EXECUTIVE SUMMARY

# SAINT LUCIA NATIONAL ENERGY TRANSITION STRATEGY AND INTEGRATED RESOURCE PLAN

Government of Saint Lucia

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## ABOUT THE ISLANDS ENERGY PROGRAM

The RMI-CWR  Islands Energy Program works to accelerate the transition of island economies from a heavy dependence on fossil fuels to a diverse platform of renewables and energy efficiency, and establish a blueprint for other isolated economies.

## ABOUT THE CLINTON FOUNDATION

The Clinton Foundation convenes businesses, governments, NGOs, and individuals to improve global health and wellness, increase opportunity for girls and women, reduce childhood obesity, create economic opportunity and growth, and help communities address the effects of climate change. The Clinton Climate Initiative (CCI) collaborates with governments and partner organizations to increase the resilience of communities facing climate change while reducing greenhouse gas emissions. CCI has helped generate over 63,000 MWh of clean energy annually in the Caribbean and East African Islands.

## ABOUT LUCELEC

We deliver efficient energy services that are safe, reliable, and environmentally responsible. We meet the expectations of our customers, shareholders and employees and we are a catalyst for social and economic development in St. Lucia.

## ABOUT DNV GL

Driven by our purpose of safeguarding life, property and the environment, we enable organisations to advance the safety and sustainability of their business.

## ABOUT THE GOVERNMENT OF SAINT LUCIA

We seek to optimize and sustain economic development and quality of life by creating a functional individual that is accepting of civic responsibility and empowered to compete in global environment.

*“The strong leadership and objective analysis from the Islands Energy Program ensured that a clear vision for the future was established, along with the ability for Saint Lucia to embark on a sustainable path for lower electricity costs and increased energy independence.”*

**—Sylvester Clauzel, Former Permanent Secretary, Ministry of Sustainable Development, Energy, Science, and Technology, Government of Saint Lucia (2012–2016)**

# EXECUTIVE SUMMARY

Saint Lucia's electricity sector faces both opportunities and challenges during a time of emerging new technologies and evolving utility business models. Saint Lucia and St. Lucia Electricity Services (LUCELEC)—the national electric utility—are currently grappling with how to incorporate renewables into the energy sector, which has raised questions regarding the technical operations of the grid, ownership of generating assets, economic viability for all ratepayers, and continued utility financial stability. At the same time, recent developments in energy efficiency, renewable energy, cleaner-burning fuels (e.g., natural gas), electricity storage, and advanced controls and metering present a myriad of opportunities.

Saint Lucia's current electricity system is well managed, reliable, and equitable. This can be primarily attributed to the fact that LUCELEC is a responsible and financially sound utility. Currently, all generation assets (ten diesel generators) are located at Cul de Sac power station, and are operated manually to meet loads and required reserves at all times. The ensuing reliance on imported diesel fuel creates relatively high and volatile costs to produce electricity, and leaves the country exposed to a single fuel source. With the increased global investment in renewable energy, changing times in the global energy sector now require a new approach to Saint Lucia's electricity sector.

In 2014, the Government of Saint Lucia announced refined energy targets, setting a renewable energy penetration target of 35 percent and an energy efficiency target of 20 percent reduction in consumption in the public sector, both to be achieved by 2020. In 2015, Saint Lucia submitted a climate action plan to the United Nations Framework Convention on Climate Change (UNFCCC) and in April 2016, ratified the Paris Agreement on Climate Change. To reach energy and climate goals while ensuring cost-effectiveness, a deliberately planned energy transition process is critical for all Saint Lucian stakeholders.

As Saint Lucia aims to reduce electricity costs and ensure energy independence through increased adoption of renewable energy and energy efficiency, a number of questions have emerged:

- How much can new technologies such as solar photovoltaics or geothermal energy generation stabilize and reduce costs while advancing Saint Lucia's goals to reduce greenhouse gas emissions?
- Do certain levels of new technologies threaten grid stability, and if so, how can these constraints be overcome?
- Will regulatory reform help ensure low-cost electricity and an equitable system for all Saint Lucians?
- How can participation from the private sector support national objectives?

To answer these questions, the Government of Saint Lucia and LUCELEC engaged Rocky Mountain Institute-Carbon War Room (RMI-CWR) and the Clinton Climate Initiative (CCI) to complete this study, with technical support from DNV GL, leveraging deep and broad expertise in energy systems through an independent and impartial approach.


