] by 2050. Not to mention that the numerous reforms to which the Tunisian agricultural sector has been subject since the 1980s with the implementation of the Agricultural Structural Adjustment Program aimed at liberalizing the sector and bringing the country into the process of globalization have led to the elimination of agricultural support and the reduction of subsidies[23], resulting in lower yields of some crops (such as citrus fruits)[24].

[18] FAO. Water efficiency, productivity and sustainability in the NENA regions (WEPS-NENA: Tunisia. https://www.fao.org/in-action/water-efficiency-nena/countries/tunisia/zh/
[19] The World Bank Group, 2021.
[20] Ghezal, Abdelkarim, Keskes, Tarek & Zahar, Hakim, 2019
[21] Nexus Dialogue Programme, 2018. The Water-Energy-Food Security Nexus Country Profile: Tunisia. https://uploads.water-energy-food.org/legacy/nexus_country_profile_tunisia.pdf
[22] Tunisia. 2021. "Updated Nationally Determined Contribution". https://unfccc.int/sites/default/files/NDC/2022-08/CDN%20-%20Updated%20-english%20version.pdf
[23] Bazzana, Davide ; Comincioli, Nicola; El Khoury, Cristina; Nardi, Fernando and Vergalli, Sergio, 2023
[24] Ibid

Clearly, Tunisia is facing soaring prices of raw materials and agricultural inputs due to the ongoing ukrainian-russian war, which has exacerbated food insecurity in the country. In fact, annual wheat imports from these countries are estimated at 54%[25]. In addition, the country is facing a shortage of fuel used in the operation of machinery and equipment, agriculture being highly carbon intensive, from the manufacture of agricultural inputs to mechanization.

The Tunisian energy landscape is characterized by a decrease in national primary energy resources in the face of a steady increase in demand at an average annual growth rate of 5% [26]. The heavy dependence on fossil fuel reserves which is expected to reach 85% by 2030[27] meant that, historically, the development of renewable energies has not been considered a priority for the Tunisian government. In fact, renewable energy production remains very limited, being 1-3% of the primary energy resources[28] (Figure 2) which is below its 2020 targets of 12%[29]. Not to mention that the Covid-19 pandemic contributed to the slowdown in the deployment of renewable energies in Tunisia leading to the reduction of renewable energy subsidies introduced in 2017 from 429 $/kW to only 179 $/kW for an installed capacity greater than 1.5 kW[30].

While renewable energy development strategies, as abundant as they are, are slow to materialize, the energy deficit continues to widen, reaching 4.7 millions tonnes of oil equivalent (Mtoe) in 2017 which represents approximately 50% of demand, leading the country to become a net importer of energy[31]. The national production of petroleum products provides 40% of primary energy consumption against 60% of imported production, 56% of the total consumption of petroleum products being distributed to the transport sector against 44% for industry, construction and agriculture[32].



Source: **Nouicer, Athir,** 2022

[25] Emam, Amr. 2022, How Russian invasion of Ukraine threatens wheat supplies in North Africa, Middle East Eye https://www.middleeasteye.net/news/egypt-ukraine-russia-wheat-north-africa
[26] The World Bank Group, 2021
[27] Ghezal, Abdelkarim, Keskes, Tarek & Zahar, Hakim, 2019
[28] Nouicer, Athir. 2022.
[29] El Amine, Yasmina, 2023
[30] Ibid.
[31] Ghezal, Abdelkarim, Keskes, Tarek & Zahar, Hakim, 2019
[32] IUCN ROWA, 2019

This dependency on energy imports which has reached 51% in 2018[33] imposes significant challenges on Tunisia in terms of the security of its energy supply and the competitiveness of its economy as well as a worsening of the situation of the national trade balance and the country's foreign currency balance sheet. Clearly, the decline in national natural gas production poses a serious problem in terms of the security of electricity production, which is 97% dependent on natural gas[34]. About 45% of Tunisia's natural gas requirements are satisfied by imports (as shown in Figure 1), mainly from Algeria[35]. The unpreparedness of existing infrastructure and generation capacities for the anticipated effects of climate change comes to add further pressure on the electricity sector, increasing the risks of system failures and energy outages.

