Igniting Action to Reduce Gas Flaring:
Real Opportunities. Real Projects. Real Results.

Country Case Study: People's Democratic Republic of Algeria

Columbia Center on Sustainable Investment
A JOINT CENTER OF COLUMBIA LAW SCHOOL AND COLUMBIA CLIMATE SCHOOL

capterio

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Context to this Case Study

This case study is part of a broader report by the Columbia Center on Sustainable Investment and Capterio, which analyzes gas flaring in depth. The report presents extensive findings and a practical set of actionable recommendations for governments, national oil companies, international oil companies, and other stakeholders. The full report and case studies are available here.

Despite bold commitments made over the past two decades, global gas flaring remains stubbornly high—at around 140–150 BCM per year—emitting up to 1 billion metric tons of CO_2-equivalent greenhouse gases annually, and representing as much as $30 billion per year in lost revenue.

We believe flaring reductions are not only technically achievable, but also commercially compelling. By capturing and using flared gas, companies and governments can increase revenue, enhance energy security, reduce emissions, and accelerate the energy transition. Among all decarbonization options, reducing gas flaring is one of the fastest and most cost-effective "quick wins."

Countries with high flaring levels can make substantial progress—if key commercial, organizational, and political challenges are addressed. Delivering flare-capture projects at scale requires a thoughtful, integrated, and collaborative approach, supported by strong leadership, aligned incentives, and a relentless focus on delivery over rhetoric.

The full report examines six case studies—including this one—to illustrate how flaring can be reduced. We go beyond analyzing the "what" and "why" of flaring, and focus on the "how" of unlocking and accelerating actual delivery. Three of these cases are project-based examples from Angola, the Kurdistan Region of Iraq, and Argentina, where flared gas has been successfully captured and used. The other three country-based studies—covering Federal Iraq, Egypt, and Algeria—highlight both progress and untapped opportunities.

The full report also explores the systemic barriers to progress, the lessons learned from the case studies, together with some innovative life-cycle considerations for greenhouse gas emissions, and a detailed set of recommendations.

We encourage readers of this case study to explore the broader report and the other case studies. Together, we hope they offer a meaningful contribution to global efforts to end routine gas flaring.

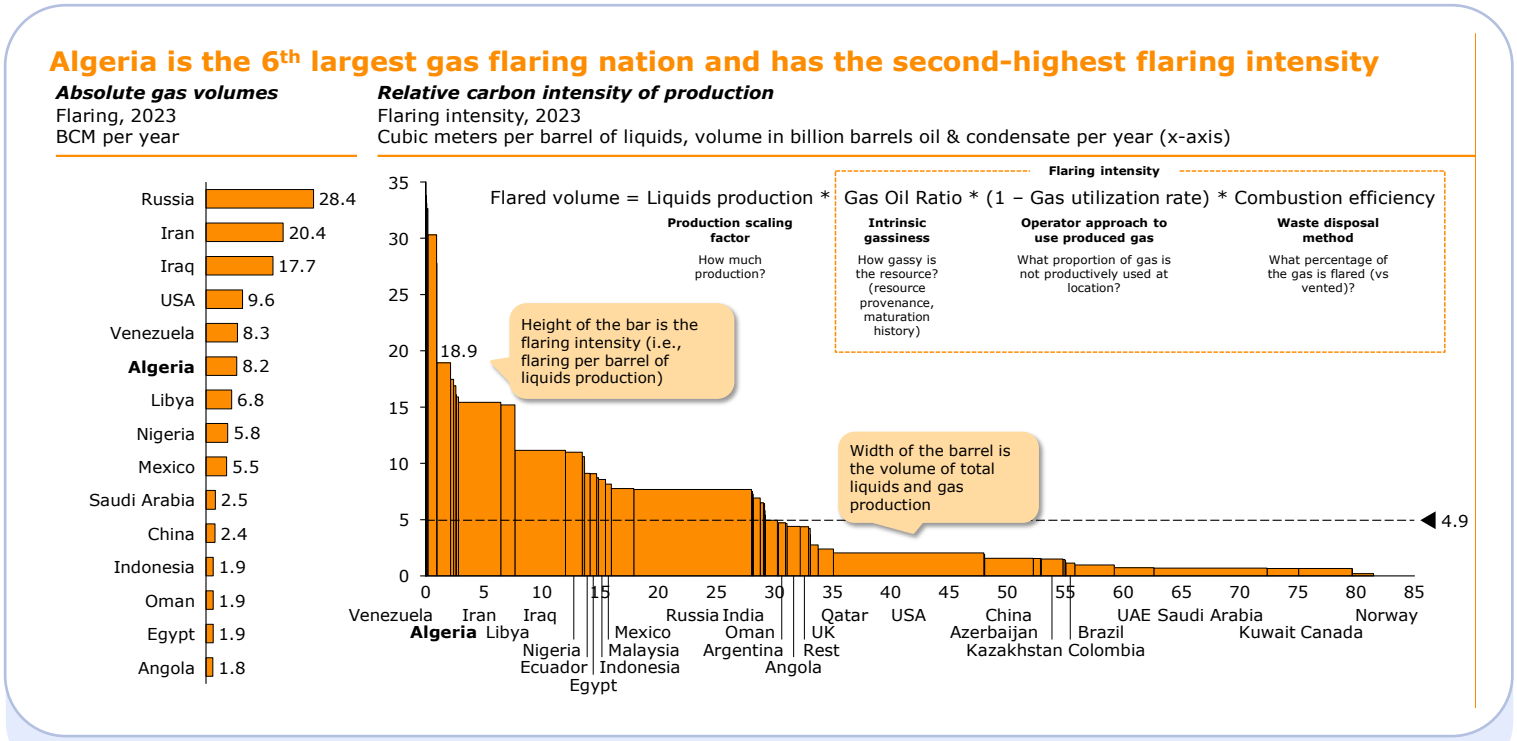
Executive Summary

Algeria has a major opportunity to cut gas flaring, increase revenue, strengthen energy security, and expand exports. Located near the European Union (EU)—a market eager to diversify its supply—Algeria is well-placed to capitalize on its connections because of its two liquefied natural gas (LNG) plants and three pipelines. But with a surge of global LNG supplies expected to intensify competition in the coming years, Algeria must act now to improve its revenue outlook and secure its role as a key, lower-carbon supplier, especially as the EU moves to penalize high-carbon imports.

Gas Flaring in Context in Algeria

In 2023, Algeria was 10th largest gas producer (at 102 BCM per year) and 17th largest oil producer (at 1.1 million barrels of oil and condensate per day[1]) in the world. It is heavily dependent on hydrocarbon revenue, with oil and gas sales generating 90% of export earnings.[2] Since the war in Ukraine, Algeria has superseded Russia as the second-largest gas-supplying country to the EU.[3] Of Algeria's hydrocarbon exports in 2022, in energy terms, gas dominates (at 51%), followed by oil (20%), refined products, liquefied petroleum gas, and condensate.[4] Also, Algeria was one of the first countries from the Global South to submit an Intended Nationally Determined Contribution to the United Nations Framework Convention on Climate Change (UNFCCC) in 2015.[5]

Yet according to the World Bank,[6] Algeria is also the world's sixth largest gas flarer, at 8.2 BCM in 2023[7] (790 million scf per day, or 8% of Algeria's total gas production, according to the World Bank). It also has the world's second highest flaring intensity (cubic meters of flaring per barrel of oil produced) at 18.9 m^3 per barrel, 3.8 times higher than the global average—see Figure 1.



Source: World Bank; Capterio analysis.

Figure 1: Global league table of gas flaring on an absolute (BCM per year) and relative (flaring intensity, cubic meters per barrel) basis. 2023.

1 Energy Institute. (2024). Statistical review of world energy. https://www.energyinst.org/statistical-review.

2 International Monetary Fund. (2024). Algeria: 2023 Article IV consultation—press release; staff report; and statement by the executive director for Algeria. p. 34. https://www.imf.org/en/Publications/CR/Issues/2024/04/12/Algeria-2023-Article-IV-Consultation-Press-Release-Staff-Report-and-Statement-by-the-547687.

3 Butt, H. (2023). Algerian pipeline gas flows to southern Europe remain robust in 2023. S&P Global. https://www.spglobal.com/commodity-insights/en/news-research/latest-news/natural-gas/052223-algerian-pipeline-gas-flows-to-southern-europe-remain-robust-in-2023.

