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Without Power, There Is No Country.

Cuba's Electricity Generation Crisis

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Content

Executive Summary

Cuba's electricity crisis has become a binding constraint on economic activity, household welfare, and the state's capacity to deliver basic services. The deficit is no longer episodic. It is chronic, system-wide, and increasingly destabilizing—driven by the deterioration of conventional generation, recurring fuel shortages, and an energy transition that remains too small and too late.

The current electricity shortfall: a long-running crisis

Electricity generation peaked in 2019 and then entered a sustained contraction. During this period, output fell from 21,155 GWh in 2019 to 15,918 GWh in 2025—a decline of roughly 25%. The crisis intensified markedly from mid-2024 onward. Average shortfalls rose from around 570 MW in summer 2024 to 1,317 MW by the fourth quarter of 2024, coinciding with repeated nationwide system collapses. In 2025, daily deficits averaged roughly 1,531 MW, with peaks near 2,054 MW—approaching one-third of effective installed capacity.

The electric power system: proximate and structural causes of the crisis

The deficit reflects both immediate, material constraints and accumulated structural weaknesses. Conventional thermal generation, which provides baseload supply, has steadily degraded due to deferred maintenance, repeated forced outages, and lack of spare parts. Available capacity in large thermal plants fell from 2,548 MW in 2022 to 1,993 MW in 2024—a 22% decline. Distributed generation—diesel and fuel-oil engines—also declined from 2,265 MW to 1,920 MW over the same period.

Fuel scarcity has become pervasive and increasingly decisive. Shortages occur on the vast majority of days, and by summer 2025, fuel constraints were responsible for roughly 42% of disruptions. This vulnerability is reinforced by the generation mix: in 2024, about 76% of electricity production depended on oil-based fuels (more than half imported), while renewables contributed only 3.6%. Technical losses compound the scarcity further, with transmission and distribution losses exceeding 16%—roughly double typical international benchmarks.

The capture of Nicolás Maduro and the new reality facing Venezuelan authorities fundamentally alter Cuba's outlook. Oil shipments are almost certain to be disrupted. Without alternative suppliers, the generation shortfall will widen.

Public policies and the government's response: limits and critiques

Crisis management has relied heavily on rationing and emergency measures, with diminishing returns. Policies to suppress demand were repeatedly tightened, culminating in Decree 110, which mandates that large consumers—both state and private—cover 50% of their daytime demand with renewables within three years, subject to penalties. While conservation and self-generation can reduce daytime load, they do not substitute for firm capacity, grid stability, and reliable fuel supply.

On the supply side, emergency contracting—including floating power plants—provides rapid dispatchable capacity but can deepen dependence on costly, import-intensive solutions. Recent efforts to restore distributed generation and accelerate solar deployment can meaningfully raise daytime output but do not eliminate the binding constraints: baseload shortfalls, storage gaps, and weak transmission and distribution infrastructure.

Investment priorities and project management: domestic drivers

The persistence of the crisis is closely tied to investment allocation and execution failures. Imports of generation equipment surged during the mid-2000s buildout (Revolución Energética) but later declined sharply, especially after 2020. This occurred even as aggregate investment rose above 10% of GDP on average in 2019–2024 and became increasingly concentrated in tourism-related real estate rather than core infrastructure. Project outcomes underscore these weaknesses. Payment arrears and ad hoc debt-service arrangements have complicated relationships with key partners, including generation assets under joint ventures. Several flagship projects have suffered multi-year delays or underperformance, including major wind and biomass initiatives. A prominent thermal-generation expansion credit was not activated due to failure to meet domestic co-financing requirements. This illustrates the central constraint: insufficient and poorly prioritized domestic resources, compounded by weak implementation capacity.

Options to shore up the power sector

Stabilizing supply requires a dual-track approach. In the near term, restoring thermal availability and distributed generation is unavoidable to rebuild firm capacity and reduce the frequency of collapses. This requires addressing maintenance backlogs, securing spare parts, restoring operational discipline, and developing a credible fuel procurement strategy. In parallel, renewables must be scaled rapidly—but in a way that matches system needs: grid upgrades, frequency control, and storage are prerequisites for integrating variable generation without worsening instability.

Demand-side measures can help at the margin, but they cannot carry the system without credible supply recovery. The sequencing matters: stabilizing the grid and securing firm capacity are necessary to ensure that new renewable additions translate into dependable service rather than incremental daytime relief.

An investment package anchored in publicly stated plans and verifiable benchmarks points to a minimum of about USD 6.6 billion (in 2024 dollars) for generation investments to close the supply gap—before accounting for substantial needs in transmission and distribution modernization, storage, and broader rehabilitation. This figure is indicative, but it clarifies the scale: incremental fixes and scattered projects are insufficient relative to the magnitude of capacity degradation and system losses.

The political economy of power: why grid modernization requires economic transformation

Technical recovery depends on institutional and economic conditions that enable sustained investment and operational reliability. Without predictable payment mechanisms, credible contracts, disciplined allocation of foreign exchange, and a viable investment climate, generation assets will continue to deteriorate. Partners will remain reluctant or demand costly risk premiums.

A durable solution therefore requires aligning incentives across state entities, investors, and consumers: expanding the feasible role of non-state actors, restoring creditworthiness, and prioritizing infrastructure as a core development objective rather than an auxiliary sectoral concern.

Washington's late February 2026 decision to ease fuel export restrictions to Cuba's private sector—including possible re-export of Venezuelan oil under license—may alleviate certain shortages but is unlikely to significantly impact national electricity generation, as the private sector does not operate industrial-scale generation facilities.

Introduction

The loss of Venezuelan oil subsidies after U.S. forces ousted Nicolás Maduro on January 3, 2026 has exposed the fragility of Cuba's energy supply and points to severe strain unless other suppliers step in with offsetting support. However, Cuba's power-sector crisis extends well beyond external factors and fuel scarcity. Above all, it reflects the cumulative effect of bad policy choices and management failures. Its causes are rooted in the shortcomings of an economic strategy that, despite clear signals and opportunities in renewables—particularly sugarcane biomass and solar power—reinforced dependence on imported oil and postponed critical investments. [1] The Cuban government prioritized alliances aimed at securing fuel rather than building domestic energy capacity.

State responses centered on managing electricity deficits and emergency measures have deepened the system's structural weaknesses. They have imposed rising social costs while heightening the country's exposure to international price volatility and internal resource limitations. The consequences reach beyond chronic blackouts and economic losses into daily life itself, eroding social trust and tightening constraints on future development. This report analyzes the background, causes, and possible solutions to a problem that represents one of the clearest manifestations of Cuba's multidimensional crisis.

This report is organized into six main sections. Following this introduction, the second sectiondescribes the key manifestations of the crisis and its broad effects. The third section discusses the crisis's proximate and structural causes, followed by an analysis of public policies and recent measures intended to address the problem. The fifth section examines investment trends in the sector and the difficulties encountered in several projects—problems that have reduced electricity generation capacity and created disincentives for attracting capital. The final section sets out the premises for more durable solutions.

[1] Orfilio Pélaez and José de la Osa, "Cuba Está En Transición: De La Oscuridad a La Luz," January 22, 2006, https://www.granma.cu/granmad/2006/01/22/nacional/artic01.html?

The Current Electricity Shortfall as a Long-Running Crisis

Cuba's current electricity generation shortfalls are its most severe in decades. As a result, the country's ability to meet the population's basic energy needs and sustain minimal economic activity has been seriously compromised, turning prolonged blackouts into a daily reality for millions of Cubans.

The most immediate antecedents can be found in the so-called "Energy Revolution," implemented mainly between 2004 and 2006. [2] That program began to take shape in May 2004, after a major breakdown at the Antonio Guiteras thermal power plant affected the National Electric Power System (Sistema Electroenergético Nacional or SEN) and triggered severe disruptions in electricity supply. In response, the Cuban government launched an initiative to transform the SEN into a system with high distributed generation penetration. However, the power mix did not diversify, and dependence on costly, imported fuels—particularly diesel–increased. What was presented at the time as an advance now represents a challenge due to high logistical and operating costs.

An analysis of the 2010–2025 period reveals two distinct phases. Between 2010 and 2019, Cuba saw electricity generation grow, rising from 17,387 GWh to 21,155 GWh in 2019—an increase of 22%. [3] This was a phase of assured external supplies, yet it unfolded without consolidating reforms to stimulate the economy or the investments needed to maintain infrastructure, increase the share of renewables, or reduce external dependence.

Figure 1. Cuba: evolution of the generation deficit (August 2024–October 2025)

Source: *Author's calculations based on data compiled by elToque and on the Unión Eléctrica (UNE) daily press releases. Where data were unavailable, values were estimated using a simple average.*

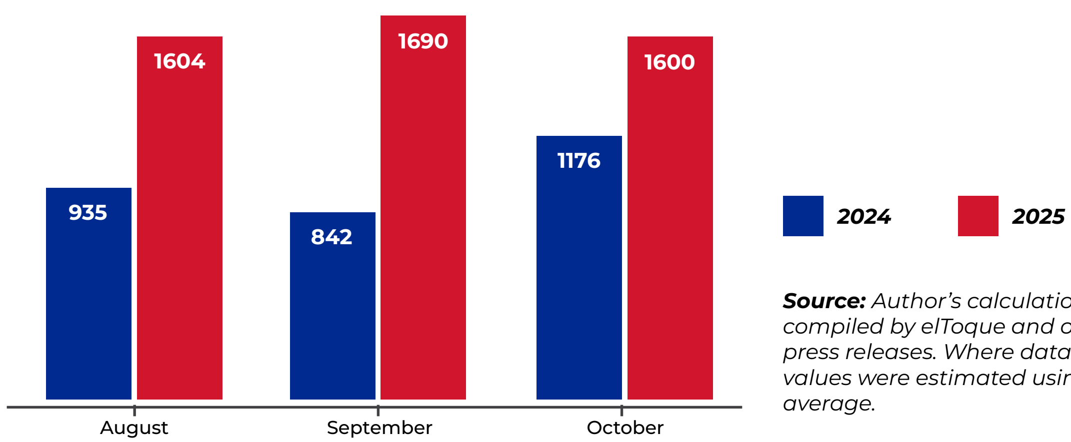
[2] The "Energy Revolution" involved replacing inefficient household appliances, distributing energy-saving light bulbs, decentralizing the power system through diesel and fuel-oil generators, and—at least in principle—promoting energy conservation and renewable sources.

