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Economic Intelligence, Digitalization, and the Electricity Transition in Algeria: A Descriptive-Analytical Approach

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Abstract:

This study uses a descriptive-analytical approach to examine if Algeria's digital connectivity progress matches its electricity transition, evaluating it against Egypt to isolate bottlenecks. Analyzed through rentier-state, carbon lock-in, and socio-technical lenses, a clear imbalance emerges: while 2023 internet penetration reached 76.9%, 2024 renewable generation constituted just 0.74% (704 GWh out of 95.18 TWh) due to heavy natural gas reliance. Furthermore, Sonelgaz's digital tools only improve internal coordination rather than creating a transparent, plant-by-plant system linking tendering to grid connection. The study recommends aligning digitalization with procurement and milestone tracking to bridge these execution gaps.

Keywords: *economic intelligence; digitalization; energy transition; renewable energy; sustainable development; Algeria.*

JEL Classification : *Q42; O33; Q56; L94.*

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1. Introduction

Energy transition has become a strategic issue for Algeria because the country combines strong solar potential, growing domestic electricity demand, and persistent dependence on natural gas in power generation. This dependence creates a structural policy problem: Algeria has expanded digital connectivity, modernized several administrative and utility information systems, and announced ambitious renewable and hydrogen programmes, but these developments have not yet translated into a proportional transformation of the electricity mix. In 2024, Algeria generated 95.18 TWh of electricity, while renewable plants produced only 704 GWh, representing approximately 0.74% of total national generation (Commission de Régulation de l'Électricité et du Gaz [CREG], 2026). This contrast raises the central research problem of the paper: why has Algeria's visible progress in digitalization and information systems not yet translated into a stronger clean-electricity transition?

The relevance of this problem is reinforced by international literature showing that digitalization can improve monitoring, forecasting, automation, system flexibility, demand management, and renewable integration, but that it does not automatically produce structural decarbonization (International Energy Agency [IEA], 2017; Mahmood et al., 2024; Zheng & Zhang, 2025). Digital tools can strengthen energy-system visibility and operational coordination, but their real effects depend on complementary institutions, credible policies, investment execution, and the ability to translate information into infrastructure outcomes. This issue is particularly important in hydrocarbon-dependent economies, where rentier-state dynamics, carbon lock-in, fossil-fuel pricing, and institutional path dependence can slow the transition even when renewable resources are abundant and official policy targets exist (Beblawi & Luciani, 1987; Geels, 2014; Seto et al., 2016; Unruh, 2000).

The paper is based on three hypotheses. H1: digitalization improves information availability and organizational coordination, but it does not automatically produce renewable-energy deployment. H2: economic intelligence becomes relevant to the electricity transition only when it is connected to concrete execution mechanisms such as tender monitoring, grid-connection planning, cost benchmarking, risk alerts, milestone tracking, and commissioning follow-up. H3: Algeria's limited renewable-energy deployment is associated less with the absence of solar potential than with institutional, regulatory, financial, and implementation bottlenecks that constrain the conversion of policy targets into operating capacity.

The significance of the study is both academic and policy-oriented. Academically, it clarifies the distinction between digitalization and economic intelligence in the context of a hydrocarbon-dependent economy. Policy-wise, it contributes to the debate on how Algeria can convert digital tools and strategic information systems into

measurable renewable-energy outcomes. This is especially relevant because Algeria is currently implementing a large solar PV programme of approximately 15,000 MW by 2035, including a first component generally presented as around 3,200 MW and a Sonelgaz contract package of approximately 3,000 MWc, while also developing a national green hydrogen strategy that requires additional renewable electricity, water planning, investment coordination, and industrial governance (International Renewable Energy Agency [IRENA], 2025; Ministry of Energy and Renewable Energies, 2026b; Sonelgaz, 2024, 2026).

The study has four objectives. The first is to document the gap between Algeria's digital development and its renewable-electricity penetration. The second is to refine the conceptual relationship between digitalization, economic intelligence, and electricity-transition outcomes. The third is to examine the observable mechanisms through which economic intelligence appears in Algerian energy institutions. The fourth is to compare Algeria with Egypt in order to clarify the role of implementation frameworks in renewable deployment. Egypt is used as a regional comparator because it shares several structural similarities with Algeria, including North African/MENA geography, strong solar resources, a historically gas-centered power system, rising electricity demand, and a significant state role in energy planning, while showing more advanced renewable implementation through instruments such as feed-in tariffs, independent-power-producer frameworks, power-purchase agreements, and large-scale renewable projects (IEA, 2016, 2025a; IRENA, 2018).

