Sunrise After the Blockade

Cheap solar could help Cuba break free of US energy dominance — and the world should help pay for it

14 Apr 2026 • Kevin Cashman

Executive Summary

Cuba is in the midst of an energy and humanitarian crisis. Long dependent on expensive, imported fossil fuels for electricity generation, Cuba has now seen its supply choked off by the US. The results are predictable: extended blackouts, hospitals without power, food and medicines spoiling, economic distress and avoidable deaths. [1]

This crisis is not of Cuba's making. It is the result of an externally imposed energy blockade under which the flow of oil and other fuel is severely restricted and subject to outside control — by the United States. It forms part of the US government's "energy dominance" strategy, which uses coercion and force to control energy supplies and in this case, ultimately, Cuba itself. [2] After the US enacted a similar blockade on Venezuela in mid-December 2025, oil shipments from Venezuela to Cuba ceased and some cargoes en route were intercepted. [3] Cuba was heavily dependent on discounted oil from Venezuela, and this disruption destabilised its energy system. In late January 2026, the US government announced a complete energy blockade of Cuba and threatened retaliatory tariffs on any country providing oil to Cuba without US permission. [4] Shipments of oil and other fuel from any source were reduced to a trickle. [5]

Cuba's electricity and fuel crisis is a humanitarian emergency, but it is also a stark demonstration of the risks of dependence on imported fossil fuels for countries facing external coercion. Expanding renewable energy offers a path out of the crisis and away from that dependence. Using a cost-optimisation energy model (which finds the cheapest combination of generation and storage technologies to meet electricity demand), this briefing evaluates a range of investment pathways for moving Cuba towards a 100 per cent renewable electricity system. It argues that development finance institutions should fund this transition on concessional terms — more generous terms than markets would provide — because it is technically feasible, economically compelling and a concrete test of the international community's commitment to climate justice and energy sovereignty. [6]

The following analysis explains how the US has made fossil fuel dependence into a lever of coercion, why Cuba is well-placed to respond, what the economics of a renewable transition now look like and why concessional public finance is appropriate to deliver it.

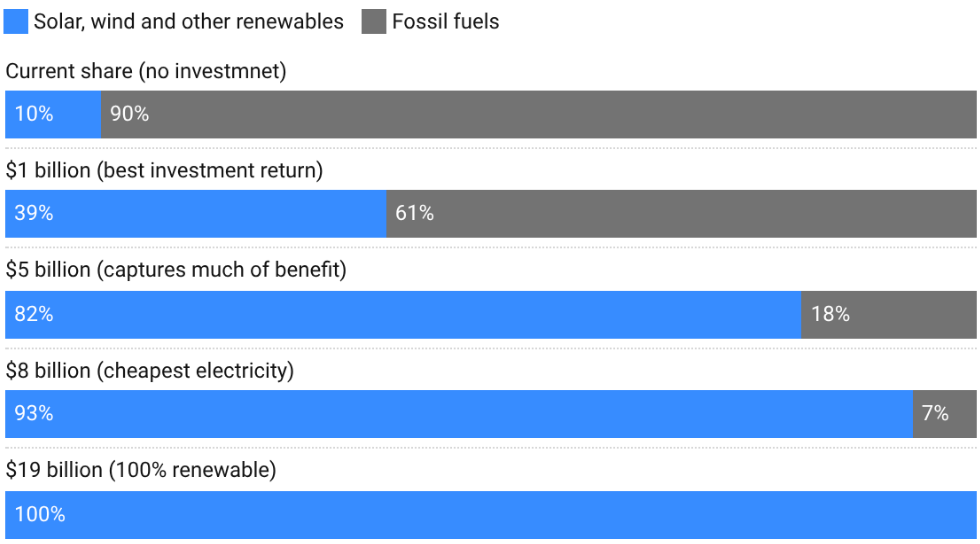
Key findings

- Cuba's dependence on imported fossil fuels has made it highly vulnerable to US coercion. The current crisis shows how this dependence creates an external lever that can be used to destabilise the electricity system and produce social and economic devastation.
- A rapid renewable electricity transition in Cuba is technically feasible and more cost-effective than continued investment in fossil fuel capacity in part because costs for key technologies have dropped dramatically. Even relatively modest investment would sharply raise renewable generation, cut operating costs and reduce exposure to imported fuel. Higher investment has an additional benefit: it cuts fuel costs dramatically, locking in more savings, even if prices fall.
- This analysis identifies two decisive thresholds. At around $8 billion, Cuba would reach 93 per cent renewable electricity generation and no longer need to import fossil fuels for electricity generation. At around $19 billion, Cuba would achieve a fully renewable power system. Smaller investments still deliver major gains (see Figure 1).

- Solar and battery systems should be central to every stage of the transition. Cuba's strong solar resources, recent deployment experience and rapidly falling technology costs mean solar-backed electrification can begin reducing fossil fuel dependence immediately. Storage strengthens resilience and supports higher renewable penetration over time. In this model, other technologies play large roles in some intermediate scenarios, but the broader strategic direction still points towards a system dominated by solar and, to a lesser extent, wind.
- Investment in Cuba's electricity system would be an act of climate justice, a form of development policy and a strategic investment in energy sovereignty. It would yield outsized economic and social returns, while providing a model for the Caribbean and economies that rely on imported fossil fuels for electricity generation.

Figure 1: Cuba's Electrical Grid: From Oil to Solar and Wind

Share of electricity generation from renewables and fossil fuels by investment scenario, per cent



"Current share" uses 2024 data and adds additional solar installed through early 2026, but does not include planned capacity. See text and other figures/tables for more detail.

Chart: Author's analysis and Ember Electricity Data Explorer; see Appendix for additional data sources • Created with Datawrapper

How Fossil Fuels Became a Lever of US Coercion

The energy blockade is not the first US attempt to isolate Cuba. For decades, the US has imposed an embargo that severely limits Cuba's trade with foreign entities. [7] Economy-wide sanctions and secondary sanctions regimes deter foreign firms by exposing them to legal and financial penalties, as well as the risk of losing access to the US financial system or market. This often leads to widespread over-compliance. [8] These tactics have widely been condemned as illegal under international law and as a form of collective punishment, given the toll they take on the Cuban people and economy. [9] A 2018 United Nations estimate put the economic damage of the embargo to Cuba at $130 billion, though some estimates are considerably higher. The losses to the US itself are also thought to run into the billions annually. [10] For example, the embargo has devastated Cuba's health system by severely restricting access to medicines, medical equipment and life-saving technologies, with especially harsh effects on children and other vulnerable groups. [11]

The US government's energy blockade is an escalation and an act of war on Cuba. [12] It is a more direct and indiscriminate form of the coercion Cuba has long faced for pursuing a social and economic model the US seeks to overturn. [13] Cutting off imported fuel intensifies suffering immediately: it disrupts hospitals, water systems, refrigeration, transport and other essential infrastructure, turning economic coercion into an acute energy, economic and humanitarian crisis. Although in February 2026 the US Supreme Court invalidated the commonly used legal basis for retaliatory tariffs, including on countries supplying oil to Cuba, those countries still face US sanctions and other forms of coercion. These include the interception and seizure of ships, for which no legal justification has been provided. [14]

The US is employing other strategies as well. It is investigating Cuban officials for alleged violations of US law, seeking to prosecute them in US courts under Washington's authority. [15] The US has also coerced countries to end their participation in Cuba's doctors abroad programme, a vital source of hard currency needed for trade, undermining a system that gives dozens of recipient countries access to low-cost medical care. [16] These are attempts to isolate Cuba, to put pressure on Cuban leaders through the immiseration of the civilian population and to destroy the Cuban economy.

