

Renewable energies in Tunisia: an alternative development strategy?

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IN SHORT

EN

- With the economic and ecological crisis that Tunisia is experiencing, an energy transition is needed to benefit from the potential of renewable energies.
- Since the 1980s, an institutional framework has been in place to encourage the implementation of Tunisia's solar plan.
- Several players are involved in the governance of the renewable energy sector, although the sector suffers from a lack of good governance mechanisms.
- Given the focus on exporting green energy to Europe, the energy transition is perceived in an extractivist logic that does not benefit Tunisia's energy security.

DE

- Angesichts der wirtschaftlichen und ökologischen Krise in Tunesien ist eine Energiewende erforderlich, um das Potenzial erneuerbarer Energien zu nutzen.
- Seit den 1980er Jahren fördert Tunesien Solarenergie und entwickelte dazu einen Solarplan.
- Der Sektor der erneuerbaren Energien leidet in Tunesien unter suboptimaler politischer Steuerung,
- Aufgrund der einseitigen Ausrichtung grüner Energieproduktion auf den Export nach Europa, steht die nationale Energiesicherheit und Selbstversorgung mit lokal produzierter Energie nicht im Vordergrund. Es dominiert nach wie vor eine extraktivistische Logik.

FR

- Face à la crise économique et écologique que connaît la Tunisie, une transition énergétique s'impose pour profiter du potentiel des énergies renouvelables.
- Depuis les années 80, un cadre institutionnel a vu le jour pour encourager la mise en place du plan solaire tunisien.
- Plusieurs acteurs s'impliquent dans la gouvernance du secteur des énergies renouvelables, alors que le secteur souffre de l'absence de mécanismes de bonne gouvernance.
- Vu l'orientation vers l'exportation de l'énergie verte vers l'Europe, la transition énergétique est perçue dans une logique extractiviste qui ne bénéficie pas à la sécurité énergétique de la Tunisie.

ES

- Ante la crisis económica y ecológica que atraviesa Túnez, es necesaria una transición energética para aprovechar el potencial de las energías renovables.
- Desde los años ochenta, existe un marco institucional que favorece la puesta en marcha del plan solar tunecino.
- Varios actores participan en la gobernanza del sector de las energías renovables, aunque el sector adolece de falta de mecanismos de buena gobernanza.
- Dada la orientación hacia la exportación de energía verde a Europa, la transición energética se inscribe en una lógica extractivista que no beneficia a la seguridad energética de Túnez.

Introduction

Extractivism refers to the large-scale extraction of natural resources, often non-renewable, such as oil, gas, minerals and coal. This economic approach has historically fueled industrial growth, but it is also associated with numerous environmental problems, including climate change. Working Group I of the Intergovernmental Panel on Climate Change (IPCC) highlighted the major impact of human activities, particularly greenhouse gas emissions, on climate change in its sixth assessment report of 2021 (IPCC, 2021). The Paris Agreement aims to keep global warming below 1.5°C. Energy transition plays a key role in this ambition. The use of renewable energies is often presented as a solution to the environmental problems

caused by extractivism, in particular by helping to reduce greenhouse gas emissions.

This study examines the issue of energy transition in Tunisia, which began in the 1980s, with a target of 35 percent renewable energy by 2030. The research focus is on the guarantees of economic advancement and territorial equity provided by this transition, the effect of transferring green energy technologies from Europe, and the political and economic repercussions of enhanced energy connectivity. The hypothesis suggests that this energy transition can generate economic benefits, while presenting obstacles in terms of energy security, sovereignty and social inequalities.

Tunisia's renewable energy potential vs energy imbalance

An energy deficit with development potential

Since the 1980s, Tunisia has been confronted with economic challenges linked to energy sufficiency. While the energy sector played a key role in the country's economic development in the 70s and 80s, the decline in hydrocarbon export revenues and the growth in national energy needs led to a significant reduction in the energy sector's share of GDP, from 12.9 percent to 5.9 percent between 1980 and 1997, and to 15 percent by 2022 (World Bank, 2023).

