

Economic Analysis of Algeria's Transition to LPG

Lakehal Elamine^{1*},

¹ Rural economic development laboratory, Tiaret University (Algeria),
elamine@univ-tiaret.dz

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Abstract:

Algeria's commitment to the Paris Agreement on Climate Change (COP 21) has sparked efforts to convert one million automobiles to liquefied petroleum gas (LPG) by 2030 in order to reduce carbon dioxide emissions and improve resilience within the country. Even with significant domestic fuel output, LPG use is still limited. This research looks at the economic effects of Algeria switching from petroleum derivatives to LPG, with an emphasis on economic growth, ecological sustainability, and energy efficiency. Using a descriptive methodology, the study explores how the adoption of LPG affects financial savings, employment creation, emissions reduction, and energy autonomy. The analysis is guided by proposed assumptions on energy autonomy, financial benefits, local economic stimulation, and emissions abatement. The findings indicate that a broad adoption of LPG might result in significant economic and environmental benefits, in line with Algeria's long-term sustainability goals.

Keywords: Public Policy; Liquefied Petroleum Gas ; Clean Energy ; Emissions.

Jel Classification Codes : Q28 ; Q40, Q420

* Corresponding author.

Introduction:

After approving the Paris Agreement on Climate Change (COP 21) in 2015, Algeria's dedication to reducing climate change and guaranteeing sustainable energy practices has assumed a central role. One of its bold plans is to switch one million cars to liquefied petroleum gas (LPG) by 2030 in an effort to reduce emissions that hurt the environment. This action is a reaction to Algeria's high carbon dioxide emissions, a large amount of which are caused by the country's road transportation industry. Algeria is a big producer of fuel, but it imports a significant amount as well, which highlights the need to increase national sustainability and reliance on local resources. Since Algerian refineries are working hard to satisfy the country's fuel needs, the use of LPG is still relatively low when compared to other fuels. This means there is room for LPG to be widely adopted in the transportation sector in order to reduce emissions and improve environmental sustainability.

In keeping with its commitment to cleaner energy, Algeria has established a Clean Energy Program (2015–2030) that lays out a strategic course for addressing environmental issues and guaranteeing the sustainable use of fossil fuel resources. This initiative focuses on the building, transportation, and industrial sectors—three major energy-consuming industries. These industries strive to develop new techniques, increase energy efficiency, and diversify fuel supply structures, particularly through the use of compressed natural gas (CNG) and LPG, in order to achieve significant energy savings and support ancillary health and environmental benefits.

Moreover, the use of LPG in Algerian transportation has been greatly aided by public policy measures. Since LPG was first introduced in 1983, significant efforts have been made to encourage its use despite obstacles including the transportation industry's reliance on petroleum products. These initiatives consist of setting up conversion facilities, growing distribution networks, and putting in place price plans meant to encourage consumption. Furthermore, by means of incentive schemes and simplified regulatory structures, the government's proactive approach has accelerated the growth of LPG-

powered automobiles, thereby supporting Algeria's wider objective of achieving a sustainable energy transition.

This paper seeks to provide a comprehensive economic analysis of Algeria's transition policy from petroleum derivatives to LPG, examining the drivers, challenges, and socioeconomic implications of this transformative endeavor. By delving into policy frameworks, market dynamics, and industry trends, this study aims to offer valuable insights into the economic viability of Algeria's energy transition strategy and its implications for sustainable development

Research Question:

Given the outlined context, the research seeks to answer the following question:

"How does Algeria's transition from petroleum derivatives to Liquefied Petroleum Gas (LPG) impact its economy and contribute to environmental sustainability?"

Hypotheses:

1. The transition from petroleum derivatives to LPG will result in cost savings for both consumers and the government, fostering economic development and reducing reliance on imported fuels.
2. Investments in LPG infrastructure and distribution networks will stimulate job creation and local economic growth, particularly in the energy sector.
3. The promotion of LPG utilization will enhance energy security and reduce the country's vulnerability to fluctuations in global oil markets.

These hypotheses will guide the empirical analysis and assessment of Algeria's transition policy from petroleum derivatives to LPG, shedding light on its economic implications and potential benefits.

