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Contrasting dynamics of energy consumption in MENA countries: between energy transition and fossil fuel dependency

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Abstract. This article analyzes energy consumption dynamics in the MENA region, highlighting the contrasts between persistent fossil fuel dependence and emerging renewable energy efforts. Drawing on empirical data, it underscores the differentiated trajectories of regional countries in addressing energy transition challenges. The study sheds light on untapped solar and wind energy potential while examining the challenges tied to policy choices, economic constraints, and regional cooperation. Finally, it emphasizes the need for an integrated and equitable approach to achieve a sustainable energy transition in a context marked by climate urgency and resource pressures.

Keyword: Renewable energy, fossil fuels, energy transition, MENA region, sustainability, public policies, energy dependence, regional cooperation.

1 INTRODUCTION

The energy issue today represents one of the major challenges of sustainable development on a global scale. In a context marked by rising environmental concerns, climate change, and the commitments made under the Sustainable Development Goals (SDGs), SDG 7 – "Ensure access to affordable, reliable, sustainable and modern energy for all" – holds a central place. Energy, as a key driver of economic and social progress, lies at the heart of public policies aimed at achieving inclusive and environmentally friendly growth.

Energy sources are traditionally divided into two main categories: renewable energies (solar, wind, hydro, biomass, geothermal), considered inexhaustible on a human timescale and with a low carbon footprint; and non-renewable energies (oil, natural gas, coal), which remain the primary contributors to greenhouse gas emissions. The use of fossil fuels continues to dominate the global energy mix, particularly in developing countries and economies heavily reliant on natural resources.

In this context, the energy transition refers to the process of transforming energy systems towards more sustainable models, based on energy efficiency, reduced dependence on fossil fuels, and the promotion of renewable energy sources. This transition represents not only an ecological imperative but also a major economic, technological, and geopolitical opportunity—especially for MENA (Middle East and North Africa) countries, which are highly exposed to the effects of climate change and have historically depended on hydrocarbon exploitation.

From a theoretical perspective, the analysis of energy behavior can be approached through several frameworks: energy economics examines trade-offs between energy sources based on relative costs, available technologies, and public policies; the theory of energy dependence explores the effects of resource concentration on growth, security, and national sovereignty; and institutional approaches emphasize the role of regulatory frameworks and incentives in driving a sustainable transition.

This study aims to analyze, using recent empirical data, the contrasting trends in energy consumption across MENA countries, highlighting the differentiated dynamics by energy source and national trajectory—between fossil fuel inertia and emerging ambitions for energy transition.

2 ANALYSIS OF STYLIZED FACTS: ENERGY CONSUMPTION DYNAMICS IN THE MENA REGION

The analysis of stylized facts is a crucial step in understanding the ongoing energy dynamics in the MENA region. By examining empirical trends in the consumption of both fossil and renewable energy, this section highlights structural patterns, turning points, and divergences among the countries under study. The aim is to identify significant regularities and contrasts that reveal forms of energy dependence, efforts toward diversification, and barriers to the energy transition. This comparative perspective thus provides valuable insight into the trajectories being followed and the prospects for a more sustainable energy future in the region.

Between 2000 and 2020, natural gas consumption in MENA countries shows divergent trends shaped by national economic and structural conditions. Algeria, Iran, and Turkey all experience sustained growth, driven by rising energy demand, industrial expansion, and energy strategies that prioritize natural gas—particularly through domestic resource exploitation and investments in gas-based power generation.In Egypt, consumption rises sharply during the first decade, followed by stagnation between 2011 and 2015 and then a slight recovery. These fluctuations likely reflect supply constraints, economic reforms, and adjustments in the country's energy policy.

In summary, three broad consumption profiles emerge. Some countries, like Iran, Algeria, and Turkey, exhibit stable and sustained growth, often tied to national energy strategies. Others, such as Morocco, Tunisia, and Syria, display more unstable consumption, affected by structural or geopolitical constraints. Lastly, Gulf countries like the UAE show more volatile consumption, reflecting their exposure to major energy projects and economic diversification.

