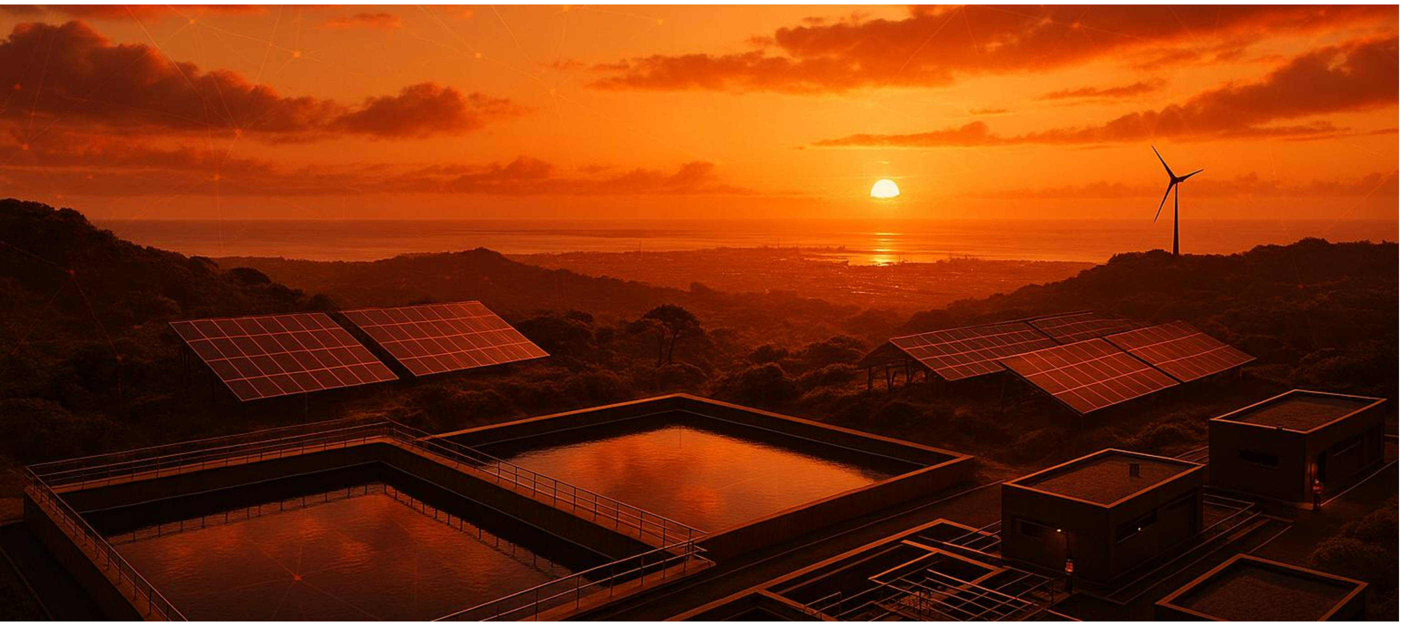

From Sensing to Strategy A C4ISR–DMDU Framework for Energy and Water Security in Mauritius

Combining Defence-Grade Situational Awareness with Robust Planning to Identify Low-Regret Investments under Deep Uncertainty

1. Introduction

This study examines how Mauritius can enhance long-term energy and water security by integrating defence-inspired situational-awareness principles (C4ISR) with advanced methods for decision-making under deep uncertainty (DMDU). As a small island developing State (SIDS), Mauritius faces a convergence of climate, economic and infrastructural pressures that cannot be addressed through conventional, forecast-based planning. The report evaluates the structural vulnerabilities of both sectors—including high fossil-fuel import reliance, ageing distribution networks, growing water scarcity, and exposure to cyclones and rainfall variability—as documented throughout the main report, including the analyses in **pages 3–7** . It applies a comparative policy lens informed by international benchmarks (IMF, World Bank, IEA), labour-market and macroeconomic dependencies, and the institutional frameworks governing utilities such as the CEB, CWA and URA. The methodological approach blends empirical data, robustness screening, and exploratory scenario logic to identify low-regret pathways that remain valuable across widely divergent futures. The study also assesses the governance and financing landscape, recognising that Mauritius requires not only technical upgrades but a coordinated institutional architecture able to sense, anticipate and adapt to rapid shifts in climatic, technological and economic conditions.