3. Tunisia's Resilience Building Goals for 2030 through National Initiatives

As stated in its updated Nationally Determined Contribution (NDC), in line with its efforts to achieve the Sustainable Development Goals (SDGs) and the mandates of the Paris Agreement, the Tunisian government aims to promote a Tunisia that is resilient to climate change, which can reduce, anticipate and absorb the effects of climate disturbances through adaptation, solidarity and innovation. This implies evolving towards a new state of balanced equilibrium that preserves the functionality and performance of its natural and human systems while being able to ensure an inclusive and sustainable socio-economic development model that can lead to progress. This objective will be achieved by relying on a comprehensive and cross-cutting adaptation framework that encompasses all aspects of the nation and its development.

As part of the country's efforts to tackle the challenges related to the on-going water scarcity, the Tunisian Water Strategy 2050 ("Eau 2050")[36] aims to provide the government with a long-term vision and strategy for the development and sustainable management of the water sector. The priorities of water resilience set by the Tunisian government consist of improving the quantitative and qualitative management of conventional water resources and increasing the use of non-conventional water resources,namely treated wastewater and desalinated water while strengthening the technical, scientific, and institutional capacities of water stakeholders to adapt to climate change. This involves focusing on transferring knowledge and skills to practitioners, introducing good water management practices, exploring nature-based solutions, and fostering research and action.

[33] The World Bank Group, 2021
[34] El Amine, Yasmina, 2023
[35] The World Bank Group, 2021
[36] Tunisia-Development of the 2050 water vision and strategy. https://projectsportal.afdb.org/dataportal/VProject/show/P-TN-EAZ-004

In this regard, Tunisia has been able to develop a complex and diverse water infrastructure allowing the country to mobilize and exploit available water resources in order to ensure access to drinking water for the majority of the urban and rural population through 2030 and to provide supplies for agricultural irrigation, as well as the industrial and tourism sectors. Various adaptation measures have already been implemented to improve water use efficiency in the country, such as the Djerba, Sfax, Zarrat, and Sousse desalination plants. Additional efforts include transferring excess water from the extreme north to inland regions, reusing treated wastewater, and enhancing and securing water supplies to major urban centers, including Greater Tunis, Cap-bon, the Sahel and Sfax.

In terms of food resilience, the Tunisian government aims to support the transition to climate-resilient agricultural/food production systems and to develop a dynamic and effective scientific, technical and institutional framework in response to climate imperatives through progressive and transformative adaptation in order to ensure food security for the Tunisian population in a sustainable manner (i.e. in sufficient quantity and with the required quality). This implies achieving the digital transition of agro-sylvo-pastoral production systems, livestock, fisheries and aquaculture, converting to conservation agriculture and organic farming and enhancing the sharing of information, data and knowledge. It is worth noting that, in its efforts to strengthen agricultural security as well as the economic benefits of increased exports, the government has embarked on a set of policy actions and measures such as increasing mixed crop-livestock production in highly vulnerable regions, increasing meteorological and climatic monitoring, primarily focused on extreme events which can cause significant crop damage, and the development of innovative systems for arable crops.

Furthermore, as a response to climate change issues, Tunisia has initiated its National Policy for energy efficiency since 1980, based on three pillars: national coverage and total energy supply at lower cost for users, increase in energy autonomy and contribution to reducing greenhouse gas emissions. In its updated National Development Contribution (NDC)[37], the government strengthened its commitment to the international climate change governance system by raising its macroeconomic greenhouse gas emission reduction target from 41% to 45%. The country's unconditional contribution corresponds to a decrease in carbon intensity of 27% in 2030 compared to that of 2010, which is largely above the first NDC where the unconditional effort is set to generate only 13% reduction in carbon intensity. The country developed an energy strategy that aims to ensure the security of the country's energy supply while guaranteeing access to energy at an affordable price for the Tunisian economy and population.

[37]Tunisia. 2021. "Updated Nationally Determined Contribution"

This strategy focuses on the development of national hydrocarbon resources, in particular natural gas, the strengthening of institutional and technical capacities in the energy sector, namely the improvement of the refining, transport and distribution of petroleum products, the development of electricity production and the enhancement of interconnections, and the transition towards better energy efficiency through the development of renewable energies, such as the exploitation of domestic hydro, wind and solar resources. In this regard, Tunisia seeks to reduce its primary energy consumption (by 30%) by reaching a share of renewable energies in electricity generation of 30% by 2030[38].

