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Economic Barriers to Renewable Energy in Developing Countries: The Case of Algeria

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Abstract:

Across the developing world, the shift toward renewable energy remains stalled , not for lack of sun, wind, or political rhetoric, but because the economic conditions required to unlock large-scale investment simply do not exist. This article explores the financial and structural obstacles that block the renewable energy transition in developing countries, using Algeria as a detailed and instructive case.

Drawing on recent data from IRENA's 2024 Renewable Power Generation Costs report, the IMF's 2024 Country Report on Algeria, and CEREFE's national assessments, we identify six interconnected barriers: the heavy upfront cost of renewable infrastructure, the market-distorting effect of fossil fuel subsidies, inadequate access to international climate finance, underdeveloped domestic financial systems, currency risk, and the absence of a coherent investment incentive framework. Algeria captures this contradiction with unusual clarity. The country sits atop one of the planet's finest solar resources, yet by the end of 2023 had installed only 590 MW of renewable capacity, less than three percent of its own 22,000 MW target for 2030. Closing that gap will require far more than engineering or regulation; it demands a fundamental rethinking of how Algeria manages its fiscal revenues, engages international capital markets, and structures its energy economy. The article concludes with concrete recommendations addressed to both national policymakers and international financial institutions.

Keywords: renewable energy, economic barriers, Algeria, developing countries, energy transition, energy policy

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1. Introduction:

Decarbonizing the global energy system has moved from aspiration to urgency. The scientific case for limiting warming to 1.5°C is settled, and the technological case for renewables has never been stronger. Solar photovoltaics, onshore wind, and concentrated solar power have all seen cost declines that would have seemed implausible two decades ago. By 2024, utility-scale solar PV was generating electricity at a global weighted average of just USD 0.043/kWh ,41% cheaper than the least-cost fossil fuel alternative, according to IRENA. Onshore wind had reached USD 0.033/kWh. These are not incremental improvements; they represent a structural shift in the economics of energy.

Yet the transition is not happening equally everywhere. In most of the developing world, renewables remain marginal despite often superior natural resources. The reasons are rarely technical. They are economic, financial, and institutional , the kind of barriers that do not appear in engineering assessments but show up relentlessly in investment decisions and project pipelines. Algeria makes this tension impossible to ignore. Its Saharan regions receive over 2,263 kWh/m²/year of solar irradiation. It enjoys 3,000 sunshine hours per year on average. The German Aerospace Center has identified Algeria as holding the largest long-term solar thermal potential in the entire Mediterranean and African region. And yet, with six years remaining until its 2030 deadline, Algeria has installed less than 3% of its renewable energy target.

This article asks :What economic forces explain such a gap between resource endowment and realized capacity? How do they operate specifically within Algeria's political economy? And what would it take, concretely, to overcome them?

2. Literature Review :

2.1.The Capital Cost Problem:

Renewable energy projects are capital-intensive by nature. Nearly all of the cost is paid upfront , on turbines, panels, land, and grid connection ,while fuel costs are essentially zero. This cost structure is favorable in the long run, but it creates a significant financing challenge in the short run, particularly in emerging markets where capital is scarce and expensive. IRENA's 2024 analysis makes the scale of this challenge precise: the weighted average cost of capital (WACC) for renewable projects ranged from 3.8% in Europe to 12% in Africa. That difference ,seemingly abstract , translates directly into electricity prices. A solar project financed at 12% in Algeria will produce electricity at two to three times the cost of an identical project financed at 4% in Germany, even if the panels, the land, and the sunlight are better in Algeria. The financing premium, not the technology, is the decisive variable.

2.2. Fossil Fuel Subsidies :

Fossil fuel subsidies are perhaps the single most distorting force in global energy markets. According to the IMF's 2023 update, global fossil fuel subsidies reached $7 trillion in 2022 , equivalent to 7.1% of world GDP and the highest level ever recorded. Explicit subsidies, which involve governments directly undercharging for supply costs, more than doubled since 2020. Implicit subsidies, which represent the value of unpriced environmental and health externalities, account for nearly 60% of the total. Together, they ensure that

fossil fuels appear artificially cheap relative to renewables, systematically tilting investment decisions in the wrong direction.