[3] ONEI, Anuario Estadístico de Cuba 2024 (Oficina Nacional de Estadística e Información, 2025). The number includes electricity imports from floating power plants

Starting in 2020, total generation entered a pronounced decline, falling to 15,918 GWh in 2025—a 25% drop from the 2019 peak. [4] The crisis is particularly concentrated in thermal power plants, which are the backbone of the SEN. These facilities experienced a sharp 22% reduction in available installed capacity, falling from 2,548 MW in 2022 to 1,993 MW in 2024. Meanwhile, distributed generation units declined by 15%, dropping from 2,265 MW to 1,920 MW over the same period. This combined loss of 900 MW—roughly 17% of total generation capacity—underscores the accelerated deterioration of the infrastructure. [5]

In the summer of 2024, the generation deficit averaged 570 MW. [6] By the final quarter of that year, three nationwide system collapses occurred, and the shortfall escalated to 1,317 MW. Figure 1 shows the worsening trajectory of the deficit throughout 2025, including two additional nationwide SEN collapses (in March and September). Between January and October 23, 2025, the country experienced daily outages averaging 1,531 MW, with peaks reaching 2,054 MW. These figures represent roughly 29% of the country's total generation capacity, highlighting the depth of the structural crisis. [7] According to the same data, in 2025 the national power utility served only about half of electricity demand during the evening peak. [8]

Figure 2. Year-on-year deterioration in electricity availability
(average monthly deficit, MW)



Source: *Author's calculations based on data compiled by elToque and on the UNE daily press releases. Where data were unavailable, values were estimated using a simple average.*

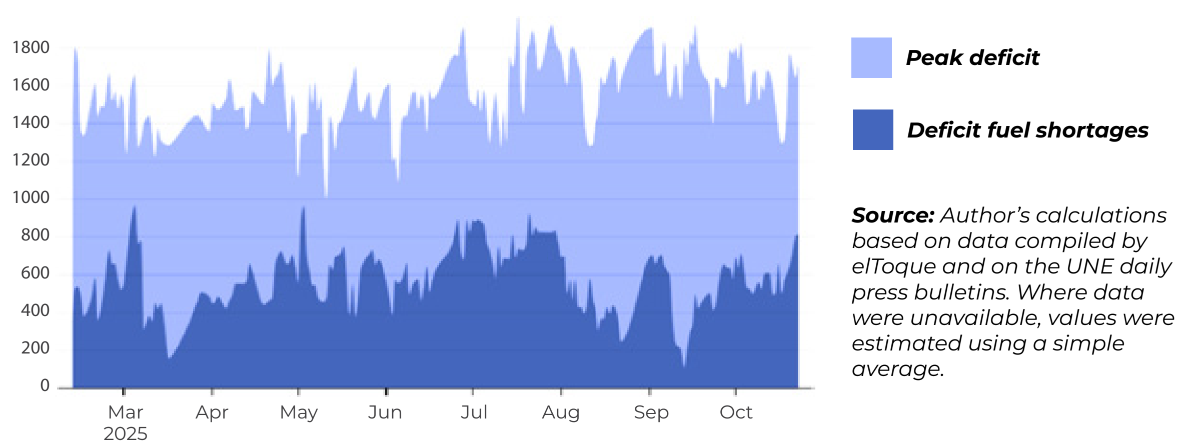
[4] ONEI, Anuario Estadístico de Cuba 2024 (Oficina Nacional de Estadística e Información, 2025); Cubadebate, "Cuba proyecta un crecimiento del 1% del PIB para 2026," Economía, Cubadebate, December 18, 2025, http://www.cubadebate.cu/noticias/2025/12/18/cuba-proyecta-un-crecimiento-del-1-del-pib-para-2026/.
[5] ONEI, Anuario Estadístico de Cuba 2024.
[6] Centro de Estudios de la Economía Cubana, Reporte Sobre Economía Cubana Julio-Diciembre 2024 (2025).
[7] Based on Jorge Piñón's estimates of installed capacity in 2024 (5,345 MW), a figure not reported in that year's statistical yearbook. This refers to nominal installed capacity, which differs from operational availability due to the accelerated deterioration of the infrastructure. For example, on December 2, 325 MW were out of service due to breakdowns, and 373 MW were offline for maintenance. UNE, "Estado del Sistema Eléctrico Nacional," Unión Eléctrica, December 3, 2025, https://www.unionelectrica.cu/nota-informativa/.
[8] AFP, "Cuba apenas satisface la mitad de sus necesidades de electricidad," Yahoo Finance, January 19, 2026, https://es-us.finanzas.yahoo.com/noticias/cuba-satisface-mitad-necesidades-electricidad-094651304.html.

As shown in Figure 2, comparing the same months in 2024 and 2025 reveals a 70% year-on-year increase in the deficit on average, a gap that cannot be attributed to seasonality. In fact, numerous solar parks had been installed by the selected months in 2025: 26 by the end of August, 31 by September, and 32 by October. This gap implies that, even under the best operational scenario, Cuba's power system is stretched to its limits.

The situation is compounded by the fact that electricity demand, far from declining, has grown due to the population's basic needs and the requirements of economic activity. Contributing factors include the importation of large quantities of air-conditioning equipment and other appliances, the dynamism of the private sector, [9] demand spikes following service restoration, and a higher share of electricity used for cooking given shortages of other fuels for household use.

Meanwhile, fuel scarcity has become an increasingly central cause of power shortages. The data show that on 90.6% of the days analyzed, problems related to lack of fuel were reported. While this was a marginal factor in the first months of the year, by summer it accounted for 41.7% of all disruptions (Figure 3). A defining feature of Cuba's power mix is its dependence on imported primary inputs, which account for more than half of total needs. In 2024, 76.2% of the country's electricity generation depended directly on oil, more than half of which was imported. This exposure leaves the system critically vulnerable to any disruption in international supply chains. The situation was further aggravated by the reduction in oil shipments from Venezuela through 2025, Cuba's main supplier for more than two decades.

Figure 3. Cuba: fuel scarcity and the generation deficit
(February–October 2025, daily MW)



Source: *Author's calculations based on data compiled by elToque and on the UNE daily press bulletins. Where data were unavailable, values were estimated using a simple average.*

[9] Although this runs counter to widespread perceptions, the private sector accounts for only 3.9% of total electricity consumption.ONEI, Anuario Estadístico de Cuba 2024.

Beyond the numbers, Cuba's electricity crisis is a human drama, affecting every sphere of the country's social and economic life. Prolonged outages have transformed the daily routine of millions of people, forcing them to reorganize their activities around electricity availability schedules. The most vulnerable groups–including older adults, children, and individuals with medical conditions requiring electrical equipment—face additional risks. The most severe impacts are concentrated among roughly half of customers served by the so-called load-shedding circuits. This group has endured average outages of 19 hours or more during 2025. Social media has documented episodes exceeding a full day, and in a growing number of cases, more than 30 hours.

The economic impact is equally severe: small businesses that rely on refrigeration lose inventory, labor productivity declines, and adaptation costs—such as generators, batteries, and alternative fuels—impose an unsustainable financial burden on many families and entrepreneurs. The state sector is also significantly affected. Since at least 2016, consumption-rationing measures have been introduced in both services and production. For example, work shifts for large consumers are designed to avoid peak-demand hours, or production processes are halted altogether. In agriculture, the use of irrigation equipment has been reduced. Authorities also attribute up to half of the problems in water distribution to blackouts. Additionally, the poor condition of distribution networks causes abrupt voltage fluctuations that damage household and commercial devices.

Blackouts have also become a source of social and political tension. Residential outages—which disrupt basic services such as refrigeration, lighting, and communications—have significantly reduced the population's quality of life and triggered public expressions of discontent. [11] ***The government's inability to ensure a reliable electricity supply erodes institutional legitimacy and complicates the implementation of long-term economic policies.*** The tourism sector, vital to the Cuban economy, is also undermined by the international perception of instability in basic services. Even when some hotels have their own power generation, the lack of electricity in surrounding areas negatively affects the experience of the already limited number of visitors.

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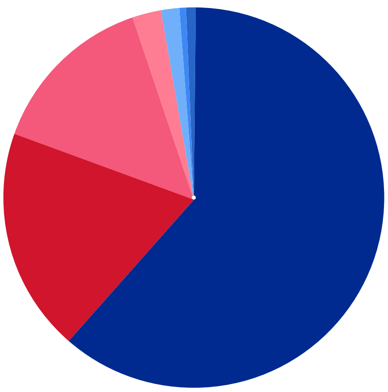
[10] Author's calculations based on data compiled by elToque and on the UNE daily press releases.

[11] Between December 1 and 12, Cuba's daily electricity generation shortfall increased sharply compared with previous weeks, marking a severe escalation of a situation that was already unsustainable. During the worst days, the unserved load was consistently above 2,000 MW—about 65% of peak demand. As a result, the duration of blackouts surged, particularly in Havana, which had previously experienced somewhat more favorable conditions than the rest of the country. The situation escalated to such extremes that, on the night of December 8, protests were reported in several areas of the capital and in other parts of the country.

Proximate and Structural Causes of the Power System Crisis

With only modest variations over the last five years, the structure and core characteristics of Cuba's electric power system have remained relatively stable. The power mix depends heavily on conventional thermal generation. In 2024, the bulk of domestically generated electricity [12] (11,520 GWh) came from public-utility companies using fossil fuels, especially thermal power plants (8,836 GWh) and gas turbines (2,684 GWh). The contribution from renewable sources—wind, solar PV, and others—was marginal, totaling only 391 GWh (Figure 4).

Figure 4. Cuba: structure of electricity generation by source, 2024
(percentages; excludes electricity imports)



Source: *Author's calculations based on the Cuba's Statistical Yearbook.* [13]

Total installed capacity in Cuba's National Electric Power System in 2024 was 5,345 MW. The composition confirms the dominance of thermal technologies, with conventional thermal power plants representing the main component (1,993 MW). Another large segment (1,920 MW) corresponds to distributed generation based on fuel oil and diesel, including emergency generator sets. Installed capacity in renewables—hydropower, wind, solar—was very low, just 338 MW, highlighting a delayed energy transition.

At the same time, there has been an internal shift within thermal generation. While capacity and output from conventional thermal power plants have declined, dependence on gas turbines, generator sets, and electricity imports (3,647 GWh in 2024), which is a costly solution, has increased. Another critical trend is the collapse of sugar-industry generation, which fell from 547 GWh in 2020 to just 85 GWh in 2024, nearly eliminating this renewable source. [14]

[12] Excluding electricity imports, what the Cuban government refers to as "mobile generation," supplied by floating power plants operated by a Turkish company.
[13] ONEI, Anuario Estadístico de Cuba 2024.
[14] In practice, the sugar industry's net electricity contribution is negligible, due to shortages of feedstock and the obsolete technologies in use (except for the Ciro Redondo bioelectric plant). Between 2003 and 2017, total net deliveries amounted to 391 GWh, equivalent to 2.7% of total generation in 2024. "Bioenergía, otra alternativa en el cambio sostenible de la matriz energética cubana - Cubadebate," Ciencia y Tecnología, Cubadebate - Cubadebate, Por la Verdad y las Ideas, April 1, 2021, http://www.cubadebate.cu/especiales/2021/04/01/bioenergia-otra-alternativa-en-el-cambio-sostenible-de-la-matriz-energetica-cubana/.