By its own rhetoric, there is little ambiguity about the US government's intentions, nor do US officials appear concerned about the legality or humanitarian consequences of their policy. [17] The objective is clear: a government aligned with Washington's political objectives. [18] Washington is demanding that President Miguel Díaz-Canel resign and seeking compliant Cuban leaders who would accept political subordination. The US government is also reportedly lining up wealthy Republican donors for roles in a potential UScontrolled government. [19] These are transparent efforts to cultivate constituencies in and outside Cuba that oppose the government and prepare the ground for a US takeover. [20] To that end, while starving the island of fuel, the US government is also positioning itself as arbiter of who receives it and attempting to privatise the energy sector, so that Cuba becomes newly dependent on US fuel. [21] With Washington's permission, US suppliers can bypass the blockade to provide fuel to private enterprises but not to hospitals or other critical civilian infrastructure, shifting control away from the Cuban public sector. [22]

Cracks have begun to show in Washington's energy dominance strategy following the start of the illegal US–Israeli war on Iran in February 2026. [23] Seeking to stabilise oil prices, the White House issued temporary waivers on fuel from Russia and even Iran itself. [24] It was in that context that a Russian oil tanker was permitted to deliver its cargo to Cuba, with Trump saying he had "no problem" with the shipment. [25] This moment may therefore present an opportunity to break Cuba's dependence on imported fossil fuels through investment focused on renewables. Cuba is not starting from nothing; it has resources, experience and a foundation from which to respond.

Cuba's Green Foundations

Cuba's electricity system has historically relied on oil-fired thermal plants supplemented by smaller amounts of domestic natural gas, hydropower and, more recently, solar. [26] Its government has long recognised the vulnerabilities created by reliance on this ageing system and imported fuel. Its 2025 National Strategy for Energy Transition in Cuba aims for 100 per cent renewable energy by 2050, with intermediate targets along the way. [27] A 2024 study found that a 100 per cent renewable electricity grid would require investment of $25.8 billion. It also found that increasing the share of electricity generation from renewables would lower the cost of electricity relative to continued reliance on fossil fuels. [28] As the costs of renewable technologies continue to fall, renewable electricity is likely to play a much larger role in Cuba's transition, and sooner than expected.

Cuba also has a strong base from which to accelerate its energy transition: a national transition plan, an active solar and battery buildout, falling technology costs and strong solar potential. Over the last year, Cuba has brought more than 1,000 megawatts of solar online with Chinese imports, assistance and financing with roughly the same amount planned for the coming years. [29] This buildout has been described by experts as one of the most rapid solar expansions in the world. [30] The current solar deployment, and the wider transformation it could support, point towards greater energy sovereignty, since the sun cannot be blockaded.

Under any scenario, however, an energy transition in Cuba will require broader economic and social transformation, especially under newly intensified external constraints. Cuba has done this before. The end of Soviet support in the 1990s forced a rapid shift in agriculture towards agroecology and greater food self-sufficiency, a process now widely studied as a model of economic resilience. [31]

A Renewable Electricity System Is Affordable and Within Reach

Steep declines in solar and battery costs have changed the economics of the transition

Cuba's strong solar potential has long posed a familiar challenge: how to balance a renewable electricity system when demand peaks at night and solar output falls. Recent advances in battery technology have made that constraint much less binding. Batteries are now cheaper and more efficient, allowing daytime electricity to be stored and used more effectively at night. [32]

At the same time, the economics of solar have entered a new phase. Solar has already been cheaper than fossil fuel power on a lifetime basis in some contexts for at least a decade, but upfront costs have long remained a barrier. [33] That barrier is now weakening: solar is becoming competitive on upfront cost as well, while retaining vastly lower operating costs because it does not require fuel. Estimates vary, but even conservative readings point to steep declines for key technologies. Solar and wind costs have fallen by well over 30 per cent over the past five years. [34] Battery costs have fallen by about 40 per cent over the past year and by roughly 20 per cent per year over the past decade. [35]

Together, these shifts make a renewable electricity transition in Cuba much more feasible, especially if fuel prices rise further. [36] The case for renewable investment does not depend on the blockade continuing, however. While the blockade makes action more urgent, the economic fundamentals support a move to renewables in any case, particularly given wider vulnerabilities such as fossil fuel shocks. [37]

Two thresholds to energy sovereignty

Prior to the current crisis, electricity consumption reached approximately 19 terawatt-hours per year, a recent peak and the benchmark used in this analysis. [38] Renewables account for a growing but still modest share of total generation. The remainder still depends on imported and domestic fossil fuels — the vulnerability at the centre of this briefing. [39]

This analysis uses a cost-optimisation model to estimate how much upfront renewable investment would be needed for a 100 per cent renewable electricity system, what $1 billion and $5 billion of investment would deliver and what level of investment would yield the lowest-cost electricity when investment is not capped. [40]

These renewable investment scenarios are compared with a no-blockade baseline scenario. It assumes no energy blockade, uses mid-March 2026 market prices for fossil fuels and accounts for recently installed and planned renewable generation, including significant solar additions. [41] This scenario is nevertheless optimistic because it assumes that all existing fossil fuel generation capacity is available and that fuel supplies are adequate. These assumptions significantly overstate current operational reality.

The results identify two distinct thresholds. At around $8 billion, Cuba achieves low-cost electricity and no longer needs imported fossil fuels for electricity generation. At around $19 billion, Cuba achieves a fully renewable electricity system. [42] The first threshold breaks the main external lever of US coercion; the second completes the electricity transition.

Table 1 summarises the main results. [43] Several broader points emerge. Each investment level materially improves Cuba's electricity system, but the gains are not linear. The renewable share of generation rises from 23.7 per cent in no-blockade baseline scenario to 39.2 per cent with $1 billion investment, 82.0 per cent with $5 billion, 93.4 per cent with $8.0 billion (the least-cost electricity scenario and the first threshold that prevents future coercion) and 100 per cent with $19.2 billion. [44] Every pathway makes economic sense at current fuel prices and even more so if fuel prices rise. A $1 billion investment has the shortest simple payback period, from fuel savings and lower operating costs, versus the no-blockade at less than two years. [45] The $5 billion and $8 billion scenarios pay back in roughly two to three years, and even the fully renewable system has a simple payback period of only seven years. Electricity is cheaper in every renewable investment scenario than in no-blockade baseline scenario. The cost per unit of energy falls from 14.3¢ per kilowatt-hour in the baseline scenario to 12.1¢ with $1 billion of investment, 7.3¢ with $5 billion and 6.5¢ with $8.0 billion. For the fully renewable case, it rises to 9.9¢ because the model overbuilds capacity to deal with periods of low solar and wind output.

Table 1: Summary of Results by Investment Scenario

Share of electricity generation from renewables, annual savings, and simple (undiscounted) payback periods by investment scenario

Investment scenario	Investment, $B	Renewables generation	LCOE, ¢ per kWh	Annual savings, $B	Payback, years	No fuel imports
No-blockade baseline	*$0.0*	*23.7%*	*14.3*	-	-	-
$1 billion	$1.0	39.2%	12.1	$0.6	1.7	-
$5 billion	$5.0	82.0%	7.3	$2.1	2.4	-
Least-cost	$8.0	93.4%	6.5	$2.5	3.2	✅
100% renewable	$19.2	100.0%	9.9	$2.7	7.0	✅

Scenarios include planned renewable generation capacity. LCOE is the levelised cost of electricity and includes annualized capital costs (at 7.5 per cent weighted average cost of capital), fuel and operation and maintenance costs for all plants, including existing capacity. kWh is kilowatt-hour. Annual savings is the reduction in fuel and operation and maintenance costs compared to no-blockade baseline. Simple (undiscounted) payback periods are defined as: total investment divide by the annual operating cost savings versus no-blockade baseline. Least-cost scenario includes a small amount of imported fuel that could be replaced with domestic sources for negligible cost. See text and other figures/tables for more detail and Appendix Table 1 for full results including fuel price sensitivity.