In recent years, Tunisia has been facing a preoccupying energy problem. Indeed, the country has been grappling with a marked energy imbalance, which is becoming more pronounced with each passing year. A striking example is the considerable widening of the energy balance deficit, which has risen from 1 million dollars in 2021 to 2 million dollars in 2022. This situation underlines the imperative need for a successful energy transition to ensure the country's energy security and independence, and to support its economic development. However, despite this somewhat gloomy picture, Tunisia harbors a major asset that could hold the key to solving this problem: exceptional potential for the development of photovoltaic solar energy. Thanks to its favorable climate, characterized by generous and constant sunshine, Tunisia is particularly well placed to harness this renewable energy source.

Tunisia boasts an abundance of solar resources, with an average of over 3,000 hours of sunshine per year. Nevertheless, some regions enjoy more generous sun exposure than others. For example, most of the south of the country enjoys more than 3,200 hours of sunshine a year, reaching up to 3,400 hours in the south. However, in the northern regions, the minimum sunshine duration is between 2,500 and 3,000 hours in full sunshine equivalent. According to the Global Atlas of the International Renewable Energy Agency (IRENA), solar irradiation ranges from 1,800 kWh/m²/year in the north to 2,600 kWh/m²/year in the south of the country.

In 2022, Tunisia's energy panorama is largely dominated by natural gas, which forms the backbone of electricity generation with a considerable share of 98.1 percent. Renewable Energies (RE) in Tunisia still play only a minor role in electricity generation, accounting for a mere 1.9 percent of total production. This is well below the 35 percent target set by the Tunisian government for 2030, illustrating the major challenge facing the country in its transition to clean energy. In terms of the breakdown of the various forms of renewable energy, solar power contributes just 0.15 percent to electricity production, while wind power accounts for 1.6 percent. Hydropower, meanwhile, accounts for a modest 0.09 percent of total electricity production (MIME, 2022).

The water challenge in a country seeking solutions through renewable energies

Tunisia faces a crucial challenge in terms of efficient water management. With an increasingly limited resource, the country is experiencing difficulties in coping with water shortages, exacerbated by decreasing rainfall and the pressures of demographic and economic growth. Water has become a vital concern for both the government and the population, and plays a fundamental role in various sectors of the Tunisian economy, including agriculture, industry and the supply of potable water for domestic use.

To counter these challenges, the Tunisian government has launched initiatives designed to minimize the impact of water shortages and promote more sustainable management of this precious resource. One of the key strategies is the implementation of seawater desalination projects to increase freshwater reserves.

Several desalination plants are currently under construction or already operational, including Sidi Abdelhamid in Sousse, Gargour in Sfax, Djerba and Zarat in the governorate of Gabès. These plants supply the main coastal towns with drinking water.

In addition, photovoltaic solar energy is used to power these desalination systems, particularly in arid regions. This use of unconventional water resources by renewable energies represents an optimal solution to water scarcity. Solar energy, in particular, meets the energy needs of desalination plants, reducing their dependence on traditional electricity, the cost of which continues to rise. It also offers the possibility of harnessing underground brackish water and developing sustainable agricultural practices, demonstrating once again Tunisia's commitment to sustainable and innovative water management.

Energy transition in Tunisia: history, strategies and stakeholders

Historical development of the renewable energies framework

Initially launched in 1985 with special provisions, this evolution saw the creation of the Agence pour la Maîtrise de l'Énergie (AME)¹ in 1985, followed by the introduction of mandatory, periodic energy audits in 1986-1987. The following years saw successive reinforcements of the AME, financial measures in favor of energy management, tax benefits for investments in this field, and tax exemptions on specific equipment. The AME evolved to become the Agence Nationale des Énergies Renouvelables (ANER)² in 1998, then the Agence Nationale pour la Maîtrise de l'Énergie (ANME)³ in 2004, under different administrative auspices.

This development was accompanied by new energy management measures, such as energy certification of

equipment, specific regulations for cogeneration, etc. Later, in 2005, an energy management system was introduced, later replaced by the Fonds National de Maîtrise de l'Énergie (FNME)⁴ in 2005, reinforced by specific taxes. Subsequent revisions of laws and decrees, notably in 2009 and 2013, introduced incentives for self-generation of electricity from renewable energies and modified the structure of funds to support the energy transition. Finally, laws and decrees adopted in 2015, 2017, 2018 and 2019 continued to promote electricity generation from renewable sources, while improving the investment climate and setting conditions for the realization of projects for the production and sale of electricity from renewable energies, until the February 2020 decree.