Generation infrastructure is in critical condition, with most plants operating equipment more than 30 years old. This technological obsolescence has translated into a systematic reduction in effective generating capacity. In 2024 and 2025, only about 70% of capacity in thermal power plants has been operational. [15] Other indicators also point to serious deficiencies. Transmission and distribution losses exceed 16% of total generation, [16] nearly double international efficiency benchmarks of around 10%. [17] To put that figure in perspective, those losses are equivalent to the combined generation of Energás [18] and all renewable sources in 2024.

The deterioration of large thermal plants is also linked to the continuous use of Cuban crude. Oil produced in Cuba is heavy, with a high sulfur content. [19] That reality, combined with insufficient resources devoted to mitigating its negative effects on equipment, has increased maintenance needs, led to unplanned outages, and reduced infrastructure reliability. While the decision can be justified in terms of using a domestic resource, over the long run it has produced adverse consequences for the plants.

In addition, the decline in domestic oil production and the reduction in imports from Venezuela (prior to January 3, 2026) increased the need to import fossil fuels at international market prices, placing significant pressure on the country's foreign-exchange reserves. Since 2003, crude output has fallen by 40%. [20] In 2024 alone, volumes declined by 138,000 tons compared to the previous year. [21] For 2024, estimates suggest that Cuba imports nearly 60% of its total energy supply. [22] In electricity generation, domestic sources meet only slightly more than half of national needs. [23]

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[15] Unpublished estimates by energy expert Jorge Piñón.
[16] ONEI, Anuario Estadístico de Cuba 2024.
[17] Ariel Yépez-García and Raul Alberto Jimenez Mori, "Economics of Electricity Losses in Latin America and the Caribbean," IDB Publications, ahead of print, Inter-American Development Bank, May 17, 2024, Latin America and the Caribbean, https://doi.org/10.18235/0012971.
[18] A Cuban–Canadian joint venture engaged in electricity generation using associated petroleum gas. It has an installed capacity of approximately 580 MW.
[19] According to specialized sources, most of the oil produced (Varadero, Puerto Escondido, Boca de Jaruco) is classified as heavy crude with a high sulfur content (9–15° API, 5–9% sulfur).Christopher Schenk, "Jurassic-Cretaceous Composite Total Petroleum System and Geologic Assessment of Oil and Gas Resources of the North Cuba Basin, Cuba," in Data Series, nos. 69–M (Geological Survey (U.S.), 2008), https://doi.org/10.3133/ds69M.
[20] ONEI, Anuario Estadístico de Cuba (Oficina Nacional de Estadística e Información, several years).
[21] S. W. I. swissinfo.ch, "Cuba produce actualmente solo una tercera parte del crudo que consume, según el Gobierno," SWI swissinfo.ch, March 24, 2025, https://www.swissinfo.ch/spa/cuba-produce-actualmente-solo-una-tercera-parte-del-crudo-que-consume,-según-el-gobierno/89058557. According to information CUPET published on social media, the 13-year decline in oil production was halted in 2025, and crude output exceeded 2024 levels by 80,000 tonnes. Natural gas production also increased to 1.13 billion cubic meters, the highest level in nine years.
[22] OLACDE, PANORAMA ENERGÉTICO DE AMÉRICA LATINA Y EL CARIBE 2025 (Organización Latinoamericana y Caribeña de Energía, n.d.), https://www.olade.org/wp-content/uploads/2025/12/PANORAMA_ENERGETICO_DE_ALC_2025.pdf
[23] Radio Angulo, "Cuba Moves towards Change in the Energy Matrix," Radio Angulo, March 26, 2025, https://www.radioangulo.cu/en/2025/03/26/cuba-moves-towards-change-in-the-energy-matrix/

In recent years, through the end of 2025, Venezuelan oil shipments to Cuba became increasingly irregular and smaller in volume. In 2024 they fell sharply (–44% year-on-year through November), partly due to refinery outages in Venezuela. Average flows were 27,000 b/d through June 2024, compared with 51,500 b/d a year earlier. [24] In 2025 they reached a low point mid-year (8,000 b/d in June) and then rebounded to 31,000 b/d in July (crude and refined products), but remained below 2023 levels. The capture of Nicolás Maduro and the new reality facing Venezuela's authorities fundamentally alter Cuba's outlook. Oil shipments are almost certain to be disrupted, if not discontinued altogether. Without alternative suppliers, the generation shortfall will widen.

Cuba's economy—characterized by low domestic value added and limited export capacity—generates little foreign exchange, constraining its ability to import fuel, spare parts, and technology needed by the energy sector. The weakening of other external income sources, such as tourism and remittances, [25] has further exacerbated this shortfall.

Cuba has also lagged behind in integrating renewable sources, representing a missed opportunity in the context of the current crisis. ***Despite substantial solar, wind, and biomass potential, renewables accounted for less than 3% of total generation in 2024.*** [26] This contrasts sharply with global trends toward energy transition and underscores the lack of strategic investment in technologies that could reduce dependence on fossil fuels and strengthen system resilience.

The effects on an already weakened economy marked by severe supply deficits have been devastating. A range of studies finds that blackouts can lead to losses of about 2% of annual GDP, [27, 28] potentially more depending on the severity of disruptions. These impacts include direct losses from interrupted production processes; damage to equipment and machinery due to unplanned outages and voltage fluctuations; investment in backup

[24] Orinoco Tribune 2, "Venezuelan Oil Supply to Cuba Jumps in July, According to News Agencies," Central America and the Caribbean (+Mexico), Orinoco Tribune - News and Opinion Pieces about Venezuela and Beyond, August 12, 2025, https://orinocotribune.com/venezuelan-oil-supply-to-cuba-jumps-in-july-according-to-news-agencies/.

[25] There are multiple estimates of remittance flows, none of them official and all based on scattered information. They nevertheless converge on a marked contraction in recent years, driven by a combination of factors that include U.S. restrictions, a shift toward online purchases of goods delivered directly in Cuba, and the prioritization of financing migration to a range of destinations.

[26] ONEI, Anuario Estadístico de Cuba 2024.

[27] Matthew A. Cole et al., "Power Outages and Firm Performance in Sub-Saharan Africa," Journal of Development Economics 134 (September 2018): 150–59, https://doi.org/10.1016/j.jdeveco.2018.05.003.

[28] Other authors estimate the impact on Cuba at between USD 24 million and USD 120 million per day when the shortfall reaches 1,500 MW and persists for eight hours, and at roughly 6–14% of GDP. See Armando Camacho, "EL IMPACTO DEL SHOCK ENERGÉTICO SOBRE LAS EMPRESAS ESTATALES Y LA PRODUCCIÓN. (Modelo Cobb-Douglas & VoLL)," ASCE's 35th Annual Meeting, Miami, October 24, 2025; Juan Belt, "The Cuban Power Sector: The Achilles Heel of the Economy," ASCE's 35th Annual Meeting, Miami, October 24, 2025.

self-generation (conventional or renewable); reduced labor productivity due to knock-on effects associated with inadequate cooling, poor lighting, and fatigue from irregular rest; and lower incentives for investment—both domestic and foreign—stemming from reduced returns to capital linked to the channels described above. In other words, the repercussions are not only static; they also accumulate over time.

In sum, insufficient electricity supply acts as a negative multiplier that compounds the country's structural economic difficulties. The literature highlights a "vicious circle": blackouts reduce production, which hurts exports and fiscal revenues, leading to less foreign exchange available to import fuel and spare parts and to carry out maintenance—thereby reinforcing the energy crisis as both a driver and an outcome of the wider economic distress. Cuba is trapped in this cycle. International tourism is a clear example. Even though investment in hotels has increased, these assets become unproductive if they cannot provide basic, reliable service. Global perceptions of Cuba as a destination plagued by prolonged blackouts are deeply damaging for the industry.

Public Policy and Government Response

Recent developments in the Cuban government's power-sector policy show a sequence of successive adjustments that combine long-term objectives with emergency responses. A key regulatory starting point is 2014, when the renewable energy and energy efficiency policy was adopted with a 2030 horizon to reduce dependence on fossil fuels and increase the share of renewable sources such as solar, wind, and sugarcane biomass. This strategic orientation has coexisted from the outset with financial and technological constraints that have conditioned its implementation.

Beginning in 2016, tightening availability of Venezuelan crude [30] triggered a first round of containment measures. The government prioritized savings in the state sector through fuel cuts, limits on air conditioning, shorter workdays, and service reductions, while preserving—so far as possible—supply to the residential sector, tourism, and nickel mining. [31] This was a demand-management package aimed at coping with scarcity.

[29] Policy for the Prospective Development of Renewable Energy Sources and the Efficient Use of Energy, 2014–2030. "Políticas y Lineamientos," Ministerio de Energía y Minas, March 16, 2021, https://www.minem.gob.cu/es/actividades/energias-renovables-y-eficiencia-energetica/politicas-y-lineamientos.
[30] Since August 2017, following the withdrawal of Venezuela's PDVSA from the Cuvenpetrol joint venture, the Cienfuegos Oil Refinery has operated as a fully Cuban state-owned entity under Unión Cuba Petróleo (CUPET). Cuts in Venezuelan crude exports to Cuba had already been occurring since 2016.
[31] "Cubadebate," July 8, 2016, http://www.cubadebate.cu/noticias/2016/07/08/marino-murillo-venen-ajustes-en-la-economia-sin-afectar-servicios-fundamentales-a-la-poblacion/.

In 2018, the authorities turned to contracting floating power plants as a partial measure to mitigate the shortfall. [32] These mobile units provided fast, dispatchable capacity and came to represent a significant share of generation, albeit with high costs and contractual dependence that make them more of a stopgap than a structural reform.

The legal framework was strengthened in 2019 with Decree-Law 345, [33] which elevated the development of renewable sources and the efficient use of energy to a national priority. However, effective investment remained behind the system's needs, partly due to external constraints and partly due to internal bottlenecks in management and financing.

As part of the 2021 Tarea Ordenamiento, electricity tariffs were reformed, including the creation of specific schemes for the non-state sector—pursuing the dual objective of encouraging conservation and bringing prices closer to costs. [34]

In 2022, amid recurring breakdowns and fuel constraints, a reinforced conservation package was implemented: staffing was reduced to the minimum necessary at workplaces, schedules were rearranged, and labor measures were introduced to reduce electricity consumption. [35] Meanwhile, the electric utility (Unión Eléctrica, UNE) scheduled maintenance in several blocks at multiple thermal plants to recover available capacity.