Methodologically, the paper adopts a descriptive-analytical approach based on secondary data from official Algerian and international sources, including CREG, Sonelgaz, ARPCE, the World Bank, IEA, IRENA, and Tracking SDG 7. The method does not aim to establish econometric causality. Instead, it triangulates official indicators, regulatory evidence, utility reports, and comparative data to identify a policy-relevant asymmetry between digital progress and electricity-transition outcomes (Autorité de Régulation de la Poste et des Communications Électroniques [ARPCE], 2025a, 2025b; CREG, 2022, 2026; Energy Sector Management Assistance Program [ESMAP], n.d.; IEA, 2017; IRENA, 2025; Sonelgaz, 2024, 2025, 2026; World Bank, n.d.-a, n.d.-b, n.d.-c). The article is structured as follows: Section 2 develops the conceptual framework; Section 3 presents Algeria's energy-transition context and the Egyptian comparison; Section 4 explains the data and methodology; Section 5 discusses the results; Section 6 derives policy implications; and Section 7 concludes with recommendations.

2. Economic Intelligence, Digitalization, and Energy Transition

2.1. Conceptual foundations

Applied to the energy sector, economic intelligence refers to the capacity of institutions to transform technical, regulatory, financial, and operational information into usable knowledge for steering infrastructure systems and managing long-term constraints (CREG, 2022; IEA, 2017; Sonelgaz, 2026). Digitalization is one of the practical channels through which that informational capacity becomes operational. It provides the technical infrastructure of platforms, databases, dashboards, sensors, automated systems, and communication networks. The IEA emphasizes that digital technologies can improve the safety, productivity, efficiency, and sustainability of energy systems, while recent reviews stress the relevance of artificial intelligence, Internet of Things architectures, digital twins, and advanced data systems for smart grids, renewable integration, and demand response (IEA, 2017; Mahmood et al., 2024).

For the purposes of this study, economic intelligence is operationalized through four observable dimensions. The first is strategic scanning, meaning the ability to collect and interpret regulatory, technological, financial, and market information relevant to energy planning. The second is coordination intelligence, meaning the use of information systems to connect institutions, operators, regulators, contractors, universities, and innovation partners. The third is project-execution intelligence, meaning the use of dashboards, milestone tracking, alerts, and traceability mechanisms to monitor tenders, land availability, grid connection, equipment delivery, testing, and commissioning. The fourth is economic-control intelligence, meaning the use of reference costs, benchmarking, and post-award monitoring to reduce cost overruns and improve investment discipline. This operationalization separates economic intelligence from digitalization: digitalization is the technical infrastructure, whereas economic intelligence is the decision-making capacity produced when digital information is interpreted and used for strategic action (CREG, 2022; IEA, 2017; Sonelgaz, 2026).

Yet a stronger conceptual foundation is needed for hydrocarbon-dependent economies such as Algeria. Rentier-state theory explains how dependence on external hydrocarbon rents can weaken diversification incentives and sustain allocative political bargains, while carbon lock-in theory shows how infrastructures, prices, and institutions co-evolve around fossil systems and slow the uptake of alternatives (Beblawi & Luciani, 1987; Seto et al., 2016; Unruh, 2000). Socio-technical transition scholarship adds that incumbent regimes often resist deep change even when low-carbon niches are available (Geels, 2014). For Algeria, these perspectives imply that slow renewable deployment is not simply a technical lag; it is also a manifestation of

institutional path dependence within a hydrocarbon-centered political economy (Bouckaert, 2024; Tagliapietra, 2019).

2.2. Digitalization and renewable outcomes

The digitalization literature does not justify any automatic assumption that more connectivity will immediately deliver better transition outcomes. Recent cross-country evidence suggests that digitalization can promote renewable-energy development, especially where financial systems, institutional quality, and human capital are stronger, which means that national context remains decisive in shaping actual outcomes (Zheng & Zhang, 2025). In hydrocarbon-dependent or rentier settings, this point becomes even sharper. Rentier-state theory emphasizes that external resource rents can weaken diversification incentives and sustain allocative state structures, while carbon lock-in literature shows how infrastructures, prices, and institutions co-evolve around fossil systems and delay the uptake of alternatives (Beblawi & Luciani, 1987; Seto et al., 2016; Unruh, 2000). Transition scholarship similarly warns that incumbent regimes often resist deep change even when low-carbon niches exist (Geels, 2014). For Algeria, the relevant question is therefore not whether digitalization exists, but whether it is being connected effectively to project execution, renewable integration, and the reduction of implementation bottlenecks in a hydrocarbon-centered system (Haddoum et al., 2018; Poudineh et al., 2018; Zheng & Zhang, 2025).

