

Success Factors for Renewable Island Mini-Grids

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Executive Summary

Small islands continue to face profound energy-related vulnerabilities. Their electricity systems are typically isolated, diesel-dependent, and exposed to highly volatile international fuel markets. This dependency results in elevated electricity costs, recurring supply risks, and significant carbon emissions. At the same time, islands are disproportionately affected by climate impacts such as storms, sea-level rise, and saltwater intrusion, making the transition to resilient renewable electricity systems both an economic and environmental imperative.

This report examines how islands can successfully shift toward high shares of renewable electricity by analyzing eleven real-world case studies, most of which already operate between 80% and 100% penetration of renewable energy generated electricity, as documented in Hecker [25]. The goal is not merely to catalogue barriers but to extract actionable success factors that explain why certain island transitions succeed and how these lessons can be replicated elsewhere. The analysis rests on three components. First, an extensive literature review. Second, five expert interviews with island practitioners. Third, a structured assessment using a success-factor matrix spanning four project phases (Preparation, Design, Implementation, Monitoring & Evaluation) and five factor categories (Social, Political, Technical, Economic, Environmental). This mixed-methods approach enables a systematic comparison across diverse contexts while retaining the nuance necessary for small-scale, community-oriented systems. Across the case studies, the research identified 111 individual success factors, of which 13 key factors were distilled based on their recurrence across multiple interviews. Two social and political enablers stand out as the most universal across all islands, alongside strong technical universals such as long-term planning and grid strengthening for variable renewable energy integration:

1. Strong stakeholder engagement throughout all project phases, requiring transparency, trust-building, and continuous communication.
2. Local champions or leadership figures who mobilize support, maintain momentum, and bridge community, political, and technical actors.

One of the clearest findings is the decisive importance of the Preparation phase, which accounts for nearly half of all identified success factors. Early-stage actions, such as community engagement, resource and grid assessments, political alignment, financing strategies, and technical feasibility studies, provide the foundation for successful system design and implementation. Islands that invest

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heavily in preparation tend to experience smoother deployment processes, higher acceptance, and more reliable long-term operations. The implications are straightforward but powerful. Policymakers, utilities, development agencies, and island communities can accelerate renewable energy transitions by systematically addressing these success factors across all five dimensions. Success on islands is neither accidental nor purely technical, it results from sustained alignment of social legitimacy, political support, technical robustness, economic viability, and environmental stewardship. Overall, the report offers a structured, evidence-based roadmap for islands aiming to achieve resilient, affordable, and sustainable electricity systems, while contributing valuable insights for off-grid and edge-of-grid applications worldwide.