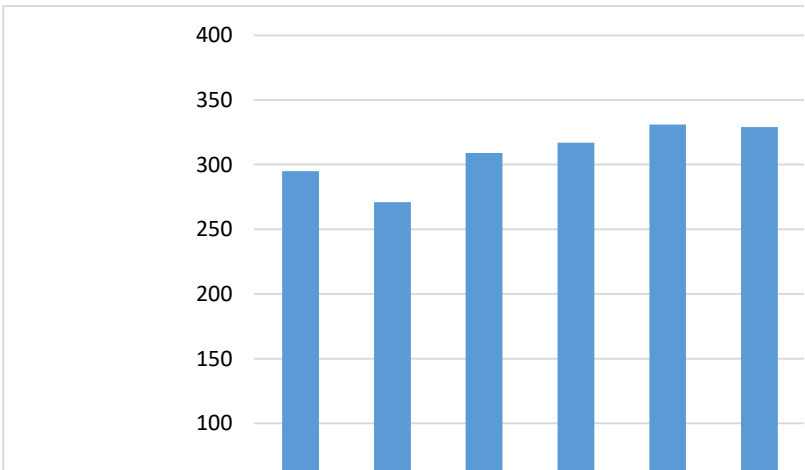
1- The applications of Liquefied Petroleum Gas (LPG) Wordwild

The trends in the global liquefied petroleum gas (LPG) industry can be observed in multiple noteworthy aspects. The primary energy source for LPG production is natural gas, which is produced at a far higher rate than crude oil.

1.1 Global market of LPG

The majority of LPG is extracted from natural gas, with the remainder being produced during crude oil refining processes in refineries. According to United Nations data, 02/05/2024), the volume of natural gas liquids originating from the United States in 2021 reached approximately 151,604 metric tons, the highest globally, exhibiting a 4.2% increase compared to 2020 (WLPGA, 2022). Additionally, it is notable that the highest LPG production from natural gas occurs in North America, significantly contributing to the global share of produced LPG. International data indicates a rise in the volume of North American production of natural gas liquids, reflecting an increased demand for this vital commodity in the global market.

Figure (1): Global market of LPG (million tons)



The source : Prepared by the researcher based on WLPGA reports

According to the table above, it is evident that the global production of liquefied petroleum gas (LPG) has demonstrated a robust and consistent upward trajectory since 2015. As delineated by estimates from the World LPG Association (WLPGA), annual

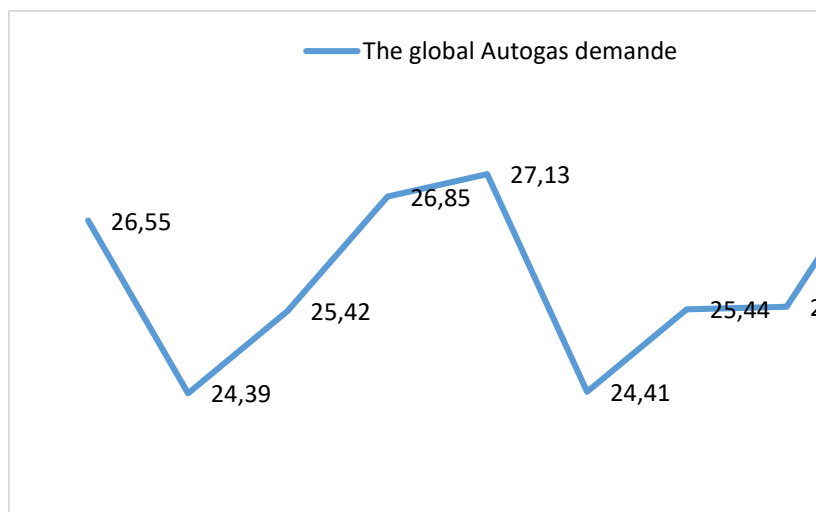
production volumes have surged from 295 million tons in 2015 to subsequent increases of 271, 309, 317, 331, 329, 341, 344, and 350 million tons from 2016 to 2023 respectively. Despite the unprecedented challenges posed by the COVID-19 pandemic, which inflicted significant disruptions across various sectors including fuel production, the LPG industry exhibited remarkable resilience during this period. This resilience is attributed to the critical role of LPG in household activities such as cooking and heating, which consistently constitute a substantial portion of global demand (Nektarios & Konstantinos, 2022, p 245)

, ranging between 44% and 46%. Consequently, the unwavering demand for LPG in domestic applications has served as a stabilizing force, ensuring sustained production levels and mitigating the impact of external disruptions on the industry's performance (WLPGA, 2022).