Discussion at an Integrated Resource Plan stakeholder meeting

*Image courtesy of RMI*

## THE ENERGY TRANSITION PROCESS

Any transition to pursue energy efficiency and renewable energy requires a thoughtful and participatory process, involving all key stakeholders to align around clear and unifying goals. This is particularly true for island nations given the fact that there is significant competition for land use due to their constrained geographical size. Developing a pathway toward future improvements to the electricity system requires the creation of a fact base focused on the current state, which can then be used to examine future opportunities. Forward-thinking leadership from the Government of Saint Lucia and LUCELEC progressively established the necessary conditions for effective planning and built an open dialogue between all parties. Ultimately, the process led to the co-development of a strategy made by and for the Government of Saint Lucia, LUCELEC, and the people of Saint Lucia.

The Government of Saint Lucia and LUCELEC initiated the National Energy Transition Strategy (NETS) process to create a forward-looking strategy for the energy sector. This document specifies the results of the analysis and strategy by defining the techno-economic opportunities, pathways, and implications of the energy transition, established through the creation of an Integrated Resource Plan (IRP). The Government of Saint Lucia and LUCELEC commissioned RMI-CWR and CCI—with support from the independent consulting engineers at DNV GL—to support the NETS and the IRP. Funding was provided by the Global Environment Facility through the United Nations Development Program, the Dutch Postal Code Lottery, and the Norwegian Agency for Development Cooperation. The process managed by RMI-CWR and CCI was conducted in an objective manner—independent of any single party and agnostic to any technology.

The strategy development process involved data collection, analysis, synthesis, review, and periodic public participation. The strategy informs LUCELEC, the Saint Lucia Government, public participants, and the National Utilities Regulatory Commission (NURC), which can learn from this process to inform future regulation for the electricity sector. The process compared many technologies and proposed projects, and examined how different combinations of future investments would work together in the system from a technical, financial, and economic perspective. The ultimate analysis and results were shaped by three main priorities: grid reliability, cost containment, and energy independence (including environmental protection and emissions reductions). This document outlines the techno-economic strategy developed through an IRP process.

## RESULTS

Saint Lucia's energy transition opportunity provides a win-win situation in which the Government of Saint Lucia supports constituents through cheaper electricity, and LUCELEC continues to profit and provide reliable service.

The analytical team supporting the IRP initially examined 14 scenarios for the future energy mix of Saint Lucia, spanning different mixes and ownership approaches for new energy generation. Upon detailed investigation, five viable focus scenarios emerged (as shown in Table 1 below), each forecasting net benefits when compared against the existing diesel-based generation business-as-usual case, although all scenarios included the continued operation of diesel generation to ensure system stability and cost reduction.

The IRP finds that a portfolio of centrally owned diesel, solar, wind, and storage offers the best economics (low cost to operate the system, lowest rates at the end of the studied timeframe, relatively low debt, and a strong hedge against volatility in diesel fuel prices), while providing continued reliability.