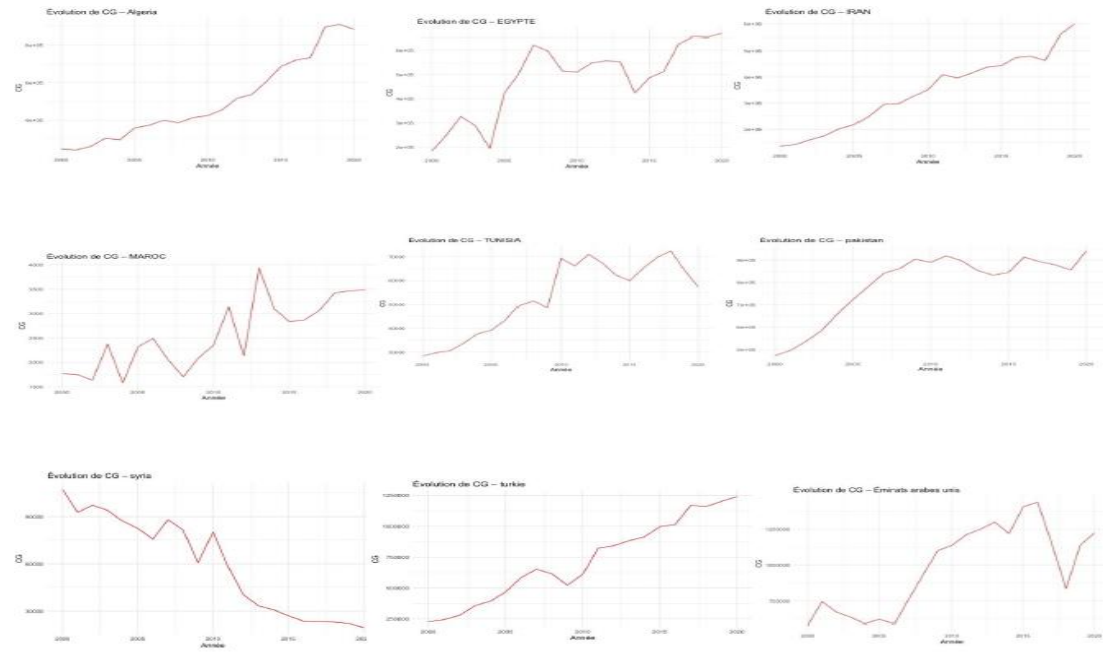

Figure 1: Analysis of Gas Consumption Trends by Country (2000–2020)

The evolution of coal consumption in MENA countries and their neighbors between 2000 and 2020 reveals divergent trajectories, shaped by policy choices, structural constraints, and major geopolitical events.

Coal consumption trends between 2000 and 2020 reveal contrasting national trajectories in the MENA region and neighboring countries. Pakistan, Turkey, Iran, and the UAE show rising coal use, driven by growing electricity demand, industrialization, energy security concerns, and, in Iran's case, sanctions-related constraints. In contrast, Algeria, Morocco, and Tunisia progressively reduce or phase out coal consumption, reflecting shifts toward gas, imported electricity, and renewable energy sources. Syria represents an extreme decline due to conflict and energy system collapse. Egypt follows a distinct path, with a temporary post-2014 surge in coal use to address energy shortages before subsequent policy-driven adjustments. Overall, coal dynamics reflect divergent policy choices, structural conditions, and geopolitical pressures across countries.

In conclusion, two major trends emerge. On one hand, countries like Pakistan, Turkey, Iran, and the UAE show growing coal dependence, often driven by industrialization or electricity security needs. On the other, nations like Morocco, Tunisia, Algeria, and Syria reduce or abandon coal, reflecting either energy transition strategies or deep internal crises. These trends underscore the role of national policies, energy choices, and geopolitical factors in shaping regional energy mixes.

