

National Electricity Sector Policy 2026 (NESP 2026)

Public Consultation Submission · 21 May 2026

Dear Minister,

Thank you for the opportunity to comment on the NESP 2026.

As a Bermudian and parent of both a young adult and a teenager, I am understandably concerned with how policies shape energy costs and energy independence, both for this and future generations.

I have a direct financial stake in decisions that will determine electricity bills for 30 years or more, and a generational stake in whether Bermuda's energy policy is consistent with the climate trajectory that most affects this island.

The analysis and sources in this submission are drawn entirely from publicly available material, including Bermuda's own regulatory documents, peer-reviewed research, and data from the IEA, IRENA, and BloombergNEF.

1. RISING BILLS HAVE A STRUCTURAL CAUSE THAT THE POLICY DOES NOT ADDRESS

Electricity bills rise when fixed infrastructure costs are shared among fewer customers. Population changes, the prolonged closure of major commercial facilities, and island-wide efficiency improvements have all reduced total electricity consumption in recent years. Distributed solar generation (rooftop and ground-mounted) accounts for roughly 3% of Bermuda's total electricity supply. It is not, and cannot be, the primary cause of rising tariffs.

The Fuel Adjustment Rate — the variable fuel cost component on every customer's bill — is the single largest driver of bill variability. It rises and falls with global energy prices. Switching from oil to LNG does not eliminate this exposure; it transfers it to a different imported fuel subject to the same global market forces.

Bermuda's experience is consistent with the documented vulnerability of small island economies worldwide: the United Nations Development Programme and the International Renewable Energy Agency (IRENA) both identify fossil-fuel import dependency as the primary driver of high and volatile electricity costs for Small Island Developing States (SIDS).

"SIDS have some of the highest electricity costs in the world, due in part to their dependence on imported fossil fuels." — UNDP Climate Promise, 2024.

"As remote island nations, these states face challenges in securing reliable and affordable energy as they remain highly dependent on importing fossil fuels." — IRENA / Asian Development Bank, 2025 Energy Transition Readiness Assessment.

I urge the Ministry to commission a clear, public analysis of what is actually driving demand decline before finalising policy.

RECOMMENDATION: The Ministry should publish a **Customer Bill Transparency Report** that disaggregates the components of the average residential bill — base tariff, fuel adjustment, capital recovery, and distribution — with a five-year trend line. This would allow the public to assess the actual drivers of cost increases and evaluate competing policy claims against a common factual baseline.

2. LNG HAS ALREADY BEEN EXAMINED AND REJECTED, TWICE, FOR CLEAR REASONS

Bermuda conducted two rigorous, independently reviewed Integrated Resource Planning exercises in 2019 and 2024. Both pointed away from LNG.

The 2019 RA-approved IRP selected the non-LNG path, warning that an LNG commitment “*would influence energy policy and prices for up to 50 years.*” LNG was only approximately 6% cheaper under **base case** assumptions, and a 25% increase in costs would reverse that advantage entirely. BELCO’s **own** 2024 Preferred Plan also rejected LNG, selecting solar, battery storage, and other renewables instead. BELCO’s **own** generation cost data shows solar at \$0.072/kWh, the cheapest available option by a wide margin.

The history of the North Power Station confirms the risks. Documents released under the Public Access to Information Act confirm BELCO optimised that station for LNG **without** Regulatory Authority approval. When LNG was rejected, the resulting soot problems required a \$2.4 million retrofit. The courts ruled those costs could not be passed to electricity customers. Bermuda has already absorbed the cost of one rejected LNG plan.

The 2026 Iran conflict and Strait of Hormuz closure has powerfully confirmed the risk Bermuda’s planners identified. Beginning on 4 March 2026, Iranian forces declared the Strait closed, halting traffic through the waterway through which, according to the IEA’s May 2026 assessment, more than 20% of globally traded oil and liquefied natural gas transits under normal conditions.

The IEA characterised this as “*the largest energy crisis we have ever faced.*” Simultaneously, global combined-cycle gas turbine (CCGT) plant costs have risen 16% to \$102/MWh — their highest level on record — according to BloombergNEF’s LCOE 2026 report published in February 2026.

