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Is Investment in Compressed Natural Gas Justified in Africa?

BLUF: Some African countries are pursuing compressed natural gas (CNG) for transportation, primarily to reduce imported fuel and improve urban air pollution. CNG-powered vehicles offer some benefits over electric alternatives. But significant challenges — including competing priorities, financing hurdles, long-term gas supply risks, and uncertain emission impacts — caution against large-scale adoption in most cases. Where CNG is playing a role with some success is confined to countries with existing natural gas resources and infrastructure, industries that can integrate niche applications, local-vehicle assembly, and conditions that limit electrified alternatives.

Why this matters: Africa's current vehicle fleet relies on imported fuel and contributes to local air pollution in urban centers. Advocates argue that using the continent's natural gas resources as CNG for transportation can tackle both issues. Countries, notably Egypt, South Africa, Nigeria, Tanzania, and Mozambique have developed initiatives, set targets, and invested in infrastructure. However, the financing challenges facing domestic natural gas projects and the emerging electric vehicle market raise questions about the need for scaled CNG investment. This memo weighs CNG's advantages against its risks and challenges, and highlights the key characteristics shared by countries where it makes the most sense.

Efforts led by governments and the private sector to promote compressed natural gas (CNG) as a transportation solution are growing in African countries like Egypt, South Africa, Nigeria, Tanzania, and Mozambique. CNG, a compressed form of natural gas at standard pressure, can be used for fuel, heat, and power generation. However, transportation has been a primary focus of the push for adoption in Africa for two main reasons:

- **CNG is cleaner than conventional fuels.** The gasoline- and diesel-powered transportation sector worsens air pollution in cities and drives a disproportionate share of Africa's carbon emissions. In contrast, vehicles powered by CNG emit 20–30% less CO_2 emissions, produce fewer nitrogen oxides, and reduce particulate matter at the tailpipe, improving both local air quality and emission.
- **CNG reduces fuel imports and costs.** African countries spent over $95 billion on petroleum imports in 2023. Fuel prices have risen with currency fluctuations and fuel subsidy cuts in Nigeria, Congo, Senegal, Tunisia, and other countries. Many countries, therefore, see CNG produced from domestic gas resources as a way to cut costs, reduce foreign currency outflow, and strengthen economic resilience.

These same factors led low-income countries like Pakistan and Bangladesh to become early adopters of CNG in the early 1990s and 2000s, respectively. However, with the rise of electric

vehicles (EVs), it's fair to question: *Does investment in CNG still make sense for African countries?*

CNG has some potential advantages over electric vehicles…

CNG offers some advantages:

- **More affordable.** Lack of finance keeps motorization low in Africa, highlighting the need for affordable options. Retrofitting a vehicle for CNG, especially with incentives like those available in Egypt and Nigeria, costs $100–$1,000. This is a more viable option than purchasing a new EV, which costs over $20,000.
- **Faster and familiar refueling.** Unlike EVs, which require 1–10 hours of charging and a reliable electricity grid, CNG vehicles refuel in minutes and don't require grid power. Both these factors make adoption easier.
- **Well-suited for heavy-duty vehicles.** The electrification of trucks and buses lags well behind passenger vehicles due to high cost and battery weight challenges. As a lighter fuel with mature technology, CNG is cleaner than diesel(in some scenarios providing up to 51% reduction in CO_2) and cheaper than electrified heavy-duty vehicles.
- **Can help reduce gas flaring.** Extracted gas is flared when it can't be reinjected, transported, or sold profitably. In 2023, natural gas sites in Africa flared approximately 450 billion cubic feet of gas, or 7% of the continent's consumption. CNG can help create a small domestic market for excess gas, reducing flaring and minimizing both environmental damage and economic losses.

But in most cases, CNG's benefits don't outweigh the risks and challenges

While CNG offers a domestic use for their natural gas resources, pollution reduction, and affordability benefits, its role in the near- and long-term is limited due to the following factors:

- **African countries (rightly) prioritize high-value uses over transportation.** Countries favor using their domestic gas for more efficient and strategic end uses like power generation and industry, as seen in Nigeria's fertilizer industry growth and Tanzania's gas-powered electricity expansion.
- **CNG's real competition is newer conventional vehicles.** To curb urban air pollution, countries including Uganda, Kenya, Gabon, Gambia, Cote d'Ivoire, and Ghana have restricted the import of old, used cars. Without an existing CNG market, affordable imports, or other push factors, consumers who have recently switched to newer vehicles may lack the financial capability and the motivation to retrofit or buy new CNG vehicles.
- **Domestic gas projects face financing hurdles.** Gas export markets are lucrative, but domestic projects struggle with unreliable payments and limited support from development agencies. African countries seeking to develop domestic projects are, therefore, left to their own devices with uncertain tools like the African Energy Bank or Chinese banks, which have shown interest in select projects.