¹ Agency for Energy Management

² National Agency for Renewable Energies

³ National Agency for Energy Management

⁴ National Energy Management Fund

The Tunisian solar plan: a pillar of energy transition

Since 2014, Tunisia has embarked on an ambitious energy transition policy aimed at reducing its primary energy consumption by 30 percent compared with the trend scenario by 2030, while also targeting a 35 percent share of renewable energies in electricity production by the same deadline. This transition is part of a national drive to promote sustainable development and achieve national energy self-sufficiency.

The strategy adopted by Tunisia is essentially based on the promotion of solar energy, particularly via thermal and photovoltaic applications. With this in mind, the government is encouraging the adoption of this renewable energy by households through several measures and programs (Benalouache, 2013).

As the spearhead of this energy policy, the Tunisian Solar Plan (PST, in French) has been set up as an operational program to significantly increase the share of renewable energies in electricity production. Two major initiatives stand out under this plan: "Prosol Résidentiel" and "Prosol Elec", both designed to promote the use of photovoltaic solar energy in Tunisia. These programs

perfectly embody the optimization of national resources through an appropriate and effective public-private partnership.

"Prosol Résidentiel" is a program encouraging the use of solar water heaters in Tunisian households. It offers financial incentives, including subsidies and low-interest loans, to facilitate the purchase and installation of these systems. The program has been a resounding success, with tens of thousands of solar water heaters installed across the country, contributing to significant energy savings and a reduction in greenhouse gas emissions (Missaoui, 2007).

Similarly, the "Prosol Elec" program aims to encourage the installation of solar photovoltaic systems for electricity generation in residential, commercial and industrial buildings. Like "Prosol Résidentiel", this program offers financial incentives to cover the initial installation costs of these systems. In addition, it enables homeowners to transfer their surplus electricity to the Société Tunisienne de l'Électricité et du Gaz (STEG).⁵

Stakeholders in Tunisian energy policy

Implementing energy policy requires the participation of multiple players who interact within a complex network. At the institutional level, Tunisia's energy policy is characterized by an integrated strategy coordinated by several key government players, and is focused on promoting renewable energies and energy efficiency. The Tunisian government, first and foremost, plays a central role in defining strategic objectives, drawing up action plans and introducing regulations to stimulate the development of renewable energies. It is also responsible for developing energy efficiency policies and promoting clean technologies.

A second major player in Tunisian energy policy is the Agence Nationale pour la Maîtrise de l'Énergie (ANME). The mission of this government body is to promote energy efficiency, develop renewable energies and coordinate initiatives in the energy sector. ANME plays a vital role in implementing programs and projects aimed at increasing the share of renewable energies in the national energy mix.

The Société Tunisienne de l'Électricité et du Gaz (STEG), and its subsidiary, Energie Renouvelable (STEG ER), as a historic player in the energy sector, is responsible for the production, distribution and marketing of electricity and gas. Faced with the new challenges of energy transition, STEG must adapt its practices to the evolution of the country's energy policy, by integrating a growing share of renewable energies into its own energy mix. In this context, STEG plays a decisive role in the implementation of solar photovoltaic energy projects and contributes to achieving the objectives of the Tunisian Solar Plan. However, the transition to renewable energies also involves challenges for STEG in terms of managing the power grid and fluctuating demand. As a result, STEG is required to develop storage and adaptation capacities to guarantee a stable and reliable electricity supply despite the variability of renewable sources.

Regarding the private sector in Tunisia's dynamic energy transition, its role has become crucial. In particular, its involvement in the development of solar energies has

⁵ Tunisian Electricity and Gas Company

become vital, through two major categories of players: logistical contractors and financial institutions, notably banks.

Logistical contractors are one of the most important elements in the solar energy value chain. These companies are responsible for the installation of solar systems, whether for private homes, businesses or large-scale industrial projects. Their role is vital not only in the physical deployment of solar installations, but also in guaranteeing the performance and safety of the systems installed. Their expertise and ability to install efficient, sustainable systems are therefore key factors in the success of Tunisia's energy transition.

The banking sector also plays a major role in financing solar energy. By offering long-term loans of up to seven years, these financial institutions facilitate consumer access to solar energy. These loans enable consumers to acquire the necessary equipment without having to bear all the costs immediately.