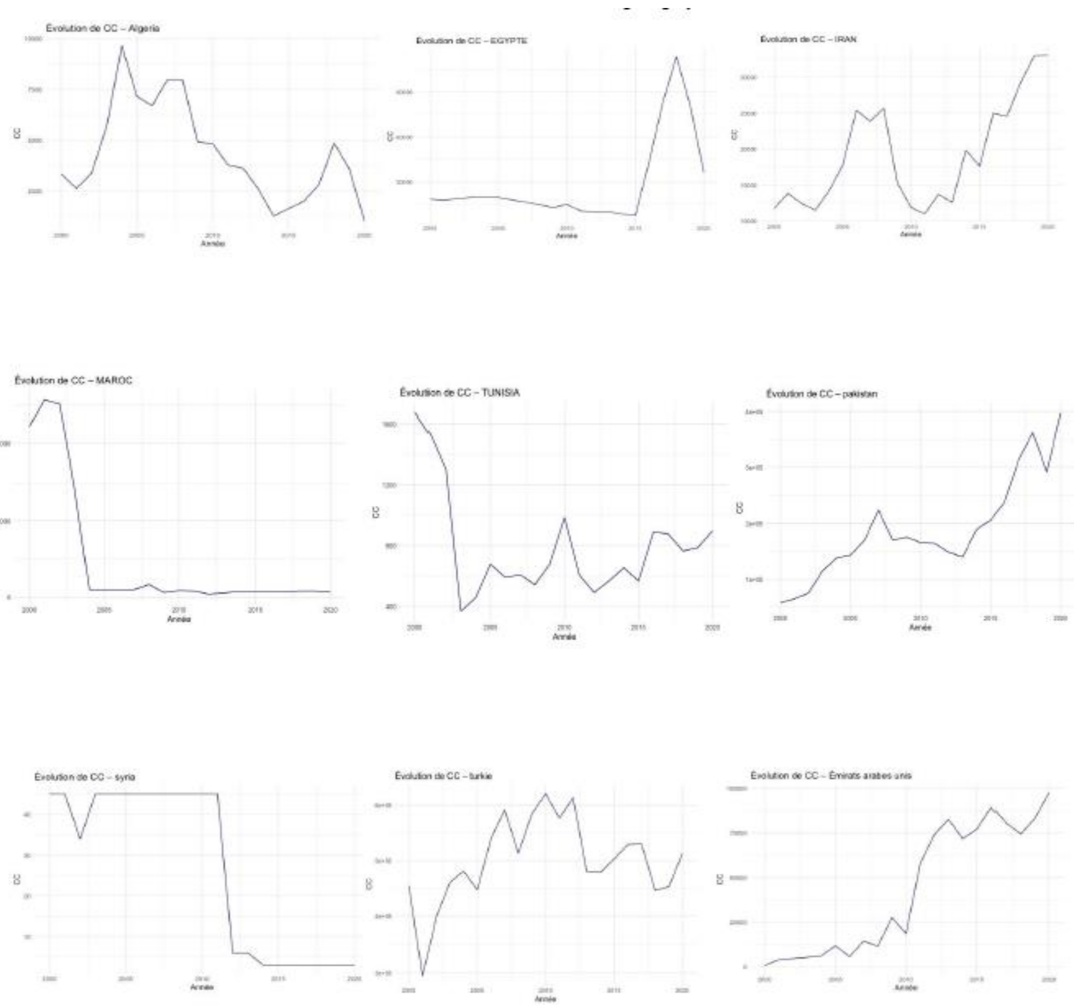

Figure 2: Analysis of Coal Consumption Trends by Country (2000–2020)

The study of oil consumption trends between 2000 and 2020 in a sample of MENA countries and their neighbors reveals contrasting dynamics, shaped by economic, geopolitical, and energy-specific contexts.

Some countries exhibit steady and sustained oil consumption growth, reflecting economic modernization and heavy oil use in transport and industry. Algeria, for instance, shows continuous growth over two decades, driven by urbanization, rising motorization, and widespread fossil fuel use in infrastructure and public services. The UAE follows a similar trend, with consistent growth until 2015, fueled by strong domestic demand despite its status as a major exporter. Petrochemicals and transport are key drivers.

Oil consumption trends show divergent and often unstable trajectories across countries. Turkey and Pakistan experience strong growth driven by economic expansion, industrialization, and rising transport demand, though Turkey records a slight decline after 2017 due to diversification efforts. Egypt, Morocco, and Tunisia display more volatile patterns shaped by energy diversification policies, import dependence, political instability, and declining domestic production. Exogenous shocks play a decisive role in some cases.

In summary, this analysis highlights differentiated trajectories. Countries with sustained growth—Algeria, Turkey, Pakistan, and the UAE—signal positive economic momentum but persistent oil dependence. Conversely, geopolitical or structural shocks explain trend breaks in Iran or Syria. Finally, nations like Morocco, Egypt, and Tunisia, with more vulnerable energy structures, exhibit cautious consumption profiles shaped by economic constraints and policy adjustments.