1.2 Global Autogas market

Autogas, encompassing LPG/Auto LPG, asserts its prominence as the world's third most prevalent transport fuel, concurrently serving as the most accessible alternative within the transportation sector. With a staggering global fleet exceeding 28 million vehicles and an annual consumption surpassing 25 million tonnes of LPG, Autogas solidifies its position as an indispensable energy source. Noteworthy for its minimal particulate emissions, reduced CO₂ output, and diminished NO_x pollutants (<https://www.lpgweek.com/autogas-day-2023> , 20/05/2024), LPG embodies a compelling proposition for environmentally conscious transportation solutions. Furthermore, the economic appeal of driving an LPG vehicle is underscored by its safety, ease of operation, and notably lower costs relative to traditional petrol or diesel models (Bai & Lam. 2019, p 376).

. As the discourse surrounding sustainable energy intensifies, the narrative supporting Autogas gains additional impetus, particularly with the growing utilization of renewable sources in LPG extraction, thus further fortifying its stature as a clean and contemporary transport fuel (Nektarios & Konstantinos, 2022, p 246).

Figure (2): Global Autogas demande (million tons)

The source : (WLPGA/Liquid Gas Europe, 2023)

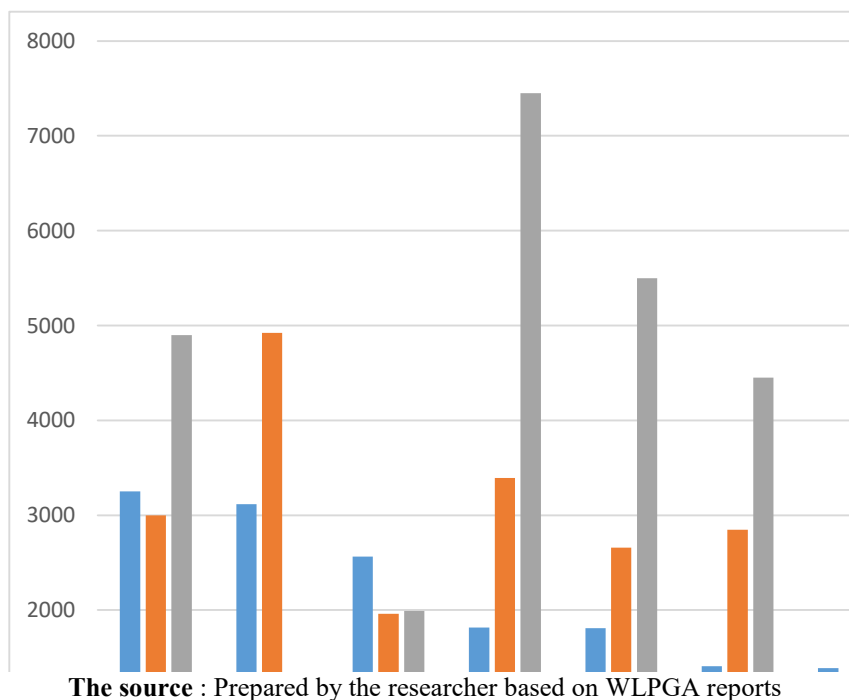
According to the World LPG Association's annual reports spanning from 2015 to 2023, the demand for liquefied petroleum gas (LPG) as a vehicular fuel experienced notable fluctuations throughout the referenced period. Notably, there was a discernible downturn from 2020 through 2022, marked by a 10% reduction in demand in 2020 compared to the preceding year, largely attributed to the pervasive impact of the COVID-19 pandemic. The pandemic-induced lockdown measures adopted by numerous nations precipitated a pronounced contraction in the transportation sector, consequently dampening the need for LPG as a fuel. Nevertheless, the subsequent two years witnessed a marginal amelioration in demand, despite the gradual relaxation of lockdown measures, indicative of a modest recuperation in the public health landscape. The pronounced deceleration in growth can be predominantly ascribed to the Russo-Ukrainian crisis, which disrupted gas supplies due to restrictions imposed on Russian gas. Notably, the demand surged notably in 2023 by an estimated 2 million tons. This resurgence can be attributed to the stabilization of non-Russian gas alternatives and an escalating focus on cleaner fuel alternatives within the transportation domain.