In a way to achieve this goal, the government has implemented several initiatives to encourage the transition towards renewable energy resources. The government is engaged in reforming the whole energy system and ensuring its transition and plans over a billion dollars in renewable energy in the coming 2 years in a bid to reduce the dependency on fossil fuels and overcome structural challenges. At the same time, smaller targeted initiatives are taking place. For example, owing to the subsidies provided by government agencies, the demand of farmers for solar pumping irrigation systems (SPIS) is increasing. Around 124 pumps were installed, from 2010 to 2017, with a combined capacity of 1.07 MWp[39]. According to the Ministry of Agriculture, Hydraulic Resources and Fisheries, as stipulated in the Tunisian Water Strategy 2050 ("Eau 2050"), the CRDA (Regional Commissionership for Agricultural Development)/GDA (Grouping for Development of Agriculture and Fishery) pumping stations adapted to the MV network will be equipped with photovoltaics connected to the network. This will make it possible to achieve 50% energy autonomy in 2040. The 10,000 surface wells and shallow fodders of the private sector will also be equipped with stand-alone photovoltaic systems with storage by 2040 and should achieve 100% energy autonomy.

However, although Tunisia has recognized its energy transition as an essential pillar of sustainable development and job creation, the country is still struggling to translate its policies and strategies into concrete actions on the ground[40]. There is a lack of communication between different stakeholders on the energy transition. Moreover, the involvement of the private sector in renewable energy projects in Tunisia seems to be at the expense of local involvement and development. So far, private investment in renewable energy projects has favored foreign companies, despite the presence of capable domestic players. Only half of the 22 renewable energy projects since 2015 have Tunisian project managers and only four are exclusively led by Tunisian companies[41].

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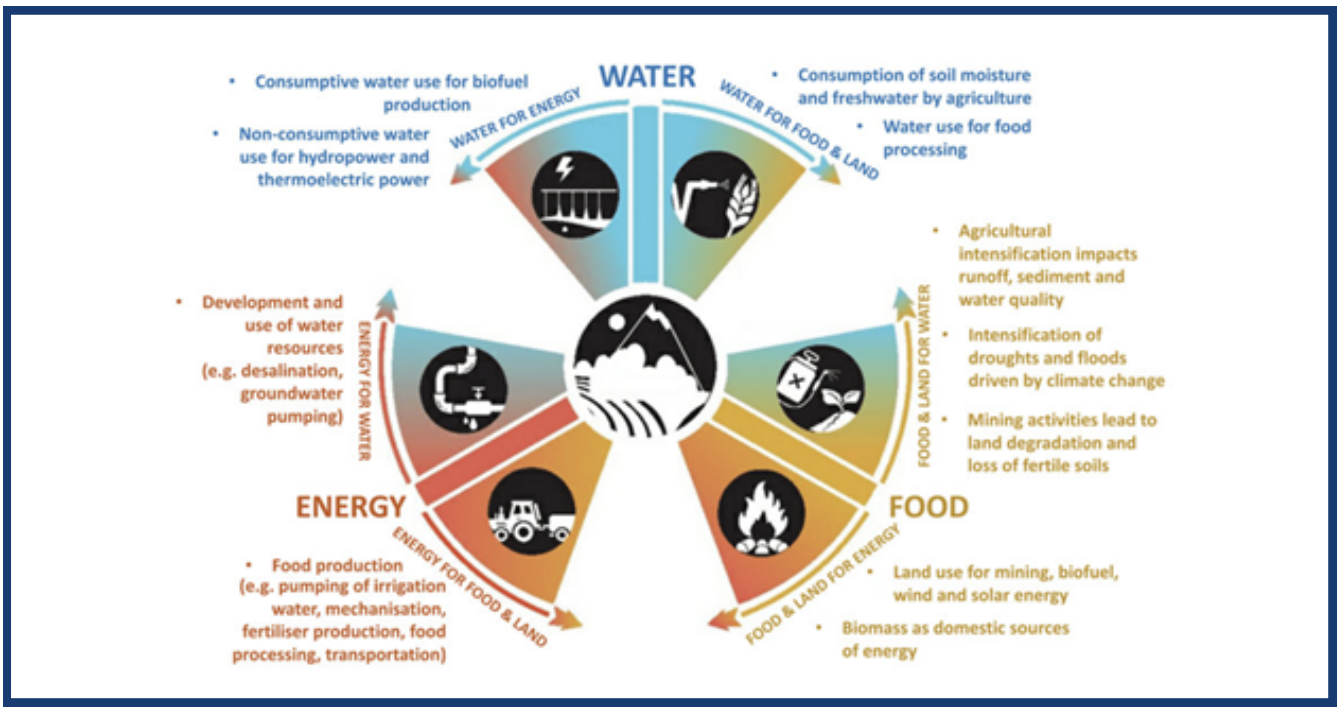
[38] Nouicer, Athir, 2022
[39] Nexus Dialogue Programme, 2018. The Water-Energy-Food Security Nexus Country Profile: Tunisia. https://uploads.water-energy-food.org/legacy/nexus_country_profile_tunisia.pdf
[40] El Amine, Yasmina, 2023
[41] Ibid