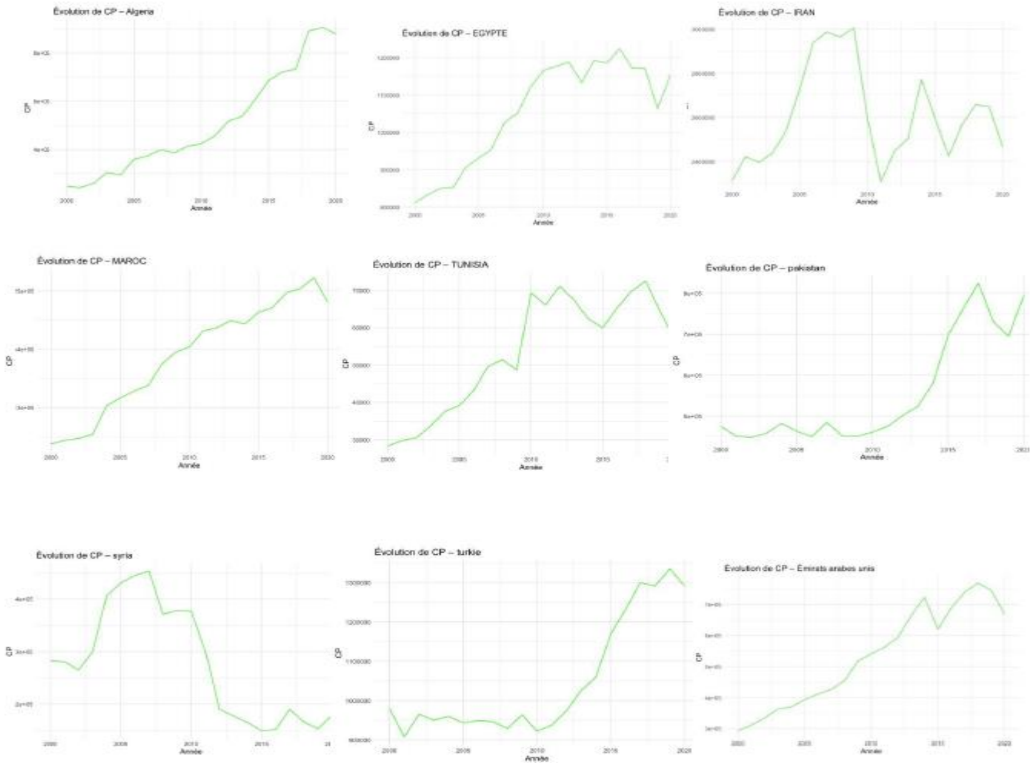

Figure 3 : Analysis of Oil Consumption Trends by Country (2000–2020)

The evolution of renewable energy consumption (REC) in major MENA economies reveals contrasting dynamics, closely tied to structural characteristics, public policies, and each country's energy resources.

Renewable energy consumption in the MENA region shows highly uneven trajectories shaped by resource endowments, policy choices, and structural constraints. Algeria and Egypt maintain low or declining renewable shares, reflecting persistent reliance on fossil fuels despite strong renewable potential. Iran and Pakistan display modest but gradual progress, suggesting emerging diversification efforts. Morocco stands out as a regional leader, with historically high renewable shares and major solar and wind projects, even though rising fossil fuel use has reduced renewables' relative weight. Tunisia shows limited and fluctuating progress, while Turkey's renewable share stabilizes after an initial decline amid rapid energy demand growth. The UAE exhibits a late but sharp increase in renewables after 2015, driven by large-scale solar investments, whereas Syria experiences a collapse in renewable development due to conflict-related infrastructure destruction.

Overall, comparative analysis highlights stark disparities. Morocco, Egypt, and Iran have the highest renewable shares, though their trajectories differ due to national contexts. Hydrocarbon exporters like Algeria and the UAE began their transitions later, while fossil-scarce nations like Tunisia and Morocco adopted pro-renewable policies earlier.

These trends stem from key determinants: fossil resource availability, geopolitical constraints, policy priorities, and investment capacity. Together, these factors shape national trajectories, underscoring the heterogeneity of energy transitions in the MENA region.