A long-term LNG commitment made today would lock Bermuda into procurement from the same global market that has just experienced its worst-ever supply shock.

“We are facing the biggest energy security threat in history.” — IEA Executive Director Fatih Birol, CNBC, April 2026. Birol urged governments to bolster resilience specifically through renewables, noting that solar, wind and electric vehicles would all benefit from the crisis.

The IEA has documented that short-term supply losses from the 2026 conflict could result in a cumulative loss of around 120 billion cubic metres of LNG supply between 2026 and 2030, with impacts felt through 2026 and 2027. — IEA, The Middle East and Global Energy Markets, 2026.

I ask the Ministry to please explain what new evidence justifies reversing two carefully considered planning decisions in light of this geopolitical context.

RECOMMENDATION: The Ministry should formally address, in writing, the geopolitical risk dimension of any LNG proposal. Any assessment of LNG cost competitiveness must include a **supply security stress test** modelling Bermuda’s exposure under a sustained Strait of Hormuz closure, and must compare that exposure against a scenario in which the same capital is invested in domestically generated solar and storage.

3. CAPITAL MUST BE INVESTED IN FLEXIBLE SOLUTIONS, NOT LOCKED INTO FOSSIL FUEL INFRASTRUCTURE

Under Bermuda’s regulatory framework, every dollar of approved capital investment in LNG infrastructure earns a guaranteed return recovered from electricity bills for the life of that asset, potentially 30 years or more. That same capital directed toward battery storage, smart grid technology, and demand management would create flexible, upgradeable assets whose costs are falling, year on year. Capital committed to LNG cannot be redirected when better solutions emerge. Capital invested in flexible technologies retains that option.

As Bermuda deploys more renewable generation, the volume of LNG required would decrease, driving per-unit LNG costs progressively higher. LNG becomes more expensive the more successful Bermuda’s renewable programme becomes. To understand why this matters, it is worth briefly explaining how the regulatory framework operates.

Under Bermuda’s rate-of-return model, the Regulatory Authority sets BELCO’s allowed revenue based on an approved capital base and a permitted return on that base — set at 7.79% for 2024 and 2025. Every dollar of capital investment approved by the RA earns that return, recovered through customer tariffs, for the economic life of the asset. This creates a structural incentive for a capital-intensive utility to prefer large infrastructure investments over demand-side or software-based solutions, because only physical capital earns a regulated return.

Battery storage, smart grid software, demand response programmes, and time-of-use pricing infrastructure deliver consumer benefits but generate less regulated return than a gas terminal or generation plant. The Ministry and the RA should be alert to this dynamic when evaluating any LNG proposal and should consider whether the regulatory framework itself needs to be adapted to properly reward flexible, lower-capital alternatives.

The stranded asset risk is not theoretical. A 2025 peer-reviewed analysis published in *ScienceDirect* found that planned LNG import infrastructure across developed economies risks severe overcapacity as renewable costs continue to fall, creating exactly the stranded asset scenario that Bermuda’s own 2019 IRP warned against. The Global Energy Monitor has quantified this risk across Asia at \$379 billion in committed LNG capital that now faces stranding as solar-plus-battery generation at \$30–40/MWh decisively undercuts LNG-fired power at \$80–120/MWh.

A February 2026 analysis found that “\$394 billion in committed LNG capital faces stranded asset risk as solar at \$30-40/MWh defeats LNG-fired power at \$80-120/MWh.” — SolAbility, Global LNG Outlook: Stranded Assets Risk Analysis, 2026.

I urge the Ministry to require any proposed LNG investment to be explicitly evaluated against equivalent capital invested in modern, flexible alternatives, with the cost comparison conducted using current market data rather than projections prepared prior to the 2026 CCGT cost increases.