3. Algeria's Energy-Transition Context

3.1. Policy ambitions and structural barriers

Algeria's transition debate must be situated within a policy context marked by strong fossil-fuel dependence, repeated renewable ambitions, and more recent attempts to move from planning to implementation. The IEA notes that Algeria updated its Renewable Energy and Energy Efficiency Development Plan in 2015 and reinforced the role of large-scale solar photovoltaic and wind deployment within that framework (IEA, 2025b; Stambouli et al., 2012). The current official objective is to develop approximately 15,000 MW of solar photovoltaic capacity by 2035, with a first component of about 3,200 MW and a Sonelgaz contract package of approximately 3,000 MWc already launched or under implementation (Ministry of Energy and Renewable Energies, 2026b; Sonelgaz, 2024, 2026). According to the Ministry of Energy and Renewable Energies and Sonelgaz, this first phase includes photovoltaic power plants located mainly in southern and High Plateau provinces, with unit capacities generally ranging from 80 MW to 220 MW (Ministry of Energy and Renewable Energies, 2026b; Sonelgaz, 2024). Sonelgaz further reports that the closure of the "Solar 1000" and "2,000 MW" tender processes led to the signature of 19

contracts for the realization of 20 photovoltaic plants with a total capacity of approximately 3,000 MWc (Sonelgaz, 2024). These contracts cover engineering, civil works, equipment supply, transport, installation, training, testing, and commissioning, which indicates that Algeria's renewable strategy has moved from broad planning to project contracting.

However, this implementation sequence remains embedded in a power system still dominated by fossil fuels. Algeria's renewable ambitions have historically encountered structural barriers. Haddoum et al. (2018) argued that subsidy structures, implementation failures, and weak incentive effectiveness limited the practical development of renewable energy, even when the official strategic direction appeared favorable. More recent work on resource-rich MENA economies similarly stresses that grid inadequacy, institutional-capacity gaps, risk allocation problems, and fossil-fuel pricing structures often undermine renewable deployment even when ambitions are announced at scale (Poudineh et al., 2018; Tagliapietra, 2019). In the Algerian case, this broader literature is reinforced by recent rentier-state analysis suggesting that diversification remains uneven because the incumbent hydrocarbon-centered model still organizes incentives, fiscal room, and state–society relations (Bouckaert, 2024). Official Algerian planning documents also show how central natural gas remains to the energy system. CREG's indicative gas-supply programme is built as a ten-year exercise using three scenarios and consultation with operators, while explicitly taking the renewable programme into account. In other words, renewables are present in planning, but they remain embedded in a system whose core balancing logic is still gas-based (CREG, 2022).

The green hydrogen strategy adds a second layer to Algeria's clean-electricity transition. IRENA reports that Algeria's national hydrogen strategy includes a target of 2.5 GW of PEM electrolysers by 2040, with potential production of around 40 TWh of green hydrogen per year, equivalent to approximately 1.2 million tonnes annually, and with an estimated investment requirement of around USD 25 billion (International Renewable Energy Agency [IRENA], 2025). This hydrogen trajectory depends directly on the expansion of renewable electricity, because electrolyser deployment cannot be considered clean unless it is supplied by additional low-carbon electricity. Green hydrogen should therefore not be treated only as a future export opportunity; it should also be analysed as a test of Algeria's ability to coordinate renewable generation, water resources, grid infrastructure, industrial demand, investment governance, and external energy partnerships within one integrated transition framework (IRENA, 2025; Ministry of Energy and Renewable Energies, 2026b; Müller et al., 2024).

The central analytical issue is therefore not whether Algeria has renewable ambitions, but whether announced and contracted capacity can be commissioned fast enough to change the national electricity mix. This distinction is crucial for the present study because it links the policy context directly to the role of economic intelligence: Algeria's transition requires not only strategic targets and digital tools, but also stronger mechanisms for monitoring tenders, tracking milestones, coordinating grid connection, controlling costs, and ensuring that planned projects become operating renewable capacity.

3.2. The Egyptian comparison

Egypt is selected as a comparative case because it represents a most-similar regional comparator with more advanced renewable-energy implementation. Like Algeria, Egypt is a North African/MENA country with abundant solar resources, a historically gas-centered electricity system, rising domestic electricity demand, and a strong state role in energy planning. However, Egypt differs from Algeria in the policy and execution mechanisms used to convert renewable targets into operating capacity. Egypt has introduced electricity-sector reforms, gradually reduced subsidies, adopted feed-in tariff mechanisms for solar PV and wind, opened renewable generation to independent power producers, and developed competitive bidding and build-own-operate frameworks under its Renewable Energy Law (IEA, 2016, 2025a; IRENA, 2018). Large-scale projects such as the Benban Solar Park, together with hydropower from the Aswan High Dam and wind development in the Gulf of Suez corridor, show that Egypt has been more effective in translating renewable policy instruments into deployed capacity (IRENA, 2018). The comparison is therefore not intended to present Egypt as a perfect model for Algeria, but to isolate an analytically relevant contrast: under broadly comparable regional and resource conditions, Egypt has advanced further because implementation mechanisms, investment frameworks, and project-execution capacity have been stronger. This reinforces the paper's central argument that Algeria's constraint is not primarily the lack of solar potential, but the insufficient conversion of digitalization and economic intelligence into concrete deployment intelligence for renewable-energy projects.

