THE GOVERNMENT OF THE TURKS & CAICOS ISLANDS

FORTIS TCI
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TURKS AND CAICOS ISLANDS RESILIENT NATIONAL ENERGY TRANSITION STRATEGY

EXECUTIVE SUMMARY

ROCKY MOUNTAIN INSTITUTE

Authors & Acknowledgments

Contributors

Kaitlyn Bunker, Rocky Mountain Institute
Devon Cox, FortisTCI
Malike Cummings, TCIG
Ruth Forbes, FortisTCI
Sidney Jules, Rocky Mountain Institute
Archie Gaviola, FortisTCI
Justin Locke, Rocky Mountain Institute
Sparkle Prentice, TCIG
Rachell Roullet, FortisTCI
TeAnn Thomas, FortisTCI
Roy Torbert, Rocky Mountain Institute

Contacts

Kaitlyn Bunker, kbunker@rmi.org
Roy Torbert, rtorbert@rmi.org

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ABOUT US

THE
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About the Ministry of Infrastructure, Housing, and Planning

The Ministry of Infrastructure, Housing, and Planning seeks to provide safety for all persons living or visiting the Turks and Caicos Islands through the development and implementation of policies, procedures, programs, and initiatives to ensure adequate, safe and well-maintained works and Infrastructure to support the social and economic development of the TCI. The Ministry is also responsible for the oversight and regulation public utility services across the TCI.

FORTIS TCI

About FortisTCI Limited

FortisTCI Limited (FTCI), a subsidiary of Fortis Inc., is the sole provider of electricity in the Turks and Caicos Islands on Providenciales, North Caicos, Middle Caicos, South Caicos, East Caicos, and adjacent Cays. Turks and Caicos Utility Limited (TCU), the sole provider of electricity on the Islands of Grand Turk and Salt Cay, was acquired by FTCI in 2012. Together the two companies serve approximately 15,000 customers across the archipelago. FTCI and TCU have an aggregate diesel-fired generating capacity of approximately 90.7 megawatts across their multiple service territories.

ROCKY MOUNTAIN INSTITUTE

About Rocky Mountain Institute

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. RMI has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing.

Executive Summary

The continued economic growth and development of the Turks and Caicos Islands (TCI) depends to a large extent on detailed planning, sound investment, and the sustainable development of electricity infrastructure over the short, medium, and long term. The major energy stakeholders have committed to transform the energy landscape to ensure planning for cost-effective, reliable, resilient, and environmentally sustainable supply of energy that supports economic growth, development, and the well-being of the people of the TCI. The experience of severely strong Hurricanes Irma and Maria in 2017 tested electricity systems across the Caribbean and caused widespread but relatively short outages in the TCI. Threats including hurricanes and other dangers, when coupled with new evolving technology options and costs have prompted the opportunity to update FortisTCI's 2015 Integrated Resource Plan. Starting in 2018, energy stakeholders in the TCI began a Resilient National Energy Transition Strategy (R-NETS) process. The R-NETS process evaluates the TCI electricity system for the 22 year period from 2019 to 2040, and offers an important step forward in joint understanding of the options and opportunities available in the TCI to achieve shared goals in this sector. The results provide decision makers in the TCI with a common platform to review options, and to guide future investment decisions while continuing a transition to an electricity system that is low-cost, reliable, resilient, and environmentally sustainable. The R-NETS was developed through an inclusive process in partnership between the Government of the TCI (TCIG) and FortisTCI, with support from Rocky Mountain Institute.[i] Through these multi-party efforts, new solutions can be identified, and projects can be advanced to benefit all in the Turks and Caicos Islands.