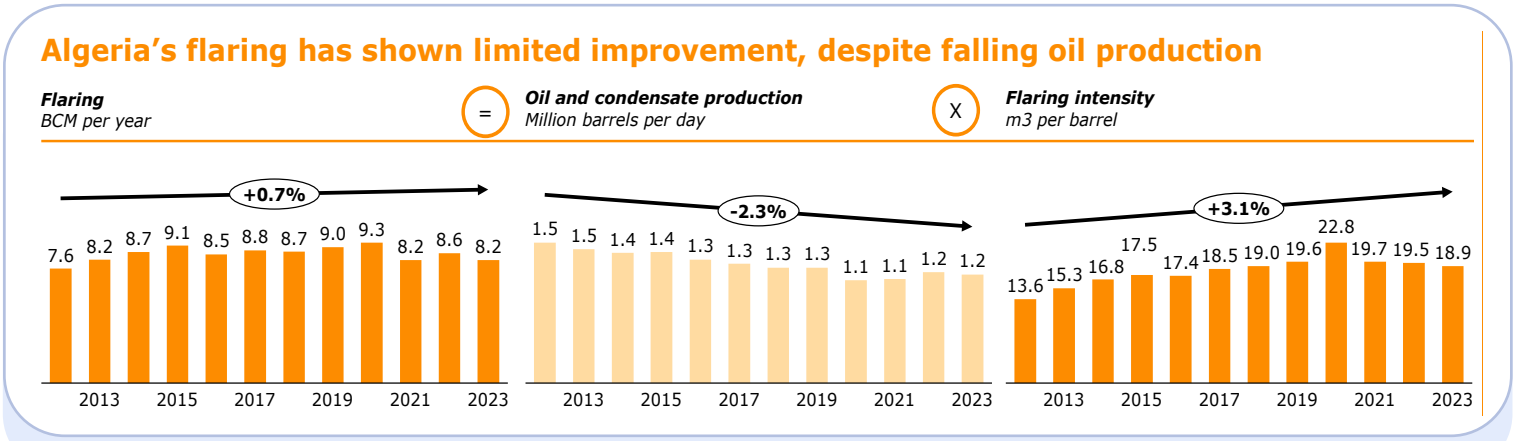
4 Sonatrach. (2024). Energy map of Algeria. National Institute of Cartography and Remote Sensing. https://sonatrach.com/wp-content/uploads/2024/10/ENERGY-MAP-OF-ALGERIA-2024_compressed.pdf.

5 Boukhatem, I., & Oei, P.-Y. (2023). Fossil gas lock-in risks: Analysis of Algeria's electricity sector and implications for a renewable energy transition. Sustainability Nexus Forum, 31, 25–40. https://doi.org/10.1007/s00550-024-00532-2.

6 The World Bank publishes annual data on gas flaring and makes this freely available. Capterio processes data from NASA and National Oceanic and Atmospheric Administration satellites on a daily basis and makes this data available for clients and publications. Under the 1967 Outer Space Treaty (to which Algeria is a party), space-based data are not subject to national sovereignty. Also, the 1986 U.N. Principles on Remote Sensing outline how the use of such data should be for the benefit of all countries and should support environmental protection.

7 World Bank Group. (2023). Global gas flaring tracking report. https://www.worldbank.org/en/programs/gasflaringreduction/publication/2023-global-gas-flaring-tracker-report.

According to the World Bank's data, flaring has slightly declined since 2016, after increasing from 2012 to 2016. Since oil and condensate production have declined slightly more, the flaring intensity since 2016 increased slightly to around 18.9 m^3 per barrel (Figure 2), also reflecting an increase from 2012 to 2016 (see Figure 2).



Source: World Bank; Capterio analysis.

Figure 2: Flaring, oil, and condensate production and derived flaring intensity over time for Algeria. Flaring has slightly declined, and flaring intensity has slightly increased since 2016.

When an estimated 3.8 BCM of methane from venting, incomplete combustion at flares and fugitive emissions are included, using data from the IEA's 2025 methane tracker[8], the total volume of wasted gas that could potentially be captured rises to 12.0 BCM per year, representing up to 230 million CO2-equivalent metric tons per year[9]. If all of this gas were sold for export at the average DES East Mediterranean Marker for January 2025 ($14.2 per MMbtu), the annual revenue earned would be over US$6.1 billion. At a more conservative $5 per MMbtu, the revenue opportunity is some $2.1 billion per year.

Algeria's national oil company, Sonatrach, has endorsed the World Bank's Zero Routine Flaring by 2030 initiative[10], and it has also committed to reducing flaring to less than 1% of all gas production (from a reported 3.7% in 2022[11]). These commitments also appeared in Algeria's Intended Nationally Determined Contribution, published in September 2015 in anticipation of the Paris Agreement, as well as its Third National Communication under the UNFCCC, published in October 2023.

These commitments also follow a long arc of focus on flaring, dating to 1966, when nonemergency flaring without a permit was first prohibited by law in Algeria.[12] To date, gas reinjection for oil field pressure maintenance and enhanced oil recovery have been the main flare-reduction techniques.

Indeed, activities in the early 2000s led to a dramatic reduction in gas flaring and Sonatrach receiving a certificate of excellence for its efforts in 2012.[13] Sonatrach claims to have substantially reduced gas flaring through investment in more than 30 projects. It should be noted that Sonatrach's estimate of flaring (3.1 BCM in 2022 and 2.7 BCM in 2023[14]) was significantly lower than the World Bank's (8.6 BCM and 8.2 BCM, respectively). Estimates from the Algerian Space Agency are, however, somewhat higher (4 BCM for 2021). These

8 International Energy Agency. (2025). Global methane tracker 2025. https://www.iea.org/reports/global-methane-tracker-2025.
9 Assuming a Global Warming Potential of methane of 82.5x that of CO2, over a 20-year period.
10 World Bank Group. (n.d.). Zero routine flaring by 2030 (ZRF) initiative. https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030/endorsers.
11 Sonatrach. (2023). Annual report 2022. https://sonatrach.com/wp-content/uploads/2023/11/RA_2022_EN_Web.pdf.
12 World Bank Group. (2023). Global methane and flaring regulations: Algeria. https://flaringventingregulations.worldbank.org/algeria.
13 World Bank Group. (2018). Sonatrach renews commitment to reduce flaring. https://www.worldbank.org/en/news/feature/2018/05/31/sonatrach-renews-commitment-to-reduce-flaring.
14 Sonatrach. (2024). Annual report 2023. p. 56. https://sonatrach.com/wp-content/uploads/2025/01/Rapport_Annuel_2023-30M.pdf.

discrepancies would merit further exploration, especially since few flares are metered[15] and many appear not to be reported to the regulator ALNAFT (the National Agency for the Development of Hydrocarbon Resources). Nevertheless, our conversations with authorities have at least agreed on one thing: The number is large, and the need to act is urgent, whether the figure is 3, 4 or 8 BCM per year.

Algeria is well connected to the international markets, with three pipelines (Medgaz, Trans-Mediterranean, and the former Maghreb line) and two liquefaction plants (in Skikda and Arzew). Data from the European Network of Transmission System Operators for Gas show that there is significant spare export capacity in 2024 (some 21 BCM, of which 9 BCM is in Trans-Mediterranean, 12 BCM is in Maghreb, and 0.4 BCM is in Medgaz). Kpler data on LNG vessels highlight that there is another 18 BCM of spare capacity at the two LNG plants).

The stakes are high because most of Algeria's gas is sold to major international buyers in the EU, which will begin enforcing its methane performance standard in 2027 with mandatory measurement—and introduce financial penalties for imports with high flaring and mathane intensity starting in 2030. If the EU were to impose an effective carbon price through its methane performance standard regulation of, say, $50 per metric ton[16] (equivalent to $2.6 per MMBtu), Algeria's gas and oil could become more expensive and less competitive because of its high level of flaring (especially compared with other sources, such as Norway and the United States), putting billions of dollars of export revenue at risk.[17]

This should be a wake-up call since the EU gas market is in long-term decline, from energy-efficiency measures, substitution from renewable sources, and increasingly attractive alternatives (such as U.S. LNG).

Flaring also leads to a loss of revenue (flaring accounts for 1% of Algeria's gross domestic product), but it also has an avoidable environmental impact (flaring in Algeria generates 60 million carbon dioxide (CO_2)-equivalent metric tons[18]). For many stakeholders engaged in—or receiving gas from—Algeria, flaring is a becoming a reputational issue of concern.

More than ever therefore, Algeria needs to monetize every molecule. Arguably, the backstory behind the termination of piped gas from Algeria to Morocco through the Maghreb pipeline in 2021 is simple: Algeria is running out of marketable gas[19] and is probably optimizing its export infrastructure use on economic and political grounds. Wood Mackenzie projects that gas production is peaking and will decline by about 25%, to under 90 BCM, by 2034. However, this could be offset if Algeria proceeds with expected gas license rounds in 2025.[20]

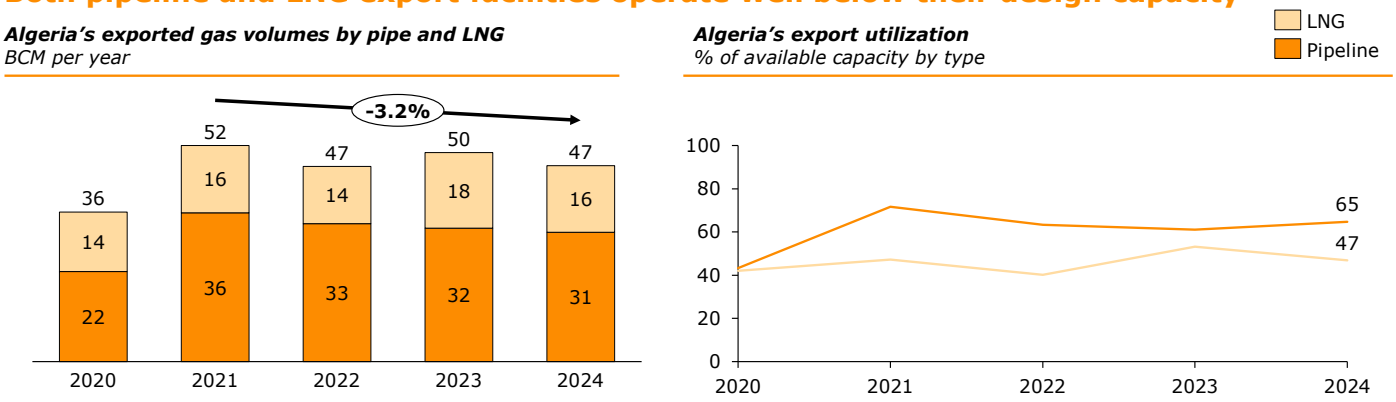
Domestic demand for gas (which generated 95% of electricity in 2019[21] and is delivered by a state monopoly, Sonelgaz) is projected by to grow significantly, rising from 20 GW in 2018 to 36 GW in 2028 (a rate of 6% per year, driven by heat waves and air-conditioning).[22,23] Also, because gas prices are heavily subsidized, they are well below the cost of production,