In Algeria, this dynamic has been studied empirically. Research by Matallah et al. (2023), published in Resources Policy, found that the country's generous fossil fuel subsidy regime has structurally blocked the renewable transition by suppressing the relative price signal that would otherwise make solar and wind investment attractive. At the same time, subsidies drain the fiscal resources that governments might otherwise direct toward clean energy programs.

2.3 Access to International Climate Finance :

The international climate finance system, for all the commitments made at successive COP negotiations, has struggled to direct money where it is most needed. Buchner et al. (2023), writing for the Climate Policy Initiative, document persistent gaps between what developing countries need and what they actually receive. The barriers are not only financial , they are administrative and institutional. Many governments lack the fiduciary systems, project management capacity, or legal frameworks that multilateral funds require before disbursing money. There is also a structural bias toward large, bankable projects, which disadvantages smaller economies with limited project development capacity. African countries, despite holding some of the world's best renewable resources, capture a disproportionately small share of global climate finance.

2.4 The Cost of Capital Gap:

IRENA's 2024 data makes a striking and under-appreciated point. For onshore wind in Africa, the average LCOE is USD 0.051/kWh , almost identical to the European average of USD 0.052/kWh. Yet the underlying cost composition is entirely different. In Europe, the dominant cost driver is capital expenditure on equipment. In Africa, it is the cost of financing that equipment. This means that even as the prices of solar panels and wind turbines continue to fall globally, African developers capture relatively little of that benefit because their financing costs remain stuck at levels that counteract the equipment savings. Solving the technology cost problem without solving the capital cost problem will not be enough.

2.5 Key Comparative Statistics: Renewable Energy Economics (2024):

Table N°1. Table 1. Comparative Renewable Energy Economics: Europe/OECD vs. Africa/MENA

Indicator	Europe / OECD	Africa / MENA	Source
WACC for RE Projects	3.8%	12.0%	IRENA, 2025
Solar PV LCOE (avg.)	USD 0.045/kWh	USD 0.060–0.080/kWh	IRENA, 2025
Onshore Wind LCOE	USD 0.052/kWh	USD 0.051/kWh*	IRENA, 2025
Fossil Fuel Subsidies	< 1% of GDP	5–20% of GDP	IMF, 2023
RE Share of Electricity	~40%	~10%	IEA, 2024

Source: IRENA, 2025

3. The Algerian Energy Context: Updated Data 2023–2025:

3.1 Energy Resource Endowment

Few countries are as well positioned for solar energy as Algeria, and few have done less with that position. The country receives an average of 3,000 sunshine hours per year. In the northern regions, global horizontal irradiation averages 1,700 kWh/m²/year; in the Saharan south, it climbs to 2,263 kWh/m²/year , figures that place Algeria among the world's premier solar destinations. The German Aerospace Center has formally assessed Algeria as holding the largest land potential for concentrating solar thermal power in both the Mediterranean region and Africa as a whole.

Against this backdrop, Algeria's energy reality is almost entirely fossil fuel-based. As of 2023, natural gas accounted for 99% of the country's 85,390 GWh of electricity production. Total primary energy consumption reached 70 Mtoe in 2023, growing at 7% per year since 2020 , one of the fastest rates in the MENA region. CO2 emissions from combustible fuels stood at 143.25 million tonnes in 2021, a 133% increase over earlier decades, placing Algeria among Africa's leading emitters both in cumulative and per capita terms.

Table 2. Algeria Key Energy Statistics (2021–2024).