RECOMMENDATION: The Regulatory Authority should be directed to publish a **comparative capital allocation analysis** showing the 30-year total consumer cost (including fuel, capital recovery, and stranded asset risk) of three scenarios: (a) LNG infrastructure; (b) equivalent capital in battery storage and solar; and (c) a hybrid approach. This analysis should use BloombergNEF’s February 2026 benchmark data, which places four-hour battery storage at \$78/MWh — below the cost of new CCGT generation.

4. RENEW THE COMMITMENT TO CLEAN ENERGY WITH THE TOOLS TO DELIVER IT

Bermuda’s own Integrated Resource Planning process — conducted by the Regulatory Authority — has found that 59% renewable electricity is achievable. The tools exist: solar at \$0.072/kWh, rapidly improving battery storage, island-wide smart meters already installed, and time-of-use pricing that incentivises demand shifting.

Battery storage costs have reached record lows that fundamentally alter the energy economics. BloombergNEF’s Levelized Cost of Electricity 2026 report, published February 2026, found that the global benchmark cost for a four-hour battery storage project fell 27% year-on-year to \$78/MWh in 2025 — the lowest level recorded since BNEF began tracking in 2009.

The LCOE for a four-hour battery system is now below \$100/MWh in six markets globally. By contrast, the LCOE for new combined-cycle gas turbines rose 16% to \$102/MWh — their highest level ever recorded. Battery storage is now **cheaper than new gas plant** construction on a like-for-like basis.

“As costs continue to drop, we expect battery storage to strengthen solar project revenues, support broader renewable deployment and accelerate the shift toward storage-led system balancing over fossil-fuel-based peaking capacity.” — Amar Vasdev, Senior Energy Economics Associate, BloombergNEF, February 2026.

BNEF forecasts further LCOE reductions of 30% in solar and 25% in battery storage by 2035, while gas turbine prices are expected to remain elevated due to high demand from data centers. — BloombergNEF LCOE 2026 Report.

Proponents of LNG often argue that it offers cost certainty relative to renewables. The opposite is true. The future cost of solar generation, once installed, is essentially knowable: equipment and installation costs are well understood, and the fuel is free. LNG infrastructure, by contrast, permanently exposes every customer bill to a global commodity market beyond Bermuda’s control. The 2026 Iran conflict and Strait of Hormuz closure — and the resulting price surge from \$72/barrel to over \$100/barrel within weeks — illustrates precisely what “cost certainty” from LNG actually means in practice. Once installed, solar generation carries no fuel cost and therefore no equivalent of the quarterly Fuel Adjustment Rate. Storage costs are similarly fixed at the point of capital investment. LNG, by contrast, exposes every bill to commodity market movements in perpetuity.

“The fundamental problem with any fossil fuel investment is uncertainty. Aside from infrastructure, the buyer is permanently exposed to a global commodity market that is beyond their control... Contrast that with solar. The future cost of solar generation is largely knowable. Equipment and installation costs are well understood. Once solar panels are installed, the fuel is free.” — Honolulu Star-Advertiser, May 2026.

That knowable cost has also been falling at a rate without precedent in the history of electricity generation. The solar and storage cost advantage over LNG is significant today; the more important point is that it is **structural and widening**. Solar PV LCOE has fallen over 90% since 2010 — from approximately \$0.40/kWh to \$0.033/kWh in the most competitive markets today. Battery storage costs have fallen 89% over the same period.

These are not marginal improvements; they represent a fundamental reshaping of the economics of electricity generation. The 2025 supply chain disruptions that caused a temporary 6% rise in the solar benchmark to \$39/MWh are a short-term deviation in a long-term structural trend. BloombergNEF projects a further 30% reduction in solar LCOE and 25% reduction in battery LCOE by 2035, with battery storage forecast to reach \$58/MWh.

The LCOE of utility-scale solar PV fell over 90% between 2010 and 2023, reaching as low as \$0.03/kWh in sun-rich regions. Battery storage costs fell 89% over the same period, from \$2,511/kWh to \$273/kWh. — IRENA, 2024; Rezaee and Silva, Energy & Environmental Materials, January 2026.