Numerous studies project a sustained demand for liquefied petroleum gas (LPG) in the transportation sector, driven by both the rising preference for vehicles powered by this energy source and the ongoing conversion of vehicles operating on alternative energy sources. Given the anticipated continuity of supportive governmental policies (WLPGA, A GLOBAL ROADMAP FOR AUTOGAS, 2019, P 07), global Autogas consumption is poised for substantial expansion, reaching a zenith surpassing 31 million tonnes by 2030. This projection reflects an approximate 19% escalation from the levels observed in 2023.

1.3 Global Autogas Markets in 2021

The liquefied petroleum gas (LPG) market in the automobile sector is a crucial aspect of the global energy landscape, providing an alternative fuel option for vehicles (Bai & Lam. 2019, p 377).. LPG, primarily composed of propane and butane, offers advantages such as lower emissions and cost-effectiveness compared to traditional gasoline or diesel. It serves as a viable option for vehicle owners looking to reduce their environmental footprint and operating costs. Despite challenges such as limited infrastructure and vehicle availability, the LPG market in the automobile sector continues to grow, driven by increasing awareness of environmental issues and government incentives promoting cleaner fuels. As the world transitions towards sustainable transportation solutions, LPG remains a significant player, offering a practical bridge between conventional and greener fuel technologies.

According to the WORLD LIQUID GAS ASSOCIATION, there are 28.3 million Autogas vehicles in use worldwide, accompanied by over 81,500 refueling sites. These figures have demonstrated consistent growth in recent years, although a slight decline was observed in 2020 due to the global health crisis. In 2021, Autogas comprised 7.6% of the global LPG consumption, with significant variations observed across different countries. For instance, Ukraine boasts the highest share at an impressive 92%, whereas in the United States, it stands at just 0.4%. Consumption data are available for further analysis.

Figure (3): Autogas markets

Based on the gravique above we can see that the data indicates significant disparities in the global liquefied gas market. Russia leads in consumption with 3,250 thousand tonnes, closely followed by Turkey at 3,117 thousand tonnes. Turkey also boasts the highest number of vehicles at 4,923 thousand, along with a substantial number of refueling sites at 10,950. Meanwhile, Korea stands out with a relatively high number of refueling sites (1,992) compared to its consumption (2,563 thousand tonnes) and vehicle count (1,961 thousand). Poland and Ukraine demonstrate a balanced infrastructure with moderate consumption and a considerable number of vehicles and refueling sites. Notably, China and Japan lag behind in both consumption and vehicle adoption, indicating potential growth opportunities with appropriate infrastructure development. Overall, the data underscores regional variations in liquefied gas consumption

and infrastructure, highlighting opportunities for market expansion and development.

2- Algeria's Clean Energy Program: 2015-2030

The Algerian program for clean energies spanning the period from 2015 to 2030 delineates a strategic trajectory aimed at mitigating environmental challenges and ensuring sustainable utilization of finite fossil fuel resources. This commitment was formalized through the initiation of an ambitious renewable energy development program, endorsed by the Government in February 2011. Subsequent revisions in May 2015 underscored Algeria's steadfast commitment, further solidified by its elevation to a matter of national priority in February 2016, as articulated by President Abdelaziz Bouteflika during the Government's Restricted Council deliberations.

Aligned with the strategy delineated by the Ministry of Energy, the program converges on three pivotal sectors known for their significant energy consumption within Algeria.

