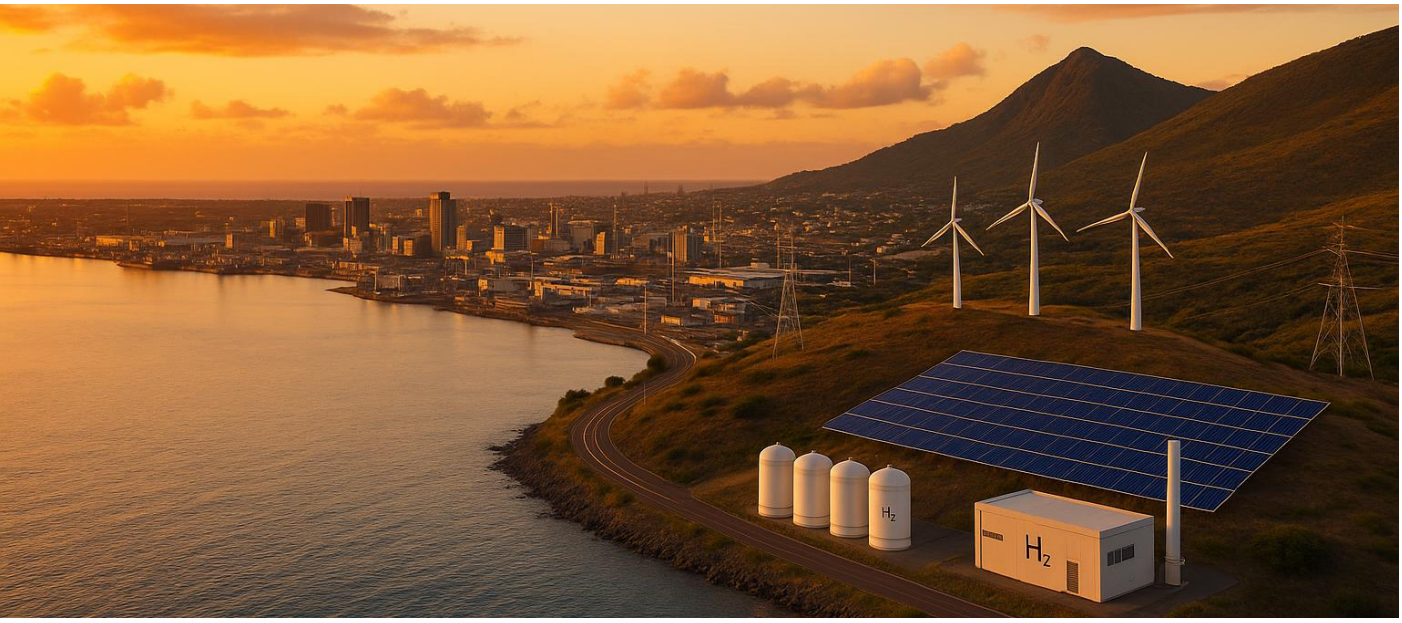

Securing the Lights: Hydrogen Storage as Mauritius' Turnkey Insurance Against Blackouts

Assessing H_2 storage as a fast, modular and financeable solution for blackout risk and on-demand low-carbon power in Mauritius

Introduction

This study examines whether hydrogen-based long-duration storage can serve as an effective insurance mechanism for Mauritius' increasingly strained power system. Against a backdrop of rising peak demand, ageing thermal units, and growing renewable penetration, the island's reserve margin has narrowed to levels at which a single 30 MW outage has already triggered public conservation appeals and localised load reductions (see diagnostic on pages 3–8). With total generation at 3,018.8 GWh in 2023—of which only 15.6% came from renewables—and peak demand reaching a record 567.9 MW in early 2025, the system faces structural adequacy challenges.

The study uses a comparative systems-analysis lens, drawing on official Mauritian datasets (Ministry of Energy and Public Utilities, Statistics Mauritius, CEB), long-duration storage cost assessments (PNNL), global technology reviews (IEA, IRENA), and small-island case studies. It evaluates hydrogen's value not as a bulk-energy source but as long-duration resilience infrastructure capable of mitigating multi-hour or multi-day blackout risks—risks that have substantial macroeconomic impacts in a service-intensive economy. The methodology focuses on technology benchmarking, economic reasoning grounded in the value of avoided outages, and alignment with institutional, regulatory and financing frameworks. It concludes with a phased roadmap that reflects international best practice for islands transitioning to high-renewable, low-carbon electricity systems.