4. Data and Methodology

The analysis relies on a descriptive-analytical methodology based on secondary official sources rather than a strict causal design. The empirical material combines long-run international indicators of digital diffusion and electricity structure with recent Algerian regulatory and utility evidence. The long-run indicators are drawn from World Bank data pages covering internet use, mobile subscriptions, fixed broadband, access to electricity, electricity production from renewable sources

excluding hydroelectric, and electricity production from natural gas sources. The recent sector evidence is drawn from ARPCE observatories, CREG key figures for 2024, the CREG gas programme, CREG's renewable-electricity regulatory pages, Sonelgaz activity reports for 2023 and 2024, Sonelgaz-Energies Renouvelables data, Sonelgaz announcements on the 3,000 MWc solar tenders, IEA country pages, and Tracking SDG 7 country data (ARPCE, 2025a, 2025b; CREG, 2022, 2026, n.d.; ESMAP, n.d.; IEA, n.d.-a, n.d.-b; Sonelgaz, 2024, 2025, 2026; World Bank, n.d.-a through n.d.-f). The intentional blending of sources across years serves a descriptive purpose: the World Bank series provide internationally comparable structural benchmarks, whereas CREG, Sonelgaz, and ARPCE provide the most recent national-sector evidence for 2024–2025. These datasets are therefore juxtaposed rather than merged into a single statistical series.

The use of secondary data imposes several limitations that must be acknowledged. First, the sources used in this paper do not always follow the same publication calendar: World Bank indicators are useful for long-term international comparability, whereas CREG, Sonelgaz, and ARPCE provide more recent national-sector evidence. Second, official reports may emphasize announced, contracted, or planned projects, while the electricity transition depends ultimately on commissioned capacity and actual generation. Third, the descriptive-analytical approach cannot establish a causal effect of digitalization on renewable-energy deployment; it can only identify patterns, asymmetries, institutional mechanisms, and plausible implementation bottlenecks. To reduce these risks, the study triangulates multiple official and international sources, distinguishes between capacity, generation, tenders, and commissioning, and reports author calculations transparently. The results should therefore be read as a policy diagnosis rather than as a causal econometric demonstration.

The method is deliberately modest because the purpose is not to claim causal proof but to establish a policy-relevant asymmetry using official evidence. The study compares the scale and direction of digital expansion with the most recent structure of the electricity sector, then interprets institutional mechanisms through the lens of economic intelligence (CREG, 2022, 2026; IEA, 2017; Sonelgaz, 2026).

Table 1. Key official indicators used in the analysis

Indicator	Latest value	Year / period	Main source
Internet users (% of population)	76.9	2023	World Bank
Mobile subscriptions (per 100 people)	111.6	2023	World Bank
Fixed broadband (per 100 people)	12.01	2023	World Bank

Access to electricity (% of pop.)	100.0	2023	World Bank
Electricity from renewables excl. hydro (% of total)	0.9	2021 (latest WB)	World Bank
Electricity from natural gas (% of total)	99.0	Latest WB	World Bank
Energy intensity (MJ/2021 USD PPP)	4.3	2022	Tracking SDG 7
Installed power capacity (MW)	25,126	2024	CREG
National generation (TWh)	95.18	2024	CREG
Renewable generation (GWh)	704	2024	CREG
Renewable share of 2024 gen. (%)	0.74	2024 (calc.)	Author from CREG
Sonelgaz RE installed capacity (MW)	393.3	2024	Sonelgaz (n.d.)
Internet subscribers (millions)	59.1	Q2 2025	ARPCE
Mobile subscribers (millions)	54.87	Q2 2025	ARPCE
Internet subs. that are mobile (%)	88.71	Q2 2025	ARPCE

Source: Compiled by authors from ARPCE (2025a, 2025b), CREG (2026), ESMAP (n.d.), Sonelgaz (2025), and World Bank (n.d.-a through n.d.-f). The 0.74% renewable share is an author calculation (704 GWh / 95.18 TWh). The World Bank renewable-electricity indicator is retained as the latest internationally harmonized benchmark, while the 2024 CREG figures are used to characterize the current national generation mix.