The worsening of deficits in 2024 led to a more restrictive turn. Toward the end of that year, Decree 110 required large consumers—state and private—to cover 50% of their daytime demand with renewable sources within three years, backed by penalties for noncompliance (fines and temporary disconnections). [36] The measure sought to alter consumption patterns and accelerate investment in self-generation, although effective compliance depends on access to equipment and financing.

In parallel, between 2024 and 2025, the authorities implemented measures aimed at demand-side management. Reduced work hours were established from Monday to Thursday (8:00–14:00), nonessential entities were closed on

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[32] F. Yaren Öztürk, "Power Outages in Cuba and Cooperation with Turkey - Yaren Öztürk," Bilkent EPRC, November 21, 2022, https://www.bilkenteprc.com/post/power-outages-in-cuba-and-cooperation-with-turkey-yaren-öztürk.

[33] On the development of renewable energy sources and the efficient use of energy. https://www.minem.gob.cu/sites/default/-files/documentos/goc-2019-o95_0.pdf

[34] Granma, "Nuevas Opciones de Tarifa Eléctrica Para El Sector No Estatal (+Video) › Tarea Ordenamiento › Granma," enero 2021, https://www.granma.cu/tarea-ordenamiento/2021-01-26/nuevas-opciones-de-tarifa-electrica-para-el-sector-no-estatal?

[35] Redacción Nacional, "Sector Estatal Refuerza Medidas Para Ahorro Energético (+ Video) › Cuba › Granma," agosto 2022, https://www.granma.cu/cuba/2022-08-02/sector-estatal-refuerza-medidas-para-ahorro-energetico-02-08-2022-17-08-12?

[36] Regulations for the control and efficient use of energy carriers and renewable energy sources. http://media.cubadebate.cu/wp-content/uploads/2024/11/goc-2024-o115.pdf

Fridays, state-sector energy plans were cut by 30%, and some consumers faced full disconnections on weekends. During summer 2025, consumption at food-production centers was restricted during peak hours, and a mandatory 5% reduction was imposed on large users. [37] These measures helped smooth peak deficits but displaced economic activity, generated significant productive and social costs, and showed diminishing returns.

Supply-side measures advanced along two tracks, but they became more concentrated from late 2024 onward, as the severity of the crisis made clear that rationing would not address the underlying problem. First, cooperation with China to restore existing distributed generation through spare parts and equipment (a cumulative target of up to 400 MW): an initial shipment returned 38 diesel units (53–54 MW) to service, and a second shipment with similar characteristics supported further recovery. [38] Also, the installation of China-manufactured diesel engines to expand capacity was reported—for example, at the Trinidad power station [39] —and donations of new units at the provincial level, such as in Ciego de Ávila. [40] Second, the accelerated deployment of solar PV. Over 2025, 34 new solar parks (744 MW) were active by December, bringing the operational total close to 1,043 MW. [41] Solar's monthly share of generation rose from about 2% in January to roughly 9% in September, [42] with effects concentrated in daytime hours.

This push was formally incorporated in October 2025 into an official document titled "Government Program to correct distortions and re-energize the economy." [43] The roadmap set out immediate operational targets: recover 850 MW of distributed generation, raise average availability of thermal plants running on domestic fuel to around 1,400 MW, promote household photovoltaic kits financed over time, and reactivate local capacity to manufacture panels and spare parts. It also projected a jump in electricity generation based on

[37] Yeilén Delgado, "Un tema estratégico para los destinos del país (+Audio)," Presidencia de Cuba, July 5, 2025, https://www.presidencia.gob.cu/es/noticias/un-tema-estrategico-para-los-destinos-del-pais-audio/.

[38] ACN, "En Cuba, Segundo Lote Del Donativo Chino Para La Recuperación de Grupos Electrógenos › Cuba › Granma," January 22, 2025, https://www.granma.cu/cuba/2025-01-22/en-cuba-segundo-lote-del-donativo-chino-para-la-recuperacion-de-grupos-electrogenos-22-01-2025-00-01-30?

[39] Portal Cuba, "Central Eléctrica de Trinidad reforzará generación con nuevo motor chino," May 23, 2025, http://www.cuba.cu/economia/2025-05-23/central-electrica-de-trinidad-reforzara-generacion-con-nuevo-motor-chino/67354.

[40] Cubainformación, "Instalan en Ciego de Ávila doce motores diésel de donativo chino," cubainformación.tv, October 4, 2025, https://www.cubainformacion.tv/solidaridad/20251004/118295/118295-instalan-en-ciego-de-avila-doce-motores-diesel-de-donativo-chino.

[41] Luis Alberto Portuondo, "Somos El País Que Convierte El Bloqueo En Inventiva y La Escasez En Creatividad › Cuba › Granma," July 17, 2025, https://www.granma.cu/cuba/2025-07-17/debaten-ejecucion-del-programa-de-gobierno-para-la-recuperacion-del-sistema-electrico-nacional-17-07-2025-14-07-22. In December 2025, the Prime Minister stated that the country had completed 41 solar parks, but Unión Eléctrica reported only 34 in its daily bulletins in early 2026. The 2025 additions to installed capacity add to the capacity already in place at the end of 2024.

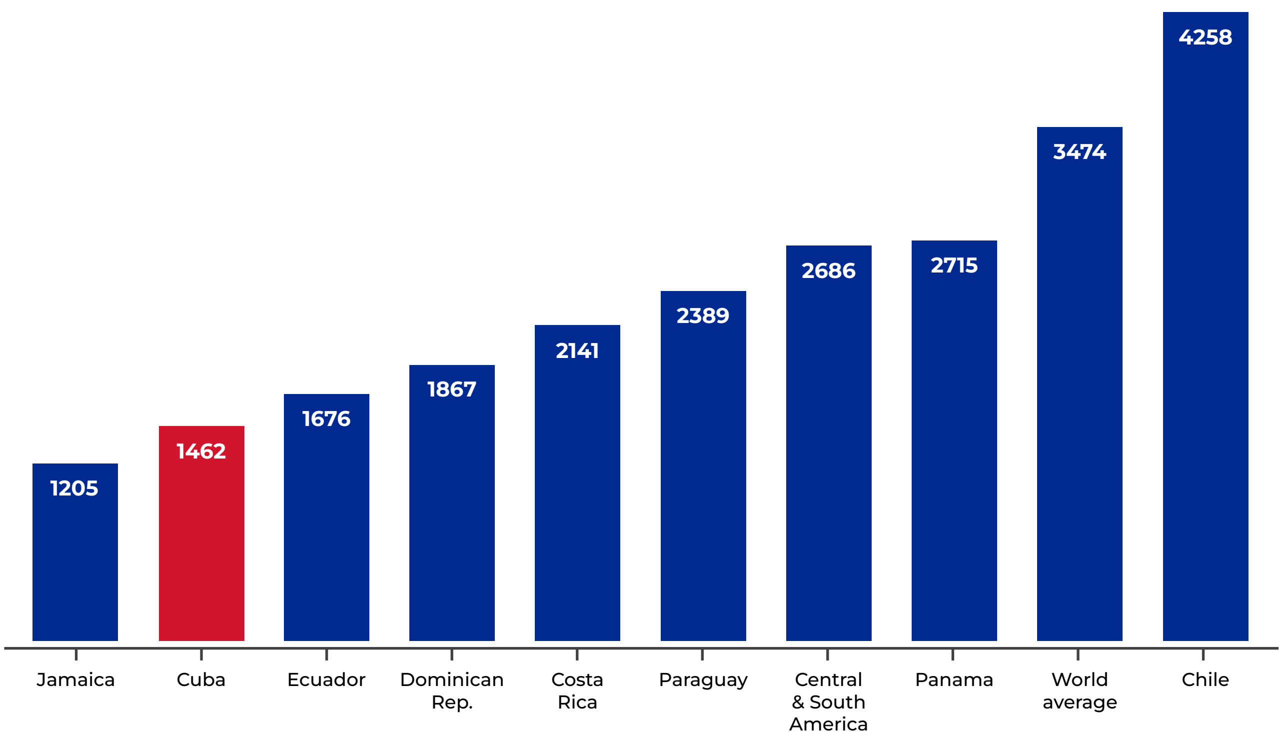
[42] Mesa Redonda, "Mesa Redonda: Situación Del Sistema Electroenergético Nacional," October 16, 2025, http://mesaredonda.cubadebate.cu/mesa-redonda/2025/10/16/mesa-redonda-situacion-del-sistema-electroenergetico-nacional/.

[43] Gobierno de Cuba, "Programa de Gobierno para corregir distorsiones y reimpulsar la economía," website, Ministerio de Economía y Planificación de Cuba, December 3, 2025, https://www.mep.gob.cu/es/programa-de-gobierno-para-corregir-distorsiones-y-reimpulsar-la-economia.

renewable sources to 1,735 GWh per year (from 531 GWh in 2024) and estimated UNE's financing needs at around USD 1.9 billion for 2025 and 2026 (with USD 1.15 billion allocated for 2025)—figures whose impact will depend on effective mobilization and execution.

Taken together, the recent package combines administrative rationing with the expansion and recovery of capacity. On the demand side, scheduled blackouts and time restrictions have been the most immediate adjustment instrument, but their marginal effectiveness declines in a country with relatively low per capita electricity consumption (Figure 5) and an economy already operating below its potential.

Figure 5. Electricity consumption, 2023
(kWh per capita, selected countries and regions)



Source: *International Energy Agency (IEA).* [44]

[44] IEA, "Energy Statistics Data Browser – Data Tools," IEA, November 6, 2025, https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser.

Without a more sophisticated demand-management approach, administering scarcity tends to prolong damage while failing to close the underlying gap. On the supply side, rehabilitating thermal units and distributed generation, together with the push for solar generation, can provide relief, but these efforts rest on critical bottlenecks: external financing, spare-parts logistics, and operation and maintenance capabilities.

Integrating intermittent renewables requires complementary investment in grids and storage, as well as dispatch rules and contracts that align incentives. The success of the official program would depend on execution, timelines, construction quality, and transparency, and on consistency between targets, schedules, and funding sources. The next section assesses the Cuban authorities' track record in these areas through concrete projects.

Investment Priorities and Project Management Shaping Cuba's Electricity Crisis

Given the severity of the current crisis and its harsh impact on people's daily lives and productive activity, debate has intensified over its causes. The Cuban government has defended itself by attributing the problems to U.S. sanctions.[45] ***While the embargo has negative effects on both the economy and the power sector, it is simplistic—and ultimately counterproductive—to blame the entire crisis on a single external factor when the available evidence points to serious internal failures: weak economic performance attributable to the model itself, the cumulative impact of policy choices for the electricity sector, and mismanagement of relationships with foreign investors and creditors.***

What have been the investment priorities?