An LNG infrastructure commitment made in 2026 would earn a guaranteed regulatory return for 30 years or more. Over that same window, solar and storage costs will fall materially further. The capital recovery mechanism that makes LNG infrastructure attractive to investors is precisely what makes it dangerous for electricity consumers: it locks in today’s higher cost against a technology curve that runs in the opposite direction.

Every year that Bermuda delays a solar and storage commitment is a year of unnecessary exposure to fossil fuel price volatility; every year of delay on LNG is a year in which the avoided cost grows larger.

Bermuda’s solar resource further strengthens this case. Bermuda’s latitude and Atlantic position give it a solar irradiance profile substantially better than northern European markets where solar has already displaced gas as the default new-build choice. BELCO’s own cost figure of \$0.072/kWh for solar — already the cheapest generation option in the 2024 Preferred Plan — reflects Bermuda-specific conditions.

As global benchmark solar costs continue falling toward and below \$30/MWh, Bermuda’s resource advantage means its own solar economics will improve in parallel. The island’s relatively small grid also means that the absolute storage capacity needed to firm solar output is modest and achievable at lower total cost than on a continental grid.

What has been missing is the implementation framework: land-use planning, a storage roadmap, and tariff reform that shares costs fairly among all customers.

I urge the Ministry to commit to these mechanisms with defined timelines rather than reopening a fuel pathway that its own planning has twice set aside.

This direction is consistent with the trajectory of global energy investment. IRENA’s Renewable Capacity Statistics 2025 recorded the largest single-year increase in renewable capacity in history in 2024 — 585 gigawatts added, representing 92.5% of all new global power capacity that year. The IEA’s Net Zero by 2050 roadmap states explicitly that beyond projects already committed as of 2021, no new oil and gas fields should be approved for development. These are not advocacy positions: they are the published conclusions of the same multilateral energy agencies whose data this submission cites throughout. Bermuda’s proposed direction — solar, storage, demand management, and no new fossil fuel infrastructure — aligns precisely with the global consensus on what an evidence-based energy transition requires.

“Beyond projects already committed as of 2021, there are no new oil and gas fields approved for development in our [net zero] pathway, and no new coal mines or mine extensions are required.” — IEA, Net Zero by 2050: A Roadmap for the Global Energy Sector, 2021.

RECOMMENDATION: The NESP 2026 should include a **Renewable Energy Implementation Plan** with specific milestones for: (1) land use consents for solar development; (2) a battery storage procurement roadmap; (3) time-of-use tariff introduction; and (4) a demand response programme utilising the existing smart meter infrastructure. Each milestone should have a defined completion date and an accountable agency.

5. THE EMISSIONS CASE FOR LNG DOES NOT HOLD UNDER PROPER MEASUREMENT

The environmental case for LNG as a “bridge fuel” rests on comparing only end-use combustion emissions — an incomplete and misleading methodology. When the full lifecycle is measured, the picture reverses entirely.

Peer-reviewed research by Professor Robert Howarth of Cornell University, published in *Energy Science & Engineering* (Wiley, October 2024), found that LNG’s greenhouse gas footprint is 33% greater than coal over a 20-year measurement timeframe — and equals or exceeds coal even on a 100-year basis. End-use combustion accounts for only 34% of LNG’s total emissions; the remaining 66% comes from methane leakage during production, shipping, and regasification.

The 20-year timeframe is the appropriate lens for Bermuda. Methane is approximately 80 times more potent as a greenhouse gas than CO₂ over 20 years. Satellite measurement studies (Sherwin et al., 2024, using nearly one million aerial measurements) have found that US oil and gas field leakage rates reach 2.95% — above the 2.8% used in the Howarth study and well above the threshold at which LNG’s climate impact exceeds coal.

Given Bermuda’s acute vulnerability to near-term climate impacts — sea level rise, storm surge, and coral reef degradation — the near-term emissions picture is the correct frame for evaluation.

“The idea that coal is worse for the climate is mistaken – LNG has a larger greenhouse gas footprint than any other fuel. To think we should be shipping around this gas as a climate solution is just plain wrong.” — Professor Robert Howarth, Cornell University, October 2024.