Indicator	Value	Year	Source
Installed renewable capacity	590 MW	End-2023	CEREFE / Climate Analytics
2030 renewable target	22,000 MW	Official	Ministry of Energy
RE share of electricity	~1%	2022	IEA / Climate Analytics
Natural gas share of electricity	99%	2021	Wikipedia / EIA
Total electricity production	85,390 GWh	2021	Wikipedia
Total primary energy consumption	70 Mtoe	2023	Enerdata
Annual sunshine hours	3,000 hrs/year	Average	CEREFE
GHI (southern regions)	2,263 kWh/m²/year	Average	CEREFE
CO2 emissions (energy sector)	143.25 Mt	2021	IEA via Wikipedia
Hydrocarbon share of exports	>90%	2022	EIA
Hydrocarbons share of GDP (avg.)	~19%	2018–2022	PV Magazine, 2024

3.2 The Implementation Gap: Targets versus Reality

Algeria's own 2022 Programme for the Development of Renewable Energy sets a 22 GW target by 2030, with solar PV accounting for roughly 62% and wind for 23%. Hitting that target would place renewables at 37% of total installed capacity and 27% of the power mix, a genuinely transformative outcome for a country currently at 1%.

The problem is the starting point. CEREFE's Director of Energy Efficiency, Mourad Issiakhem, acknowledged in October 2024 that installed capacity was barely over 600 MW , less than 3% of the target with six years remaining. Algeria had already missed its intermediate 2020 target of 4,500 MW by a factor of nearly eight. Achieving 22 GW from a

base of 590 MW would require installing roughly 3,500 MW per year through 2030. Algeria's historical pace has been 60 to 70 MW per year.

There are genuine signs of change. In late 2023, the state utility Sonelgaz launched two major tenders — the Solar 2,000 MW and Solar 1,000 MW programs. By March 2024, nineteen projects had been awarded, drawing €1.8 billion ($1.96 billion) in investment commitments. Chinese firms secured approximately 60% of the awarded capacity. Turkish contractor Özgün İnşaat broke ground on the 362 MW Hassi Delaa plant in Laghouat province in March 2024. A Chinese consortium began work on 780 MW across five additional sites in September 2024. These are real projects, and they represent a meaningful shift in political commitment. But they cannot, by themselves, close a gap of this magnitude.

3.3 The Hydrocarbon Dependency Trap

Algeria's fiscal and political structure is organized around hydrocarbon rents. Between 2018 and 2022, hydrocarbons averaged 19% of GDP and provided over 90% of export earnings. The IMF estimates that Algeria's per-capita fossil fuel support exceeds $500 annually , placing it among the top subsidizers in the world by this measure. These subsidies are not merely a financial drain; they are load-bearing elements of Algeria's social compact, providing cheap energy to households and keeping industrial costs artificially low.

The IMF's 2024 Country Report (No. 24/89) modeled the macroeconomic effects of full subsidy elimination over six years, beginning in 2024. The analysis, conducted using the Climate Policy Assessment Tool, found that Algeria's current GHG emissions substantially exceed its Paris Agreement commitments, and that subsidy reform would generate fiscal savings large enough to fund generous targeted cash transfer programs for low-income households while still freeing substantial resources for renewable investment. The political obstacles to such reform are real, but the economic arithmetic increasingly favors it , particularly as domestic gas consumption grows at 7% annually, progressively squeezing the volumes available for export.

4. Economic Barriers to Renewable Energy Deployment in Algeria:

4.1 The High Upfront Capital Cost:

Renewable energy infrastructure requires substantial investment before a single kilowatt-hour is produced. This front-loaded cost structure is manageable when financing is cheap; it becomes prohibitive when it is not. Algeria is firmly in the latter category. IRENA estimates a 12% WACC for African renewable projects , more than three times the European benchmark. A solar farm that a European developer could finance at USD 0.045/kWh becomes a USD 0.07–0.08/kWh proposition in Algeria, not because the sun shines less but because the capital costs more.

The implications for Algeria's 22 GW target are stark. Mobilizing that level of investment , which analysts estimate requires between $30 and $40 billion depending on procurement model and technology mix ,at Algerian financing rates would result in electricity costs far above what the current tariff structure can accommodate, or what household budgets would bear without subsidies. The capital cost barrier is not peripheral; it is the central economic obstacle.

4.2 Fossil Fuel Subsidy Distortions:

Algeria's residential electricity tariff stands at approximately $0.025/kWh , less than half the $0.05–0.06/kWh LCOE that solar projects tendered in 2024 are achieving. This gap makes market-based renewable energy essentially non-viable. No private investor can sell electricity below their cost of generation, and no government can sustainably bridge a gap of this magnitude through direct subsidy indefinitely.