2. Key Findings

- **Mauritius' energy and water systems exhibit high structural exposure.** Heavy fossil-fuel import dependence (~85%), low renewable penetration (~18–22%), and NRW levels around 60% create vulnerability to global price shocks, climate pressures and infrastructure failures.

- **Existing infrastructure planning relies heavily on deterministic forecasts.** Current sectoral roadmaps (e.g., Renewable Energy Roadmap 2030/2035, Master Plan for Water Resources) do not fully account for climate uncertainty, technological volatility or compounding hazards.
- **A civilian-adapted C4ISR architecture provides a coherent situational-awareness backbone.** Integrating sensing, SCADA, hydrological monitoring, secure communications and shared data platforms would improve real-time visibility and coordinated response capacity (see Figure 3, page 10) .
- **DMDU methods offer a structured way to navigate uncertainty.** Techniques such as Robust Decision Making (RDM) and Dynamic Adaptive Policy Pathways (DAPP) help identify strategies resilient across thousands of plausible futures rather than a single predicted scenario.
- **Low-regret investments emerge clearly from stress-tested futures.** These include grid digitalisation, NRW reduction, rooftop PV + storage on critical facilities, energy efficiency measures, and expansion of wastewater reuse—each delivering value regardless of fuel prices or rainfall patterns.
- **Energy and water interdependencies amplify systemic risks.** Failures in one sector propagate quickly to the other, particularly during cyclones and severe droughts, underscoring the need for integrated modelling and crisis response (page 16) .
- **Institutional fragmentation remains a binding constraint.** CEB, CWA and MEPU operate parallel data and operational systems, limiting cross-sector coordination, while climate-finance mobilisation requires more unified strategic framing.
- **Mauritius' financing gap necessitates externally backed resilience investment.** International partners (World Bank, AfDB, IMF, GCF) view climate resilience as macro-critical, yet competition for adaptation funds remains high, making robust, data-driven proposals essential.

3. Recommendations

- **Establish a National Energy and Water Resilience Cell.** Create a permanent multi-agency unit with the mandate to operate a national C4ISR platform, coordinate crisis response, and guide robustness-based planning across both sectors.
- **Expand digital sensing and data governance frameworks.** Accelerate AMI deployment, expand DMAs, strengthen SCADA coverage, and adopt unified data standards overseen by a dedicated regulatory function.
- **Integrate DMDU methods into all major infrastructure decisions.** Require large-scale projects—dams, desalination plants, grid upgrades, storage facilities—to undergo robustness testing across climate, demand and price uncertainty ranges.
- **Prioritise low-regret investments in the short term.** Focus on NRW reduction, grid modernisation, distributed solar-plus-storage, and efficiency programmes, which deliver immediate benefits and reduce risk exposure.
- **Develop adaptive investment pathways rather than fixed masterplans.** Sequence projects so that contingent, capital-intensive measures (e.g., desalination) are triggered only when signposts—such as multi-year droughts or rising peak demand—are crossed.
- **Strengthen cross-sector operational readiness.** Implement shared situational dashboards and joint emergency protocols to prevent cascading failures during cyclones, floods or prolonged droughts.
- **Facilitate access to international climate finance.** Align future projects with the evidentiary requirements of GCF, AfDB, and World Bank resilience windows, supported by transparent modelling and integrated risk assessments.
- **Build domestic analytical capacity.** Invest in training for DMDU, systems modelling, cybersecurity, and data science within MEPU, CEB, CWA and the regulatory ecosystem to ensure long-term sustainability.