2.1 The building sector

Efforts in this sector are directed towards the promotion of innovative practices and technologies, notably focusing on thermal insulation for both existing and new constructions. Moreover, the program advocates for the widespread adoption of efficient equipment, including solar water heaters and energy-saving lamps, aimed at enhancing indoor comfort while concurrently curbing energy consumption. The establishment of a local industry catering to insulation materials and efficient equipment assumes paramount importance in bolstering energy efficiency within this domain. The overarching goal of the program is to achieve cumulative energy savings exceeding 30 million tons of oil equivalent (TOE) by 2030. This is delineated as follows: i. Thermal insulation: Anticipated cumulative savings surpassing 7 million TOE. ii. Solar water heaters: Projected energy savings exceeding 2 million TOE. iii. Compact fluorescent lamps (CFLs): Anticipated savings approaching 20 million TOE by 2030. iv. Public lighting: Targeting energy savings nearing 1 million TOE by 2030, with the aim of alleviating energy expenditures for local communities.

2.2 The transportation sector

The program seeks to promote the utilization of readily available and environmentally friendly fuels, particularly liquefied petroleum gas (LPG) and compressed natural gas (CNG). This strategic shift aims to diversify the fuel supply structure while mitigating reliance on diesel, thereby fostering ancillary health and environmental benefits. The envisaged outcome is substantial energy savings exceeding 16 million tons of oil equivalent (TOE) by 2030.

2.3 The industry sector:

Efforts in this sector are directed towards incentivizing industrial enterprises to adopt enhanced energy efficiency measures. Given the anticipated surge in energy consumption accompanying the sector's resurgence, effective energy management assumes paramount importance. The program foresees energy savings exceeding 30 million tons of oil equivalent (TOE) within this sector, underscoring the imperative of sustainable energy practices

3. Public Policy Initiatives for LPG/C Adoption in Algerian Transportation

The transportation sector stands as a cornerstone of the national economy; however, its growth trajectory has been overshadowed by a concerning surge in the utilization of petroleum products. Notably, the reliance of road transport on liquid petroleum products has surged to approximately 94%, starkly contrasting with a mere 6% reliance on LPG/C. Various prospective studies further project a substantial 60% increase in diesel consumption within this sector between 1999 and 2020, driven by escalating demand. Consequently, without sustained efforts to promote gas fuels, a looming escalation in diesel consumption is foreseen.

3.1 The introduction of LPG fuel in Algeria

began in 1983 and was led by NAFTAL. In the years that followed, NAFTAL was instrumental in the construction of more than 400 distribution stations and more than twenty conversion centers. The private sector was included to the conversion activities' purview in 1995. Currently, there are an estimated 120,000 automobiles that have been converted to LPG/C, and there are more than 100

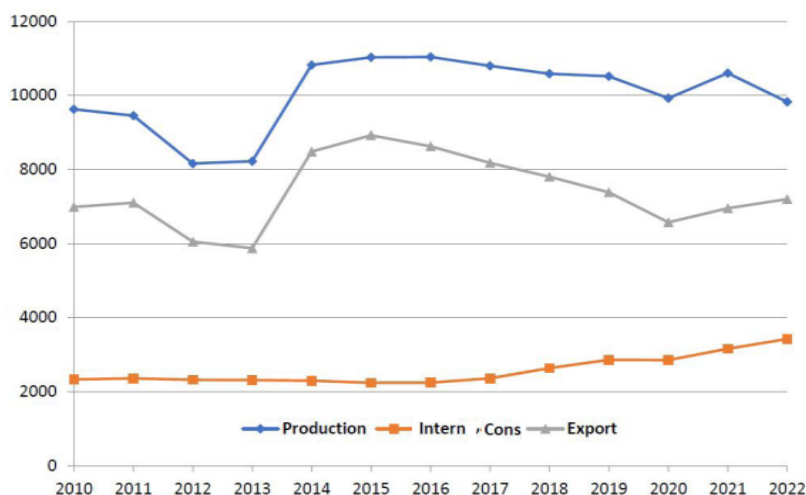
authorized installers spread out over the country. (APURE, 2019, p 03).