- **CNG faces an infrastructure gap.** Most existing and planned natural gas pipelines in Africa are built for export, limiting domestic use cases. While Egypt — and to a lesser extent Nigeria and Tanzania — have refueling stations, other countries will require an increase in infrastructure investment to support a viable CNG market.
- **CNG supply poses long-term risk.** Pakistan's domestic gas supply failed to meet rising demand from its 3 million CNG vehicles in 2013 — a fleet number equivalent to half of Nigeria's or Egypt's current gasoline vehicles fleet. This ultimately led to rationing and imports. Ongoing gas shortages continue to disrupt various sectors in Bangladesh and Pakistan. Similarly, Mozambique's expected gas cliff in 2026 could severely hurt South Africa's industry and cause wider socio-economic consequences in both countries.
- **Emission benefits of natural gas favor electrified vehicles.** While CNG lowers emissions, methane leaks during the extraction and distribution of natural gas can increase greenhouse gas emissions, putting its emission reduction benefits in question. Full supply chain analysis of passenger vehicles suggests natural gas is more effective at cutting emissions when converted to electricity for EVs rather than used directly in CNG vehicles.
- **CNG also depends on a reliable grid, though to a lesser extent than EVs.** Gas compression units can use both gas and electricity, and electric-powered gas compressors are vulnerable to power outages and grid instability — a challenge seen in Texas (2021) and Pakistan (2013).

Figure 1 : Compressed Natural Gas(CNG) initiatives, infrastructure, incentives and cost in Egypt, Nigeria and Tanzania.

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	Egypt	Nigeria	Tanzania
Initiatives & Targets	• Converted more than 103,000 CNG vehicles • Targeting 1.5 million vehicles for conversions, government contracts	• Presidential CNG Initiative, Gas Expansion Program • Targeting 1 million CNG vehicles by 2027	• 5000 commercial CNG vehicles converted • Targeting all government vehicles to run on gas by 2050
Infrastructure	• More than 700 fueling stations , some integrated at petrol stations • Local conversion facilities for public transit	• 35 fueling stations serving 3700 vehicles daily • 7 pilot vehicle conversion centers and growing private sector	• 4 commercial fueling stations in Dar es Salaam, already causing queues • Private filling stations set up by industrial sector
Incentives	• Five-year tax holidays, cash incentives to replace old vehicles	• Free retrofitting for public vehicles, 50% subsidies for ride-share operators • Value-added tax waivers on purchases, value chain duty waivers	
Cost	• Retrofitting cost ranges from $99-150 due to government subsidies	• Retrofitting cost ranges from $61-1100 for tricycle,s passenger cars, and vans	• Retrofitting cost ranges from $700-1000 depending on vehicle type

Why some African countries pursue it

Despite the barriers, regional variability in capital, existing infrastructure, and market ecosystems encourage CNG adoption in countries where:

- **Existing natural gas infrastructure makes CNG integration easier**. Nations like Egypt, South Africa, and Algeria, which already have pipelines, refueling networks, and gas processing facilities, are well-positioned to integrate CNG cost-effectively. CNG vehicles make up 1.4% of Egypt's fleet, and both Nigeria and Egypt have set ambitious targets to grow that number tenfold.
- **Natural gas-reliant industries drive a niche heavy-duty CNG transport market.** Industries using natural gas for power or chemical processes can integrate CNG for specialized uses like industrial trucks and mass transport, especially as diesel prices remain high. Examples like Dangote Cement's CNG-powered trucks in Tanzania, CNG-fueled bus and rapid transport systems in South Africa, and Nigeria's repurposing of flared gas for CNG buses illustrate targeted adoption that can create economic and environmental benefits.
- **Local assembly and retrofitting capability reduce CNG vehicle costs.** Established CNG assembly and conversion programs reduce import dependence, lower costs, and build a self-sustaining CNG mobility ecosystem. Companies like Geyushi Motors in Egypt and Innoson Vehicle Manufacturing in Nigeria produce cheaper CNG vehicles locally.
- **Conditions that disfavor electrified options increase CNG's adoption likelihood.** Nations with natural gas resources but weak grids, like Nigeria and Tanzania, face grid instability, frequent outages, and reliance on costly, emission-intensive diesel backup power. In these conditions, CNG presents a viable alternative to electrified vehicles.

Conclusion

CNG will not be a universal solution for reducing fuel import costs or urban air pollution in African cities. In the near term, widespread adoption is unlikely as transportation competes with higher-priority uses of gas, and pollution reduction may be curbed by restricting older vehicles. Long-term expansion faces major hurdles, including financing constraints, costly infrastructure, gas supply, and competition from electrified transportation. Instead, CNG's role remains hyper-localized to select countries with natural gas resources, infrastructure, industries suited for niche applications, local vehicle assembly for low-cost retrofits, and market conditions that limit electrified alternatives.

Endnotes

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