Table: Author's analysis; see Appendix for additional data sources • Created with Datawrapper

These differences matter even more once fuel price risk is considered. This matters in particular because forecasts suggest fuel prices could remain elevated even if the war on Iran ends in the near term. [46] A greater investment buys cheaper electricity and makes the investment more resilient to fuel price changes. The $1 billion scenario has the fastest payback at current prices, but it still depends on fossil fuels for 61 per cent of generation. If fuel prices fell 15 per cent, the simple payback period would rise from 1.7 to 5.3 years. [47] If prices rose by 15 per cent, the payback period would fall to just one year (see Appendix Table 1). By contrast, higher investment pathways produce more persistent savings. For example, even if a 100 per cent renewable scenario were more expensive per kilowatt-hour than a no-blockade baseline scenario in a world with very cheap oil, the investment would still pay off because annual operating costs are much lower: there is no fuel bill. Thus, the more a country invests in renewables, the less its electricity costs depend on a volatile imported commodity and more savings is locked in by avoiding fuel costs.

In this model, the technology mix changes as investment rises (Tables 2 and 3). The $1 billion scenario is driven mainly by bioenergy; the $5 billion scenario relies heavily on bioenergy and wind. The least-cost scenario is solar-led with significant contributions from bioenergy and wind. Under this model, solar becomes the biggest source of generation and, along with batteries, receives the largest share of investment. In the 100 per cent renewable scenario, solar and batteries take on an even larger role, handling about 75 per cent of generation and receiving more than half of the investment.

Table 2: Higher-Investment Scenarios Are Increasingly Driven by Solar and Batteries

Investment by investment scenario and technology, $ billions

Investment scenario	Investment ▲	Solar	Bioenergy	Wind	Hydro	Batteries	Grid upgrades
$1 billion	$1.0	$0.0	$1.0	$0.0	$0.0	$0.0	$0.0
$5 billion	$5.0	$0.1	$2.9	$1.6	$0.0	$0.5	$0.0
Least-cost	$8.0	$2.4	$2.9	$1.5	$0.0	$1.2	$0.0
100% renewable	$19.2	$9.8	$2.9	$1.1	$0.2	$3.3	$2.0

See text and other figures/tables for more detail.

Table: Author's analysis; see Appendix for additional data sources • Created with Datawrapper

Table 3: Rising Investment Rapidly Shifts the Power Mix Toward Renewables

Share of electricity generation by investment scenario and source, per cent

Investment scenario	Investment, $B ▲	Fossil fuels	Solar	Bioenergy	Hydro	Wind
No-blockade baseline	*$0.0*	*76.3%*	*14.4%*	*3.0%*	*0.5%*	*5.8%*
$1 billion	$1.0	60.8%	14.4%	18.5%	0.5%	5.8%
$5 billion	$5.0	18.0%	14.9%	40.6%	0.5%	26.0%
Least-cost	$8.0	6.6%	37.2%	31.2%	0.5%	24.5%
100% renewable	$19.2	0.0%	74.1%	5.6%	0.9%	19.4%

Scenarios include planned renewable generation capacity in the baseline. See text and other figures/tables for more detail.

Table: Author's analysis; see Appendix for additional data sources • Created with Datawrapper

Table 4 shows the additional generation and storage capacity needed for these scenarios. Importantly, the scenarios that end dependence on imported fuel rely on major additions of solar and battery capacity. While the total solar capacity needed to build a fully renewable system in Cuba is significant — over 14 gigawatts — it represents just four days' worth of China's annual solar manufacturing capacity and eight days' worth of its actual output.[48]

Table 4: Adding Solar and Battery Capacity is Essential to Ending Dependence on Imported Fuel

Additional electricity generation and storage capacity by investment scenario and technology, megawatts

		Additional renewable generation capacity					
Investment scenario	**Investment, $B**	**Solar**	**Wind**	**Bioenergy**	**Hydro**	**Total**	**Batteries**
No-blockade baseline	*$0.0*	*2,000*	*431*	*77*	*65*	*2,573*	*0*
$1 billion	$1.0	0	0	400	0	400	0
$5 billion	$5.0	82	1,532	1,143	0	2,757	981
Least-cost	$8.0	3,494	1,471	1,143	0	6,108	2,413
100% renewable	$19.2	14,149	1,089	1,143	70	16,451	6,503

No-blockade baseline is installed and planned renewable generation capacity. Batteries are four-hour duration batteries. Existing or planned grid stabilization batteries are not included. See text and other figures/tables for more detail.

Table: Author's analysis; see Appendix for additional data sources • Created with Datawrapper

Policy pathways and sequencing the transition

This points to a practical pathway for Cuba: first eliminate the vulnerability created by imported fuel, then build from that more secure position towards a fully renewable system.[49] Renewables should be the focus of that process, with different technologies prioritised at each stage. In these scenarios, bioenergy and wind do more of the work at some intermediate stages, while solar and batteries become increasingly important as the system moves towards higher shares of renewable generation. Even so, solar and battery systems should be scaled throughout, with the exact mix shaped by costs, implementation constraints and the practical limits of domestic bioenergy.

These results are best read as indicative rather than predictive. The exact figures will change with technology costs, fuel prices, future demand and the practical constraints of implementation under embargo and blockade conditions. There are also good reasons to think some of these scenarios may be conservative. If solar, wind and battery technology costs averaged 30 per cent lower over the investment period, the estimated cost in a 100 per cent renewable scenario would drop from $19.2 billion to $14.9 billion, while the $8 billion scenario would fall to $6.5 billion (See Appendix Table 1). [50] The model also builds in flexibility by assuming fossil fuel plants are maintained even if they are not regularly used. It also excludes demand-side management, which could shift some demand from evening peak hours to midday and modestly improve system economics. [51]

A real electricity transition plan, however, would need to grapple with constraints that the model cannot fully resolve on its own. It would need to account for future demand growth, longer-term system change and the practical challenges of construction, maintenance, transport and spare parts under embargo conditions, even with sustained outside support. There are also genuine risks. Ageing infrastructure could reduce existing generation capacity, while a poor sugar cane harvest could limit fuel for bioenergy. [52] Recent energy projects have also revealed implementation problems. Delays in wind projects raise costs, and disappointing performance at one bioenergy plant may point to wider deployment problems. [53] These constraints are themselves intensified by the embargo and the energy blockade. If the technical assistance, concessional finance and implementation capacity that supported Cuba's recent solar rollout cannot be replicated for wind or bioenergy, costs could rise. [54] Even so, these risks do not overturn the basic case for transition: if bioenergy proves more limited than expected, wind, solar and storage remain viable alternatives. [55]

Those constraints might require flexibility in sequencing, not postponing the transition. Existing fossil fuel capacity should be consolidated into more reliable backup as renewable generation expands. This matters in part because the analysis in this briefing targets a previous peak of electricity consumption and does not model future demand increases. If demand rises, domestic oil and gas could meet part of that need in the short term instead of imported fuel. Decentralised solar can also play a useful complementary role. More than 10,000 solar kits have already been deployed in Cuba. [56] While they are not a substitute for grid electricity, they can provide backup power, some additional generation and greater resilience in moments of stress. [57] The challenge is thus one of policy design: how to sequence investment so that near-term resilience and long-term decarbonisation reinforce one another.