15 Most flare estimates are probably estimates or based on gas-oil-ratios.
16 This is an estimate; the precise details are a work in progress by the EU.
17 FlareIntel. (2021). How the EU's CBAM will impact energy imports from countries that flare gas. https://flareintel.com/insights/how-the-eus-cbam-will-impact-energy-imports-from-countries-that-flare-gas.
18 Here we use the IEA's estimate for Algeria of 9.5% methane slip and a global warming potential of methane that is 82.5 times that of CO_2 on a mass basis, according to the Intergovernmental Panel on Climate Change.
19 Menas Associates. (2021). *The real reason for Algeria's closure of the GME gas pipeline.* https://www.menas.co.uk/blog/the-real-reason-for-algerias-closure-of-the-gme-gas-pipeline.
20 Wood Mackenzie. (2024). *What next for Algeria's burgeoning gas market?* p.3. https://www.woodmac.com/reports/upstream-oil-and-gas-what-next-for-algerias-burgeoning-gas-market-150294226.
21 Sonelgaz. (n.d.). *Direction analyse et prévision, bulletin statistique des sociétés énergétique du groupe.* https://rise.esmap.org/data/files/library/algeria/Renewable%20Energy/Algeria_SONELGAZ%20Statistical%20bulletin_2017.pdf.
22 United Nations Framework Convention on Climate Change. (2015). *Troisième communication nationale sur les changements climatiques.* p. 80. https://unfccc.int/sites/default/files/resource/tgonc3.pdf.
23 Boukhatem, I., & Oei, P.-Y. (2023). Fossil gas lock-in risks: Analysis of Algeria's electricity sector and implications for a renewable energy transition. *Sustainability Nexus Forum, 31*, 25–40. https://doi.org/10.1007/s00550-024-00532-2.

transmission, and distribution (only Turkmenistan and Venezuela have lower prices, which discourages energy efficiency). With gas prices around $0.50 per kWh,[24] Algeria's subsidy amounted to $4 billion (2% of gross domestic product) in 2018.[25] Progress on renewables deployment (which could enable greater gas exports) is constrained by a lack of political commitment, subsidies on fossil alternatives that price them out of the market, and vested interests from government decision-makers.

Exports by pipeline are down (almost 5% per year since 2021, but significantly higher than the COVID lows of 2020). LNG exports were up slightly in 2023, increasing by 4 BCM, but then fell in 2024. The reduction in exports by pipeline is disappointing, given the 2022 deal between Sonatrach and Eni (in the context of an urgent need to diversify imports away from Russia) to boost exports via the Trans-Mediterranean pipeline by 9 BCM in 2023–2024. Independent data from ENTSOG show the contrary: flows to Italy declined by 2% in 2023 and 9% in 2024. The aggregate utilization of export facilities for LNG and pipeline has hovered around 65% and 47%, respectively, with close to 39 BCM per year of spare capacity (see Figure 3).

Algeria's pipeline exports to Europe have fallen in recent years. Both pipeline and LNG export facilities operate well below their design capacity



Source: World Bank; Capterio analysis.

Figure 3: Algeria pipeline and LNG exports from 2020 to 2024, presented on an aggregate annual basis, based on data from ENTSOG (for pipeline gas) and Kpler (for LNG). The shutdown of the Maghreb pipeline to Morocco does not appear to have led to an increase in exports via the alternative pipelines.

These falling gas exports have occurred even though (or perhaps because) oil production has been lower due to OPEC constraints. Lower oil production results in lower associated gas production, but lower oil production should also reduce the call on gas for reinjection as part of an enhanced oil recovery scheme (some 50 BCM per year is not atypical). Also, investment in new gas projects has been hindered by a suite of unattractive fiscal terms under a 2005 law that governs most existing contracts, leading to low exploration activity.

Concerns over the predicament for gas exports have led the Algerian government to embark on a number of bold initiatives in an attempt to boost production by up to 20 BCM per year. These include: (1) the first exploration licensing round since 2014,[26] with bids scheduled for April 2025 (plus a plan to hold new rounds annually, with a new suite of fiscal terms under a 2019 law); (2) the development of memorandums of

24 Aissaoui, A. (2016). *Algerian gas: Troubling trends, troubled policies.* Oxford Institute for Energy Studies. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2016/05/Algerian-Gas-Troubling-Trends-Troubled-Policies-NG-108.pdf.

25 Ouki, M. (2019). *Algerian gas in transition: Domestic transformation and changing gas export potential.* Oxford Institute for Energy Studies. https://doi.org/10.26889/9781784671457.

26 Calik, A. (2024). Algeria Eyes 20bn m³/yr new gas output from bid round. Argus Media. https://www.argusmedia.com/en/news-and-insights/latest-market-news/2626823-algeria-eyes-20bn-m3-yr-new-gas-output-from-bid-round (six onshore blocks have been offered; fiscal terms will be under the New Hydrocarbon Law of 2019, which is improved after previous terms showed disappointing results in 2014).

understanding and commercial discussions with U.S. exporters ExxonMobil and Chevron about the exploitation of abundant shale resources (it is likely their commercialization will be technically challenging, and it has already met fierce local opposition); and (3) the signing of another 12 memorandums of understanding with international investors. To further shore up gas exports, the country is gradually adding solar power capacity to reduce the demand for gas.

However, one dramatically underexploited gas supply source is gas flaring reduction, which could bring over 8 BCM to market without generating additional lock-in, in part through better utilization of infrastructure.

Material reductions in gas flaring will, however, require substantial changes to the operating models in Algeria. Many visionary statements, targets, and commitments have been made and missed. Policies, mandates, regulations, and execution are needed, but the issue is probably enforcement, not inadequate legislation.

Algeria's Legal and Fiscal Framework

The 2019 hydrocarbon law in Algeria established a framework to manage hydrocarbons and address gas flaring. ALNAFT oversees upstream activities, and ARH (the Hydrocarbon Regulatory Authority) regulates downstream operations and standards. Sonatrach, the state-owned oil company, dominates production and infrastructure. International oil companies (IOCs) partner with Sonatrach, but contract terms have not been disclosed.

Article 158 of the 2019 law prohibits flaring without authorization. A 2021 law limits flaring in upstream operations to 1% of production, 12 months in cases of inadequate infrastructure, with similar restrictions downstream. Emergency flaring is allowed for safety purposes, but must be reported. Article 210 imposes a tax of 12,000 DZD (about $89) per 1,000 m^3 (about $2.50 per MMBtu), increasing by 50% for unauthorized flaring. Exemptions for regions with insufficient infrastructure could undermine the law's effectiveness.

However, most existing contracts in Algeria are still under the 2005 hydrocarbon law, which prohibits flaring without authorization and imposes similar financial penalties without exemptions for inadequate infrastructure. If imposed, these penalties could raise close to $900 million per year (but actual collections are reportedly a fraction of this figure).

Sonatrach operates all downstream gas infrastructure in Algeria, even though the 2019 law opened the sector to other operators.[27] Domestic gas prices are heavily subsidized, reportedly at levels well below what is needed to recover costs. A gradual price liberalization process is underway, but it is limited to large industrial customers. Prices for electricity production and residential distribution will remain regulated, at least for the near future, making the liberalization scheme unlikely to improve the economics of most domestic market sales. In the meantime, exports appear to be the most logical route to producing a reasonable return for flare gas capture.

To align with environmental goals, Algeria must close legal loopholes, enforce penalties across contracts, and hold operators accountable. Transparency and investment in gas-capture infrastructure are critical to reducing flaring effectively.

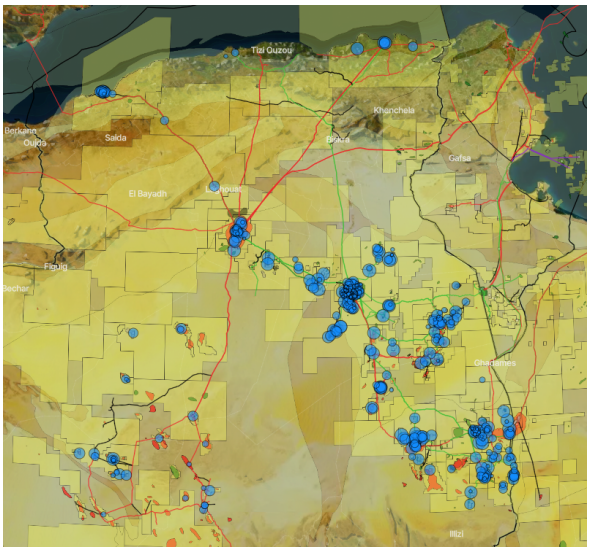
27 Wood Mackenzie. (2024). *What next for Algeria's burgeoning gas market?* p. 13. https://www.woodmac.com/reports/upstream-oil-and-gas-what-next-for-algerias-burgeoning-gas-market-150294226.