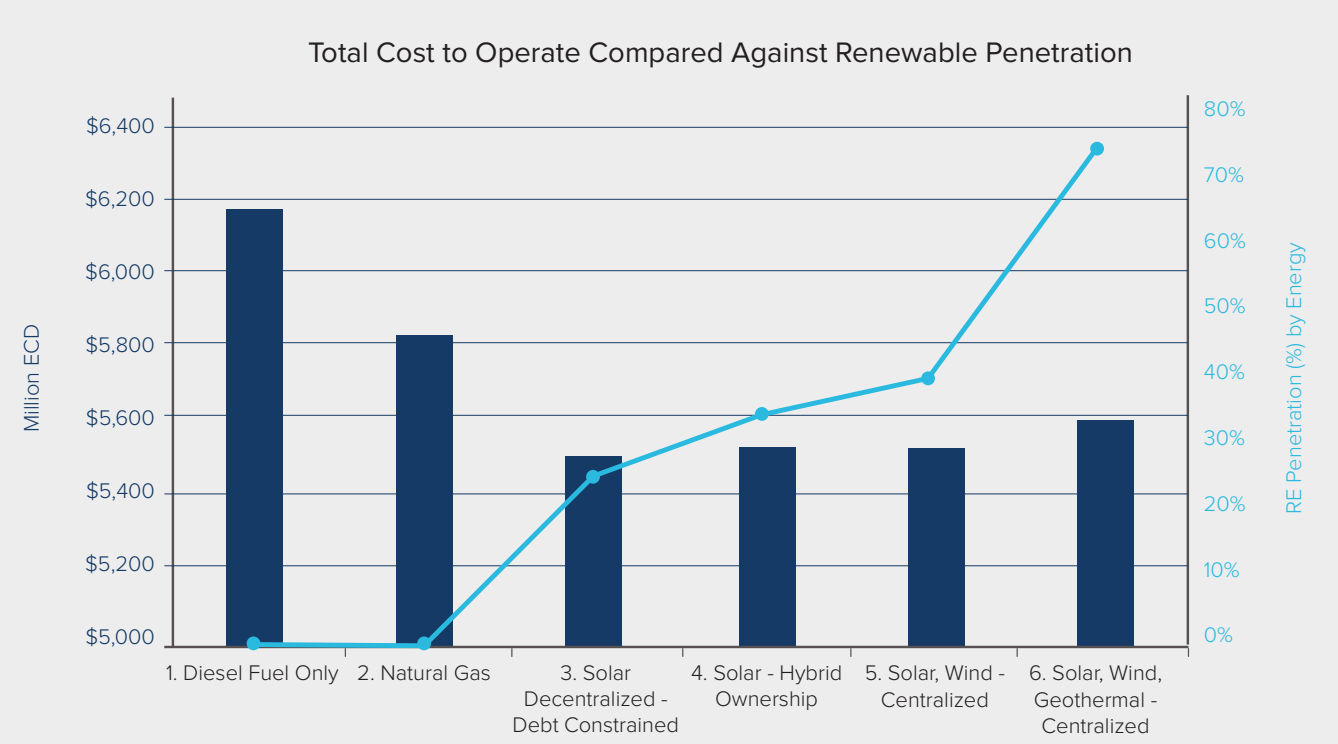
TABLE 1
DESCRIPTION OF SELECTED FOCUS SCENARIOS

| SCENARIO | TOTAL COST TO OPERATE (Millions of Eastern Caribbean Dollars over 20 years)[1] | 2025 RENEWABLE PENETRATION (by energy) | DESCRIPTION OF GENERATION ASSETS (in 2025) |
|---|---|---|---|
| 1. Diesel Fuel Only (Reference Case) | $6,173 | 0% | Continued diesel, new diesel installed in 2023 (12.4 MW) |
| 2. Natural Gas | $5,821 | 0% | Natural gas (40 MW) from retrofits and diesel (46.3 MW with new 12.4 MW in 2023) |
| 3. Solar, Decentralized—Debt Constrained | $5,497 | 18.6% | Solar (47 MW, 60% owned by LUCELEC), storage (16 MWh), and continued diesel |
| 4. Solar—Hybrid Ownership | $5,514 | 33.1% | Solar (54 MW, 80% owned by LUCELEC), storage (18 MWh), and diesel |
| 5. Solar, Wind—Centralized. Recommended | $5,533 | 38.9% | Solar (54 MW), wind (18 MW), and storage (27 MWh), diesel—optimal rate reduction |
| 6. Solar, Geothermal, Wind—Centralized | $5,595 | 75.3% | Solar (23 MW), wind (12 MW), geothermal (30 MW), storage (19 MWh), and diesel |

[1] Total cost to operate includes all projected costs to operate the electricity system, including fuel costs, debt service on previous and projected assets, and other fixed and administrative costs. The cost is netted over the coming 20 years (the IRP timeframe).

**FIGURE 1**

TOTAL COST TO OPERATE AND RENEWABLE PENETRATION BY SCENARIO




All scenarios presented in Figure 1 meet financial constraints for LUCELEC (including debt tolerance) and maintain or improve grid reliability under all tested load conditions when supported by the inclusion of battery energy storage (between 12 MWh and 27 MWh). Projections for increased electricity usage show that current generation will be sufficient until 2023; however, selectively installing renewable generation in the near-term will provide economic benefit for the country.