The Case for Concessional Finance

With hospitals still losing power and preventable deaths mounting, the question of how to finance Cuba's transition is not abstract. If the move to renewables is feasible and cheaper than continued fossil fuel dependence, the central question is how to finance it. The case for concessional finance rests on four overlapping grounds: the humanitarian emergency caused by the blockade, the economic merits of the transition, the need to restore energy sovereignty and the demands of climate justice.

Any of the investment pathways modelled here would be a strong candidate for concessional lending through development finance institutions. These pathways finance essential infrastructure, require significant upfront investment and would generate large social and economic returns over time. [58] The case is especially compelling because renewable power offers lower operating costs over time and increasingly competitive upfront costs as well. It also avoids the fuel imports that make fossil fuel-based systems so expensive and vulnerable. Although the transition requires more upfront investment than continued fossil fuel dependence, those costs would be recovered relatively quickly through lower fuel imports and operating costs.

That case becomes even stronger if development partners help Cuba access equipment and technical support on better terms than those available in distressed or sanctions-constrained markets. Where financing for a renewable rollout remains expensive, the premium often reflects country risk, currency volatility and policy uncertainty more than the cost of renewable technology itself — constraints that concessional finance can substantially reduce. [59] The result of the transition would be a cheaper, more secure electricity system and reduced reliance on imports and thus more economic policy space. By reducing the need for hard currency to pay for fuel imports, the transition would ease pressure to prioritise tourism and other hard-currency-earning sectors over domestic needs. It is also a matter of climate justice: Cuba is a low-emissions country, yet financing its transition would contribute to global decarbonisation while helping it escape a form of fossil fuel coercion.

Private or blended finance should not be a focus of Cuba's electricity transition. Extensive private control of the power system would move the country further away from public control, energy democracy and sovereignty. [60] Given the difficulty of mobilising private capital in less constrained contexts, and the urgency of Cuba's humanitarian crisis, the better route is concessional finance aimed at restoring electricity access, reducing external vulnerability and preserving public ownership. [61] A public development financing model would reduce fuel imports and hard currency pressure, whereas private capital is neither likely to arrive at the necessary scale nor desirable as the basis for rebuilding the system, although it could play a minor role. [62]

Puerto Rico is a cautionary example for Cuba. The island is already under US rule, its electricity system is undergoing privatisation and it has abundant renewable potential. Yet it continues to suffer chronic outages and very high electricity prices that privatisation was supposed to solve. [63] Since June 2021, Puerto Rico's grid has been run by the consortium LUMA. In December 2025, the Puerto Rican government sued to terminate the contract, citing chronic outages, rising bills and slow reconstruction. [64] In Puerto Rico, privatised electricity has not delivered reliability, affordability or a rapid shift to renewables, which suggests an externally managed and privatised reconstruction is a poor model for Cuba's recovery. [65]

The legal landscape for supplying Cuba's energy transition is more permissive than is often assumed, but sanctions risk and an opaque licensing process deter many actors exposed to the US financial system. [66] This helps explain why China, which can more easily operate outside that system, has emerged as Cuba's dominant partner in solar deployment. For other potential financiers, the issue is less formal legality than political willingness and risk tolerance. Blocking statutes — legislation that protects those conducting lawful trade — and multilateral channels, including those able to operate through alternative financial infrastructure and non-dollar currencies such as the renminbi, could partly address this problem. [67] Cuba is a BRICS partner country and may be able to access financing through the associated New Development Bank; United Nations funds, like the Green Climate Fund, have already supported projects in Cuba and the European Union's Global Gateway programme includes Cuba as a Caribbean partner. [68] Any serious financing strategy will need to combine Chinese bilateral support with multilateral mechanisms that can reduce risk and expand investment.

Why This Matters Beyond Cuba

Cuba exemplifies a wider reality across the Caribbean and much of the Global South: dependence on imported fossil fuels creates chronic vulnerability, while falling renewable costs create a viable route out. Jamaica, Barbados and many other similar economies face the same dependence on imported fuel and the same broad opportunity to reduce it through renewable energy. If Cuba cannot make this shift despite the strength of the case for it, that would reveal how little the international system — especially countries that have committed to UN climate targets — is willing to help when fossil fuel dependence is deliberately weaponised.

Cuba's case brings the politics of climate responsibility into sharp focus. Financing this transition should be understood as a form of reparative climate finance. There is a strong case that much of the cost should be borne by the Global North. [69] Cuba sharpens that argument to an unusual degree: it is a low-emissions country whose fossil fuel dependence has been deliberately weaponised by the world's largest historical emitter. The coercion it faces is a deliberate strategy to use energy as a tool of political control, not an abstract vulnerability. If the international community accepts this without a serious response, it sets a dangerous precedent. It would show both that fossil fuel dependence can be exploited to force political concessions from other countries, and that the global climate finance architecture has no answer when that happens. The annual United Nations climate summits — the Conferences of the Parties, or COPs — have increasingly acknowledged that those least responsible for the climate crisis often bear its greatest costs. The loss and damage framework advanced at COP27 and COP28 was intended to respond to precisely this kind of global inequality. [70] Financing Cuba's transition is therefore a concrete test of whether those commitments will be honoured in practice.

Beyond its direct economic benefits, investment in Cuba's electricity system would demonstrate that a rapid shift to renewables is possible even under severe external constraints. An $8 billion investment would give Cuba the highest non-hydro renewable electricity share in the world and place it among the first countries to approach a near-complete electricity transition (see Table 5). [71] A 100 per cent renewable system in Cuba would nearly double installed renewable power capacity in Central America and the Caribbean. [72] Either scenario would make Cuba an outsized contributor to the COP28 goal of tripling global renewable energy capacity by 2030. [73] These are extraordinary outcomes, giving Cuba unusual strategic significance as a test case for rapid renewable deployment.

Table 5: Investment to Escape the US Energy Blockade Would Make Cuba an Example to the World

Rank and share of electricity generation from renewables, excluding hydro, by country, per cent

	Country	Non-hydro renewable generation
1	**Cuba**	92.9%
2	Denmark	89.1%
3	Luxembourg	83.4%
4	Lithuania	78.3%
5	Kenya	68.1%
6	Uruguay	65.2%
7	El Salvador	58.2%
8	Estonia	55.3%
9	Germany	53.8%
10	Portugal	53.7%

Cuba data depicts the least-cost, $8.0 billion investment scenario. Other countries use 2024 data. See text and other figures/tables for more detail.

Table: Author's analysis and Ember Electricity Data Explorer • Created with Datawrapper

It would also create jobs in Cuba, particularly in the installation and maintenance of solar and battery systems. Around half of all solar jobs are local, a much larger share than for wind, making solar especially valuable as a source of domestic employment. [74] Much like Cuba's medical missions abroad, a solar-heavy transformation could lay the foundation for a solar corps that could later export technical expertise across the region, with Cuban technicians helping install and maintain systems elsewhere. That would bring much-needed hard currency to the island while lowering costs for other countries in the Global South beginning their own transitions — a practical form of green internationalism. Over time, wider regional deployment could also support local supply chains for key components.

An International Response

The analysis above points to a clear practical conclusion: Cuba's electricity transition is technically feasible and economically compelling, delivering it will require coordinated international action.

Recommendations

1 Provide concessional public finance for renewable electricity generation

Development finance institutions and climate funds should prioritise grants and concessional lending for renewable generation, batteries and grid modernisation, rather than fossil fuel supply.

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2 Protect trade, shipping and payment channels from US coercion

States supporting Cuba should use blocking statutes, public guarantees, alternative payment channels and shipping protections to reduce the practical force of extraterritorial US pressure.