Review of the Current flaring in Algeria

Algeria's 8.2 BCM per year, according to the World Bank, comes from about 190 discretely resolvable flaring clusters across the country, as highlighted in Figure 4.

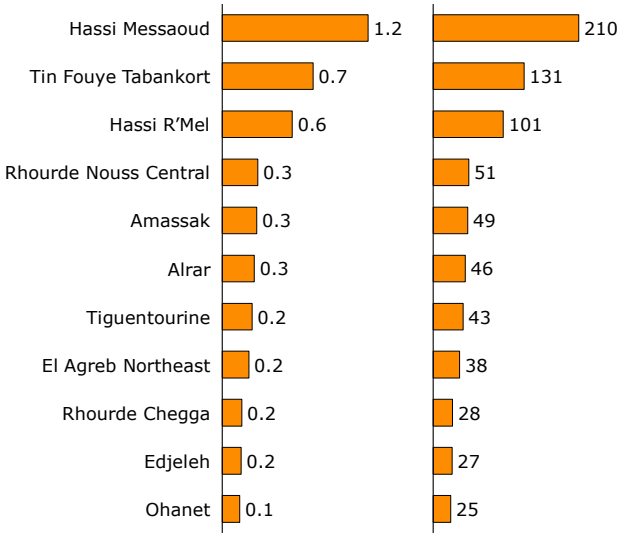
Algeria has many opportunities to capture gas, improve energy security and grow revenues

Flaring map across Algeria
Showing flares, licence blocks, fields pipelines and power lines



Top gas flaring fields in 2023
BCM, data from World Bank

*Notional annual revenue, $ million**



* At notional price of $5 per MMbtu

Source: Capterio FlareIntel; World Bank.

Figure 4: Left: map shows the location of about 190 flare cluster points resolvable in Algeria in context of the license blocks, field outlines, major gas and oil pipelines, and major power lines. Right: Volume flared in the top 10 fields in Algeria in 2023, according to the World Bank.

The top 10 assets shown in Figure 4 contribute half of the flaring volume. The fields tend to be of two types: (a) those such as Hassi Messaoud and Alrar, which are 100% Sonatrach owned and operated, and (b) those such as Tin Fouye Tabankort (TFT), which have more complex ownership. The TFT field, for example, is divided into an "oil rim" (which has very large flaring of associated gas) and a condensate or gas cap that is owned by the IOC, TotalEnergies, plus Sonatrach. This ownership complexity is an underlying core driver of the economics of flaring solutions, as discussed below.

Hassi R'Mel is an interesting case in point. It is a gas field but also a major gas-aggregating hub, with direct links via pipelines to LNG terminals at Arzew and Skikda, plus the Medgaz and Trans-Mediterranean pipelines for export. With flaring at 0.4-0.5 BCM per year on a base of 50 BCM of production, this represents a 1% loss. In addition, multiple academic studies have highlighted that there is considerable venting of uncombusted methane from Hassi R'Mel, with one of the largest observed releases being 4.5 metric tons of methane per hour (about 5.7 million scf per day) from a compressor station in 2021.[28] Other gas fields, such as Krechba, also have significant gas flaring, at some 0.5 million scf per day of gas.

Given that gas is the primary product from this major gas field, we expect there is a significant opportunity to dramatically reduce emissions with better maintenance programs and improved equipment reliability, with a potential upside of up to $100 million of additional export revenues.[29]

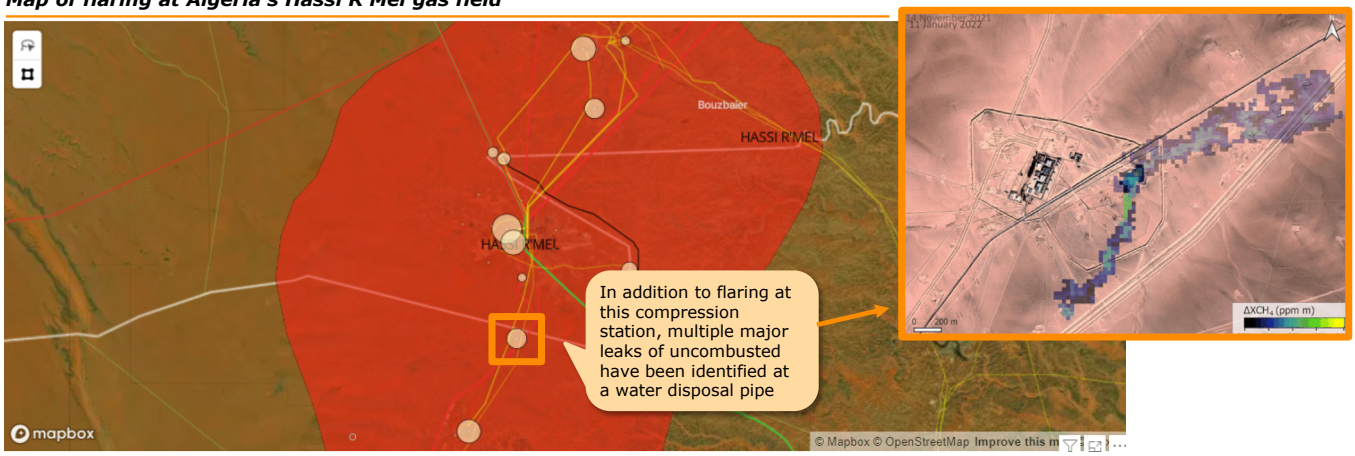
28 Clarke, J. S. (2022). Scientists uncover decades old methane leak in Algerian desert. *Unearthed*. https://unearthed.greenpeace.org/2022/05/30/methane-satellite-algeria-gas-eu.

29 Assuming a very conservative $5 per MMBtu..

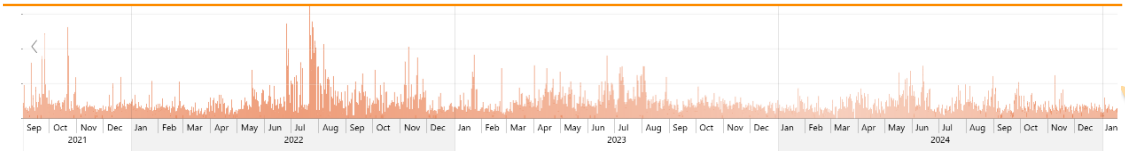
Flaring (plus venting and leaking) also occurs at major gas fields

Map of flaring at Algeria's Hassi R'Mel gas field

Image of methane plumes from Hassi R'Mel



Flaring volumes by day at Hassi R'Mel *(units million scf per day)*



Daily flaring of 0.4-0.5 billion m3 per year, with daily peaks up to 300 million ft3 per day

Source: Capterio FlareIntel; Unearthed.

Figure 5: Flaring at the major gas producer and hub of Hassi R'Mel with data from FlareIntel Pro. In addition to flaring, the location is a hot spot for the release of uncombusted gas from dewatering pipes, among other causes. Images of plumes provided by PRISMA data, operated by ASI, the Italian Space Agency.

Hints of Progress?

Algeria was highlighted by the World Bank and Capterio for showing significant progress on flaring reduction in 2023. The 5% reduction in flaring from 2022 was certainly a positive move. However, since it was also accompanied by a 2.4% reduction in oil and condensate production, the net reduction that could potentially be attributed to a performance improvement is 2.7% (meaning we see a 2.7% reduction in the flaring intensity).[30]

If possible, it is helpful to identify the main drivers of flare reduction, which we group into three main categories, and to identify the change as a result of conscious activity, rather than portfolio mix changes and underlying production changes. The three categories we identify are:

- OPEC-related production cuts
- Operational improvement projects
- Structural flare-capture projects

(a) OPEC-related production cuts

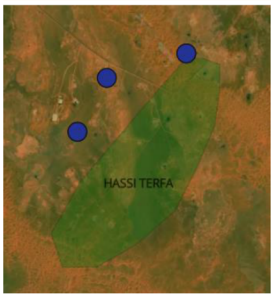
Some of Algeria's flaring reduction is likely a result of OPEC-related production cuts and cessation of production at marginal fields. A dramatic reduction in flaring at the marginal field of Hassi Terfa field (close to Hassi Messaoud) could indeed be explained by such a production shut in.

30 FlareIntel. (2024). *Gas flaring is heading in the wrong direction, but it's not too late to act differently.* https://flareintel.com/insights/gas-flaring-is-heading-in-the-wrong-direction-but-its-not-too-late-to-act-differently.