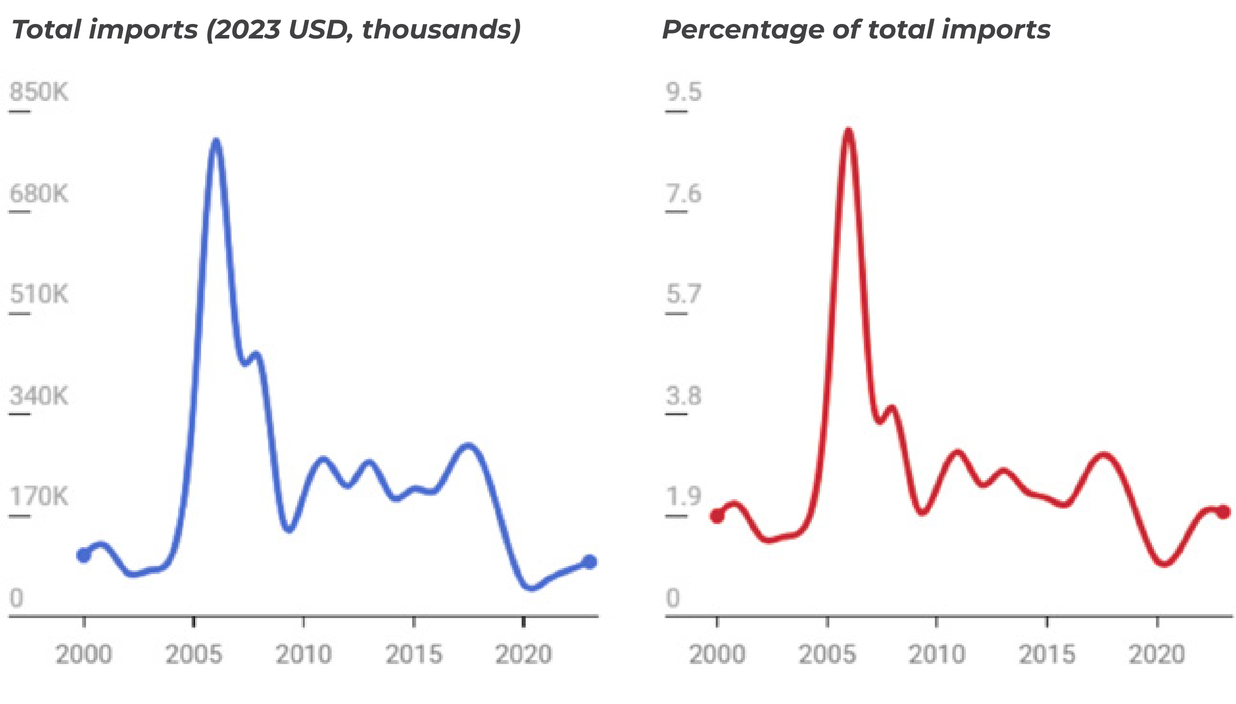
In an economy like Cuba's, the principal decisions on resource allocation rest with the central government through its relevant ministries and agencies. This is even more true for investment plans in decisive sectors and enterprises, as with the energy complex, and especially electricity generation. It is therefore reasonable to argue that resource flows in the economy reflect the authorities'

[45] CiberCuba Editorial Team, "Díaz-Canel Once Again Blames the U.S. for the Lack of Maintenance at the Guiteras Thermoelectric Plant," CiberCuba, September 26, 2025, https://en.cibercuba.com/noticias/2025-09-26-u1-e208933-s27061-nid311740-diaz-canel-vuelve-culpar-eeuu-falta-mantenimiento; "GE Completes Acquisition Of Alstom Power And Grid Businesses | GE News," accessed November 21, 2025, https://www.ge.com/news/press-releases/ge-completes-acquisition-alstom-power-and-grid-businesses-0.

priorities across the full spectrum—from the scale and composition of investment to the structure of imports. This sector, which is highly intensive in physical capital, depends heavily on the acquisition of equipment, machinery, and spare parts from abroad. In that sense, import flows provide a useful proxy for the amount of foreign exchange allocated to the electricity industry.

Figure 6 shows that imports of machinery and equipment for electricity generation follow a clear phase pattern. In 2000–2004, the effort was modest (about USD 95 million per year on average). Between 2005 and 2008, however, there was an extraordinary jump: the average rose to roughly USD 514 million per year, more than five times the earlier level, with 2006 marking the peak for the entire series (around USD 800 million). This was the major investment wave associated with the "Energy Revolution": in 2006, nearly one out of every ten imported dollars in real terms went to generation equipment.

Figure 6. Cuba: imports of machinery and equipment for power generation



Source: *Author's calculations using data from WITS (wits.worldbank.org) and price indexes (2000–2023) from CEPII (https://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=42)*

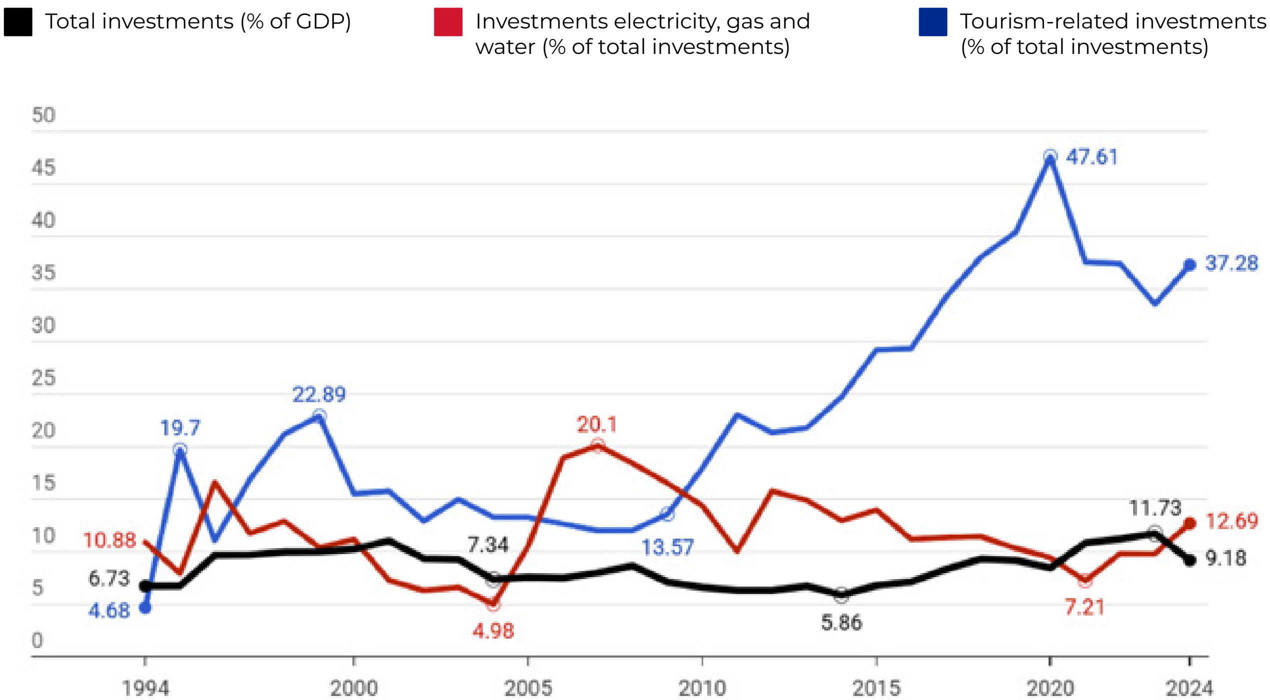
Between 2009 and 2019, purchases in real terms fell to an annual average of USD 223 million—less than half the historical peak in 2006—although they still remained above the level recorded in the early 2000s. From 2020 onward, however, the effort collapsed: the annual average declined to just over USD 71 million, and by 2023 the real volume was only about 11–12% of the maximum reached in 2006. Looking at these items as a share of total real imports reinforces the picture of an investment effort that was strongly concentrated and then abandoned. In 2000–2004, generation machinery represented around 1.7% of the total; in 2005–2008 it rose to an average of 5.4%, with the 2006 peak at 9.1%. Later, in 2009–2019, it stabilized around 2.4–2.5%. By contrast, between 2020 and 2023 the share fell to roughly 1.5–2%, levels similar to—or below—those of the early 2000s.

In short, Cuba today imports far less in real terms than it did in the 2000s, and within that reduced volume, the share devoted to renewing or expanding electricity generation capacity is also lower than in the period of greatest effort. Unfortunately, the major investments of the mid-2000s were channeled mainly into acquiring equipment for distributed generation. This ensured an immediate recovery of generating capacity but compromised the system's long-term viability. Maintenance of thermal power plants was neglected even as they were already subject to greater wear due to the burning of Cuban crude. [46] The power mix did not change: it remained anchored in conventional sources, now with a higher weight for more expensive fuels. Although this was mentioned as an intention, no decisive measures were implemented to reverse the decline of the sugar industry, and other renewable sources failed to take off.

Figure 7 shows that the total investment-to-GDP ratio sits most of the time between 7% and 10% of GDP. In the 1990s and early 2000s (1994–2004) it averaged a little over 9% of GDP; between 2005 and 2014 it fell to about 7%; but in recent years it has risen again: 7.9% in 2015–2018 and, most notably, more than 10% of GDP on average between 2019 and 2024 (with peaks of 11.2% in 2022 and 11.7% in 2023). In other words, amid a foreign exchange crisis and a decline in GDP, the state maintained—and even increased—its investment effort as a share of GDP. The issue is not "lack of investment" in the abstract, [47] but rather where that investment has been concentrated.

[46] "Discurso Pronunciado Por Fidel Castro Ruz, Presidente de La República de Cuba, En Ocasión Del Aniversario 47 de Su Entrada En Pinar Del Río, En El Acto Por La Culminación Del Montaje de Los Grupos Electrógenos En Esa Provincia. Pinar Del Río, 17 de Enero de 2006.," accessed November 21, 2025, http://www.cuba.cu/gobierno/discursos/2006/esp/f170106e.html.
[47] Whether measured through current investment flows or through gross fixed capital formation—Cuba's investment-effort ratios are low by international standards.