Opportunity for Advancing Toward Electricity Sector Priorities in the TCI

The R-NETS indicates an opportunity for leading stakeholders in TCI to implement projects with the following benefits, given projected increases in electricity demand and changes in key technology option costs:

- Reduce total system costs by US$115.2 million by 2040;[ii]
- Maintain and improve today's level of electricity system reliability during normal operations with loss of load expectation (LOLE) improving from 0.0278 to 0.0000 days per year by 2040;
- Reduce diesel use by 12.3 percent relative to a business-as-usual case, amounting to 10.3 million liters saved annually through 2040;
- Diversify electricity sources by increasing renewable penetration to 33 percent of total energy generation in 2040;
- Enhance electricity system resilience to external shocks by incorporating distributed and flexible energy resources; and
- Begin to reduce total emissions, with a 12 percent decrease over the coming 22 years versus 2018.

[i] Rocky Mountain Institute supported the data gathering, analysis, and consultations as an independent and objective third party.

[ii] In 2018 US dollars. All currency in this report is written in US dollars.

Immediate Actions to Accelerate the TCI's Energy Transition

To capture these benefits, TCIG and FortisTCI should continue working together toward a transition to an electricity system that is more distributed and utilizes more renewable energy resources. These two organizations can build on the collaborative nature of the R-NETS to continue to grow capacity and share knowledge throughout the TCI's energy transition. Specifically, FortisTCI and TCIG should:

- Pursue new energy efficiency implementation approaches, including a utility-run program that initially targets the largest customers in the TCI (large hotels) to save 6 percent of total electricity sales and $2 million per year[iii];
- Scale FortisTCI's Utility- and Customer-Owned Renewable Energy (UORE and CORE) programs to accelerate uptake of distributed solar up to 3 MW over the next 5 years, while engaging customers directly to encourage participation in the TCI's energy transition;
- Accelerate implementation of mutually agreed legislation that is precedent to support other (TCIG-FortisTCI) agreed renewable energy programs;
- Pursue additional utility-scale solar PV projects with the aim of installing up to 7 MW total of distributed solar PV across the three main electricity systems in the TCI within the next four years, in accordance with the approved RE legislation; and
- Pilot energy storage projects led by the utility to see benefits in operational efficiency in parallel with supporting increased use of renewable energy over time.
- Conduct a detailed wind resource assessment to assess the potential and viability of commercial and utility-scale wind projects in the TCI.

In parallel to the R-NETS process, a separate renewable infusion study was undertaken to examine the technical feasibility of the grid in Providenciales to operate with new distributed renewable generation sources. The infusion study results indicate that the near-term investments indicated in the R-NETS are within the technical limitations of the grid, in particular for interconnecting distributed solar PV. As the grid evolves in the coming years, further technical and economic analysis should inform additional project decisions, using the long-term analysis of the R-NETS as indicative pathways to explore.

An Inclusive R-NETS Process

The key stakeholders from TCIG and FortisTCI established a set of priorities, supporting strategic objectives, and measurements to use in evaluating various options for the future of the TCI electricity sector. Exhibit 1 includes these priorities and strategic objectives.

Specifically, the joint R-NETS team explored the viable and economical options for generating and distributing electricity to meet the electricity needs of Turks and Caicos Islanders in both the near- and long-term. To do so required four steps: 1) generating and collecting ideas on the array of resources and components which could form the TCI electricity system of the future; 2) formulating these options into distinct scenarios; 3) modeling the scenarios to determine the

[iii] The energy efficiency and cost savings potential for large hotels (greater than 101 guestrooms) were determined using the Caribbean Hotel Energy Efficiency Action Programme (CHENACT) and regional energy audit results, and informed by a survey of the Turks and Caicos Hotel and Tourism Association (TCHTA).

economically optimal amount of each resource and component in the near- and long-term; and 4) investigating the scenarios in detail.