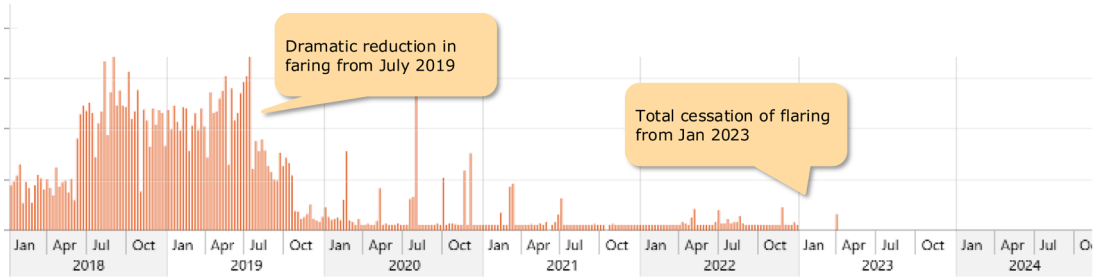
Some fields appear have stopped flaring entirely, potentially due to cessation of production

Hassi Terfa

Location map



Flaring volumes by week *(million scf/week)*



Source: Capterio FlareIntel.

Figure 6: Profiles of weekly flaring at a likely marginal oil field that may have been shut in because of OPEC-related production cuts. This type of flaring reduction may not be structural, since upticks in production may result in a reversion to higher flaring.

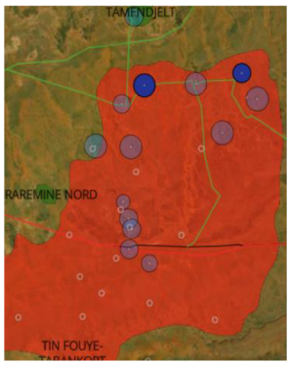
(b) Operational improvements

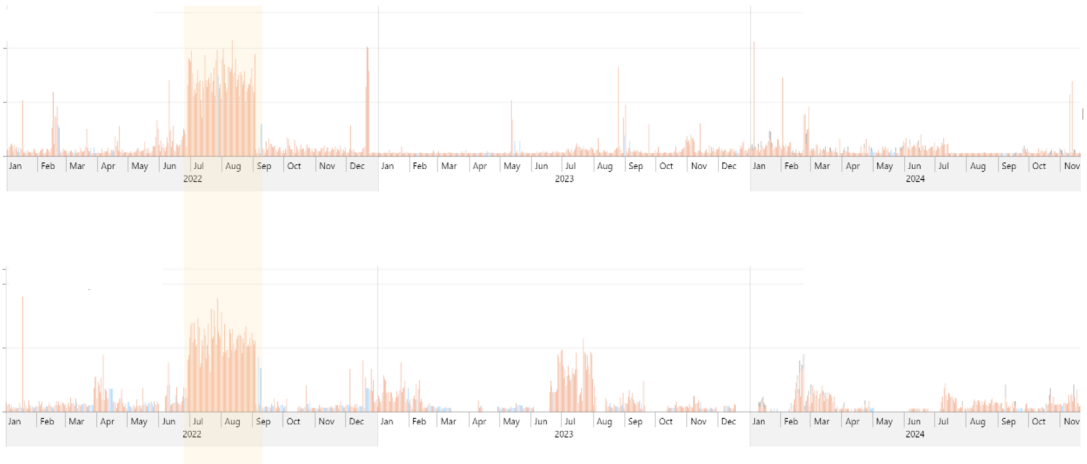
Some of the reduction of flaring can likely be attributed to improvements in operational performance following one-off incidents. Figure 7 below shows flaring at two locations, some 10 km apart, at the TFT field operated by Sonatrach.

The synchronously high flaring in July and August 2022 at these two locations (plus others on the same oil-export pipeline) suggests that some major maintenance of a pipeline and a gas compressor used for enhanced oil recovery was being undertaken, likely leading to lower oil production. After this operational outage, flaring has generally been lower and more stable (upsets are frequent in the eastern location).

Some fields show significant improvements, likely driven by improved equipment reliability

Flaring volumes by day *(million scf/day)*





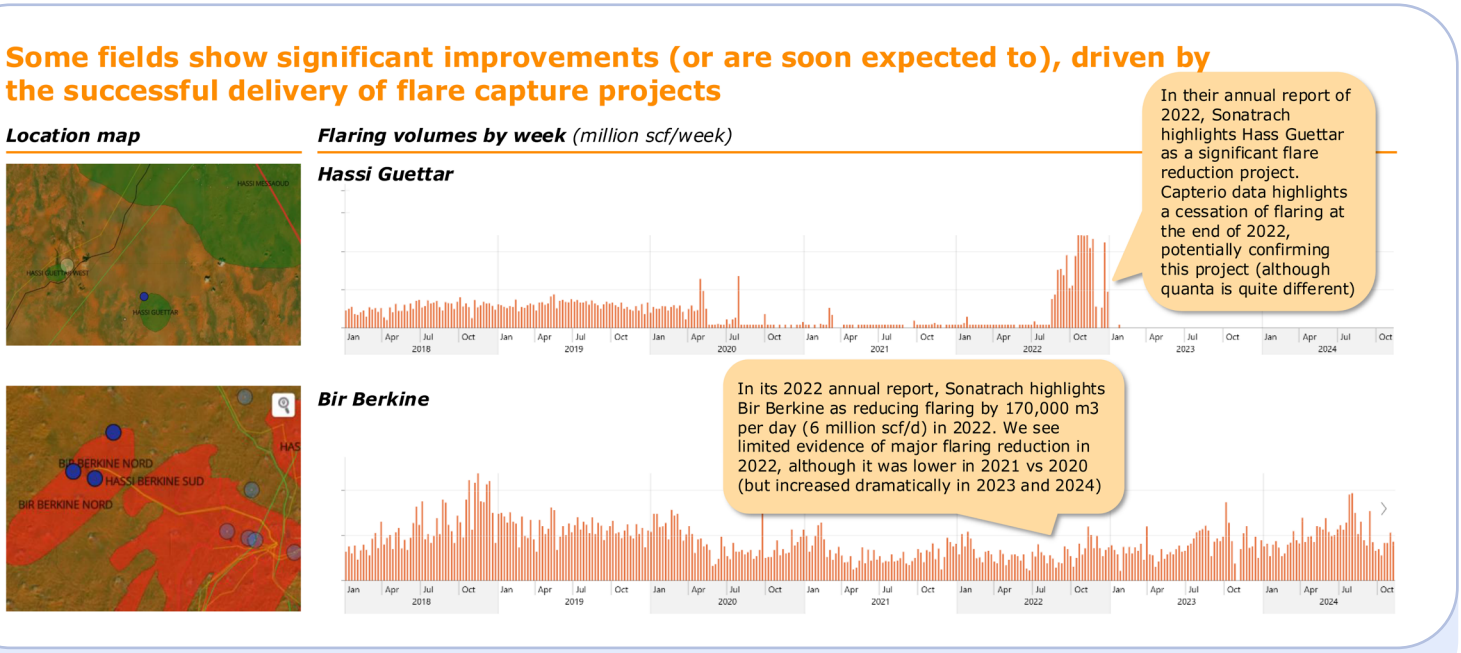
Source: Capterio FlareIntel.

Figure 7: Profiles of daily flaring at the two oil production locations highlighted within the TFT field. TFT is the second-highest flaring field in Algeria. The oil rim is operated by Sonatrach (which owns 100% of the equity), and the gas and condensate cap is operated by TotalEnergies, the lead partner.

(c) Structural flare-capture projects

Documentation from the Ministry of Environment and Renewable Energy shows that Sonatrach has invested heavily in more than 30 projects that have substantially reduced flared gas. Sonatrach highlights (in its 2022 annual report) several successful flare-capture projects, particularly a gas-oil separation project in Hassi Guettar (reported at 3 million m^3 per day, or 100 million scf per day) and a compressor at a central processing facility at Bir Birkine (recovering 0.17 million m^3 of gas, or 6 million scf per day)[5]. In 2023, Sonatrach also committed to reductions in flaring at the Ohanet field (a project planned for 2022–2026), with a $1 billion development that should enable increased production of gas, liquefied petroleum gas, and condensate and includes three new export spur pipelines that connect to the Sonatrach network.[31]

We explore the flaring at these three fields (Hassi Guettar, Birkine, and Ohanet) below using independent daily satellite data from FlareIntel Pro. We can confirm that flaring has stopped at Hassi Guettar, but the rate is dramatically lower, at 3 to 10 million scf per day (which suggests that the Sonatrach documentation may have a typo or units issue). However, flaring at Birkine appears substantially unchanged in the 2020–2022 period and has been higher since (see Figure 8).



Source: Capterio FlareIntel.