The deeper problem is that this tariff level exists precisely because fossil fuel subsidies have made it possible. Algeria currently spends more than $500 per person per year supporting fossil fuel consumption , a sum that reflects both direct pricing policy and the foregone revenue from selling subsidized gas to its own power sector at well below export parity. As long as the reference price for electricity is anchored by subsidized gas generation, no renewable energy technology can compete on cost alone, regardless of how far global equipment prices fall.

4.3 Limited Access to International Climate Finance:

Algeria is a middle-income country with a constitutional prohibition on foreign borrowing. This combination effectively excludes it from the largest pools of concessional climate finance. The Green Climate Fund, the World Bank's Climate Investment Funds, and the European Investment Bank's green lending facilities all operate primarily through sovereign lending instruments, instruments that Algeria's constitution formally prohibits.

The practical consequences are severe. Concessional financing at 3–4% WACC, which these institutions offer to eligible borrowers, could reduce Algeria's effective LCOE by 30 to 50% compared to market-rate financing. A country that cannot access those rates is competing against a handicap that technology improvements alone cannot overcome. The constitutional prohibition was enacted in the aftermath of Algeria's catastrophic 1990s debt crisis and reflects understandable caution; but as currently structured, it forecloses exactly the financial instruments that could unlock the renewable transition.

4.4 Shallow Domestic Financial Markets:

Even if foreign capital were accessible, Algeria's domestic financial system is not equipped to intermediate large-scale renewable energy investment. The banking sector is dominated by state-owned institutions with limited appetite for long-tenor, project-financed renewable energy loans. Capital markets are minimal. There is no domestic bond market for infrastructure, no institutional investor base with a mandate to hold renewable energy debt, and no established track record of project finance for energy assets. The result is that developers who cannot access international capital must rely on state utility Sonelgaz ,whose balance sheet, while supported by the state, was not designed to carry tens of billions in new renewable energy infrastructure simultaneously.

4.5 Currency Risk and Exchange Rate Exposure:

Renewable energy projects in Algeria face a structural currency mismatch that complicates financing regardless of the rate. Equipment , solar panels, wind turbines, inverters , is priced and procured in euros or dollars. Revenue, however, is collected in Algerian dinars at regulated tariffs. If the dinar depreciates against hard currencies, as it has

done periodically, the real value of dinar revenues falls while the hard currency cost of debt service remains fixed. Lenders price this risk into their required returns; developers either absorb it or fail to close financing. This currency risk premium is an invisible but persistent component of the cost differential between Algerian and European renewable energy projects.

4.6 Weak Investment Incentive Frameworks:

Algeria has not yet developed the regulatory architecture that private renewable energy investment requires. Competitive power purchase agreements (PPAs) with bankable terms, independent power producer (IPP) frameworks with transparent auction processes, grid access rules that treat renewables fairly, and dispute resolution mechanisms that international investors trust , these are the institutional prerequisites for private capital at scale. Algeria has made progress through the 2023 solar tenders, but the current EPC (engineering, procurement, and construction) procurement model, while effective for rapid deployment, is explicitly more expensive than a competitive IPP model and does not mobilize private balance sheets in the same way.

The absence of these frameworks is not unusual for a country at Algeria's stage of energy transition; it is, however, a genuine barrier that compounds the financing constraints described above.

5. Policy Recommendations:

5.1 Transition to IPP Contracting:

The most immediate structural reform available to Algeria is the shift from EPC procurement to competitive IPP contracting with bankable, long-term PPAs. Comparable markets in the MENA region , Morocco, Saudi Arabia, the UAE , have used competitive solar auctions to achieve prices well below $0.025/kWh, competitive with or below Algeria's subsidized retail tariff. Introducing exchange rate adjustment mechanisms into PPA terms would address currency risk for investors without exposing the state to unlimited fiscal liability. This reform would simultaneously reduce costs and unlock private capital at scale, potentially transforming the investment economics of Algeria's 22 GW program.