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3 Use a flexible financing architecture

Financing should use all appropriate channels in order to widen participation and reduce sanctions risk.

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4 Prioritise the first threshold that ends imported fuel dependence for electricity

Near-term financing should focus first on the investment level needed to eliminate imported fuel use in power generation, then build towards a fully renewable system.

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5 Keep the transition under public control

Support should strengthen public ownership and energy sovereignty rather than use crisis conditions to force privatisation or externally managed reconstruction.

The price for external partners for this transition is modest when set against other recent costs or public expenditures. The 2022 energy shock cost the United Kingdom and the European Union about $1.8 trillion. [75] A fully renewable electricity system for Cuba would be about one per cent of that figure. It is also less than seven per cent of the resources committed to Ukraine by the European Union, United Kingdom and Canada, and about eight per cent of global official development assistance disbursed in 2024. [76]

Supporting Cuba in diversifying its external partnerships and reducing its exposure to US coercion would have benefits well beyond the island itself. Strategies that resist US energy dominance and the wider tactics through which Washington exerts pressure would strengthen the policy space of other states. This is true in Europe, which still faces US threats over Greenland and vulnerability due to reliance on US liquefied natural gas, as well as the world more broadly, which faces US threats of a blockade in the Strait of Hormuz. [77] China has already lowered the barriers to wider support by showing that renewable technologies can be delivered to Cuba at scale and at relatively low cost — a practical contribution to climate finance in its own right. [78] Several other states, like Mexico and Türkiye, have shown a willingness to challenge the blockade. [79]

The technical and financial case for Cuba's transition is clear. The remaining barrier is political will. More specifically, financing the transition is a test of whether multilateral commitments will be honoured when fossil fuel dependence has been weaponised by a powerful state. If those commitments are to mean anything, Cuba is a case in which they should be made real.

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Appendix

Full results

Appendix Table 1: Results for All Scenarios

Investment, yearly operating costs, LCOE, and simple (undiscounted) payback periods by investment scenario

Investment scenario	Investment, $B	Renewable generation	Fuel, $B	O&M, $B	LCOE, ¢ per kWh	Payback, years: vs -15%	Payback, years: vs baseline	Payback, years: vs +15%
No-blockade (-15% fuel)	*$0.0*	*23.7%*	*$2.6*	*$0.3*	*12.5*	-	-	-
No-blockade baseline	*$0.0*	*23.7%*	*$3.0*	*$0.3*	*14.3*	-	-	-
No-blockade (+15% fuel)	*$0.0*	*23.7%*	*$3.3*	*$0.3*	*15.9*	-	-	-
$1 billion	$1.0	39.2%	$2.4	$0.3	12.1	5.3	1.7	1.0
$5 billion	$5.0	82.0%	$0.8	$0.4	7.3	3.0	2.4	2.1
Least-cost (-30% key costs)	$6.5	93.4%	$0.4	$0.4	5.9	3.1	2.6	2.3
Least-cost	$8.0	93.4%	$0.4	$0.4	6.5	3.9	3.2	2.8
100% renewable (-30% key costs)	$14.9	100.0%	$0.0	$0.4	8.2	6.4	5.4	4.8
100% renewable	$19.2	100.0%	$0.0	$0.4	9.9	8.2	7.0	6.2

Scenarios include planned renewable generation capacity in the baseline. LCOE is the levelised cost of electricity and includes annualized capital costs (at 7.5 per cent weighted average cost of capital), fuel and operation and maintenance (O&M) costs for all plants, including existing capacity. kWh is kilowatt-hour. Lower-cost scenarios reprice solar, wind and batteries at 30 per cent lower. Simple (undiscounted) payback periods are defined as: total investment divided by the annual operating cost savings versus no-blockade baseline scenario. See text and other figures/tables for more detail.

Table: Author's analysis; see Appendix for additional data sources • Created with Datawrapper

Methodological notes

Notes: This is an indicative analysis that builds on Maximilian Brandts, Paul Bertheau, David Rojas Plana, Katrin Lammers and Manuel Alejandro Rubio Rodriguez, "An energy system model-based approach to investigate cost-optimal technology mixes for the Cuban power system to meet national targets", *Energy*, 2024, vol. 306, 132492. Key differences include: updated technology costs, different fuel price assumptions, the addition of budget-constrained scenarios and updated installed capacity figures. The analysis uses the Open Energy Modelling Framework (*oemof*) to find cost-optimal electricity generation mixes for Cuba. The hourly model optimises dispatch and investment across solar, onshore wind, bioelectricity, hydro, pumped hydro and battery storage, compared against no-blockade baseline fossil fuel scenarios. Installed and committed renewable capacity is credited. There is also some existing off-grid generation capacity that is excluded from the analysis. The model targets 19 terawatt-hours of end-use consumption which is a recent relative peak from before the current crisis. Low-cost scenarios reprice full-cost scenarios rather than re-optimising. This is conservative; the true cost reduction would likely be larger.

Assumptions: The weighted average cost of capital is 7.5 per cent, which factors into optimisation decisions. Technology costs reflect global benchmarks unless local costs are available. Fuel prices reflect world market prices in mid-March 2026 (crude oil at $100 per barrel, heavy fuel oil at $785 per metric ton, diesel at $4.23 per gallon) plus a 10 per cent delivery premium for imported fuels, which accounts for logistics and sanctions risk. For no-blockade baseline scenarios, transmission and distribution losses are assumed to be 16 per cent. For 100 per cent renewable scenarios, $2 billion in grid upgrades are assumed to reduce losses to 11 per cent; this may understate the full cost of grid modernisation. Domestically produced crude oil and gas is not distinguished from imported fuel in the cost optimisation. No-blockade baseline scenarios are optimistic; they assume all existing fossil fuel capacity is available and there is adequate fuel, which significantly overstates current operational reality.

Sources: Renewable technology costs are updated from "Renewable Power Generation Costs in 2024", International Renewable Energy Agency, 2025. Available here; and Kostantsa Rangelova and Dave Jones, "How cheap is battery storage?", Ember, 2025. Available here. Installed and committed capacity figures are cross-referenced with "IRENASTAT Online Data Query Tool", International Renewable Energy Agency, [undated], Available here. Hourly solar and wind profiles are from renewables.ninja: Iain Staffell and Stefan Pfenninger, "Using bias-corrected reanalysis to simulate current and future wind power output", *Energy*, 2016, vol. 114, pp. 1224–1239; and Stefan Pfenninger and Iain Staffell, "Long-term patterns of European PV output using 30 years of validated hourly reanalysis and satellite data", *Energy*, 2016, vol. 114, pp. 1251–1265. The synthetic demand profile is synthesised from Jyrki Luukkanen, Anaely Saunders Vazquez, Jasmin Laitinen and Burkhard Auffermann, "Cuban energy futures: The transition towards a renewable energy system", Finland Futures Research Centre, 2022. Available here. Hydro seasonality is based on Yalina Montecelos-Zamora, Tereza Cavazos, Thomas Kretzschmar, Enrique R. Vivoni, Gerald Corzo and Eugenio Molina-Navarro, "Hydrological Modeling of Climate Change Impacts in a Tropical River Basin: A Case Study of the Cauto River, Cuba", *Water*, 2018, vol. 10(9), 1135. Pumped hydro costs are from Vilayanur Viswanathan, Kendall Mongird, Ryan Franks, Xiaolin Li, Vincent Sprenkle and Richard Baxter, “2022 Grid Energy Storage Technology Cost and Performance Assessment”, Pacific Northwest National Laboratory, 2022. Available here. Cuba electricity system data and generation statistics are from Oficina Nacional de Estadística e Información, “Anuario estadistico de Cuba 2024, Mineria y energia”, Oficina Nacional de Estadística e Información, 2025. Available here.