Bermuda’s specific physical exposure makes this more than an abstract policy choice. The Government of Bermuda’s own commissioned study found that within the next 25 years, Bermuda is expected to experience extreme weather events that previously occurred once every hundred years occurring annually — including more intense storms, higher sea levels and tides, and accelerated coral reef degradation. Hurricane Fiona in 2022 caused island-wide power outages; the frequency and intensity of such events is projected to increase.

An energy policy that selects a fuel with a 33% worse 20-year emissions profile than coal is not a neutral decision for a low-lying Atlantic island: it actively worsens the climate trajectory that most threatens Bermuda’s physical infrastructure, its insurance costs, its freshwater lens, and its reef-dependent marine ecosystem. The emissions framework for evaluating LNG is not a technicality — it is a question of whether Bermuda’s energy policy is consistent with Bermuda’s long-term resilience and survival interests.

“Rising sea levels will bring more frequent flooding in low-lying areas within the next few decades... more frequent and more powerful hurricanes... one need only look at the coastal flooding events we have seen in recent years to get a glimpse at what the future will hold.” — Dr Mark Guishard, Climate Change and Bermuda, BIOS / Bermuda Airport Authority, 2023.

The NESP 2026 specifies no emissions framework for evaluating any LNG proposal. This is a significant omission. Any LNG proposal submitted in response to this policy must be required to include a full lifecycle emissions analysis using a 20-year global warming potential, with independent verification.

RECOMMENDATION: The Ministry should adopt a **mandatory lifecycle emissions standard** for any new electricity generation proposal. Specifically, no fossil fuel generation project should be approved without a full-chain greenhouse gas assessment using the 20-year global warming potential (GWP20), independently audited. This standard should be codified in the Regulatory Authority’s approval criteria and applied prospectively to any IRP or generation licence application.

6. BERMUDA’S EXISTING INFRASTRUCTURE SUPPORTS SMARTER ALTERNATIVES TODAY

BELCO’s island-wide smart meter rollout is already complete. The data infrastructure for time-of-use pricing, demand response, and Virtual Power Plant coordination already exists. These are not future investments — they are **installed assets** that are currently underutilised.

EV-based distributed storage offers a uniquely Bermuda-appropriate opportunity. Bermuda’s geography makes EV battery aggregation particularly viable: at 25% EV adoption, the vehicle fleet holds an estimated 56 MWh of available distributed storage — already exceeding BELCO’s planned 40 MWh grid battery investment.

Hawaiian Electric’s experience provides direct evidence of what is possible on isolated island grids. Hawaiian Electric, operating comparable stand-alone island grids with high renewable penetration, contracted with Swell Energy in 2021 — in a programme approved by the Hawaii Public Utilities Commission — for 80 MW of battery capacity and 100 MWh of stored energy, aggregated from approximately 6,000 residential customers across three islands. This programme provides capacity, frequency response, and peak demand reduction through a Virtual

Power Plant arrangement, delivering grid services that displace equivalent new generation investment entirely.

“Our islands have small, stand-alone grids with a high level of renewable generation, which makes them sensitive to frequency events — the aggregated VPP provides fast frequency response and capacity that would otherwise require new generation plant.” — Hawaiian Electric, on the Swell Energy VPP contract, 2021.

Furthermore, Hawaiian Electric has since contracted for grid-scale battery systems providing black-start capability, synthetic inertia, and fast frequency response — services previously only available from conventional generation plant. These are services that LNG proponents cite as justifications for maintaining dispatchable fossil fuel generation; Hawaiian Electric has demonstrated they can be sourced from storage instead.

These options deserve full evaluation before any LNG commitment is made. The NESP 2026 should explicitly direct the Regulatory Authority to evaluate VPP, demand response, and aggregated storage options against any proposed LNG capacity before approving new generation infrastructure.