5.2 Phased Fossil Fuel Subsidy Reform:

The IMF's CPAT modeling for Algeria provides both the justification and the roadmap for subsidy reform. Full elimination over six years, beginning immediately, would generate fiscal savings large enough to fund targeted social protection for low-income households , the primary political concern around reform , while freeing substantial additional resources for renewable energy investment. Algeria's position as a growing LNG exporter to Europe since the 2022 Russian supply disruption provides a favorable revenue context in which to begin this transition. Establishing a dedicated transitional social fund, capitalized from hydrocarbon revenues before reform begins, would help build the political legitimacy that subsidy reform requires.

5.3 Establishing a Green Finance Architecture:

Algeria should create a dedicated national green development bank or renewable energy financing window, capitalized with a mix of public equity and recycled subsidy savings. Such an institution would provide long-term, local-currency financing for renewable energy

projects, directly addressing the currency mismatch that suppresses investor appetite. Algeria's growing solar panel manufacturing sector ,500 MW of assembly capacity in 2024, targeting 600–700 MW by end-2025 , provides a natural anchor for supply chain localization that could reduce project costs and strengthen the industrial case for a specialized financing institution.

5.4 Selective Revision of the Foreign Debt Prohibition:

A narrowly scoped constitutional revision , limited explicitly to concessional climate financing from multilateral development banks and recognized international climate funds, would allow Algeria to access World Bank Climate Investment Funds, EIB green lending, and the Green Climate Fund without reopening the broader question of commercial foreign borrowing that motivated the original prohibition. Given that IRENA identifies the 12% WACC as the central factor distinguishing Algerian from European renewable economics, access to concessional finance at rates below 5% could reduce effective LCOE by 30–50%, fundamentally changing the investment calculus for the 22 GW program.

5.5 Deepening International Climate Engagement:

Algeria's existing NDC commitments ,a 7% unconditional GHG reduction by 2030, rising to 22% with international support , provide a foundation for a more systematic climate finance mobilization strategy. This would involve translating the 22 GW renewable target into a pipeline of investment-ready projects with standardized documentation, engaging Green Climate Fund direct access modalities, and converting the existing bilateral partnerships with Germany on green hydrogen and China on solar PV into structured long-term technology transfer and financing agreements.

6. Conclusion:

Algeria's situation is, in one sense, an extreme version of a story playing out across the developing world. The technology exists. The resources , in Algeria's case, among the finest on the planet are available. The stated commitment is there. And yet the energy transition stalls, year after year, against a set of economic barriers that policy frameworks have not yet been designed to overcome.

The numbers tell the story plainly. A 12% cost of capital makes Algerian solar roughly twice as expensive as equivalent projects in Germany. Residential electricity tariffs of $0.025/kWh , anchored by decades of fossil fuel subsidies , make market-based renewable deployment financially impossible. Per-capita fossil fuel support of $500 annually exceeds the entire renewable energy investment budget. And a constitutional prohibition on foreign borrowing closes the door to the concessional financing instruments that could halve the effective cost of capital overnight.

Against this backdrop, the recent acceleration is genuinely encouraging. The €1.8 billion in solar contracts awarded in early 2024, construction now underway across multiple large-scale sites, and growing domestic manufacturing capacity all signal a political commitment that was absent a decade ago. But acceleration at the current pace , even significantly faster than historical rates , will not deliver 22 GW by 2030 without structural reform of the underlying economic conditions.

Those reforms are not beyond reach. Phased subsidy reform with strong social protection is fiscally feasible and increasingly urgent as domestic gas consumption eats into exportable volumes. IPP contracting is proven in comparable markets and can reduce costs substantially. A national green finance institution is buildable with existing resources. A limited revision to foreign borrowing rules, targeted exclusively at concessional climate finance, would not recreate the vulnerabilities that motivated the original prohibition.

Algeria has everything it needs to become a regional leader in renewable energy — possibly a significant exporter of green electricity and hydrogen to Europe. What stands between the country's solar endowment and that future is not technology, and not political will alone. It is a set of specific, identifiable, and correctable economic barriers. Naming them precisely, as this article has attempted to do, is the first step toward dismantling them.

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