4. Opportunities and challenges for a WEF Nexus approach in Tunisia

While climate change threatens water availability, thus exerting significant pressure on the agricultural sector, the main solutions envisaged, namely wastewater and water desalination, lead to increasing pressure on the energy sector. Clearly, examining the water-energy-food challenges in an integrated approach rather than in each sector individually is crucial to reduce trade-offs and build synergies, thereby ensuring sustainability, community well-being, social justice, and the achievement of the green economy. These sectors are strongly interconnected, their mutual impact being perceptible in any initiative undertaken (Figure 3), which requires harnessing these resources in ways that limit problems and mitigate the adverse effects of climate change.

Figure 3: examples of the WEF interconnections



Source: Adapted from United Nations Economic Commission for Europe, 2016

In Tunisia, prioritizing the preservation of water, which is a finite and irreplaceable resource, is therefore crucial and requires an assessment of the long term renewable and stored water resources as well as finding alternative solutions for food production and energy use that take water security into account in order to ensure sustainable agriculture[42].

The nexus approach has been proposed by experts as the predominant solution, in the context of the energy transition, to fight the lack of resources as well as the impacts of climate change. Evidently, in Tunisia, implementing the WEFN approach will help maximizing food production by efficiently and sustainably deploying renewable water and energy and strengthening an Ecosystem where all stakeholders will be engaged.

[42] Ganoulis, Jacques, 2021

Opportunities to address the links between water scarcity, energy efficiency and food production include: deployment of photovoltaic technology for pumping (i.g. solar pumping irrigation system) and other uses in the water sector, including for desalination, using the energy potential of biogas and biosolids in wastewater from treatment plants to offset part of the energy needs; and establishing pumped and turbine energy storage stations near dams and canals, where possible.

In fact, the Tunisian government faces several challenges with respect to WEFN governance. There is a lack of an overall agricultural strategy with support mechanisms adapted to the development of value chains and the country's food challenge, in particular through the establishment of an agricultural map which considers the availability of water resources while integrating energy as an additional determining factor.

Undoubtedly, the country has to deal with limitations in the coordination of parties in the decision-making mechanisms, difficulties in arbitrating various water needs (including environmental) while ensuring priority for drinking water and agriculture, degraded infrastructure and poor management of irrigation and drainage systems, difficult implementation and monitoring of existing laws and regulatory frameworks for groundwater conservation, particularly in terms of imposing penalties, and insufficient financial resources for the necessary interventions in infrastructure, water management, training, and awareness-raising.

5.Conclusion and recommendations

In Tunisia, addressing existent environmental and resources challenges would require a high-level cooperation among the water, energy and food sectors to anticipate trade-offs and build on intersectoral synergies and an active engagement of local actors, private companies, and investors in order to ensure the formulation, implementation and adoption of adequate national policies.
Tunisia should pursue the development and implementation of new innovative regulatory and financial models to increase efficiency, particularly for utilities, (e.g economic incentives and reduced subsidies to promote efficient water use in irrigation and varieties of non-water-intensive crops) while implementing energy savings programs for customers and new approaches to electricity supply, including renewable energies. This will require revising the energy tariff for water pumping to promote energy efficiency and strengthen solar pumping in the agricultural sector while supporting research and technology development to enable the electricity sector to cope more effectively with climate change.