Figure 7. Cuba: allocation of investments



Source: *Author's calculations based on the Cuba Statistical Yearbook (various years), ONEI.*

As a share of total investment, resources allocated to the energy sector do show a clear peak during the "Energy Revolution" period: around 19–20% in 2006–2008. After that, it normalized around 12–15% and, during the recent crisis phase, fell below 10% in key years such as 2020, 2022, and 2023. The bottom line is that investment in basic infrastructure—electricity, water, gas—never disappears, but it does not grow in proportion to the system's rising needs or to the impact of accumulated obsolescence. If restaurants and hotels, along with tourism-related real estate, are included, tourism absorbs roughly 15–17% of total investment in the 1990s and 2000s, rising to more than 30% in 2015–2018, and nearly 40% between 2019 and 2024. In 2020, almost half of total investment (47.6%) went to tourism, while electricity, gas, and water received only 9.4%. ***The pattern suggests that, even during the years when the economic crisis deepened (2019–2024), the government chose to sustain a high overall investment effort*** [48] ***but concentrated a disproportionate share of resources in the tourism chain–hotels and associated real estate–rather than strengthening energy or water infrastructure.***

[48] This choice is striking because, in Cuba's recent economic history, investment has tended to behave procyclically during periods of crisis. That pattern can be interpreted as the government opting for lower future growth in order to protect (to some extent) immediate consumption. In the most recent cycle, however, that logic no longer appears to apply.

Sherritt and Energás

Energás is a joint venture between Sherritt, Cuba Petróleo (CUPET), and the Unión Eléctrica (UNE), with each party holding 33.3% of the operation. Over two decades, Sherritt financed and built integrated gas-processing and power-generation complexes in Varadero, Boca de Jaruco, and Puerto Escondido that today contribute on the order of 580 MW—close to 10% of the country's installed capacity. Reconstructing costs from corporate reports and specialized sources suggests investments in the range of USD 650–700 million (approximately USD 1.1 billion in 2024 dollars). [49]

Despite being a large investment involving modern equipment—and producing some of the lowest-cost electricity in the system—the Cuban side accumulated arrears on payments associated with electricity sales to UNE. In 2022, given persistent overdue balances, Sherritt and the Cuban counterpart signed the so-called "Cobalt Swap," an agreement to recover, over five years, the full stock of Cuban accounts receivable (about USD 368 million) by redirecting the cobalt dividend from the Moa joint venture to Sherritt up to pre-set annual caps. [50] In practice, Cuba is servicing a significant share of its energy-related debts by ceding future foreign-exchange flows from the mining sector, revealing both tight external liquidity and a long record of delayed payments. Sherritt is the largest foreign investor in Cuba, with additional interests in nickel, and in the past it participated in oil and gas production. [51] That the Cuban government manages this relationship so poorly from a strategic standpoint is, at a minimum, paradoxical: if this is how it treats its largest partner, what can others expect?

The La Herradura wind farm

The La Herradura wind complex—comprising La Herradura 1 and 2 on the north coast of Las Tunas—was conceived as Cuba's largest wind project. It was designed with 54 Chinese turbines (34 Goldwind units of 1.5 MW and 20 Dongfang units of 2.5 MW), for a planned total capacity of about 101 MW, financed

[49] Sherritt, Annual Information Form (2019), https://sherritt.com/wp-content/uploads/2024/12/2019-AIF-March-20-2020.pdf.

[50] Sherritt, Annual Information Form (2022), https://sherritt.com/wp-content/uploads/2024/12/sic-2022-aif-03-31-23-sedar.pdf.

[51] Pebercan was a small Canadian oil company whose main business consisted of production-sharing contracts with CUPET in Cuba, in association with Sherritt. In the mid-2000s, CUPET began to accumulate payment arrears amounting to tens of millions of dollars, generating recurring financial strains. In January 2009, the Cuban side decided to terminate the contract early (originally set to run through 2018) and agreed to a one-time payment of USD 140 million, which settled outstanding debts and transferred to CUPET all assets and liabilities associated with the project. As a result, Sherritt (a partner in the operations) reportedly lost up to 25% of its production at the time. Shortly thereafter, Pebercan ceased operations and was liquidated, distributing most of those funds to its shareholders. Cuban authorities never provided a public explanation for this decision. Reuters, "Cuba Revokes Canadian Oil Producer's Contract | Reuters," January 23, 2009, https://www.reuters.com/article/markets/commodities/cuba-revokes-canadian-oil-producers-contract-idUSN23329579/.

almost entirely through a Chinese development credit of USD 160 million. [52] However, although the first foundations began to be poured in 2019 and the government promised commissioning starting in 2020, by 2025 the project has still not delivered a single kWh to the SEN. Only the 22 foundations for the first stage of La Herradura 1 have been completed—enough to install 22 turbines (about 33 MW)—while the rest of that park and all of La Herradura 2 remain in limbo. [53] Over more than a decade, the project has accumulated repeated delays driven primarily by internal causes: planning failures and unrealistic timelines; limited capacity of Cuban enterprises to execute the civil works, substation, and the 110kV line; stoppages due to shortages of equipment, cement, steel, and other inputs; and repeated cuts to the provincial investment plan despite the project's strategic importance. [54] This protracted experience suggests that ***even with Chinese financing, technology, and oversight, institutional weaknesses, logistical bottlenecks, and the Cuban state's own fiscal constraints have been the main obstacles to implementing wind energy projects.***

The Ciro Redondo bioelectric plant

The bioelectric plant annexed to the Ciro Redondo sugar mill in Ciego de Ávila was conceived as the flagship project to increase the role of biomass in the power mix. Designed for 60 MW of capacity, the plant was expected to cover the mill's steam and electricity needs. It would also deliver the surplus to the SEN, saving around 100,000 tons of oil per year and supplying up to 50% of the province's electricity demand. [55] The plant belongs to Biopower S.A., a joint venture between Zerus S.A. (AZCUBA, 51%) and Havana Energy Ltd. (United Kingdom, 49%), with core technology and financing from Shanghai Electric Group through a supplier credit signed in 2016 for USD 186 million [56] (approximately USD 234 million in 2024 dollars). In parallel, the Ciro Redondo mill underwent the largest modernization in its history, estimated at about USD 113 million (USD 142 million in 2024 dollars). [57]

Yet the plant has never delivered the expected output on a stable basis. The cornerstone was laid in 2017 with a target start-up in 2019, but synchronization

[52] Boston University (Global Development Policy Center), "La Herradura Wind Farm Project," BU: China's Overseas Development Finance, 2025, http://www.bu.edu/gdp/chinas-overseas-development-finance/.
[53] "Civil Works on La Herradura Wind Farm Are About to Finish," Cuba Si, January 17, 2025, http://cubasi.cu/en/news/civil-works-la-herradura-wind-farm-are-about-finish.
[54] "El parque eólico de La Herradura no se detiene pese a las dificultades actuales | Radio Cabaniguán," May 6, 2021, https://www.radiocabaniguan.cu/el-parque-eolico-de-la-herradura-no-se-detiene-pese-a-las-dificultades-actuales/?utm_source=chatgpt.com.
[55] Amaury Perez Sanchez, "Cuba's First Biomass-Fired Power Plant Inaugurated," POWER Magazine, July 1, 2020, https://www.powermag.com/cubas-first-biomass-fired-power-plant-inaugurated/.
[56] "Shanghai Electric Group Provides Supplier's Credit for 62 MW Bio-Electric Power Plant Project at the Ciro Redondo Sugar Mill (Linked to Record ID#54944) | AidData Project," accessed November 21, 2025, https://china.aiddata.org/projects/69924/?utm_source=chatgpt.com.
[57] Ortelio Martínez, "El tiempo muerto del Ciro Redondo y la bioeléctrica," Granma.cu, January 16, 2024, https://www.granma.cu/cuba/2024-01-16/el-tiempo-muerto-del-ciro-redondo-y-la-bioelectrica-16-01-2024-20-01-59.

tests were postponed until 2020, when only about 23–27 MW were achieved with a single boiler. This multimillion-dollar project has not translated into stable generation due to boiler failures, [58] rotor vibrations, pressure problems, and above all a lack of sugarcane biomass and marabú. [59] Meanwhile, the collapse of the sugar sector reduces the supply of cane and bagasse, and Ciro Redondo has accumulated multiple missed harvests and more than 170,000 tons of sugar not produced relative to plan. [60]

As early as 2017, an investigative report asked whether Ciego de Ávila was truly the right province for a bioelectric plant of this scale, warning that available bagasse, marabú, and agricultural residues would not be sufficient to sustain continuous operation, and that the "energy forests" solution was advancing far behind schedule. [61] ***In February 2024, during a visit to Ciro Redondo, Miguel Díaz-Canel summed up the situation by saying, "Here we have buried the country's money,"*** questioning why, after more than three years, an investment of this magnitude was not producing results for either the harvest or the SEN.[62] Assuming the plant remained in this situation from 2021 through 2024, and using the design parameters and the limited published operational data, the Ciro Redondo bioelectric plant may have failed to deliver on the order of 220–320 million GWh per year to the SEN—equivalent to USD 20–29 million per year in electricity not generated.

The case highlights two key points. First, betting on renewables financed with external credit does not guarantee structural improvements if projects are built on a declining productive base and weak management capacity: the outcome can be a stranded asset that generates neither fuel savings nor the revenues needed to service debt. Second, it reveals a lack of coordination between energy policy and agro-industrial reality: without cane there is no bagasse, and without bagasse there is no electricity. Ciro Redondo thus becomes a symbol of poor planning—and of how projects labeled "energy transition" can, in practice, deepen the fragility of the power system and of public finances.

The Russian credit for building thermal generation units

In October 2015, the official press reported that the Russian government had approved a state export credit of EUR 1.2 billion to expand Cuba's thermal

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[58] EFE EFE, "Cuba's First Bioelectric Plant Begins Testing Phase," Cuba, OnCubaNews English, January 20, 2020, https://oncubanews.com/en/cuba/cubas-first-bioelectric-plant-begins-testing-phase/.
[59] Sanchez, "Cuba's First Biomass-Fired Power Plant Inaugurated."
[60] Martínez, "El tiempo muerto del Ciro Redondo y la bioeléctrica."
[61] Amanda Padrón, "Industria azucarera y cambio de matriz energética: las deudas de la bioeléctrica," OnCubaNews, October 23, 2024, https://oncubanews.com/cuba/economia/industria-azucarera-cambio-matriz-energetica-bioelectrica/.
[62] "Realiza presidente cubano recorrido por Ciego de Ávila - Cubadebate," Noticias, Cubadebate - Cubadebate, Por la Verdad y las Ideas, February 8, 2024, http://www.cubadebate.cu/noticias/2024/02/08/realiza-presidente-cubano-recorrido-por-ciego-de-avila/.

power generation by building four 200 MW units—one at the Máximo Gómez thermal plant in Mariel and three at the East Havana/Santa Cruz del Norte thermal plant–an agreement that was further developed in 2015–2016. [63] However, in 2022 the Deputy Minister of Energy and Mines, Tatiana Amarán, acknowledged that Cuba never accessed the credit because it could not raise the required 10% domestic contribution as a prior condition set by Moscow—about EUR 120 million. As a result, "none of that credit has been used for anything," since it is managed entirely from Russia and was never disbursed to the Cuban side. [64] From 2024–2025 onward, the same cooperation framework was reconfigured into a more modest project, presented as the modernization of three 100 MW units and the construction of a new 200 MW unit at the Ernesto Guevara de la Serna thermal plant in Santa Cruz del Norte, Mayabeque. [65] In other words, a strategic ally offered, from the mid-2010s, to finance up to 800 MW of new thermal capacity, but the Cuban state was unable to mobilize the required 10%—even as it built dozens of high-end, low-occupancy hotels in Havana and other tourist hubs between 2015 and 2025—revealing a deliberate choice of investment priorities rather than a purely external constraint.