EXHIBIT 1
SUMMARY OF R-NETS PRIORITIES AND STRATEGIC OBJECTIVES

PRIORITY	STRATEGIC OBJECTIVE
1. LEAST-COST	Reduce total system cost
	Reduce cost volatility
2. RELIABILITY	Maintain or improve continuity of electricity service for all TCI customers
	Remain adaptable to changing conditions
3. RESILIENCE	Increase energy security
	Increase system flexibility
4. ENVIRONMENTAL SUSTAINABILITY	Reduce emissions
	Limit lifetime impact (including end-of-life considerations, and potential for health or environmental hazards)

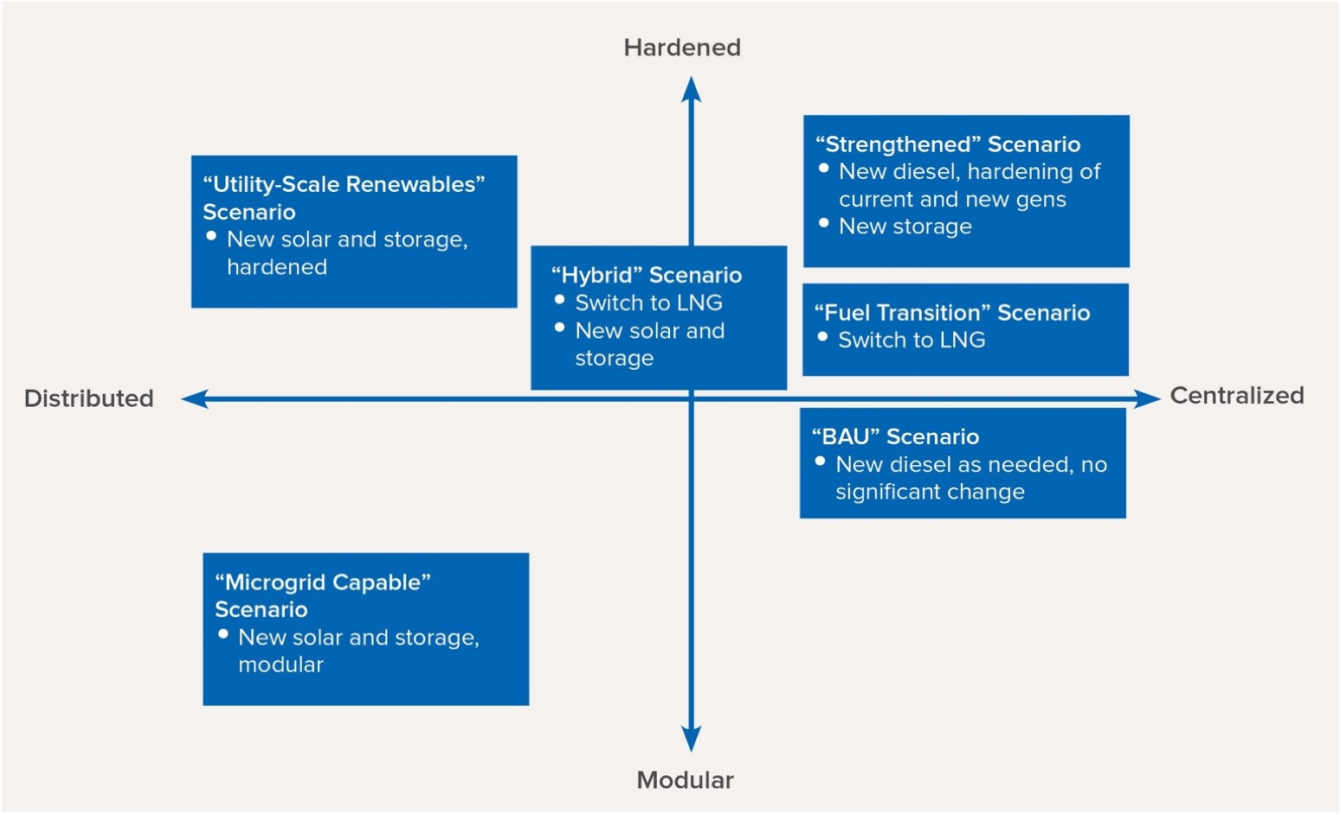
For the first step in the R-NETS analysis, the team forecasted future electricity demand in the TCI for the 22 year period from 2019 to 2040, given population and economic growth projections, among other factors. For the separate electricity systems in the TCI, estimated annual growth in electricity consumption ranges from 2.8 to 5.3 percent. The team then reviewed existing resource assessments and incorporated recent Caribbean project cost information to determine which technology options to include in a set of scenarios to test options that span both location and changeability.[iv]