There is a need to strengthen the enforcement of existing water conservation laws as well as transboundary cooperation for sustainable management of groundwater resources while strengthening water demand management (including through water-saving programmes) which requires taking environmental needs into account in the water balance of the aquifer.

It is also vital to put in place agricultural policies oriented towards rational, sustainable and productive agriculture and to develop a sustainable programme for diversified, multipurpose renewable energy and sustainably upscale small- scale solar irrigation.

This can be achieved through the establishment of a WEFN council under the aegis of the National Environmental Protection Agency (ANPE) in Tunisia which will deliberate on the opportunities and challenges of embracing a nexus approach supporting integrated natural resource management with the aim of developing coherent and synergistic policies and strategies adapted to the future that address interdependencies and trade-offs among these sectors while raising awareness of culture change regarding WEF consumption.

More specifically, the WEF council will be in charge of:

1. ensuring the efficiency of water use for food production and its recovery by contributing to the improvement of agricultural practices, especially in rainfed crops while promoting the reuse of treated wastewater and unconventional water sources for agricultural irrigation and groundwater recharge;
2. improving water efficiency for energy production, targeting power generation from flowing water sources, pumping and turbine systems near existing rivers, and marine or ocean energy and all renewable energies extracted or that may come from the marine environment, and
3. enhancing the efficiency of the energy consumed for the treatment and transport of water by aiming to intensify the reduction of water leaks while increasing the production of energy from wastewater and recycled agricultural wastes, targeting the production of biogas from liquid waste, the reuse of biomass at the farm level for cogeneration and heating, the recovery of waste in the agro-food industries and the use of wastes with calorific values for the production of residue derived fuels.

Moreover, this committee will stimulate creative thinking and the development of a culture of innovation among youth and the community by building the capacity of researchers and entrepreneurs engaged in WEFN research and development projects to innovate while fostering networking and collaboration among WEFN small and medium-sized enterprises (SMEs) through dedicated platforms and events, enabling knowledge exchange and partnership opportunities. It will contribute to the exchange of practices on how to increase efficiency through innovation and infrastructure optimization and rehabilitation while supporting the overall assessment, management and planning of sustainable projects for global green and climate investments with the overall objective of strengthening the Tunisian economy, thereby attracting foreign investors, negotiating with donors and creating much-needed jobs.

This committee will be able to discuss proposed initiatives, which align with Tunisia's 2030 resilience building goals, including but not limited to:

- upscaling the use of non-conventional water resources through desalination and treatment of wastewater and drainage
- promoting the use of the best seawater desalination technologies such as reverse osmosis, which consumes less energy, and isobaric pressure exchanger recovery systems (enabling the energy consumption ratio (kWh/m3) to be reduced by 30% compared to older technologies)
- the introduction of smart meter applications that allow remote monitoring and control of electricity produced and water pumped (e.g. the installation of electronic variable speed that drives to improve the energy efficiency of pumping stations and pressure control in supercharged networks)
- the implementation of smart water networks allowing SONEDE[43] better control of its infrastructures in order to control and diagnose problems, to prioritize and manage maintenance operations continuously and remotely, to use the data provided to optimize the performance of water distribution networks, in particular the energy component and enable SONEDE customers to control their water consumption
- promoting the use of photovoltaic systems for uses other than solar pumping and the associated net-metering system, etc.
- improving the reliability of the electricity grid in rural areas, thus fostering the integration of renewable energies for remote and multiple uses
- enhancing innovative practices and techniques for sustainable soil and crop management and investing in their upscaling and dissemination
- increasing sewer connection and sewage treatment flow in decentralized facilities in the agricultural sector
- shifting to energy (and climate) smart farming practices, such as applying agroecological and recycling principles, e.g. in tillage, nutrient management and crop rotation
- Enhancing the strategic use of food imports to reduce agricultural water and energy needs

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Disclaimer: "This publication has been produced with the financial assistance of the European Union under the ENI CBC Mediterranean Sea Basin Programme. The contents of this document are the sole responsibility of Forum Euroméditerranéen des Instituts des Sciences Économiques (FEMISE) and can under no circumstances be regarded as reflecting the position of the European Union or the Programme management structures"

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