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1. Ed Augustin and Jack Nicas, “Cuban Patients Are Dying Because of U.S. Blockade, Doctors Say”, *The New York Times*, 26 March 2026. Available here.

2. This US strategy includes control over energy production, shipping routes, insurance, finance and the use of sanctions and force, underwritten and leveraged by the militarisation of supply lines and chokepoints. See Kevin Cashman, “Trillion Dollar Bills: The Costs of Transatlantic Dependence for Europe”, Transition Security Project, 2026. Available here; and the US description of the concept in “2025 National Security Strategy”, White House, 2025. Available here.

3. Edward Helmore, “Cuba denounces US seizure of oil tanker off Venezuela’s coast as ‘piracy’”, *The Guardian*, 13 December 2025. Available here; Edward Wong, Simon Romero, Charlie Savage and Julian E. Barnes, “Trump Orders Blockade of Some Oil Tankers to and From Venezuela”, *The New York Times*, 16 December 2025. Available here.

4. “Addressing Threats to the United States by the Government of Cuba”, Executive Order 14380, The White House, 2026. Available here.

5. For a report on a tanker that was blocked from proceeding to Cuba, see “Report: USCG Cutter Blocks Tanker Bound for Cuba with Vital Fuel Supply”, *The Maritime Executive*, 13 February 2026. Available here.

6. Public ownership of energy infrastructure and the right of communities to make decisions about their energy systems and futures.

7. This analysis uses the term blockade to refer to the energy blockade of Cuba announced in January 2026. The term embargo is used for the longstanding unilateral coercive measures used against Cuba. For a technical analysis of the effects of sanctions regimes on a country, see Andrés Arauz and Michael Galant, “Producing Scarcity”, *Phenomenal World*, 3 April 2026. Available here.

8. Michael Galant, “US Sanctions Policy: Frequently Asked Questions”, Center for Economic and Policy Research, 2026. Available here.

9. Alena Douhan, “Enforcement and recent strengthening of U.S. sanctions deepen hardships for Cuban population: Special Rapporteur”, Office of the United Nations High Commissioner for Human Rights, 2025. Available here.

10. For Cuban losses see “U.S. trade embargo has cost Cuba $130 billion, U.N. says”, *Reuters*, 9 May 2018. Available here. Two estimates of US losses from the late 2000s are $1.2 billion and $4.8 billion annually. See Margot Pepper, “The Costs of the Embargo”, *Dollars & Sense*, 1 March 2009. Available here.

11. For a detailed accounting of social impacts, see “The US Embargo Against Cuba: Its Impact on Economic and Social Rights”, Amnesty International, 2009. Available here.

12. President John F. Kennedy acknowledged that an oil blockade would be an act of war during a news conference. “News Conference 51, March 6, 1963”, The John F. Kennedy Presidential Library & Museum, 1963, Available here.

13. See, e.g., “Cuba Embargoed: U.S. Trade Sanctions Turn Sixty”, National Security Archive, 2022. Available here.

14. Michael Galant and Pedro Labayen Herrera, "CEPR Sanctions Watch February 2026", Center for Economic and Policy Research, 2026. Available here.

15. Perry Stein and Jeremy Roebuck, "Justice Department targets Cuban officials, aims for indictments", *The Washington Post*, 6 March 2026. Available here. This strategy of using legal proceedings as a form of coercion and discipline has become more common in recent years.

16. Nahal Toosi and Eric Bazail-Eimil, "Memo lays out Trump's squeeze on Cuban doctor program", *Politico*, 13 March 2026. Available here; US coercion to end these programmes is arguably a form of collective punishment as well. See Mark Weisbrot, "U.S. sanctions to hurt Cuban civilians violate the Geneva Conventions", *The Los Angeles Times*, 1 April 2026. Available here.

17. Earlier this year Trump bragged about his power: "I can destroy the trade, I can destroy the country…[and] impose a foreign country-destroying embargo". On Cuba, Trump has demanded the President Miguel Díaz-Canel resign and has said, "It may be a friendly takeover, it may not be a friendly takeover. Wouldn't really matter because they're really down to…as they say, fumes. They have no energy, they have no money", "I do believe I'll have the honor of taking Cuba" and "I think I can do anything I want with it." See Sean Boynton, "Read the transcript of Trump's response to U.S. Supreme Court tariff ruling", *Global News*, 20 February 2026. Available here; Al Jazeera Staff and Reuters, "Trump threatens Cuba again, says island nation may face 'friendly takeover'", *Al Jazeera*, 10 March 2026. Available here; and Frances Robles, Edward Wong and Annie Correal, "Trump Administration Said to Tell Cuba That Its President Has to Go", *The New York Times*, 16 March 2026. Available here.

18. This is supported by recent comments from US Secretary of State Marco Rubio and recent reporting. See "Secretary of State Marco Rubio Remarks to Press", US Department of State, 2026. Available here; and José de Córdoba, Vera Bergengruen and Deborah Acosta, "The U.S. Is Actively Seeking Regime Change in Cuba by the End of the Year", *The Wall Street Journal*, 22 January 2026. Available here.

19. Simon Romero and David C. Adams, "With Cuba Under Pressure, the Castro Dynasty Is Making a Comeback", *The New York Times*, 28 March 2026. Available here; Robles et al., "Trump Administration Said to Tell Cuba That Its President Has to Go", *The New York Times*. Available here; Vivian Salama and Sarah Fitzpatrick, "Trump's Eye Is Already on Cuba", *The Atlantic*, 22 March 2026. Available here.

20. Al Jazeera Staff and Reuters, "Trump threatens Cuba again, says island nation may face 'friendly takeover'", *Al Jazeera*. Available here.

21. Eric Martin, Jim Wyss and Daniel Flatley, "Trump Aims to Steer Cuba Toward Greater Dependence on the US", *Bloomberg*, 26 February 2026. Available here.

22. Dave Sherwood and Marianna Parraga, "Exclusive: US ramps up fuel exports to Cuba's private sector", *Reuters*, 25 March 2026. Available here.

23. This weakness does not mean the US is likely to accept concessions in lieu of control. Venezuela and Iran both made significant concessions and were nevertheless invaded, and their leaders were assassinated or kidnapped. But as Cuba negotiates – and reportedly makes concessions, including about private investment from the US – Trump nevertheless threatens war: "I built this great military. I said, 'You'll never have to use it.' But sometimes you have to use it. And Cuba is next by the way." For Venezuela, see Anatoly Kurmanaev, Julian E. Barnes and Julie Turkewitz, "Venezuela's Maduro Offered the U.S. His Nation's Riches to Avoid Conflict", *The New York Times*, 10 October 2025. Available here. For Iran, see Hannah Ellis-Petersen, "Oman claims Israel pushed US into Iran war when deal was possible", *The Guardian*, 19 March 2026. Available here. For Trump's remarks, see Steve Holland and Gram Slattery, "Trump says 'Cuba is next' in speech touting US military successes", *Reuters*, 27 March 2026. Available here. For information on negotiations and concessions, see Frances Robles, Patricia Mazzei and Dariel Pradas, "Cuban President Acknowledges Talks With Trump Administration", *The New York Times*, 13 March 2026. Available here; and Frances Robles, "Cuban Americans Will Be Allowed to Own Businesses in Cuba, but Is That Enough?", *The New York Times*, 17 March 2026. Available here.