Key Findings

- **Mauritius faces a structurally tightening reserve margin.**
  Peak demand has risen sharply while firm capacity has stagnated or declined due to de-rating of ageing units. The system now risks violating the N-1 security criterion, exposing the island to high-impact outages.
- **Dependence on imported fossil fuels remains a critical vulnerability.**
  In 2023, around 84% of electricity generation came from fossil fuels. This raises exposure to fuel-price volatility, external shocks, and logistical disruptions—risks that renewable or hydrogen-linked storage can mitigate.
- **Hydrogen storage offers a unique long-duration resilience function unavailable from batteries.**
  While lithium-ion systems excel at short-duration balancing, their costs rise steeply beyond 6–8 hours. Hydrogen's lower marginal cost for additional storage hours makes it suitable for multi-day coverage during extreme events.
- **Hydrogen is economically rational when evaluated as insurance, not as everyday energy.**
  Avoided outage costs in small islands often run into tens of millions of dollars per event. When benchmarked against these losses, the annualised cost of a hydrogen reserve becomes competitive, even with low round-trip efficiency.
- **Global island experience confirms technical viability.**
  Small-scale hydrogen systems in Réunion, Thailand, Uganda, and remote European islands demonstrate that hydrogen-battery hybrids can supply resilient, low-carbon power in isolated contexts—validating applicability to Mauritius' scale.
- **Current policy and licensing frameworks do not yet recognise storage as a distinct asset class.**
  Hydrogen storage sits awkwardly within existing generator-centric regulations. Without dedicated licensing, tariff structures and safety standards, bankable project development is hindered.
- **A phased approach is essential to manage technological, financial, and regulatory risks.**
  The report shows that a pilot (5–10 MW with 40–80 MWh storage) enables local learning and de-risking before scaling to a 30–60 MW "Hydrogen Resilience Reserve".

Recommendations

- **Adopt explicit reliability metrics to frame policy action.**
  Establish a national standard (e.g., LOLE, VoLL benchmarks) to quantify the insurance gap and enable transparent evaluation of hydrogen versus other flexibility options.
- **Integrate hydrogen storage into strategic planning documents.**
  Update the Renewable Energy Roadmap 2030, Long-Term Energy Strategy and NDC implementation framework to reflect hydrogen's role in resilience and decarbonisation.
- **Create a dedicated storage licence category.**
  Develop regulatory provisions specifying safety, data reporting, environmental rules and grid-integration requirements for hydrogen storage assets.
- **Launch a pilot hydrogen project to build institutional capability.**
  A 5–10 MW demonstration co-located with solar PV and a small BESS should test operational, safety and cost parameters under Mauritian conditions, with independent monitoring.
- **Prepare a bankable "Hydrogen Resilience Reserve" tender.**
  Structure the tender with availability-based remuneration, performance guarantees, and clear dispatch integration. Permit blended finance to reduce tariff impacts.
- **Align tariffs with flexibility and resilience objectives.**
  Introduce capacity payments and ancillary-service contracts that reward dependable long-duration storage. Complement these with dynamic pricing and demand-response incentives.

- **Strengthen hydrogen safety codes and standards.**
  Adopt ISO/IEC norms and ensure emergency services are trained in hydrogen-specific response protocols, especially given cyclone-related infrastructure risks.
- **Develop a coordinated governance body.**
  Establish a Hydrogen Storage Task Force to align MEPU, CEB, URA, MARENA, the Ministry of Finance and industry stakeholders around planning, permitting and financing.
- **Invest in local human capital for hydrogen technologies.**
  Expand technical training, certification pathways and partnerships with universities and international agencies to ensure skills are available for design, commissioning and operations.
- **Plan for multi-sector integration beyond electricity.**
  The reserve infrastructure could later support hydrogen for maritime bunkering, industrial feedstock or synthetic fuels. Safeguard this optionality in early design decisions.

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