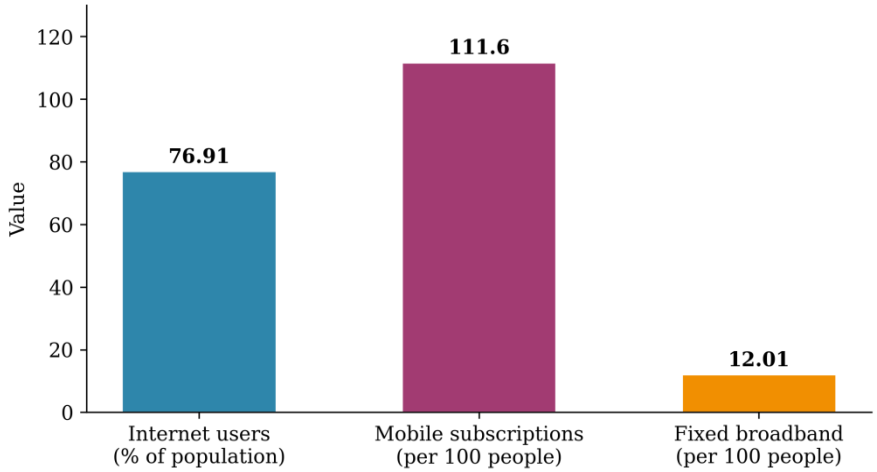
5. Results and Discussion

5.1. Digital expansion is substantial and measurable

Algeria's digital trajectory is unambiguous. The long-run diffusion indicators place the country in a far more connected position than in the early 2000s, with internet users reaching 76.9% of the population, mobile subscriptions reaching 111.6 per 100 people, and fixed broadband subscriptions reaching 12.01 per 100 people, all

in 2023 (World Bank, n.d.-e, n.d.-f, n.d.-d). These figures establish the presence of a mature digital layer capable of supporting monitoring, customer interfaces, information flows, and utility coordination. Figure 1 illustrates the three indicators.

Figure 1. Digital penetration indicators in Algeria (2023).



***Source**: World Bank (n.d.-d, n.d.-e, n.d.-f). Note: Each bar uses a different denominator.*

Recent ARPCE data reinforce the same conclusion from a current market perspective. By the second quarter of 2025, Algeria had 59.10 million internet subscribers and 54.87 million mobile subscribers, while 88.71% of internet subscriptions were mobile (ARPCE, 2025a, 2025b). For the purposes of this paper, those results show that digitalization in Algeria is a broad communications infrastructure that can, in principle, support smarter energy governance and more intensive data use across the electricity system.

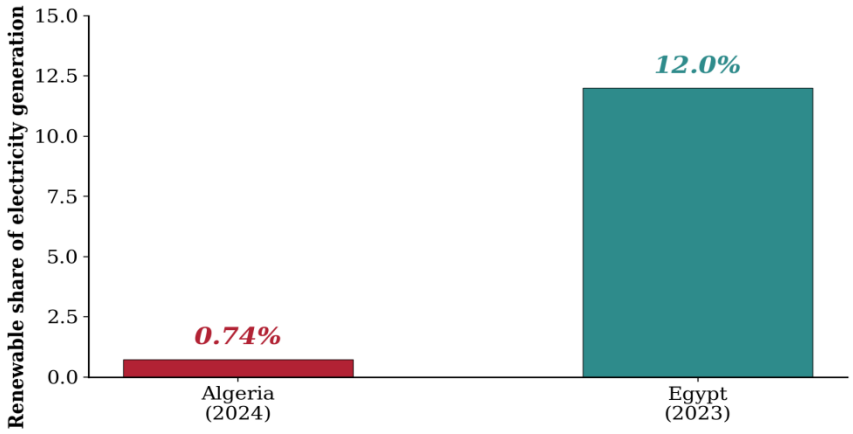
5.2. Energy-transition outcomes remain limited

The electricity side presents a very different rhythm. Algeria has achieved universal electricity access, which is a significant development achievement. Yet universal access should not be confused with a completed transition in the generation mix. The World Bank reports universal electricity access, only 0.9% electricity production from renewable sources excluding hydroelectric, and a generation structure still strongly dependent on natural gas; the IEA's electricity data similarly show Algeria's 2023 generation mix as overwhelmingly gas-based (IEA, n.d.-b; World Bank, n.d.-a, n.d.-b, n.d.-c).

CREG's 2024 key figures make the asymmetry even clearer at the sector level. Algeria generated 95.18 TWh of electricity in 2024, but only 704 GWh came from renewable plants, equivalent to 0.74% of total national generation. Within that renewable segment, photovoltaic generation represented 588.9 GWh, or 83.7% of

renewable output; solar thermal contributed 62.0 GWh (8.8%); hydro contributed 40.0 GWh (5.7%); and wind only 13.1 GWh (1.9%). Figure 4 therefore shows that photovoltaic is not merely one renewable option among others in Algeria; it is the only technology that has already achieved visible operating relevance at national scale. Solar thermal exists but remains peripheral, hydro is structurally limited, and wind is still marginal in realized output. The practical implication for the Algerian context is that near-term renewable expansion is likely to remain PV-led, which makes execution capacity, grid connection, cleaning logistics, and maintenance practices around photovoltaic plants more immediately important than broad claims about technology diversification (CREG, 2026).