Six discrete scenarios (shown in Exhibit 2) were then formulated by the joint R-NETS team to reflect distinct and viable future energy pathways for the TCI—Business-as-usual (BAU), Fuel Transition (FT), Strengthened (STR), Hybrid (H), Microgrid-Capable (MC), and Utility-Scale Renewables (USR). The results clearly show that more diversified, distributed, and renewable scenarios move the TCI closer to the priorities of an electricity system that is low-cost, reliable, resilient, and environmentally sustainable, compared to the BAU scenario.

[iv] Changeability is defined here to describe how flexible or adjustable electricity generation resources are in different situations, including their ability to be utilized in multiple ways such as operating in connection with the main electricity grid or operating separately as a microgrid. A microgrid for the purposes of the R-NETS is considered as distributed generation resources that can operate in connection with the main electricity grid, or separate to operate as an isolated, small electricity system serving nearby electrical load. The R-NETS models microgrids as owned and operated by FortisTCI.

EXHIBIT 2

SUMMARY OF SIX R-NETS SCENARIOS



Each independent electricity system in the TCI was assessed separately in the R-NETS. Exhibit 3 depicts the results of the six scenarios tested for the electricity system containing Providenciales, North Caicos, and Middle Caicos, while the four scenarios tested for South Caicos are shown in Exhibit 4, and the six scenarios for Grand Turk are shown in Exhibit 5.

While the recommendations for the next five years are clear, changing conditions mean that the R-NETS long-term pathway can be further refined as more observations are made in the coming years. To determine the most impactful inputs, the team conducted sensitivity analyses on key input variables, in particular those that were selected conservatively for the R-NETS[v]. Specifically, for the Microgrid-Capable scenario in 2031, the sensitivity analysis showed that the optimal installed capacity of solar PV increases by 10 to 70 percent while the levelized cost of electricity (LCOE) is reduced by 1.3 to 12.9 percent depending if solar becomes quickly cheaper, and reserve requirements are relaxed[vi]. The test demonstrated tremendous potential

[v] Including solar PV installed cost and/or operating reserve requirements for solar PV.

[vi] The tested sensitivities considered inputs which are likely achievable for the TCI electricity system in 2031: installed solar PV costs dropping from $2.69/W in the original assumption (inclusive of assumptions for land and labor costs in the TCI) to $2.02/W as a medium case and $1.35/W as a low case; while solar PV operating reserve requirements were reduced from 50 percent in the original case to 25 percent in the low case.

to achieve further cost savings, faster renewable energy implementation, and greater environmental savings in the TCI if key levers can be pulled to achieve cost results seen in Saint Lucia and throughout the Caribbean region. The R-NETS results and analysis capture existing costs, trends, and information in local and international markets which affect the TCI electricity system today. However, with advancements driving down the cost of solar PV and energy storage, along with breakthroughs in competitive, smaller scale natural gas, this analysis process should be updated in the next 3 to 5 years to capture all the relevant market data and trends.