However, state intervention remains essential to encourage the switch to solar energy. Indeed, the

Tunisian government offers subsidies to encourage consumers to switch to solar energy. By reducing the initial cost of installation, these subsidies make solar energy more accessible and appealing to consumers. However, while these initiatives are beneficial, they are not in themselves a guarantee of success for the energy transition. Indeed, a more holistic approach is required, including, for example, skills and capacity development, better regulation, the development of efficient market mechanisms and the promotion of innovation. In this context, the importance of an effective public-private partnership becomes evident. A sound and efficient public-private partnership can help spread the risks and benefits between the various stakeholders, while ensuring that the objectives of the energy transition are met. The involvement of private players in this partnership can stimulate innovation, accelerate the implementation of renewable energy solutions and help create an environment conducive to the expansion of these technologies. For its part, the State, through incentive and regulatory policies, can facilitate the market entry of these companies and ensure compliance with environmental standards.

Transferring energy to Europe: balancing gains or shifting profit paradigms?

Energy issues in Europe

Europe is constantly seeking to diversify its energy sources in order to secure its supply, reduce its dependence on fossil fuels and achieve its ambitious energy transition objectives. In this context, renewable energy plays a crucial role, particularly solar energy from southern Mediterranean countries.

An analysis of geopolitical tensions and their repercussions on European energy policy highlights the importance of diversifying energy sources. The Russian-Ukrainian crises of 2009 and 2023 highlighted the European Union's vulnerability due to its dependence on Russian natural gas. These conflicts led to major disruptions in energy supplies for many EU member

states. This has led the EU to rethink its energy strategy, not only to guard against supply risks, but also to align itself with its climate objectives.

In this context, Europe's commitment to achieving carbon neutrality by 2050 requires a major energy transition to renewable sources. This ambitious goal requires not only an increase in renewable energy production within its borders, but also the import of renewable electricity from sun-rich regions such as North Africa. The transfer of renewable electricity from Tunisia to Europe is therefore part of a broader vision embodied by the Mediterranean Solar Plan⁶ (Charpin and Kamel, 2009).

Projects facing obstacles to implementation

Initiatives such as "TuNur" and "Desertec" are key areas of analysis in the study of Tunisia's energy landscape.

They demonstrate Tunisia's ambition to optimally harness its solar resources, while at the same time

⁶ The Mediterranean Solar Plan (MSP), launched in 2008, aims to increase the production of solar and other renewable

energies in Mediterranean countries, with a view to exporting part of this energy to Europe.

identifying opportunities for exporting renewable energy to Europe. Analysis of these projects raises an interesting hypothesis: the potential for this energy export to strengthen Europe's energy security, by diversifying its energy sources and enriching its energy mix with a growing share of renewable energies. Tunisia could therefore emerge as a strategic partner for Europe in this field. Projects such as "TuNur" and "Desertec" are pertinent examples of this potential, which could boost not only Europe's energy security, but also economic development in Tunisia.

The implementation of large-scale, centralized renewable energy projects in Tunisia has been hampered by a number of factors. Notably, the absence of a dedicated entity, comparable to SKTM⁷ in Algeria or MASEN⁸ in Morocco, which would be responsible for implementing the PST. According to Benalouache (2017), Tunisia seems to favor an approach based on decentralized technological solutions with lower installed capacity, which are more economical and better suited to the country's size and specific needs.

The TuNur project, an international partnership bringing together investors from Tunisia, the UK and Malta,

offers an apt illustration of Tunisia's aspiration to harness its solar potential to supply Europe with renewable energy (Benalouache, 2017). The ambitious plan calls for the construction of a 2,250 MW solar power plant at Rjim Maatoug, located in southwest Tunisia, which would be connected to the European power grid via a 2 GW high-voltage DC submarine link, extending 1,000 km to Italy (Nur Énergie, 2011).

Meanwhile, the Desertec Industrial Initiative, also known as the Desertec project, is a global initiative involving several countries in the MENA (Middle East and North Africa) region and Europe. The aim is to use the solar and wind energy of these countries' deserts to supply up to 20 percent of Europe's electricity. Tunisia, with its sunny climate and geographical proximity to Europe, is an ideal location for solar power plants. However, like TuNur, Desertec has faced significant challenges, including coordination between the participating countries with their own political and economic priorities, high initial investment costs, uncertainties over long-term financial returns and concerns over security of energy supply.