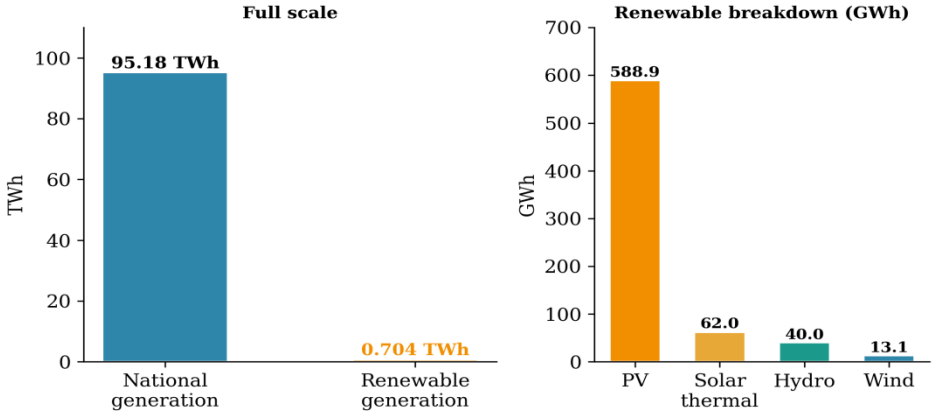
Figure 2. Renewable electricity share: Algeria vs. Egypt



Source: CREG (2026) for Algeria; IEA (n.d.-c) for Egypt.

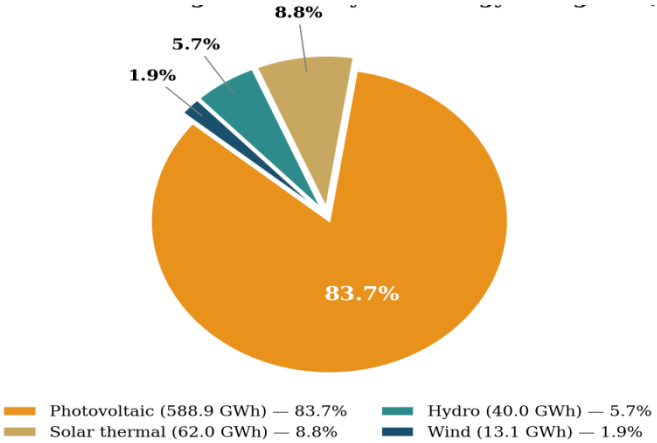
The comparison with Egypt in Figure 2 underscores that Algeria's low renewable share is not an inevitable consequence of North African geography. Egypt, operating in a similarly sun-rich environment, has achieved a renewable electricity share more than sixteen times larger than Algeria's, which reinforces the importance of policy implementation and project-execution frameworks rather than resource availability alone. The divergence points to institutional and regulatory execution as the binding constraints in the Algerian case.

Figure 3. National vs. renewable electricity generation in Algeria (2024)



***Source**: CREG (2026). PV = photovoltaic. Total renewable = 704 GWh (0.74% of national).*

Figure 4. Renewable generation by technology in Algeria (2024)



Source: CREG (2026). Total renewable generation = 704 GWh.

5.3. Economic intelligence is visible as an operational reality

Economic intelligence in the Algerian energy sector can be observed through concrete institutional devices rather than treated only as an abstract concept. Sonelgaz's 2024 activity report records a governance portal designed to facilitate access to directives, doctrines, and transitional notes, as well as a dedicated solution for managing governance bodies in order to accelerate access to strategic information and improve work traceability (Sonelgaz, 2026). The same report shows the deployment of the GAPS automatic duty-management solution, SMS alerts for grave SIE events and fatal work accidents, and a beta application for determining and managing the reference costs of energy infrastructures. These tools fit the logic of economic intelligence because they improve speed, visibility, traceability, and the quality of organizational decision support, but most of them remain closer to internal operational coordination than to the direct execution of renewable projects (Sonelgaz, 2026).

The 2023 Sonelgaz report and the CREG gas programme support the same interpretation from two different angles. Sonelgaz's earlier report documented digitized HSE data and cybersecurity action planning, while CREG's planning exercise is explicitly scenario-based, collaborative, and renewables-aware (CREG, 2022; Sonelgaz, 2025). Knowledge circulation also matters: Sonelgaz reports cooperation agreements with universities and research centres (11 agreements) as well as meetings with startups and inventors (13 meetings, including 7 with startups) under a broader partnership strategy (Sonelgaz, 2026).

Table 2. Official evidence of economic-intelligence mechanisms in the Algerian energy sector

Institution and mechanism	Evidence reported	Analytical significance
Sonelgaz 2024: governance portal	Access to directives, doctrines, transitional notes	Governance information digitized and accessible
Sonelgaz 2024: management-bodies solution	Faster access to strategic information, better traceability	Governance routines become traceable information flows
Sonelgaz 2024: GAPS duty-management	Automated duty/permanence arrangements	Organizational coordination digitized
Sonelgaz 2024: SMS alerting	Alerts for grave SIE events and fatal accidents	Operational intelligence and rapid-response
Sonelgaz 2024: reference-cost app	Beta app for energy infrastructure costs	Digitalization connected to economic evaluation
CREG gas programme: 10-year forecasting	Three scenarios, consultation, renewables integrated	Forecasting and scenario-based planning
Sonelgaz 2024: university/startup cooperation	11 agreements, 13 meetings (7 with startups)	Knowledge circulation and innovation scouting

Source: Synthesized from CREG (2022) and Sonelgaz (2026). The table documents institutional evidence, not causal rankings.