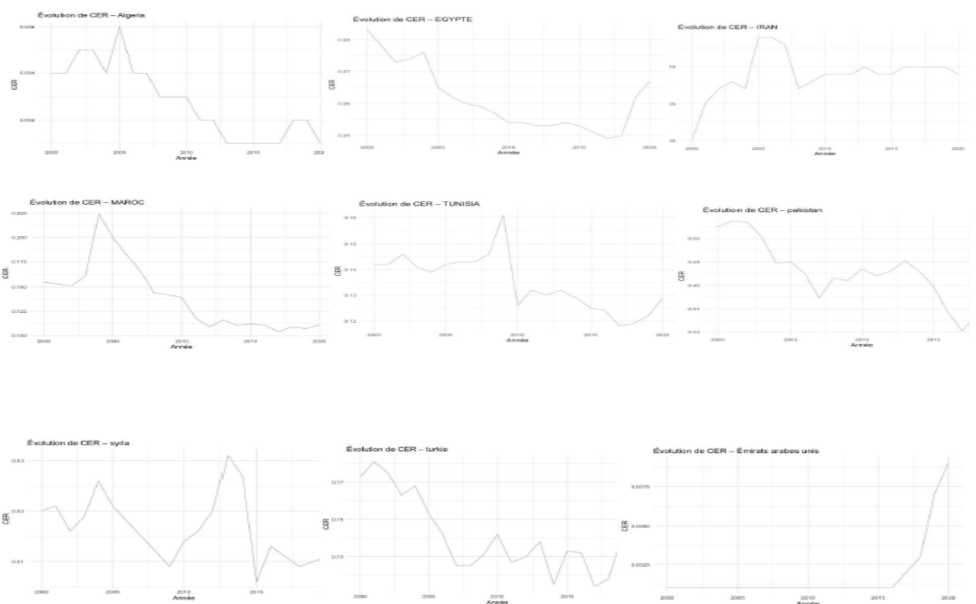

Figure 4 : Comparative Analysis of Renewable Energy Consumption Trends in Major MENA Economies

3 TOWARD A SUSTAINABLE ENERGY FUTURE IN THE MENA REGION

A cross-analysis of renewable and non-renewable energy consumption trends in MENA countries highlights contrasting dynamics that underscore both the challenges and opportunities of a sustainable energy transition. Overall, fossil fuels—oil, natural gas, and coal—still dominate the energy mix in most countries, particularly those with abundant resources like Algeria, Iran, and the United Arab Emirates (UAE). This structural dependence on fossil fuels, inherited from decades of extraction- and export-focused investments, hinders the emergence of a more balanced energy mix and limits regional decarbonization efforts.

Yet the data also reveals significant untapped potential for renewable energy, particularly solar and wind. Countries like Morocco, Egypt, and the UAE have recently initiated strategic shifts by implementing large-scale projects integrating thermal solar, photovoltaic, and wind technologies. The development of these sectors is supported by technological advancements that now offer greater energy efficiency, lower production costs, and adaptability to the Middle East and North Africa's specific climatic conditions.

The rise of energy storage solutions, smart grids, and decentralized production also presents an opportunity to address renewable intermittency and secure energy supply.

Public policies play a central role in driving this transition. Integrating climate objectives into national strategies, establishing incentive-based regulatory frameworks, and engaging in international partnerships are key to scaling up renewables. Morocco's pioneering role in sustainable energy planning illustrates the importance of strong political will, supported by dedicated institutions, innovative financing, and international collaborations. At the regional level, South-South cooperation in technology transfer, expertise sharing, and infrastructure pooling could foster an integrated and sustainable energy market.

However, ensuring an equitable transition requires meeting several conditions. These include guaranteeing financial accessibility to clean technologies for low-income countries, developing the necessary human capital to manage complex energy systems, and protecting vulnerable populations from the potential adverse effects of a rapid fossil fuel phase-out (job losses, price hikes). A successful transition must therefore balance economic efficiency, social justice, and environmental sustainability. This also entails redirecting public subsidies—still heavily skewed toward fossil fuels—toward clean energy investments while strengthening energy governance at national and regional levels.

In summary, the MENA region's energy future hinges on its ability to gradually move away from fossil fuel dependency and embrace a new paradigm based on diversification, innovation, and sustainability. The foundations for this shift are being laid, but their consolidation demands an integrated, inclusive, and forward-looking approach.

4 CONCLUSION

The MENA region stands at a critical crossroads in its energy evolution. While non-renewable energy consumption remains dominant in most countries, challenges tied to fossil fuel dependence, resource depletion, and climate pressures necessitate a strategic reorientation toward more sustainable alternatives. The analysis of renewable and non-renewable energy consumption data reveals a mixed landscape, where some nations—like Morocco and the UAE—have already made significant strides in integrating renewables into their energy mix, while others—such as Iran and Algeria—still struggle to diversify their energy approach.

Nevertheless, this dynamic landscape offers encouraging prospects. The region's renewable energy potential is vast, with underutilized solar and wind resources that could drive green and sustainable growth. However, the energy transition can only succeed through concerted efforts on multiple fronts: technological advancements to optimize energy production, clear and incentive-driven public policies, and stronger regional cooperation.

Public policies will be decisive in structuring this transition. Implementing adaptive regulatory frameworks, supporting research and development, and building infrastructure suited to renewable energy production and storage will be essential. At the same time, it is crucial to ensure an equitable transition by addressing economic, social, and environmental challenges. This will require supporting vulnerable populations, redirecting subsidies toward renewables, and carefully managing the social impacts of fossil fuel industry downsizing.

Thus, the MENA region's energy future depends on its ability to achieve a just, innovative, and sustainable energy transition. If policymakers and regional stakeholders can overcome current obstacles, the region could not only meet its future energy needs but also play a pivotal role in the global energy transition.

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