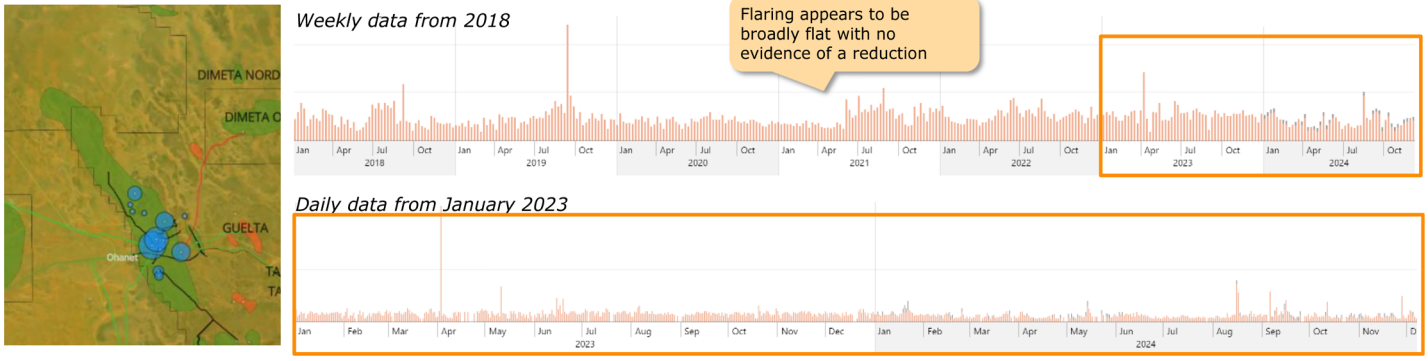
Figure 8: Gas flaring at Hassi Guettar and Berkine, two flare-capture projects identified by Sonatrach. Of these, only Hassi Guettar appears to show substantial flaring reduction (from January 2023). Berkine shows little material change.

Flaring at Ohanet also appears to have changed little. It would therefore be helpful to confirm the progress and effectiveness of these flare-capture projects.

31 Hako, N. (2024). Record-high gas flaring wastes energy much needed in Africa. *ESI Africa*. https://www.esi-africa.com/reports/record-high-gas-flaring-wastes-energy-much-needed-in-africa.

Some fields are yet to evidence their promised flaring reductions

Regional map ***Flaring volumes by week and day at Ohanet***



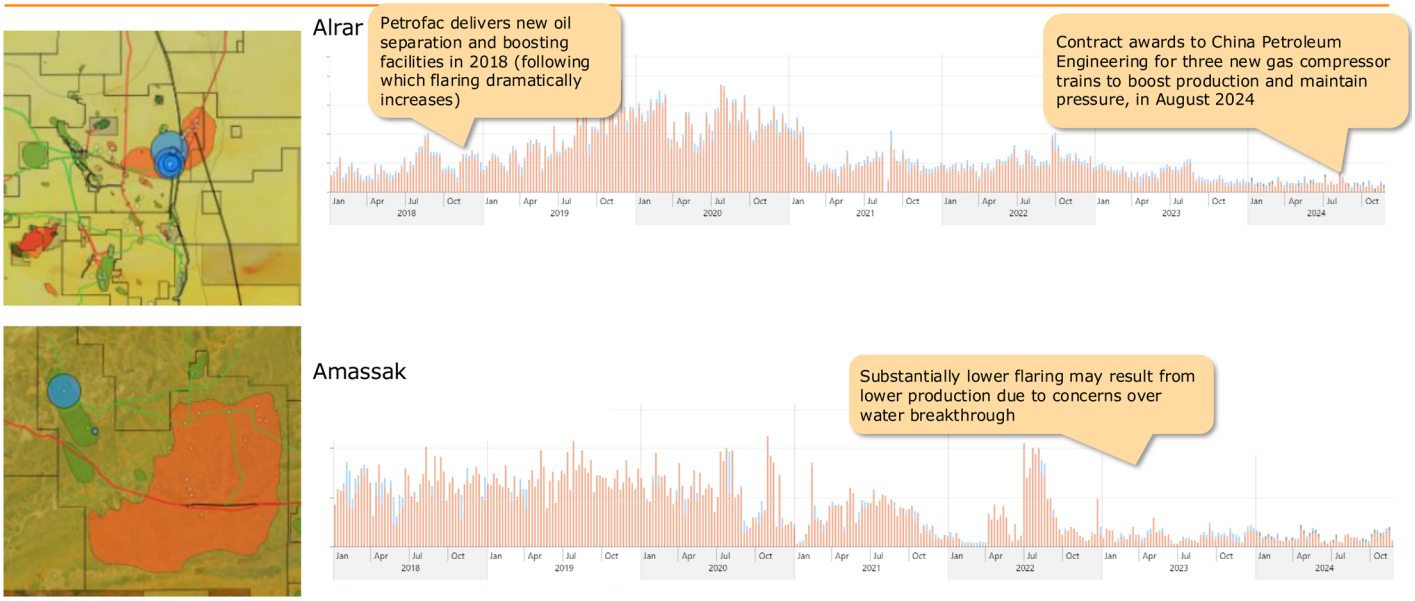
Source: Capterio FlareIntel.

Figure 9: Flaring at Ohanet, a project identified by Sonatrach, appears to show limited flaring reduction. It is not clear how effective these projects have been given that flaring appears broadly unchanged.

Satellite data are also able to identify material flaring reduction in a number of other assets, but it is hard to know whether these are the result of a deliberate flare-reduction activity or lower production due to technical difficulties. Examples from Alrar and Amassak are highlighted in Figure 10.

Satellite data can help to validate the delivery of flare captured projects

Flaring volumes by day *(million scf/day)*



Source: Capterio FlareIntel.

Figure 10: Examples of two interesting flaring profiles. Daily data give insight into the operational performance and may be able to validate progress on flare-reduction projects in these two fields.

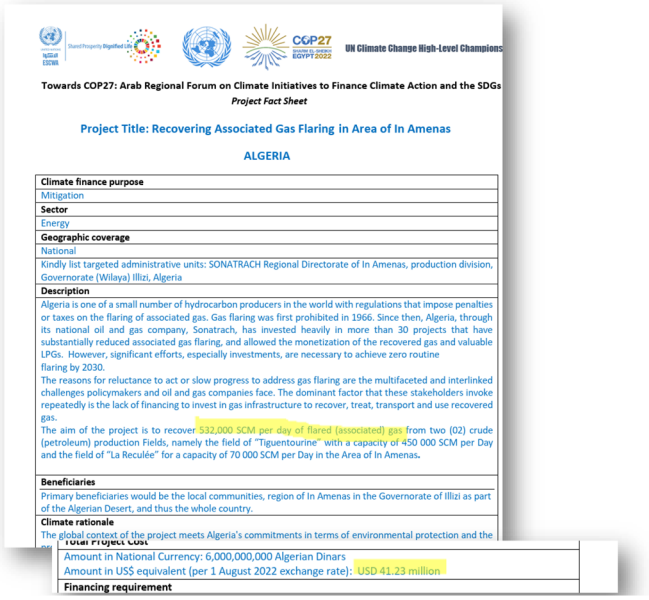
It should be noted that the progress illustrated in these three categories was offset by materially increased flaring in many fields, including Al Agreb, BenKahla, Acheb, Guelta, and El Adeb Larache. Plus, there are many fields with continued high levels of flaring, suggesting that there are many opportunities to drive operational excellence.

Future Opportunities

Looking forward, there are many opportunities to make real progress. We believe there are viable capture projects in Algeria with attractive commercial returns. We identify two substantial opportunities in the Illizi basin in the southeast, which could capture significant volumes of flared gas, create value, improve energy security, and help accelerate the energy transition. Figure 11 shows flare-capture documentation in September 2022 from the Ministry of Environment and Renewable Energy.

Several flare capture opportunities have been identified by the Ministry of the Environment

In Amenas project as of September 2022
First proposed by Capterio in 2018



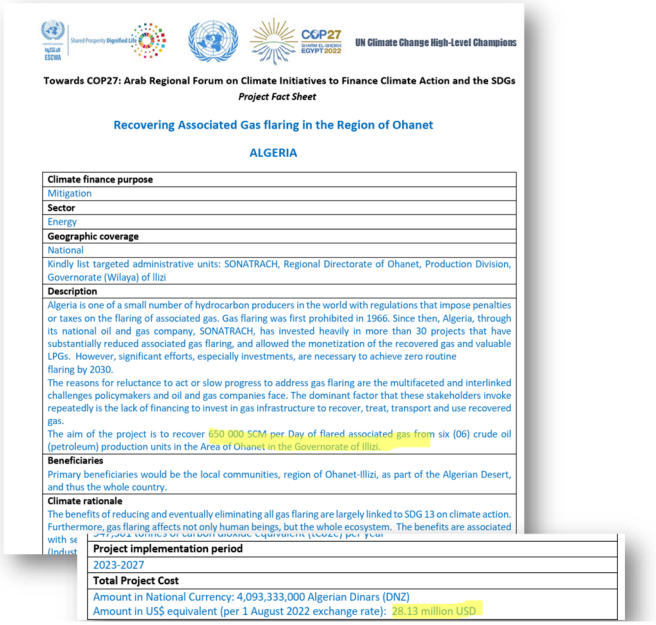
Towards COP27: Arab Regional Forum on Climate Initiatives to Finance Climate Action and the SDGs
Project Fact Sheet