RECOMMENDATION: The Ministry should commission a **Bermuda Virtual Power Plant Feasibility Study** to quantify the dispatchable capacity, frequency response, and peak demand reduction achievable through aggregation of residential and commercial battery storage, EV batteries, and demand response assets connected to BELCO’s existing smart meter network. The study should model outcomes at 10%, 25%, and 40% EV adoption rates, and compare the cost per MW of capacity against both utility-scale battery procurement and LNG peaking generation. The Hawaiian Electric model provides a direct and well-documented reference case for this analysis.

7. THE GEOPOLITICAL MOMENT DEMANDS ACCELERATED ENERGY INDEPENDENCE

Bermuda is a small, open economy with no domestic fossil fuel resources and no overland connections. It imports 100% of its fuel. The events of early 2026 — specifically the closure of the Strait of Hormuz beginning 4 March 2026, which the IEA described as causing “*the largest supply disruption in history*,” forcing global oil production to four-year lows — confirm what Bermuda’s own planners identified: small island nations face existential energy security risk from dependence on any single imported fossil fuel.

The IEA’s Executive Director explicitly stated that the cure to the current crisis is “*opening up the Strait of Hormuz*,” and that reserve releases provide only temporary relief. He identified renewables, nuclear, and electric vehicles as the structural beneficiaries of the disruption. Bermuda has an opportunity to draw the correct conclusion from this moment: accelerating domestic renewable generation and storage is not only environmentally sound and economically rational, it is the only durable energy security strategy available to a small island state.

IRENA’s 2024 publication *Small Island Developing States at a Crossroads* identified the transition away from fossil fuel imports as the primary lever for simultaneously improving energy security, affordability, and resilience in island economies. Bermuda’s situation — with installed smart

meters, proven solar resources, and a small, manageable grid — places it in a stronger starting position than most SIDS.

RECOMMENDATION: The NESP 2026 should include an explicit **Energy Security Statement** articulating the risk to Bermuda of import dependency for any fossil fuel, the consequences of a supply disruption on electricity generation, and the contribution of domestic renewable generation and storage to reducing that risk. This statement should be published alongside any IRP process and updated following any significant change in global energy supply conditions — such as the current Strait of Hormuz closure.

Two independently conducted and rigorously reviewed planning processes — in 2019 and 2024 — reached the same conclusion: Bermuda’s energy future lies with solar, storage, and demand management, not LNG. Current market data strengthens that conclusion: battery storage now costs less than new gas generation, and the cost trajectory favours renewables by a widening margin over any 30-year capital commitment horizon.

The 2026 Strait of Hormuz crisis has demonstrated, in real time, precisely the supply security risk that Bermuda’s own planners identified. The tools to act — installed smart meters, proven solar economics, a completed smart grid, and a well-documented VPP model from comparable island jurisdictions — are already in place.

What the NESP 2026 must provide is the implementation framework, the emissions standard, and the explicit commitment not to reopen a fossil fuel pathway that the evidence, on every relevant dimension, has twice and decisively set aside. To that end, I respectfully submit that no LNG generation licence application should be approved by the Regulatory Authority unless and until the following three tests have been publicly met:

1. A cost comparison conducted using current market benchmark data demonstrating that LNG is cheaper than equivalent solar-plus-storage capacity over the full regulatory return period.
2. A full lifecycle greenhouse gas assessment using the 20-year global warming potential, independently verified, demonstrating that LNG’s total emissions are lower than the renewable alternative.
3. A stranded asset analysis demonstrating that the proposed LNG infrastructure remains economically justified under BloombergNEF’s projected renewable cost trajectory to 2035.

On current data, none of these tests can be met.

Thank you for allowing me the opportunity to comment on this very important consultation.

Yours faithfully,
Kevin Gunther
Smiths, Bermuda
21 May 2026

Sources Referenced

Sources below are organised by section. All are publicly available; full URLs are available on request. Where a source is cited in both the body and the sources list, the body citation identifies the specific claim; the list entry identifies the publication in full.

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- IRENA / Asian Development Bank (2025): Energy Transition Readiness Assessment for Pacific SIDS.