The Mariel solar park

The Mariel Solar Park, a pioneering 62 MW renewable project privately financed in Cuba and developed by the British firm Hive Energy and Shanghai Electric, illustrates the structural barriers to foreign investment in Cuba's energy sector. The project, which cost approximately USD 60 million to build (about USD 74.9 million in 2024 dollars), included protections that appeared solid: a 25-year Power Purchase Agreement (PPA) with the state utility UNE at a fixed tariff of USD 0.09/kWh, expected to generate roughly USD 11 million annually, and payments "secured by first recourse to bank funds," meaning that UNE's payment obligation would take priority over other financial commitments. [66] Yet both investors sought to exit barely one year after the commercial operation date in December 2021, offering the operating asset for sale in February 2023—an exceptionally short period for infrastructure projects typically held in portfolios for 5–15 years. [67] This early exit attempt points to unfavorable conditions. Despite operating above nominal capacity (at 103% of expected output) and saving Cuba USD 8.6 million per year in fuel costs, the project cannot escape

[63] RT en Español, "Rusia concede a Cuba crédito por 1.200 millones de euros para la construcción de termoeléctricas," RT en Español, October 20, 2015, https://actualidad.rt.com/actualidad/189081-rusia-concede-cuba-credito-millones-central-termoelectrica.
[64] Ernesto Eimil, "¿Cuánto dinero dejó de invertir el Gobierno en el Sistema Electroenergético Nacional?," elTOQUE, October 22, 2024, https://eltoque.com/cuanto-dinero-dejo-de-invertir-el-gobierno-en-el-sistema-electroenergetico-nacional.
[65] Cuba montará nueva planta de generación térmica con crédito ruso en Mayabeque - teleSUR, América Latina y El Caribe, March 21, 2025, https://www.telesurtv.net/cuba-montara-nueva-planta-de-generacion-termica-con-credito-ruso-en-mayabeque/.
[66] "SE Energy Investment Co., Ltd Provides $51.1 Million Loan for 61.9MW Photovoltaic (PV) Power Plant Construction Project (Linked to Record ID#69403) | AidData Project," accessed November 21, 2025, https://china.aiddata.org/projects/54759/.
[67] Jodie Alesbury, "Our Mariel Solar Park Is Producing Power for Use across Cuba," Hive Energy, February 24, 2023, https://www.hiveenergy.co.uk/2023/02/24/our-mariel-solar-park-is-producing-power-for-use-across-cuba/.

the reality that a stagnant economy is unable to generate the foreign-exchange surplus needed to meet foreign investment commitments.

A vicious circle

Chronic payment failures and increasingly desperate financial measures have created a hostile environment for foreign capital, regardless of contractual protection. The country failed to comply with the Paris Club debt restructuring in 2020 and required another reworking in January 2025. [68] More alarming still, in April 2025 the government froze foreign-currency bank accounts held by foreign companies for millions of dollars, prohibiting withdrawals and forcing businesses to use only frozen funds within Cuba. [69] A similar measure was reportedly taken in late November, according to foreign press reports. [70]

The central issue is systemic mismanagement: ***Cuba's seven thermal power plants are at least 30 years old, yet the authorities failed to prioritize modernization during periods of more favorable economic conditions, while foreign-exchange-generating sectors cannot access the resources they produce because all proceeds must be transferred to government accounts.*** National authorities continue to determine allocations within a centralized control system that removes market incentives—ensuring that even successful projects like those described above cannot overcome the basic reality that a dysfunctional economic model lacks both the surplus to pay investors and the credibility required to attract new capital.

Options to Shore Up the Power Sector

Given today's shortfalls, addressing the sector's problems will require substantial capital outlays to restore reliability in existing infrastructure. This includes modernization and the construction of new thermal power plants, which will remain the backbone of baseload generation for many years. The options outlined below take into account global trends as well as the specific conditions of Cuba's economy. More radical changes in the domestic and external environment could eventually open the door to a wider range of alternatives. [71] Some core elements of this transformation have been acknowledged by the authorities themselves, beginning with the need to shift the generation mix—both by

[68] "Cuba Defaults on Paris Club Debt: Says It Will Meet Its Commitments," The Caribbean Council, February 17, 2020, https://www.caribbean-council.org/cuba-defaults-on-paris-club-debt-says-it-will-meet-its-commitments/.
[69] S. W. I. swissinfo.ch, "Cuba bloquea la repatriación de divisas a firmas extranjeras asentadas en el país," SWI swissinfo.ch, April 10, 2025, https://www.swissinfo.ch/spa/cuba-bloquea-la-repatriación-de-divisas-a-firmas-extranjeras-asentadas-en-el-país/89144341.
[70] Alfonso Hernandez, "Cuba extiende las restricciones de las cuentas en divisas a todas las empresas extranjeras - EFE," EFE Noticias, November 20, 2025, https://efe.com/economia/cuba-divisas-empresas-extranjeras/.
[71] See Juan Belt, "The Cuban Power Sector: the Achilles Heel of the Economy", ASCE's 35th Annual Meeting, Miami, October 24, 2025

improving installed capacity in conventional sources and by incorporating cleaner fuels. One option to consider is liquefied natural gas (LNG), given its lower environmental footprint and broad availability on international markets. A relevant reference is the Energía del Pacífico LNG-to-power plant in El Salvador. The facility has 380 MW capacity and achieved availability above 97% in 2024. Total investment exceeded USD 1 billion. [72]

LNG-based solutions require gas regasification infrastructure. Floating storage and regasification units (FSRUs), such as the BW Tatiana unit successfully deployed in El Salvador, offer a particularly attractive technological option for small countries with limited financial and technical resources. With an initial investment on the order of USD 330 million—compared with roughly USD 1 billion for an equivalent onshore terminal—FSRUs reduce entry barriers by enabling leasing arrangements that limit upfront capital needs to mooring and onshore reception infrastructure. [73] Their faster deployment timeline—about 14 to 18 months, versus roughly 38 months for a conventional terminal—allows developing countries to respond more quickly to energy crises. Operational flexibility is especially valuable for small economies: FSRUs can be relocated as demand evolves, adapted to ports with space constraints, and used as a transitional solution while permanent infrastructure is built or domestic gas resources are developed.

Another pillar—and arguably the decisive one over the medium term—is increasing the share of renewable energy. ***Among the most promising [renewable energy] options for Cuba are sugarcane biomass (bagasse) and ethanol production from sugarcane juice (guarapo).***

With a harvest of 17 million metric tons of sugarcane in Cuba and using modern steam-and-power cogeneration technologies currently deployed in Brazil and the Dominican Republic, the resulting bagasse could generate approximately 1,700 to 2,200 GWh of electricity per year, assuming performance parameters typical of efficient plants (80–130 kWh per ton of cane). [74] This would imply net deliveries to the grid equivalent to more than 6% of gross generation in a

[72] Karla Alfaro, “Energía Del Pacífico Generó 1,185 GWh En El Primer Semestre de 2025 - La Prensa Gráfica,” August 26, 2025, https://www.laprensagrafica.com/economia/Energia-del-Pacifico-genero-1185-GWh-en-el-primer-semestre-de-2025-20250826-0076.html.

[73] “LNG Terminals – Land-Based vs. Floating Storage and Regasification Technology,” Wartsila.Com, May 18, 2018, https://www.wartsila.com/insights/article/lng-terminals-land-based-vs-floating-storage-and-regasification-technology; Molly, “Is Floating LNG Really the Best Option for Emerging Economies?,” Offshore Technology, April 4, 2017, https://www.offshore-technology.com/features/featureis-floating-lng-really-the-best-option-for-emerging-economies-5778131/; How FSRU’s Are Impacting LNG Market Evolution - Timera Energy, July 9, 2018, https://timera-energy.com/blog/how-fsrus-are-impacting-lng-market-evolution/.

[74] As a point of reference, current sugar mills generate an average of about 37 kWh per ton of cane. This, together with limited cane availability, results in minimal sales to the grid, with some years in which the net contribution has been negative. “Bioenergía, otra alternativa en el cambio sostenible de la matriz energética cubana - Cubadebate.”

"normal" year such as 2019 (Table 1). Moreover, this electricity is dispatchable, which means it can be integrated into baseload generation and help stabilize the SEN as other renewables with intermittent output expand.

In addition, if half of the extracted sugarcane juice were allocated to ethanol production, the harvest could yield roughly 442 million liters of ethanol—equivalent to about 64% of gasoline consumption in a year such as 2023.

Reviving the sugarcane agroindustry has other advantages, including a clearly positive net environmental effect, job creation opportunities in rural areas, and the potential to spread economic activity beyond today's limited dynamic hubs.

Table 1. Key parameters and results for a sugarcane-biomass electricity generation projection

Parameter	***Estimated value***
Cane crushed (total harvest)	17,000,000 t
Total bagasse generated	5,100,000 t (assuming a 30% bagasse yield)
Recoverable electricity (kWh/ton of cane) (modern cogeneration)	100–130
Total electricity (GWh)	1,700–2,200 (30% consumed by the mill; the remainder exported to the grid).
Cane juice yield/ton of cane	65%, approx. 650 L/ton
Total cane juice produced (half allocated to ethanol)	5,525,000,000 L (50% of total)
Ethanol yield per cane juice (liters/liter of juice)	approx. 80 L/1,000 L of cane juice)
Ethanol produced (50% of cane juice)	Approx. 442,000,000 L

Source: *Own's calculations based on several sources.* [75]

However, the 2025 harvest fell below 150,000 tons of sugar, which implies a sugarcane crop of less than 2 million tons. Sugarcane scarcity directly determines the viability of this renewable option. [76]

[75] Moses Jeremiah Barasa Kabeyi and Oludolapo Akanni Olanrewaju, "Bagasse Electricity Potential of Conventional Sugarcane Factories," Journal of Energy 2023, no. 1 (2023): 5749122, https://doi.org/10.1155/2023/5749122; Anselmo Fioranelli and Waldir A. Bizzo, "Generation of Surplus Electricity in Sugarcane Mills from Sugarcane Bagasse and Straw: Challenges, Failures and Opportunities," Renewable and Sustainable Energy Reviews 186 (October 2023): 113647, https://doi.org/10.1016/j.rser.2023.113647; Aldair Gongora and Dorien Villafranco, "Sugarcane Bagasse Cogeneration in Belize: A Review," Renewable and Sustainable Energy Reviews 96 (November 2018): 58–63, https://doi.org/10.1016/j.rser.2018.07.034.