The R-NETS results indicate that there are several options for the TCI to transition to an electricity system that meets the nation's priorities and goals. Overall, the top and recommended scenario was evaluated to be the Microgrid-Capable (MC) scenario for all three TCI electricity systems, followed closely by the Utility-Scale Renewables (USR) scenario. These scenarios are comprised of diesel mixed with high penetrations of distributed solar PV and energy storage, and received total scores ranging between 89.6 to 95.0 (out of 100) for each system. Both scenarios recommend the addition of solar PV that will contribute between 25 and 28 percent of total electricity generation across the individual TCI electricity systems by 2031, rising to a contribution of 33 to 38 percent by 2040. The main difference between the two scenarios is in how new distributed resources are operated; in Microgrid-Capable, they are implemented in a flexible or modular way, allowing for operation both in connection with the main grid and with the option to form microgrids. The Utility-Scale Renewables scenario implements new distributed solar and storage in a hardened fashion, designed to serve one purpose of feeding into the main grid well; this additional hardening renders the system marginally less capable of adapting to changing conditions relative to the Microgrid-Capable scenario, although the two scenarios received similar scores on many metrics. Overall, the results indicate that both of these scenarios benefit from extensive reductions in overall system costs and potential cost volatility relative to the BAU scenario, as well as top marks for system reliability during normal conditions and resilience during external shock events, while minimizing environmental impact; there are small tradeoffs among these priorities for the two scenarios, which can inform initial decisions about how to begin implementing the recommended new resources.

On the other end of the spectrum, the BAU scenario received the lowest overall score between 68.6 and 75.8 for each system, driven mainly by risks of cost volatility and lack of resilience following a severe event, as well as a poor environmental sustainability outlook relative to the other scenarios. In the middle are the Hybrid (H), Fuel Transition (FT), and Strengthened (STR) scenarios, which explore new options such as natural gas and organic Rankine cycle that show benefits across all four priorities when compared to BAU. This highlights the clear case for continuing a transition of the electricity sector in the TCI, towards a more distributed, flexible, and renewable generation mix. These results show a way to save costs while responding to local priorities and taking advantage of new technologies increasingly being integrated across the Caribbean and globally.