Project Title: Recovering Associated Gas Flaring in Area of In Amenas

ALGERIA

Climate finance purpose
Mitigation
Sector
Energy
Geographic coverage
National
Kindly list targeted administrative units: SONATRACH Regional Directorate of In Amenas, production division, Governorate (Wilaya) Illizi, Algeria
Description
Algeria is one of a small number of hydrocarbon producers in the world with regulations that impose penalties or taxes on the flaring of associated gas. Gas flaring was first prohibited in 1966. Since then, Algeria, through its national oil and gas company, Sonatrach, has invested heavily in more than 30 projects that have substantially reduced associated gas flaring, and allowed the monetization of the recovered gas and valuable LPGs. However, significant efforts, especially investments, are necessary to achieve zero routine flaring by 2030. The reasons for reluctance to act or slow progress to address gas flaring are the multifaceted and interlinked challenges policymakers and oil and gas companies face. The dominant factor that these stakeholders invoke repeatedly is the lack of financing to invest in gas infrastructure to recover, treat, transport and use recovered gas. The aim of the project is to recover 532,000 SCM per day of flared (associated) gas from two (02) crude (petroleum) production Fields, namely the field of "Tiguentourine" with a capacity of 450 000 SCM per Day and the field of "La Reculée" for a capacity of 70 000 SCM per Day in the Area of In Amenas.
Beneficiaries
Primary beneficiaries would be the local communities, region of In Amenas in the Governorate of Illizi as part of the Algerian Desert, and thus the whole country.
Climate rationale
The global context of the project meets Algeria's commitments in terms of environmental protection and the
Amount in National Currency: 6,000,000,000 Algerian Dinars Amount in US$ equivalent (per 1 August 2022 exchange rate): USD 41.23 million
Financing requirement

Ohanet project as of September 2022
First proposed by Capterio in 2018



Towards COP27: Arab Regional Forum on Climate Initiatives to Finance Climate Action and the SDGs
Project Fact Sheet

Recovering Associated Gas flaring in the Region of Ohanet

ALGERIA

Climate finance purpose
Mitigation
Sector
Energy
Geographic coverage
National
Kindly list targeted administrative units: SONATRACH, Regional Directorate of Ohanet, Production Division, Governorate (Wilaya) of Illizi
Description
Algeria is one of a small number of hydrocarbon producers in the world with regulations that impose penalties or taxes on the flaring of associated gas. Gas flaring was first prohibited in 1966. Since then, Algeria, through its national oil and gas company, SONATRACH, has invested heavily in more than 30 projects that have substantially reduced associated gas flaring, and allowed the monetization of the recovered gas and valuable LPGs. However, significant efforts, especially investments, are necessary to achieve zero routine flaring by 2030. The reasons for reluctance to act or slow progress to address gas flaring are the multifaceted and interlinked challenges policymakers and oil and gas companies face. The dominant factor that these stakeholders invoke repeatedly is the lack of financing to invest in gas infrastructure to recover, treat, transport and use recovered gas. The aim of the project is to recover 650 000 SCM per Day of flared associated gas from six (06) crude oil (petroleum) production units in the Area of Ohanet in the Governorate of Illizi.
Beneficiaries
Primary beneficiaries would be the local communities, region of Ohanet-Illizi, as part of the Algerian Desert, and thus the whole country.
Climate rationale
The benefits of reducing and eventually eliminating all gas flaring are largely linked to SDG 13 on climate action. Furthermore, gas flaring affects not only human beings, but the whole ecosystem. The benefits are associated with se
Project implementation period
2023-2027
Total Project Cost
Amount in National Currency: 4,093,333,000 Algerian Dinars (DNZ) Amount in US$ equivalent (per 1 August 2022 exchange rate): 28.13 million USD

Source: Algeria Ministry of Environment and Renewable Energy, September 2022.

Figure 11: Ministry of Environment and Renewable Energy documentation from September 2022, highlighting two major flare-capture projects, their scale, and expected capital investment requirement.

Opportunity #1: In Amenas Flare-Reduction Project

This project was proposed by Capterio in 2019, highlighting a potential to capture 0.4 BCM per year for a capital cost investment of $43 million, delivering IRRs in the 40%+ range on a pre-tax basis. This project involves the capture of 6-9 flares operated by Sonatrach (with no other partners) on the "oil rim" of the Tiguentourine field and process this gas at the existing gas processing facilities with process gas and condensate from the "gas cap" (which not only have spare capacity but also have ready access to a gas pipeline) which are operated by a joint venture including IOCs ENI (previously bp) and Equinor. The proposal was detailed in a technical and commercial evaluation and was presented multiple times in 2019–2022 to equity partners.

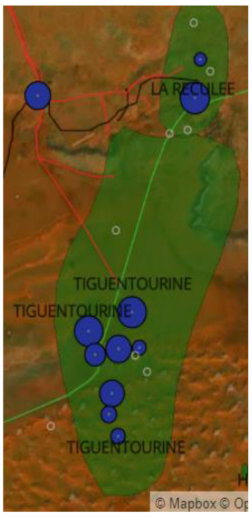
Three years later, an almost identical project was proposed by the Director of Climate Change, Ministry of Environment and Renewable Energy (and is in the public record), by Sonatrach. We estimate that up to 0.5 BCM (somewhat higher than the Ministry's figure, which potentially counts fewer flares) is flared at the Tiguentourine and La Reculée fields.

The Ministry put the total project cost at $41 million[32] and says it saves 0.45 million CO_2-equivalent metric tons of emissions per year. Assuming conservative prices of $4-6 per MMBtu at the well head,[33] we estimate that recovered gas would generate between $70 million and $110 million per year of incremental revenue.

The data below (Figure 12) suggests that the opportunity has not been realized, yet $450 million of revenue could have been captured since 2018.

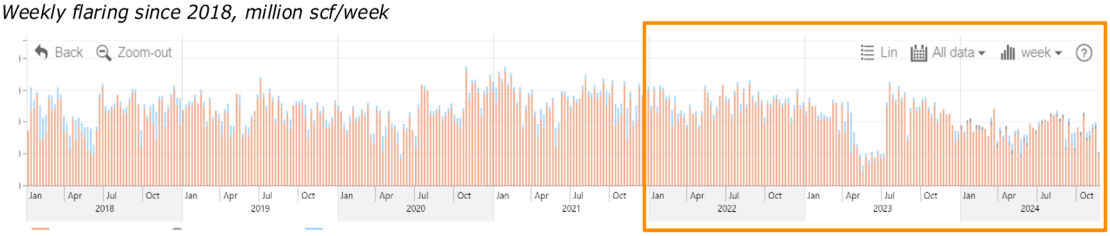
A significant untapped flare capture opportunity is found in the greater In Amenas area

Location map

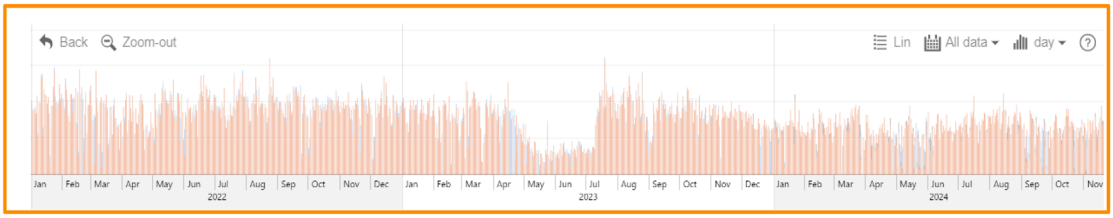


Flaring volumes

Weekly flaring since 2018, million scf/week



Daily flaring since 2022, million scf/day



Source: Capterio FlareIntel.

Figure 12: Outline of the flare-capture opportunity in the In Amenas area, which could capture 0.5 BCM per year of flared gas. This could generate at least $100 million per year in gas sales for capital investment of about $40 million, according to Sonatrach and Capterio.

The key to this project is the full collaboration between two separate commercial entities: the 100% Sonatrach entity and the Groupement venture with Equinor, ENI, and Sonatrach. There are inevitable complexities (for example, the liability of gas-quality problems from the oil-rim flares co-mingled at the central processing facility and affect the ability to export gas). However, the commercial and environmental opportunity is surely substantial enough to find creative solutions. Multiple parties supported the concept in our discussions in 2020–2022, but progress was somewhat hampered by a lack of engagement from some and negotiations over bp's exit.

We believe that there are many similar opportunities available in Algeria. A similar opportunity exists at the TFT field, where Sonatrach owns a 100% interest in the oil rim adjacent to a gas and condensate development operated by an association that includes TotalEnergies and Sonatrach. Opportunities like these could be unlocked through a collaborative and creative approach to opportunity identification, project development, financing, and more, as in the Ohanet area.