Table 2 is analytically useful precisely because it shows both the presence and the limitation of current intelligence mechanisms. The governance portal, management-bodies solution, duty-management software, and SMS alerts mainly optimize administration, safety, and internal reporting. They do not, by themselves, resolve the bottlenecks that determine renewable deployment: tender sequencing, land and permit readiness, contractor discipline, grid-connection timing, customs delays, variation-order control, and commissioning follow-up. Even the reference-cost application

remains only a supporting tool unless it is hard-wired into procurement review and post-award contract management. In this sense, Sonelgaz has built operational intelligence more successfully than deployment intelligence (Beblawi & Luciani, 1987; Bouckaert, 2024; Geels, 2014; Sonelgaz, 2026).

The same tools can nevertheless be leveraged more explicitly within Algeria's current framework. For the ongoing 3,000 MWc solar programme, the governance portal could serve as a plant-by-plant milestone dashboard covering tender award, notice to proceed, land availability, grid-connection works, delivery of modules and inverters, testing, and commissioning; the management-bodies solution could assign deadlines and responsible entities to each blocked step; and alerting tools could be extended from safety incidents to project slippages, abnormal cost deviations, customs delays, and interconnection bottlenecks. Likewise, the reference-cost application could benchmark EPC and O&M bids under the existing renewable tendering regime and flag abnormal deviations before contract award or variation approval, while commissioning data could feed CREG's certification-of-origin, premium, and fund-monitoring mechanisms more systematically (CREG, n.d.; Sonelgaz, 2024, 2026).

5.4. Renewable progress exists, but implementation constraints remain decisive

A balanced interpretation must acknowledge both progress and constraint. Sonelgaz reports that the first 3,200 MWc tranche of the national solar programme was under implementation within a broader 15,000 MWc horizon by 2035, with 21 photovoltaic plants in the realization phase (Sonelgaz, 2025, 2026). At the same time, long-standing structural constraints still matter. Haddoum et al. (2018) showed that subsidies and other barriers helped explain earlier implementation failures, and more recent work on Algeria and resource-rich MENA economies reaches a similar conclusion: cheap fossil energy, weak innovation incentives, policy uncertainty, and institutional risk reduce the competitiveness and bankability of renewables (Matallah et al., 2023; Poudineh et al., 2018). This diagnosis is consistent with broader rentier-state arguments that diversification plans are often announced more readily than they are implemented when hydrocarbon revenues continue to stabilize the incumbent system (Bouckaert, 2024; Tagliapietra, 2019). It is also consistent with modelling work suggesting that, in a country with very low domestic gas prices such as Algeria, a fully renewable power system is unlikely without deliberate policy changes and early capacity expansion (Müller et al., 2024). Algeria's Saharan geography provides exceptional solar potential, but arid conditions create operational burdens related to soiling, cleaning, logistics, and maintenance. International technical guidance stresses that soiling losses can be significant in utility-scale photovoltaic plants in arid regions (IEA PVPS, 2022; Stambouli et al., 2012).

6. Policy Implications

The first implication is analytical: Algeria should distinguish between operational digitalization and deployment digitalization. Internal portals, workflow tools, and alert systems have value, but they will not change the generation mix unless they are attached to the stages where renewable projects actually stall—tendering, land and permit clearance, grid-connection sequencing, contractor supervision, acceptance testing, and commissioning (Geels, 2014; Poudineh et al., 2018; Sonelgaz, 2026).

A concrete localized application within the current Algerian framework would be to link Sonelgaz's governance portal and management-bodies solution to the renewable tender regime defined by CREG's decrees on tendering, premiums, certificates of origin, and the renewable-energy fund. Each photovoltaic plant in the 3,000 MWc programme could have a digital stage-gate file with mandatory dates, accountable entities, supporting documents, and automatic escalation when milestones are missed. This would turn the portal from a document repository into a project-control instrument aligned with existing procurement and support rules (CREG, n.d.; Sonelgaz, 2024, 2026).

A second localized application concerns cost and commissioning discipline. The beta reference-cost tool could be used to benchmark bids, change orders, and maintenance contracts for photovoltaic plants, particularly for civil works, grid connection, cleaning systems, and spare parts in desert conditions. In parallel, plant-level production and commissioning data could be transmitted automatically to the procedures governing certificates of renewable origin and diversification premiums, reducing the gap between regulatory eligibility and operational reality (CREG, n.d.; IEA PVPS, 2022; Sonelgaz, 2026).