EXHIBIT 3

FINAL SCORES FOR SIX R-NETS SCENARIOS – PROVIDENCIALES, NORTH CAICOS, AND MIDDLE CAICOS SYSTEM

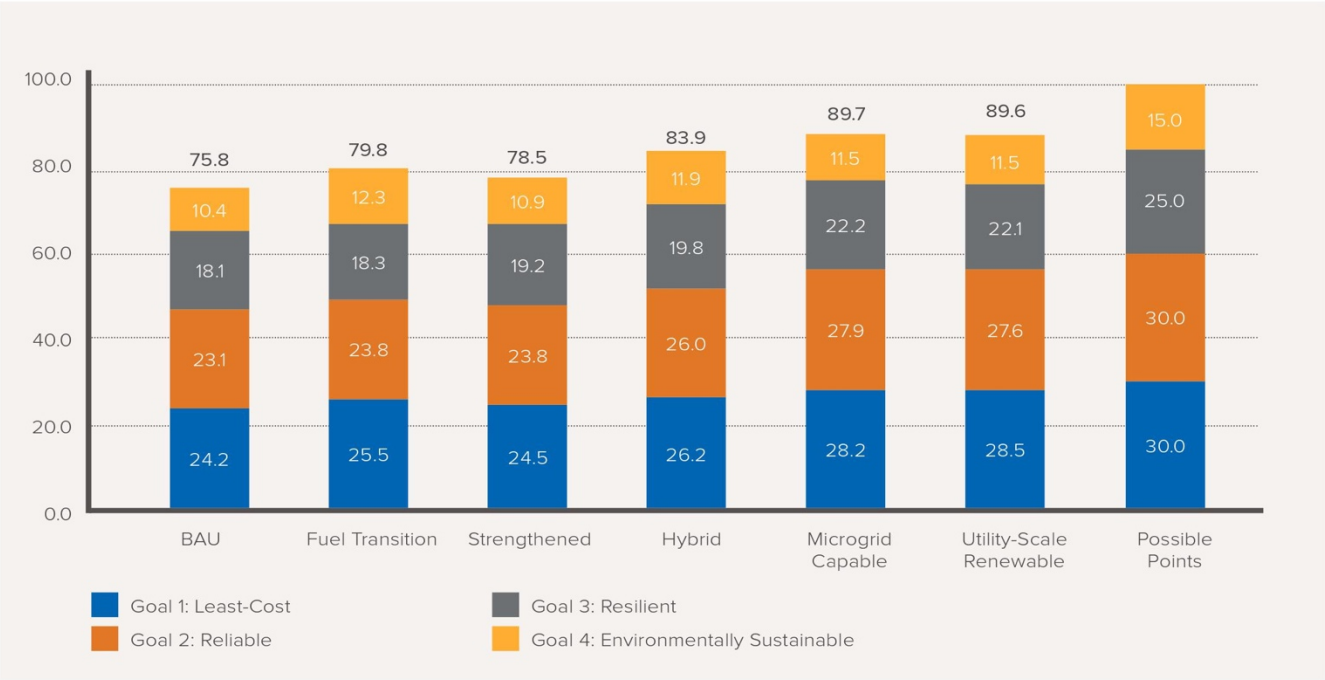


EXHIBIT 4

FINAL SCORES FOR FOUR R-NETS SCENARIOS – SOUTH CAICOS

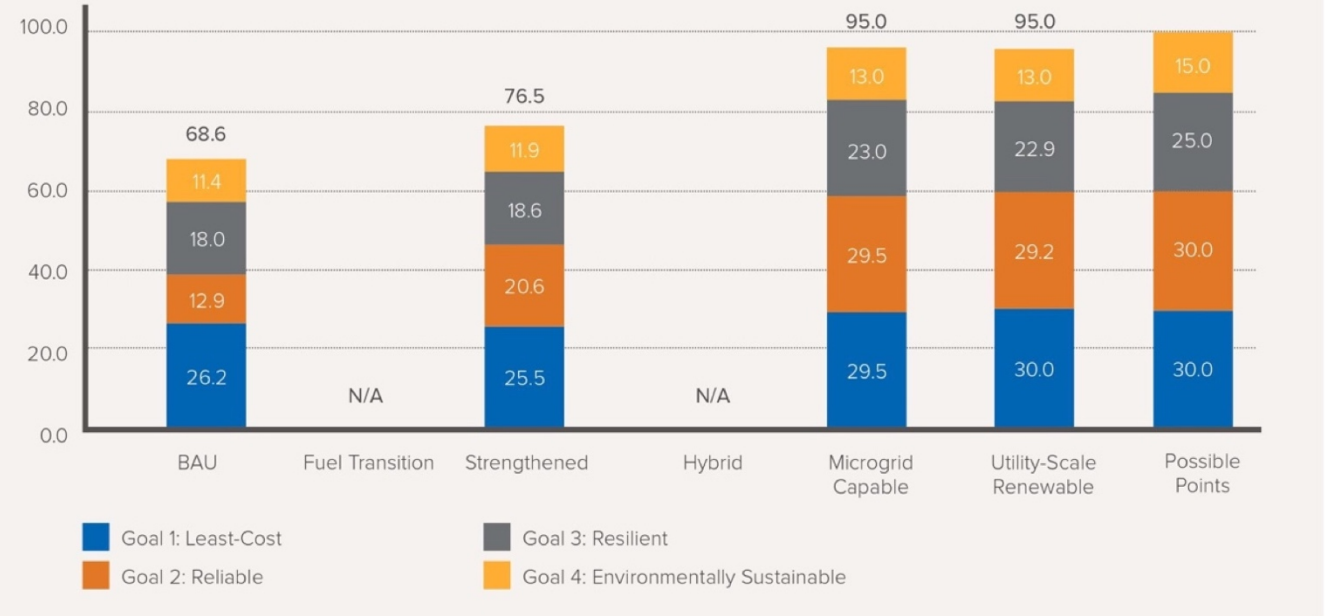


EXHIBIT 5

FINAL SCORES FOR SIX R-NETS SCENARIOS – GRAND TURK