In order to encourage usage, the original LPG/C pricing strategy—which was set at 50% of gasoline costs in 1983—was later revised and dropped to 30%. Because of the large annual miles covered, this policy revision has generated great interest in LPG/C, especially among taxi companies. (APURE, 2019, p 03).

Since the station network began to expand in 1998, particularly in cities, LPG use has expanded to include a new customer base. But since its origin, a number of obstacles have prevented this fuel from being widely used. (APURE, 2019, p 03)..

The authorities have decided to take all the required steps to produce this clean fuel in response to these obstacles. This means putting out a comprehensive plan under the auspices of the National Energy Efficiency Program that would provide financial incentives for the conversion of fleet cars and private automobiles owned by businesses and administrations to LPG/C.

Figure (4): Domestic production of LPG/C.



The source : Prepared by the researcher based on ARH data

Because of its preferential taxation, "SIRGHAZ" stands out as the most affordable fuel available today, costing only 9 Algerian Dinars per liter. It also provides an extra financial benefit because, in contrast to conventional fuels, LPG burns cleanly and produces no carbon residue, which lowers vehicle maintenance expenses. It is also free of harmful particles, benzene, and lead. The market for LPG fuel in Algeria offers attractive prospects, bolstered by plentiful resources and the potential economic advantages they provide. Naftal's strategic vision for the long and medium-term development of LPG/C is built upon four pivotal pillars:

1. Supporting the LPG/C logistics chain for effective delivery, including pipeline networks, storage, and transport fleets.
2. Increasing the scope of car conversion projects by remodeling and building conversion centers and providing installer training.
3. Extending the scope of LPG/C sales networks by setting up specialized sales locations at independent stores and petrol stations.
4. Outlining incentive programs to encourage the growth and marketing of this novel product.

3.2 National capabilities in LPG

Exploring the trajectory of national capabilities in LPG production, stemming from diverse stages of hydrocarbon extraction and processing, is essential. Equally crucial is the examination of trends in LPG export volumes and local consumption over the past decade to envision future mobilization potential for enhancing the role of LPG/C as a clean, low-carbon fuel alternative. Graph 9 showcases a relatively stable LPG production trend from 2009 to 2022, oscillating between 8000 and 11000 Ktoe. Undoubtedly, LPG production intricately intertwines with oil and gas activities at production fields and refineries (CEREFE, 2024, p 15). Moreover, it underscores how domestic LPG consumption significantly influences export allocations. This phenomenon becomes pronounced from 2016 onwards, characterized by a surge in local demand for LPG. The spike in domestic consumption, primarily fueled by the expanding fleet of LPG/C-powered vehicles since 2016 due to escalating gasoline prices

at the pump, has reshaped export priorities, with a steadfast focus on catering to local market demands for LPG.

Table (1) : Local market demands for LPG

years	Consumption	Vehicels	Refuelling sites
2015	291	24700	604
2016	352	43000	633
2017	273	60000	676
2018	650	100000	755
2019	936	120000	803
2020	1242	100000	881
2021	1385	100000	1044
2022	1550	120000	1285
2023	1730	730000 (01/01-30/06/2023)	1315

The source : Prepared by the researcher based on ARH data

It is evident from the analysis in Table 1 that Algeria has made a determined effort to significantly accelerate the conversion of vehicles to liquefied petroleum gas (LPG). In the nine years between 2015 and the latest statistics available, the yearly vehicle conversion rate has impressively quadrupled, demonstrating the strong commitment and aggressive actions made by Algerian authorities in this area. The noteworthy increase in conversion rates can be ascribed to a convergence of crucial elements, each of which has a unique impact on the trajectory of LPG acceptance in the nation.