Section 2 — LNG IRP History & Geopolitical Risk

- Bermuda Regulatory Authority (2019): Integrated Resource Plan — Final Decision.
- BELCO (2024): Preferred Resource Plan.
- IEA (March 2026): Iran Conflict and the Strait of Hormuz — declaration of “largest supply disruption in history.”
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- Congressional Research Service (March 2026): Iran Conflict and the Strait of Hormuz: Impacts on Oil, Gas, and Other Commodities (R45281).
- CNBC (April 2026): IEA Chief Fatih Birol — “We are facing the biggest energy security threat in history.”
- US Energy Information Administration (April 2026): Short-Term Energy Outlook — Hormuz closure impact assessment.

Section 3 — Capital & Stranded Assets

- Global Energy Monitor: New Asian Gas Projects Create \$379 Billion Stranded Asset Risk.
- SolAbility (2026): Global LNG Outlook — Stranded Assets Risk Analysis.
- ScienceDirect (August 2025): “Locked in a fossil-centric system paradigm: LNG expansion impedes socio-ecological transition.”
- Grantham Research Institute, LSE: What are stranded assets? (2023).

Section 4 — Battery Storage Economics

- BloombergNEF (February 2026): Levelized Cost of Electricity 2026 Report. Key findings: four-hour battery storage benchmark fell 27% year-on-year to \$78/MWh; CCGT LCOE rose 16% to \$102/MWh (record high). Forecast: battery LCOE to reach \$58/MWh by 2035.
- Bloomberg (February 2026): “Costs of Big Batteries Are Tumbling and Can Boost Clean Power.”

- IRENA (2024): Renewable Power Generation Costs. Solar PV LCOE fell over 90% between 2010 and 2023; battery storage costs fell 89% over the same period. In 2023, solar LCOE was 56% below the weighted average cost of fossil fuel generation.
- Rezaee, E. and Silva, S.R.P. (January 2026): “Solar Energy in 2025: Global Deployment, Cost Trends, and the Role of Energy Storage.” Energy & Environmental Materials (Wiley). Key finding: global weighted-average utility-scale solar PV LCOE fell over 80% between 2010 and 2023, reaching as low as \$0.03/kWh in sun-rich regions.
- PV Magazine / BloombergNEF (February 2026): Solar LCOE benchmark rose 6% year-on-year to \$39/MWh in 2025 due to supply chain constraints — a short-term deviation — while BNEF projects a 30% reduction to approximately \$27/MWh by 2035.
- Honolulu Star-Advertiser (May 2026): “LNG price volatility too rich for isles” — editorial commentary on the structural cost certainty contrast between solar (known fuel cost: zero) and LNG (permanently exposed to global commodity markets).

Section 5 — LNG Lifecycle Emissions

- Howarth, R.W. (October 2024): “The Greenhouse Gas Footprint of Liquefied Natural Gas Exported from the United States.” Energy Science & Engineering (Wiley). Key finding: LNG’s GHG footprint is 33% greater than coal over 20 years; 66% of emissions occur upstream of combustion.
- Sherwin, E. et al. (2024): US satellite-based aerial measurement study — oil and gas field methane leakage rate of 2.95%.
- Cornell University (October 2024): Press release — Liquefied Natural Gas Carbon Footprint Worse Than Coal.

Section 6 — Virtual Power Plants & Island Grid Analogues

- Swell Energy / Hawaiian Electric (January 2021): Hawaii Public Utilities Commission approval of \$25 million VPP contract — 80 MW batteries, 100 MWh stored energy, 6,000 residential customers, three islands.
- Plus Power / Hawaiian Electric (January 2024): Kapolei Energy Storage facility — grid-forming battery providing black start, synthetic inertia, and fast frequency response on isolated island grid.
- Hawaii Public Utilities Commission (April 2026): New docket opened for Virtual Power Plant grid-services programme.

Section 7 — SIDS Energy Security

- IRENA (2024): Small Island Developing States at a Crossroads: The Socio-Economics of Transitioning to Renewables.
- IRENA SIDS Lighthouses Initiative: Framework for SIDS energy transition.
- World Bank (2024): Small Island Developing States on a Path to Renewable Energy and Resilience.