### Results of the IRP are summarized below:

- Pursuing the recommended scenario of centrally owned diesel, solar, wind, and storage outlined above can provide up to 10 percent rate relief (within 20 years), stabilize electricity price volatility driven by oil markets by approximately 20 to 25 percent, and secure a financially strong position for LUCELEC for the coming decades.
- The 20-year incremental capital costs of this plan are approximately Eastern Caribbean (EC) $630 million, and overall societal value is EC$210 million net present value, making it a strong investment for Saint Lucia and LUCELEC.
- The most cost-effective measures are solar and energy efficiency. Solar in the range of 20 MW total in the coming eight years leads to a system levelized cost of electricity (LCOE) reduction of approximately 7 percent. Energy efficiency, specifically lighting, refrigeration, air-conditioning, and water heating, could save 0.5 percent per year, growing to 11 percent of annual sales by 2024, at a levelized cost of EC$0.09 per kWh saved. LUCELEC will require compensation from the NURC to pursue energy

efficiency, as current rate regimes do not provide incentives (customer energy efficiency causes lost revenue for LUCELEC). Examples of these types of rate mechanisms include rate-basing the costs of the program (as in Texas) or creating performance-based compensation (as in New York).

- Wind energy, when developed by LUCELEC, offers cost benefits, lowering system-LCOE by approximately 1 percent, and saving approximately EC$55 million in 20 years.
- Continued development of geothermal should be pursued if the resource in Soufrière can be secured at low cost (power purchase agreement [PPA] below EC$0.38 per kWh). Solar and wind can pair well operationally and financially with geothermal, without creating stranded assets.
- After reaching a total of 20 MW of solar (including both utility-owned and distributed solar), new renewable investments require firming through additional energy storage via batteries.
- By implementing the optimal scenario, Saint Lucia can exceed national targets for reducing carbon emissions. In the Intended Nationally Determined Contribution (INDC) under the United Framework Convention on Climate Change, Saint Lucia set goals of reaching 16 percent reduction in carbon emissions versus business as usual by 2025, and 23 percent reduction versus business as usual by 2030. Pursuing these investments reaches the 35 percent renewable energy penetration goal (expressed by energy) by 2022. The strategy identified in the NETS process, relying heavily on renewable energy and energy efficiency, moves the electricity generation to surpass those targets, reaching a 40 percent reduction in carbon emissions versus business as usual in 2025, and a 46 percent reduction in carbon emissions by 2030.
- Moving to deeper carbon reduction and higher renewable penetration (above 60 percent renewable penetration by 2025 if geothermal is implemented) carries net costs when compared to the optimal scenario, as does meeting renewable targets before the 2020 timeframe. These high-renewable scenarios (including geothermal) are in the range of 2 to 5 percent more costly versus the economically optimal scenario, but remain 7 to 9 percent less costly than the diesel-based reference case. Reaching renewable energy penetration above 50 percent without geothermal is possible, but ensuring cost-parity would require that the cost of solar and storage systems decline faster than 8 percent year-over-year (in average LCOE).

Pursuing renewable energy and energy efficiency investments requires making long-term decisions in the face of an uncertain future. Numerous factors will influence the economic implications of Saint Lucia's energy transition—in particular changing customer rates, project capital costs, and/or profit projections. The results of the NETS scenarios were tested against various factors to assess the impact of varying future conditions. The analysis presented herein tested four primary sensitivities—price of diesel fuel, operating reserve margin, load forecast, and energy efficiency program implementation. In particular, the global oil market, and thereby the price of imported diesel fuel, will continue to largely determine the electricity price in Saint Lucia until renewable assets are installed.

## NEXT STEPS

The integrated resource plan recommends continued efforts to develop and install projects (e.g., solar PV), establish programs (e.g., energy efficiency), modify rate structures, and test and monitor certain technologies that offer potential benefits (e.g., energy storage, automated controls). This analysis includes a five-year plan on efficiency programs, renewable energy, and storage implementation, and includes necessary regulatory changes as well as public participation.

The policies required to support this transition must properly value energy efficiency and allow for managed competition (select independent power producers [IPPs] and capped distributed generation) and local participation (governed by the NURC to ensure ratepayers benefit equitably). LUCELEC's future business model options could include: setting up an energy efficiency business unit (as enabled and supported by regulation), selling renewable energy development services to the region, and exploring new local revenue (e.g., electric vehicles and selling electricity to cruise ships).

This document, as well as all associated models and analysis are designed to be "living" documents, updated on a regular basis under the direction of the NURC.[2] As such, continued feedback and input is solicited from the Government of Saint Lucia, LUCELEC (and the LUCELEC Board of Directors), and the NURC.

[2] Performing the IRP analysis every two to three years is standard for regulated electric utilities

The geothermal project development team on a site visit to Soufrière

*Image courtesy of RMI*

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