24. Robert Jimison, "Trump Draws Bipartisan Backlash for Easing Oil Sanctions on Russia and Iran", *The New York Times*, 25 March 2026. Available here.

25. Jack Nicas and Eric Schmitt, “U.S. Allows Russian Oil Tanker to Reach Cuba, Despite Blockade”, *The New York Times*, 29 March 2026. Available here; Vanessa Buschschlüter and Will Grant, “Russian oil tanker reaches Cuba after Trump appears to loosen blockade”, *BBC News*, 30 March 2026. Available here.

26. Maximilian Brandts, Paul Bertheau, David Rojas Plana, Katrin Lammers and Manuel Alejandro Rubio Rodriguez, “An energy system model-based approach to investigate cost-optimal technology mixes for the Cuban power system to meet national targets”, *Energy*, 2024, vol. 306, 132492.

27. Anaely Saunders Vazquez, Jyrki Luukkanen, Yrjo Majanne, Jarmo Vehmas and Jari Kaivo-Oja, “A multidimensional framework for analysis of Cuba’s 100% renewable energy system and the interlinkages of sustainable development goals”, *Renewable and Sustainable Energy Transition*, 2026, vol. 9, 100144.

28. Brandts et al., “An energy system model-based approach to investigate cost-optimal technology mixes for the Cuban power system to meet national targets”, *Energy*, 132492. For a 27 terawatt-hours demand scenario, the authors found that a 100 per cent renewable electricity system (scenario 6) had a levelized cost of electricity (LCOE) of 11.3¢ per kilowatt-hour versus a cost of 11.6¢ for a business as usual system (scenario 1).

29. Jude Webber, Rachel Millard and Joe Daniels, “Power-starved Cuba deepens reliance on Chinese solar tech”, *The Financial Times*, 6 April 2026. Available here; and Anett Rios and Alien Fernandez, “Cubans fight blackouts with solar as US extends oil chokehold”, *Reuters*, 20 February 2026. Available here. Cuba has also lowered barriers to individuals acquiring renewable technologies. See Saunders Vazquez et al., “A multidimensional framework for analysis of Cuba’s 100% renewable energy system and the interlinkages of sustainable development goals”, *Renewable and Sustainable Energy Transition*, 100144.

30. See commentary from Ember analyst Dave Jones in Rebecca Tan and Rudy Lu, “Trump has choked off Cuba’s oil supply. China is stepping in with solar”, *The Washington Post*, 19 March 2026. Available here.

31. Leidy Casimiro, Margarita Fernandez and Giraldo Martin, “Bringing Cuban agroecology to the next level”, *Rooted Magazine*, 15 July 2024. Available here.

32. See Kostantsa Rangelova and Dave Jones, “Solar electricity every hour of every day is here and it changes everything”, Ember, 2025. Available here.

33. Daan Walter, Sam Butler-Sloss, Antoine Issac and Kingsmill Bond, “The electric fast-track for emerging markets”, Ember, 2026. Available here.

34. “Renewable Power Generation Costs in 2024”, International Renewable Energy Agency, 2025. Available here.

35. Kostantsa Rangelova and Dave Jones, “How cheap is battery storage?”, Ember, 2025. Available here.

36. For this analysis, it is assumed capital costs for Cuba are the global average unless Cuba-specific observations are available. While Cuba may have higher costs in some regards (e.g., shipping and logistics) it may also have lower costs in other respects (e.g., labour, land cost, concessional pricing). For the oil price forecast, see “Barclays raises 2026 Brent forecast to $85 a barrel on Strait of Hormuz”, *Reuters*, 13 March 2026. Available here.

37. For an analysis of the costs of the 2022 energy shock, see Cashman, “Trillion Dollar Bills: The Costs of Transatlantic Dependence for Europe”, Transition Security Project. Available here.

38. This is considerably higher than electricity consumption during the current energy blockade.

39. “Yearly Electricity Data”, Ember, [undated]. Available here.

40. This analysis credits installed and planned capacity. It models the electricity system only, not the full energy system. Full energy sovereignty would also require longer-term electrification or other solutions for transport, cooking, heating and agricultural fuel use, which are beyond the scope of this briefing. In addition, the cost-optimisation model does not explicitly assess grid stability, power

quality, or all of the transmission, distribution and implementation challenges associated with very high renewable generation in an isolated island system.

41. Fuel prices reflect world market prices in mid-March 2026 (crude oil at $100 per barrel, heavy fuel oil at $785 per metric ton, diesel at $4.23 per gallon). A 10 per cent delivery premium for imported fuels, which accounts for logistics and sanctions risk, is also added.

42. This analysis uses the Open Energy Modelling Framework (*oemof*) to find cost-optimal electricity generation mixes for Cuba. See Appendix for more details.

43. See Appendix Table 1 for full results including those scenarios used for sensitivity analyses.

44. The fully renewable scenario includes $2 billion for grid modernisation, which is assumed to lower the transmission and distribution losses from 16 per cent to 11 per cent.

45. Annual savings is the reduction in fuel and operation and maintenance (O&M) costs compared to no-blockade baseline scenarios. Simple (undiscounted) payback periods are defined as total investment divided by annual operating cost savings versus the no-blockade baseline scenario. Simple payback calculations ignore the time value of money, the system lifetime, and total returns. This may understate the value of investment, especially as it increases.

46. Robin Wigglesworth, "Goldman Sachs now reckons that oil could take out the 2008 record of $147", *The Financial Times*, 23 March 2026. Available here.

47. If they fell far enough, the investment would never pay off if indirect or non-monetary benefits are not taken into account.

48. China's annual solar manufacturing capacity is about 1,160 gigawatts; actual 2024 output was about 630 gigawatts. Cuba's modelled solar need is about four days of manufacturing capacity or about eight days of actual output. See "National Survey Report of PV Power Applications in China 2024", International Energy Agency, 2024. Available here.

49. See, e.g., Walter et al., "The electric fast-track for emerging markets", Ember. Available here. This is consistent with Cuba's 2025 National Strategy for Energy Transition in Cuba, which sets an early generation goal by 2030, independence from imported fossil fuels by 2035 and a fully renewable system by 2050. See Saunders Vazquez et al., "A multidimensional framework for analysis of Cuba's 100% renewable energy system and the interlinkages of sustainable development goals", *Renewable and Sustainable Energy Transition*, 100144.

50. For costs and trends, see "Renewable Power Generation Costs in 2024", International Renewable Energy Agency. Available here; and "Global Electricity Review 2025", Ember. Available here.

51. There is also some existing off-grid generation capacity that is excluded from the analysis.

52. These risks should be acknowledged clearly and put in context. Cuba's sugar sector has been hit hard by shortages of fuel, fertiliser, machinery and other inputs after a tightening of US sanctions over the last few years, and these constraints have been intensified by the energy blockade. The weak sugar harvest should therefore not be treated as a fixed constraint, but as part of the same fossil fuel vulnerability this pathway is designed to overcome. As renewable generation expands, scarce imported or domestic fuel can be redirected away from electricity generation and towards agriculture, transport and other productive uses, helping to ease the bottlenecks that now weigh on bioenergy and the wider economy. See Marc Frank, "Cuban sugar industry demise mirrors food crisis", *Reuters*, 28 November 2024. Available here.

53. See Ricardo Torres Pérez, "Without Power, There Is No Country: Cuba's Electricity Generation Crisis", Cuba Study Group, 2026. Available here.