[76] Álvaro Reynoso is often credited with a line along these lines: sugar is made in the field; it is only extracted at the mill.

The large-scale adoption of solar technologies is consistent with current sector trends and makes strong sense for a country well endowed with this resource. [77] Scaling up solar is essential for diversifying and decarbonizing the energy system, but it faces constraints stemming from variability and intermittency, especially during nighttime demand peaks. Deploying battery energy storage systems is therefore critical to offset rapid frequency and voltage fluctuations and ensure stable, secure operation of the national grid. [78] These systems—still nascent in Cuba—are central to improving grid stability, flexibility, and resilience, and they represent a priority technological and financial challenge for a sustainable energy transition.

Reference investments to close the supply gap

The following exercise is strictly informational and is based on plans and public information released by Cuban authorities at different points in time. [79] It should therefore be read as a reference scenario (not a forecast) and is subject to high uncertainty. It assumes that completing the estimated investments would eliminate blackouts caused by generation shortfalls. However, as long as fossil fuels dominate the generation mix, service continuity will depend on sufficient and stable fuel imports.

Estimating the cost of rebuilding thermal generation requires a verifiable benchmark. As a baseline, this report uses the credit offered by Russia in 2014 (EUR 1.2 billion; approximately USD 1.36 billion), which implicitly priced the installation of 800 MW across four 200 MW units. The implied cost of that offer (USD 1,700/kW in 2014) provides a basis to calibrate the analysis and update it to 2024 dollars, incorporating a later program oriented toward rehabilitating four 100 MW units. [80] This approach remains relevant because it addresses structural deficits in the thermal fleet and in the power system that have not changed materially.

For renewables, the reference is the Ministry of Energy and Mines program, disaggregated by sources and capacities. Unit costs are estimated using public

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[77] According to this study, Cuba ranks 84th worldwide in photovoltaic generation potential and shows relatively low seasonal variability. World Bank, “Global Photovoltaic Power Potential by Country | Data Catalog,” accessed December 3, 2025, https://datacatalog.worldbank.org/search/dataset/0038379/global-photovoltaic-power-potential-by-country.

[78] The state-owned electric utility (Unión Eléctrica, UNE) has announced a project it expects to complete in 2026 that involves installing four 50 MW battery energy storage system (BESS) units across two sites in Havana (Cotorro and CUJAE) and two in eastern Cuba (Holguín and Granma). The primary objective is to support grid frequency regulation by offsetting rapid fluctuations in generation, rather than to provide electricity supply after sunset. Wennys Díaz, “Instalan sistemas de baterías para controlar variaciones de frecuencia provocadas por los parques solares,” Granma.cu, August 5, 2025, https://www.granma.cu/cuba/2025-08-05/instalan-sistemas-de-baterias-para-controlar-variaciones-de-frecuencia-provocadas-por-los-parques-solares-05-08-2025-23-08-28.

[79] Ministerio de Energía y Minas, “Políticas y Lineamientos.”

[80] Cubadebate, Rusia participará en la modernización y recuperación del sistema energético de Cuba - Cubadebate, Economía, June 20, 2025, http://www.cubadebate.cu/noticias/2025/06/19/rusia-participara-en-la-modernizacion-y-recuperacion-del-sistema-energetico-de-cuba/.

information from suppliers (primarily Chinese) and from projects executed or under implementation, such as the Ciro Redondo bioelectric plant, the Herradura 1 and 2 wind projects, the rollout of solar PV parks, and the International Renewable Energy Agency's (IRENA) Renewable Power Generation Costs in 2024 report.

Table 2. Estimated required investments in the power sector
(millions of 2024 USD)

Tecnology	***Capacity*** (MW)	***N° of projects***	***Unit cost*** (USD/kW)	***Investment*** (USD million)
Conventional thermal	800	4	$1,495	$1,196
Conventional thermal (rehabilitation)	400	4	$598	$239.2
Bioelectric plants (sugar cane biomass)	550	16	$2,807	$1,543.8
Onshore wind	809	15	$2,118	$1,705
Solar PV	2,012	92	$732	$1,472
Biogas	183	Multiple	$1,710	$313.6
Hydroenergy	56	74	$2,534	$142.2
Total	4,261	-	-	$6,611.8

Source: *Note: Calculations use publicly available information, adjust for inflation, and incorporate a factor reflecting changes in the cost of each technology. For biogas, the assumption is that half of the potential identified by the authorities is developed. Source: Own's calculations based on press reports and industry documents.* [81]

The results suggest investment requirements above USD 6.6 billion (Table 2). [82] To that figure, additional substantial amounts would need to be added that are not included here. These include further thermal rehabilitations, recovery of distributed generation, and modernization of transmission and distribution (networks and substations), as well as new storage capacity.

Within the renewable component, the greatest uncertainty concerns sugarcane biomass. Its feasibility depends on a pronounced recovery in cane production and in agroindustrial infrastructure, which would imply significant additional investments outside the electricity sector narrowly defined.

[81] Cubadebate, "Cuba Proyecta Recuperar Más de 400 MW de Potencia e Incorporar Otros 500 MW Por Nuevas Inversiones Antes de Finalizar El Año (+ Video)," accessed December 13, 2025, https://www.minem.gob.cu/es/print/noticias/minem/cuba-proyecta-recuperar-mas-de-400-mw-de-potencia-e-incorporar-otros-500-mw-por; Martínez, "El tiempo muerto del Ciro Redondo y la bioeléctrica"; Ministerio de Energía y Minas, "Políticas y Lineamientos."
[82] Gobierno de Cuba, First Nationally Determined Contribution (Updated). Republic of Cuba (2020), https://unfccc.int/sites/default/files/NDC/2022-06/Cuban%20First%20NDC%20%28Updated%20submission%291.pdf.

Finally, official plans assume an electricity demand of 29,951 GWh in 2030, associated—among other factors—with possible partial electrification of transport. In today's context, this figure appears high: it equals almost twice the generation recorded in 2025 and far exceeds the peak reached in 2019. As a result, medium-term investment needs could be somewhat lower if actual demand proves weaker; however, sustained economic recovery could again push demand above projected levels.

In the short term, reducing blackouts will depend on adding temporary capacity (for example, floating power plants) and ensuring a stable fuel supply. Over the medium and long term, the solution requires substantial investment to stabilize thermal generation, expand renewables, and, for biomass in particular, rehabilitate the sugar agroindustry.

Why Grid Modernization Requires Economic Transformation

Cuba's electricity crisis is both a cause and a consequence of economic stagnation and the country's limited structural transformation. A reliable generation, transmission, and distribution system is a foundation for faster growth: it lowers costs, ensures continuity in production, and makes new sectors viable. In particular, a modern electric grid is a prerequisite for the expansion of digital services, software development, a more advanced financial system, and e-commerce—all of which depend critically on stable electricity supply.

From a productive standpoint, sufficient electricity availability would strengthen industrial and agricultural competitiveness. Irrigation, refrigeration, and food transport systems could operate with fewer losses and integrate more effectively into national and international value chains. More technology-intensive manufacturing also requires steady, high-quality power to scale output and compete in export markets. The electrification of transport—a global trend already under way—likewise depends on a substantial strengthening of generation capacity; and if the objective is to reduce emissions, the power mix cannot remain anchored in fossil fuels. The only path with a credible long-term horizon is decarbonization supported by renewable sources.

Simultaneously, faster growth generates the surplus needed to finance the investments required to modernize the SEN. This is not only about raising GDP, but about energizing tradable sectors that improve the external balance, reduce country risk, and help restore access to credit and foreign investment. Both will be essential—not only for capital, but also for technology transfer in renewables, smart grids, and energy storage.

For these reasons, ***there will be no sustainable solution to Cuba's electricity problem without reforms that restore the country's economic viability. A credible overhaul of the economic model is a precondition for attracting capital and mobilizing credit, and also for generating the incentives and capabilities needed to sustain a transformation of the sector.*** A serious reform program is the first step toward re-entering international capital markets. The scale of resources required cannot be mobilized solely within the island; foreign investment and external financing will be indispensable. But neither lenders nor investors will engage at that level without guarantees of a realistic program, clear rules, and reasonable returns.

Within that framework, creating an environment in which prices reflect scarcity and demand is central to improving efficiency and sustainability. The transition toward tariffs that reflect the real costs of generation and distribution can be phased in over the short term, but it is necessary to transmit accurate signals, encourage conservation, and better manage demand. As prices become clearer, subsidies should be redesigned and targeted to the most vulnerable households, avoiding distortions that promote inefficient resource use.

In the short run, the energy crisis is an additional obstacle for the emerging private sector: it raises operating costs, forces scarce resources into backup generation and fuel, and is compounded by rationing and requirements that large consumers invest in renewables. This slows business expansion, penalizes energy-intensive activities, and generates frequent losses, especially for firms handling perishable inputs and products.

Although Washington eased fuel export restrictions to Cuba's private sector in late February 2026—including the possible re-export of Venezuelan oil under license—a measure that could alleviate certain specific shortages, the effects on national electricity generation remain uncertain given that the private sector does not operate industrial-scale generation facilities.

Similarly, private firms involved in managing agricultural and organic waste could accelerate the adoption of biodigesters and small biogas plants, helping diversify the generation mix while addressing local environmental problems. International experience suggests that energy-service SMEs (audits, efficiency, maintenance, and automation) can deliver significant reductions in final electricity consumption when they operate under clear rules and have access to financing. In that sense, the main challenge is not only the magnitude of the crisis, but the state's ability to create an incentive [83] and regulatory environment that unlocks the potential of this emerging ecosystem as part of a more resilient, decentralized energy transition.

Finally, stronger economic momentum—combined with sensible, targeted policies—would also create opportunities to improve energy efficiency by replacing obsolete household equipment, helping moderate growth in demand. Restoring economic viability is urgent if Cuba is to reverse the collapse of its power system; and achieving this, in turn, depends on moving forward with the transformation of the economic model—a process that has been postponed too many times.

[83] The current tariff for a residential producer who sells electricity to UNE is 6 CUP for each kWh delivered to the SEN, at any time of day. Using an exchange rate of 438 CUP/USD, this is equivalent to USD 0.014 per kWh (1.4 cents). A quick review of comparable feed-in tariffs in the region suggests levels of roughly 5–9 cents in the Dominican Republic, 11 cents in Jamaica, 16 cents in Honduras, and 18 cents in El Salvador (varying by auction). The prevailing tariff in Cuba therefore lags far behind regional benchmarks—and behind the island's own urgency to attract investment and expand distributed generation.

Without Power, There Is No Country.

Cuba's Electricity Generation Crisis

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