Opportunity #2: The Ohanet Area

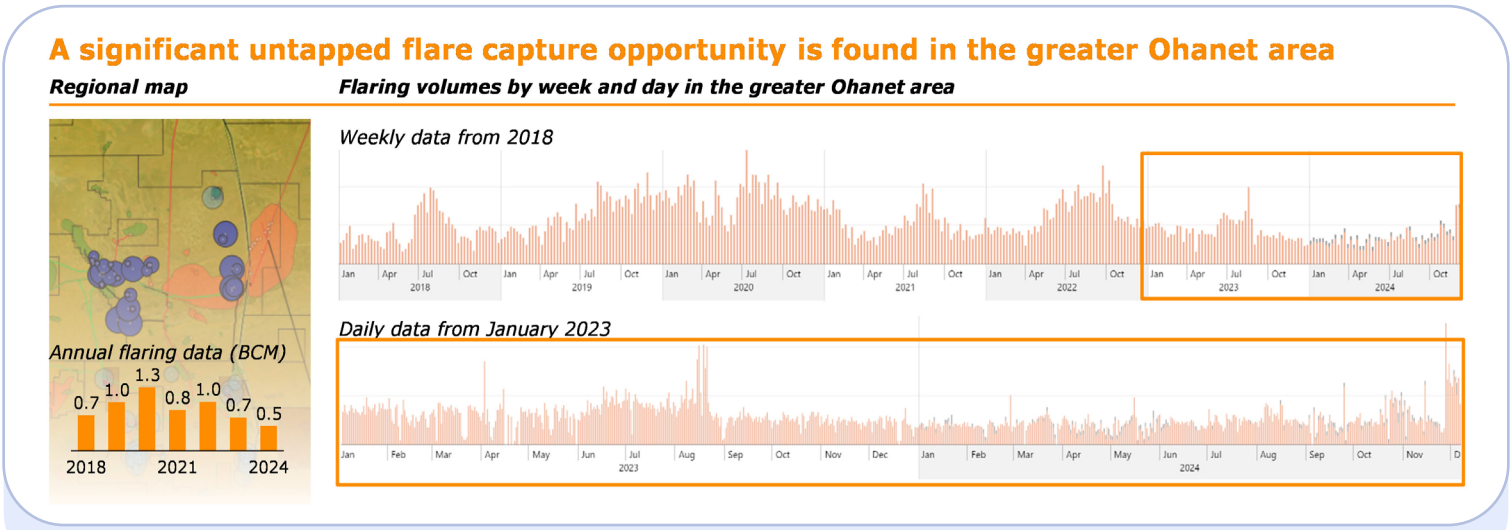
This opportunity, previously proposed by Capterio, was publicly highlighted as an investment opportunity by Algeria's Ministry of Environment and Renewable Energy before COP28. The

32 United Nations Economic and Social Commission for Western Asia. (2022). *Towards COP27: Arab regional forum on climate initiatives to finance climate action and the SDGs.* https://www.unescwa.org/sites/default/files/event/materials/Mitigation_Algeria_Project_Fact_Sheet_Algeria_Gas%20Flaring_In%20Amenas%20%2813Sept22%29_web.pdf.

33 Wood Mackenzie. (2024). *What next for Algeria's burgeoning gas market?* https://www.woodmac.com/reports/upstream-oil-and-gas-what-next-for-algerias-burgeoning-gas-market-150294226.

documentation submitted to the United Nations in 2022[34] highlights that 0.24 BCM of flared gas can be recovered by six production units in the Ohanet area, reducing emissions by 0.55 million metric tons per year for a capital investment of $28 million. Inspection of the latest energy map of Algeria[35] confirms that Ohanet and the adjacent field lie on a major gas pipeline, suggesting that a route to market is viable (assuming there is spare capacity).

Capterio's estimates for flaring, including nearby fields (Acheb, Timedratine and Alrar, see Figure 13), are broadly similar – albeit higher than – those from the Ministry. With the scale of the flaring, the economics are likely to be attractive, given that there is a revenue opportunity of up to $120 million per year[36] and payback within 3 months.[37]



Source: Capterio FlareIntel; World Bank (for annual flaring data).

Figure 13: Overview of the flaring in the Ohanet area, which shows consistent flaring around 0.7 BCM for 2023 (2024 was slightly lower, at 0.5 BCM, but with a major increase from December).

Algeria's Third National Communication indicates that this project was started in 2022 (consistent with Sonatrach's 2022 annual report) and is planned to show impact by 2026, but the daily flaring data suggest that this moment is yet to come.

Both flaring clusters represent exciting investable opportunities that are close to major gas transport (and gas export) infrastructure. These projects alone could generate over $200 million in revenue per year, with pretax paybacks in far less than a year.

34 United Nations Economic and Social Commission for Western Asia. (2022). *Towards COP27: Arab regional forum on climate initiatives to finance climate action and the SDGs.* https://www.unescwa.org/sites/default/files/event/materials/Mitigation_Algeria_Project_Fact_Sheet_Algeria_Gas%20Flaring_In%20Amenas%20%2813Sept22%29_web.pdf.

35 Sonatrach. (2024). *Energy map of Algeria.* National Institute of Cartography and Remote Sensing. https://sonatrach.com/wp-content/uploads/2024/10/ENERGY-MAP-OF-ALGERIA-2024_compressed.pdf.

36 Assuming a notional price of $5 per MMBtu—a reasonable net back, especially given that if this gas is exported, the net realized unit price would likely be significantly higher.

37 This is a slightly crude calculation since it ignores operating costs and taxes, but the project is still highly attractive.

What Needs to Change to Dramatically Reduce Gas Flaring in Algeria?

Based on our extensive on-the-ground discussions with government, regulators, producers, and service companies, we have identified several major change levers. Significant change is a collaborative effort and will require new and broader partnerships.

1: Define a National Integrated Flaring Road Map

We recommend that Algeria creates a national integrated flaring road map. This would sharpen focus and accelerate flare-capture projects, instead of relying on individual assets or operators to propose piecemeal solutions. Key steps in its development would be: (a) using the best credible flaring data available to create a data-led field-by-field inventory of flaring opportunities; (b) conducting detailed technical and commercial due diligence on the most attractive opportunities; (c) executing pilot projects; and (d) rolling out a nationwide program, supported by clear key performance indicators, and a rapid learning cycle based on best-practice sharing.

To support this road map, Algeria could appoint a qualified and dedicated implementation team—working across assets, basins, and companies—to solve technical, organizational, and commercial issues with a big-picture, nation-first approach. This would maximize the use of existing infrastructure and facilitate coordination among asset owners.

The task force should also consider leveraging the best available data, whether through flare meters, on-site sensors, drones, or satellite-based flaring quantification (as provided by the Algerian Space Agency and international groups such as Capterio). This would also address the discrepancies in data reported by Sonatrach and the World Bank. To foster transparency, Algeria could publish flaring data, drawing inspiration from the North Sea Transition Authority in the United Kingdom.

A high-level oversight team, including senior leaders from regulators (ALNAFT and ARH) and the national oil company (Sonatrach), could report at least quarterly to the Minister of Energy and the CEO of Sonatrach.

2: Innovate with New Capital and New Development Capabilities

Solving gas flaring in Algeria requires significant capital investment. However, the country is cash-constrained, and limited capital is typically prioritized for major projects (e.g., Hassi Messaoud oil field) over smaller-scale flare-capture initiatives. Since projects cannot be financed until they are technically and commercially mature, Sonatrach and its partners might explore creative funding mechanisms for the necessary project development work before a final investment decision.

A key solution is to attract companies that bring new capital, ideas, business models, and expertise. If progress is limited by Sonatrach's cash constraints, other sources of capital should be available for opportunities with rapid payback and potentially substantial returns. Specialist flare-capture companies are keen to move as fast as the decision-making infrastructure allows. Sonatrach could take advantage of flexible contractual structures available under the 2019 law to capture returns above those needed to attract investors, allowing it to reinvest in additional flare-capture projects. At the same time, funding or other support could be made available under international initiatives, such as the EU's "You Collect, We Buy" program (which highlights Algeria for one of the first country pilots[38]) or its successor, the "Methane Abatement Partnership Roadmap" announced at COP29, or from multilateral financial institutions as part of their efforts to promote flare reduction.

38 European Commission. "EU Announces €175m Financial Support to Reduce Methane Emissions at COP28," 2023. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6057.

3: Improve the Carrot-and-Stick Incentives

Algeria's law has been clear for decades—flaring is generally prohibited, and financial penalties apply. However, these penalties are rarely enforced. In addition to creating conditions to attract capital and financing, ALNAFT and ARH would be wise to enforce and collect flaring penalties (for operators and equity partners) for three key reasons:

- Enforcing penalties will sharpen the focus on flaring as a source of waste, driving self-interested action to minimize it, as seen in Norway and the United Kingdom.
- These penalties could be allocated to a flare-capture fund, which could be reinvested domestically to finance attractive flare-capture projects.[39]
- Applying penalties may potentially reduce the extraterritorial charges that the EU may impose under the forthcoming EU methane import standard (or other legislation). If Algeria can demonstrate that it enforces penalties internally, it may be exempt from additional EU-imposed costs.

With effective implementation, Algeria could enforce its anti-flaring legislation at no net cost to the industry. In fact, penalties could enhance competitiveness and secure market access in an increasingly competitive landscape.

Authorities could also encourage creative solutions (there are many) to generate more feasible investment opportunities—the carrot approach. This could include field "unitization" among adjacent blocks (see below), as well as mechanisms to pool or cluster midstream and downstream investment projects to generate economies of scale, potentially with the participation of multiple field operators to alleviate the investment burden on Sonatrach. These could benefit from fiscal incentives, such as keeping the infrastructure investments outside the upstream "ring-fence" to ensure they are taxed as ordinary industrial projects rather than being subject to more onerous upstream fiscal terms.

In conclusion, Algeria holds material potential to unlock greater revenues, expand its exports, strengthen energy security, and lead in the global energy transition—all by tackling gas flaring. Encouraging recent initiatives suggest a turning point is near, and with continued momentum, the path ahead looks optimistic.

39 FlareIntel. (2024). *Who regulates the regulators in oil and gas? The win-win that comes from greater global collaboration.* https://flareintel.com/insights/who-regulates-the-regulators-in-oil-and-gas-the-win-win-that-comes-from-greater-global-collaboration.

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