A final implication is that policy discourse should remain empirically disciplined. The most credible narrative is neither defeatist nor triumphalist: Algeria has advanced in the informational foundations of the transition, but it still needs stronger execution, larger-scale renewable deployment, and better adaptation to its own operational conditions - particularly the soiling and maintenance challenges of desert-scale solar - if it wants digitalization to become structurally transformative rather than administratively efficient (IEA, 2017; IEA PVPS, 2022; Zheng & Zhang, 2025).

7. Conclusion

This study examined the relationship between economic intelligence, digitalization, and the clean-electricity transition in Algeria. The main finding is a clear asymmetry between informational modernization and energy-transition outcomes. Algeria has achieved substantial digital diffusion and has introduced several institutional information tools within the energy sector, including governance portals,

digital reporting systems, alert mechanisms, traceability tools, scenario-based planning, and cost-reference applications (ARPCE, 2025a, 2025b; CREG, 2022; Sonelgaz, 2026; World Bank, n.d.-d, n.d.-e, n.d.-f). However, these tools have not yet produced a proportional transformation of the electricity mix. In 2024, Algeria generated 95.18 TWh of electricity, while renewable plants produced only 704 GWh, representing approximately 0.74% of total national generation (CREG, 2026). Within this limited renewable segment, photovoltaic generation represented the dominant source, confirming that Algeria's practical short- and medium-term renewable pathway is currently centered mainly on solar PV rather than on a broadly diversified renewable portfolio.

Regarding the hypotheses formulated in the introduction, the findings broadly support H1. Algeria's digitalization has improved information availability, connectivity, and organizational coordination, but it has not automatically produced a significant increase in renewable-electricity deployment. The evidence also supports H2. Economic intelligence becomes relevant to the electricity transition only when digital information is connected to concrete execution mechanisms such as tender monitoring, grid-connection planning, cost control, milestone tracking, risk detection, and commissioning follow-up. H3 is also supported, with some caution. Algeria's limited renewable deployment cannot be attributed to a lack of solar potential; rather, the evidence associates it with institutional, regulatory, financial, and implementation bottlenecks that limit the conversion of policy targets into operating renewable capacity (Haddoum et al., 2018; Matallah et al., 2023; Poudineh et al., 2018; Stambouli et al., 2012).

The study also clarifies the conceptual distinction between digitalization and economic intelligence. Digitalization refers to the technical layer of platforms, databases, applications, automated systems, and connectivity. Economic intelligence begins when this information is transformed into strategic anticipation, coordination, cost control, risk management, and decision-making. In the Algerian energy sector, the available evidence suggests that existing tools are stronger in operational intelligence than in deployment intelligence. They improve internal administration, safety reporting, governance documentation, and organizational traceability, but they remain insufficiently connected to the stages where renewable projects succeed or fail: tender execution, land readiness, grid connection, contractor performance, logistics, commissioning, and post-commissioning monitoring (CREG, 2022; Sonelgaz, 2024, 2026).

The comparison with Egypt reinforces this interpretation. Egypt was not used as a perfect model, but as a regional comparator showing that solar potential alone is not

decisive. Under broadly comparable North African and MENA conditions, Egypt has advanced further by combining renewable targets with implementation instruments such as feed-in tariffs, independent-power-producer frameworks, long-term power-purchase agreements, subsidy reform, and large-scale project execution (IEA, 2016, 2025a; IRENA, 2018). This contrast suggests that Algeria's central challenge is not the absence of renewable resources, but the need to strengthen institutional execution, investment governance, and the conversion of announced programmes into commissioned renewable generation.

The study therefore recommends four priority actions. First, Algeria should convert existing digital governance tools into a plant-by-plant renewable project dashboard for the national solar programme, covering tender award, land availability, grid-connection works, equipment delivery, testing, commissioning, and actual generation. Second, Sonelgaz and the regulator should connect digital tools to cost benchmarking and contract monitoring, especially for EPC contracts, grid connection, cleaning systems, spare parts, and maintenance under Saharan conditions. Third, the green hydrogen roadmap should be sequenced with renewable-electricity deployment, because electrolyser capacity and export ambitions will only be credible if additional PV and wind capacity is built, connected, and operated reliably (IRENA, 2025; Müller et al., 2024). Fourth, Algeria should publish more granular project-level data on renewable capacity, commissioning dates, delays, generation, grid connection, and plant performance, allowing economic intelligence to become a transparent public-governance tool rather than only an internal administrative function.

The study remains limited by its reliance on secondary data and by the descriptive-analytical nature of the method. It does not establish a causal relationship between digitalization and renewable-energy outcomes. Future research should therefore build project-level datasets, compare announced, contracted, and commissioned capacity, examine procurement and grid-connection delays, and test the relationship between digital governance tools and renewable deployment through time-series analysis, interviews, or detailed case studies. Nevertheless, the evidence is sufficient to support the central conclusion of this paper: Algeria's clean-electricity transition requires not only more digitalization, but a stronger conversion of digital information into economic intelligence for renewable-project execution.

8. References

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