3.3 Pricing and consumer behavior

The evolution of pricing dynamics emerges as a critical determinant shaping consumer behavior and fuel choice preferences. Algeria's strategic revision of fuel prices on three occasions since 2015 has engendered a transformative shift in the cost dynamics of conventional fuels, with gasoline prices soaring by a staggering 100%, escalating from 22.60 DZD per liter in 2015 to 44.62 DZD per liter in 2020. Similarly, diesel prices witnessed a parallel ascent, surging from 17.70 DZD per liter in 2015 to 28.6 DZD per liter in 2020. In stark contrast, the pricing regime governing LPG has remained remarkably stable, maintaining a nominal tariff of 9 DZD per liter. This steadfast pricing framework for LPG, coupled with its affordability vis-à-vis conventional fuels, has rendered it an increasingly attractive and

financially prudent alternative for consumers, particularly amidst the backdrop of escalating fuel costs.

The unwavering support extended by the Algerian government to bolster conversion activities has emerged as a linchpin in catalyzing the proliferation of LPG-fueled vehicles across the nation's vehicular landscape. Introducing a robust policy framework aimed at incentivizing LPG adoption, Algeria has assumed a proactive stance by subsidizing 50% of the conversion costs incurred by vehicle owners. With the conversion cost per vehicle amounting to 70,000 DZD, the public treasury undertakes a significant portion of this financial burden, subsidizing 35,000 DZD per conversion. Importantly, the regulatory landscape governing vehicle conversions in Algeria has been streamlined, with the government simplifying technical standards and prioritizing stringent safety criteria to ensure optimal compliance and adherence to quality benchmarks.

Moreover, the pivotal role played by fuel distribution infrastructure in galvanizing LPG adoption cannot be overstated. Recognizing the inherent interdependence between production, distribution, and consumption facets of the fuel supply chain, Algeria has proactively expanded its network of LPG distribution stations to meet burgeoning demand. Over the specified timeframe, Algeria has witnessed an impressive expansion in the number of LPG fuel stations, surging by over 100% from 604 stations in 2015 to 1,315 stations by 2023. This formidable expansion has been underpinned by a strategic imperative mandating fuel station operators to equip their projects with requisite LPG distribution facilities. Concurrently, Naftal, the state-owned company commanding a substantial market share, has assumed a proactive role in facilitating infrastructure development, ensuring the comprehensive preparation and equipping of all stations lacking LPG infrastructure. This concerted effort underscores Algeria's resolute commitment to fostering a conducive ecosystem for LPG utilization, thereby advancing its broader agenda of sustainable energy transition and environmental stewardship.

Conclusion:

Algeria's LPG market in the automotive sector is expected to grow significantly because of the country's supportive government and tax laws. LPG offers significant economic savings and environmental benefits, lowering emissions and vehicle maintenance costs with a price per liter of just 9 Algerian Dinars. Four major pillars comprise Naftal's strategic vision for LPG development: improving the LPG logistics chain, growing the number of car conversion projects, creating specialized sales networks, and putting incentive plans in place to encourage LPG use.

The annual conversion rate has quadrupled over the previous nine years due to the Algerian government's commitment to subsidizing 50% of the conversion expenses, or 35,000 DZD per vehicle. This has permitted a rapid surge in vehicle conversions. This indicates a resolute dedication to endorsing LPG as a competitive substitute fuel. Export priorities have been rearranged to satisfy local market demands as a result of stable LPG output, which ranged from 8,000 to 11,000 Ktoe between 2009 and 2022, as well as a spike in domestic consumption brought on by increased gasoline costs.

The infrastructure for LPG in Algeria has grown significantly; from 604 gasoline stations in 2015 to 1,315 in 2023, the number of fuel stations more than doubled. This extension facilitates the increasing number of LPG-powered vehicles on the road and guarantees accessible for all. In addition to Naftal's proactive engagement in infrastructure development, the strategic imperative requiring fuel station operators to outfit their projects with LPG distribution facilities highlights the nation's commitment to creating an environment that is favorable to LPG consumption. All things considered, Algeria has demonstrated a strong commitment to environmental stewardship and the sustainable transition of energy through its coordinated efforts to encourage the adoption of LPG through financial incentives, infrastructure development, and regulatory assistance. Algeria is in a good position to lower carbon emissions and improve energy efficiency by pushing LPG use in the transportation sector, which is consistent with its overarching objectives of environmental preservation and sustainable growth.

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