Diversification, technology transfer and socio-economic impacts in a Euro-Med context

Energy transfer from Tunisia to Europe raises a number of complex issues and requires a detailed assessment of the equity and development implications for both parties. From a European perspective, importing energy from Tunisia presents a potential advantage in diversifying energy sources, reducing dependence on specific suppliers, Algeria in particular, improving energy security and meeting environmental objectives. However, from a Tunisian perspective, the benefits may be less clear-cut and depend largely on contractual conditions and the use of the generated revenues.

The possibility of transferring clean energy technologies and services, such as solar and wind power, from Europe to Tunisia, needs to be assessed in terms of economic impact. Access to advanced clean energy technologies could boost Tunisia's energy infrastructure, stimulate economic development, attract investment and create jobs. However, it is necessary to assess how these benefits are distributed within the Tunisian society, and whether excessive dependence on energy export

revenues could leave the country vulnerable to energy price fluctuations.

The energy transition towards greater use of photovoltaic energy in Tunisia presents significant opportunities for water management, but also raises a number of important questions. These include optimizing the use of photovoltaic energy to alleviate water shortages, the technical, economic and social implementation of such systems, and the challenges associated with their large-scale deployment. In addition, it is crucial to understand how this transition can be harmonized with the specific needs of the agricultural and domestic sectors, which are the main consumers of water, and how a fair distribution of the benefits can be ensured.

Europe's energy policy towards the Maghreb has provoked much discussion and criticism. It is widely recognized that Europe is seeking to diversify its energy sources, and the Maghreb, rich in solar and wind resources, seems to offer an appealing alternative.

⁷ Sharikat Kahraba wa Takat Moutadjudida (Electricity and Renewable Energy Company)

⁸ Moroccan Agency for Sustainable Energy

Nevertheless, there are concerns about the fairness of these arrangements, the social and environmental impacts of major renewable energy projects, and the tendency to privilege technological solutions and large infrastructure projects over more decentralized and

participatory approaches. These criticisms underline the importance of an integrated approach that takes into account technical, economic, social and regional dimensions.

Conclusion

Tunisia's energy transition, centered on the exploitation of renewable energies, offers considerable potential for ensuring the country's energy security while stimulating socio-economic development. Abundant solar and wind resources offer an invaluable opportunity to diversify the national energy mix and help tackle climate change, paving the way for a more sustainable future.

However, this transition raises crucial questions of equity and sustainability. As Tunisia aspires to become an energy supplier to Europe, it is essential to ensure a fair distribution of the revenues generated by this export. Similarly, preserving national energy autonomy while meeting external demands is a delicate balance to maintain.

Furthermore, the rapid adoption of clean energy technologies needs to be carefully managed to avoid any negative social or environmental impact. This requires rigorous regulations and well-thought-out policies to

mitigate potential impacts on local communities and ecosystems.

For this complex transition to succeed, Tunisia needs to develop a balanced and equitable national strategy. This strategy should be anchored in respect for sustainable development, placing renewable energies at the very heart of its energy development. By promoting innovation, education and investment in clean energy, the country will be able not only to meet its energy needs, but also to become an example of sustainability for the region and beyond.

International collaborations, partnerships with industry experts and ongoing commitment from government, the private sector and civil society will be crucial to realizing this vision. By focusing on a holistic and inclusive approach, Tunisia can ensure a successful energy transition, offering a safer and more sustainable future for its citizens and for the planet as well.

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EXTRACTIVISM

| The Project

The collaborative research project *extractivism.de* links the Universities of Kassel and Marburg. The project scrutinizes the extractivist development model and proposes new economic, political, and sociological conceptions of extractivism. It preliminarily focuses on Latin America and the Maghreb patterns. The project researches the conditions under which these patterns affect the persistence and transformative capacity of extractivism and its respective institutional settings. Finally, it explores how extractivism affects cultural processes and habitual routines and questions under what conditions and how far the development model extends into institution-building and social practice, i.e., everyday life.

The project aims to understand extractive societies not as deviants from the Western trajectory of development but in their own logic and their own particularities. The project, therefore, combines a strong empirical focus with theoretical work. It links both broad field research and data gathering of primary data and the qualitative and quantitative analysis of available secondary sources with a stringent transregional comparison. It develops methods in cross-area studies and investigates whether and why similar patterns of social change emerge in different areas and world regions despite significant cultural, social, or religious differences. Finally, the project intends to translate the findings for politics, society, and development cooperation.

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