54. Incorporating the biggest risks from the Cuba Study Group analysis into this analysis – higher wind costs and lower bioenergy availability – leaves the $1 billion scenario largely unchanged. But it reduces the renewable share in the $5 billion scenario by about ten percentage points, raises costs in the cost-optimised

scenario by about 30 per cent, and increases the cost of the 100 per cent renewable scenario by about 40 per cent. Even under these adverse assumptions, all scenarios still have compelling payback periods and lower unit costs of electricity than the no-blockade baseline cases. Some caution is warranted, however, because these risks may be overstated. Higher wind costs make wind uncompetitive in every scenario, so no new wind capacity is built at all. That is out of step with much of the wider analysis of wind potential in the Caribbean. Likewise, the disappointing performance of one bioenergy plant and a poor sugar cane harvest may reflect current constraints rather than permanent ones. The key point is that the problems affecting current projects should be addressed, especially where they stem from inadequate technical assistance, logistical bottlenecks, or other remediable constraints. It should not be assumed that wind and bioenergy are unviable or that their respective costs are structurally shifted upwards. See "Sustainable bioenergy potential in Caribbean small island developing states", International Renewable Energy Agency, 2024. Available here.

55. A recent analysis shows that solar and battery systems are cost-effective and can now handle 97 per cent of daily electricity demand in the sunniest places. See Rangelova and Jones, "Solar electricity every hour of every day is here and it changes everything", Ember. Available here.

56. Carmen Maturell Senon and Laura Mercedes Giráldez, "Facing the energy blockade: alternatives for sustainability", *Granma*, 27 March 2026. Available here.

57. Low solar and battery prices have also dramatically reduced the cost of these kits, although they do still require a significant upfront investment. A basic kit for essentials provided to all households (3.8 million) in Cuba would cost roughly about $380 million, while a more extensive kit that could power fans and refrigerators would cost $5.7 billion. This assumes $100 for a basic kit and $1,500 for a high-end kit. See "2024 Off-Grid Solar Market Trends Report", ESMAP/World Bank, 2024. Available here. International support and savings from avoided fuel imports could finance these kits, and the deployment could scale up or down depending on the need. These kits could also be connected to the grid and provide a modest source of income to households. Torres Pérez notes that Cuba pays little compared to other countries for power supplied to the grid, so external financing is still needed. See Torres Pérez, "Without Power, There Is No Country: Cuba's Electricity Generation Crisis", Cuba Study Group. Available here.

58. The scenarios modelled in this analysis have positive net present values. At plausible social discount rates, they would have high indicative rates of return across the main investment cases. This is likely conservative, because these scenarios exclude several important economic benefits, including improved reliability, avoided outage costs, lower local pollution and residual asset value. The simple payback calculations used in this analysis may understate the value of investment, especially as it increases.

59. Walter et al., "The electric fast-track for emerging markets", Ember. Available here.

60. Public control and energy democracy are increasingly the focus of civil society around the world, especially given the recent global energy shocks. For background see, e.g., Sean Sweeney, "Towards a Public Pathway Approach to a Just Energy Transition for the Global South", Trade Unions for Energy Democracy, 2023. Available here; and Sean Sweeney, "Mapping a Public Pathway for Europe's Energy Transition", Trade Unions for Energy Democracy, 2024. Available here.

61. For structural constraints to private finance, see Torres Pérez, "Without Power, There Is No Country: Cuba's Electricity Generation Crisis", Cuba Study Group. Available here. For the US's recent attempts to introduce private investment in Cuba, see Robles, "Cuban Americans Will Be Allowed to Own Businesses in Cuba, but Is That Enough?", *The New York Times*. Available here. For a discussion on major problems with blended finance, see Farwa Sial, "Blended finance can perpetuate climate colonialism", *Climate Home News*, 15 February 2024. Available here.

62. Indeed, a private solar park in Cuba faces considerable constraints on its business activity. See Webber et al., "Power-starved Cuba deepens reliance on Chinese solar tech", *The Financial Times*. Available here.

63. See "Puerto Rico Grid Resilience and Transitions to 100% Renewable Energy Study (PR100): Summary Report", National Renewable Energy Laboratory, 2024. Available here.

64. Dánica Coto, “Puerto Rico sues Luma in first push to cancel contract with private power company”, *Associated Press*, 12 December 2025. Available here.

65. Set against the Puerto Rico example are public electrification efforts such as the Tennessee Valley Authority and the Rural Electrification Administration, which show that essential power infrastructure has often been built through public institutions and subsidised federal lending rather than by waiting for purely commercial returns.

66. Douhan, “Enforcement and recent strengthening of U.S. sanctions deepen hardships for Cuban population: Special Rapporteur”, Office of the United Nations High Commissioner for Human Rights. Available here.

67. For blocking statutes from the European Union and United Kingdom, see “INSIGHT: Cuba Sanctions”, Skuld, 2025. Available here.

68. BRICS is the intergovernmental organisation named for early members Brazil, Russia, India, China and South Africa. For Cuban programmes, see Directorate-General for International Partnerships, “Two years on: the EU, Latin America and the Caribbean turn Global Gateway commitments into action”, European Commission, 2025. Available here; and “Green Climate Fund approves a $119 million climate resilient project for Cuba”, Food and Agriculture Organization, 2020. Available here.

69. For a complete argument, see Fayola Jacobs, Patrick Bigger, Ketaki Zodgekar, Avery Sinclair Raines and Shady Lawendy, “Reparative Fiscal Justice for Caribbean Climate Action”, Climate and Community Project, 2024. Available here.

70. See “Taking responsibility: Towards a fit-for-purpose Loss and Damage Fund”, UNCTAD, 2023. Available here. At COP29, parties agreed to provide a floor of $300 billion per year in climate finance by 2035. See “All roads lead to reform: A financial system fit to mobilize $1.3 trillion for climate finance”, UNCTAD, 2026. Available here.

71. Based on an analysis of electricity data from Ember. See “Yearly Electricity Data”, Ember. Available here.

72. See Figure 1.1 in “Renewable Power Generation Costs in 2024”, International Renewable Energy Agency. Available here.

73. “COP28 Agreement Signals “‘Beginning of the End’ of the Fossil Fuel Era”, UNFCCC, 2023. Available here.

74. “Renewable Energy and Jobs: Annual Review 2025”, International Renewable Energy Agency, 2026. Available here.

75. This cost is from higher prices and public spending. See Cashman, “Trillion Dollar Bills: The Costs of Transatlantic Dependence for Europe”, Transition Security Project. Available here.

76. For Ukraine aid, see “EU solidarity with Ukraine”, Council of the European Union, [undated]. Available here; “UK support to Ukraine: factsheet”, The UK Government, 2026. Available here; and “Government of Canada reaffirms unwavering support for Ukraine four years into Russia’s full-scale invasion”, Government of Canada, 2026. Available here. For estimates of official development assistance, see Sara Harcourt and Jorge Rivera, “Official Development Assistance”, ONE Campaign, 2025. Available here.

77. Cashman, “Trillion Dollar Bills: The Costs of Transatlantic Dependence for Europe”, Transition Security Project. Available here; Dan Sabbagh and Sam Jones, “Trump says US will blockade strait of Hormuz after Iran peace talks fail”, *The Guardian*, 12 April 2026. Available here.

78. Although the terms are largely unknown, support from China thus far is likely a combination of concessional financing, in-kind donations and payments and grants. See Webber et al., “Power-starved Cuba deepens reliance on Chinese solar tech”, *The Financial Times*. Available here. In practice, heavily discounted solar exports function as a transfer of value to importing countries, lowering the capital cost of transition.

79. “President Sheinbaum defends Mexico’s right to supply oil to Cuba”, *Reuters*, 30 March 2026. Available here; Macarena Hermosilla, “Cuba reactivates floating power

plants operated by Turkish company”, *UPI*, 7 April 2026. Available here.