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White Paper

A MICROGRID FLEET IS THE KEY INNOVATION ENABLING THE BAHAMAS TO MEET UTILITY SUSTAINABILITY GOALS

Deploying a Single Control Platform to Manage a "Microgrid for the Masses™" Approach Could Become a Model for the Rest of the World

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EXECUTIVE SUMMARY

The mission of Bahamas Power and Light (BPL) is to provide reliable, cost-effective, and safe electricity to ensure the continued growth and prosperity of the Bahamas. The vision shaping the strategy of how best to meet this mission is ambitious: lead the Caribbean Islands in energy innovation and sustainability, setting new standards in grid reliability and environmental stewardship. Bringing such a vision into commercial reality is no doubt a complex and challenging task.

The concept of a microgrid – self-contained energy systems which can integrate and orchestrate multiple types of distributed energy resources – is vital to BPL's future decarbonization strategy.

Given the dispersed nature of BPL's discontinuous service territory consisting of multiple islands not linked together by any traditional grid network, the concept of a microgrid – self-contained energy systems which can integrate and orchestrate multiple types of distributed energy resources (DERs) – is vital to BPL's future decarbonization strategy.

The default solution for remote power and isolated power systems in the Bahamas – and the rest of the world -- has been diesel generators. Though these diesel generators have been a long-standing solution for remote islands and nations located in Latin America, Africa and the Asia Pacific where traditional utility grid infrastructure is rare, fuel can be very expensive. The technology also generates substantial air emissions. Often incremental in design, microgrids may incorporate legacy assets such as diesel generators, but can also integrate new and more advanced technologies.

The current focus of state-of-the-art deployments of microgrids is to include diverse, cleaner distributed energy resource (DER) assets – such as solar photovoltaics (PV) and battery energy storage systems (BESS) – to reduce regional air pollution, limit contributions to climate change and boost resiliency. Yet to achieve these broad goals, microgrids need to be able to really count on a microgrid controller – the brains of the system – that can talk to assets manufactured by different companies and then developed and installed by multiple IPPs. A fleet approach to microgrids can capture economies of scale. Yet if such a fleet relies upon multiple control layers provided by multiple parties, a utility such as BPL could never have a single unified view of its microgrid fleet.

The solution is a "Microgrid for the Masses™" approach first articulated and now being deployed by Encorp in the Bahamas.

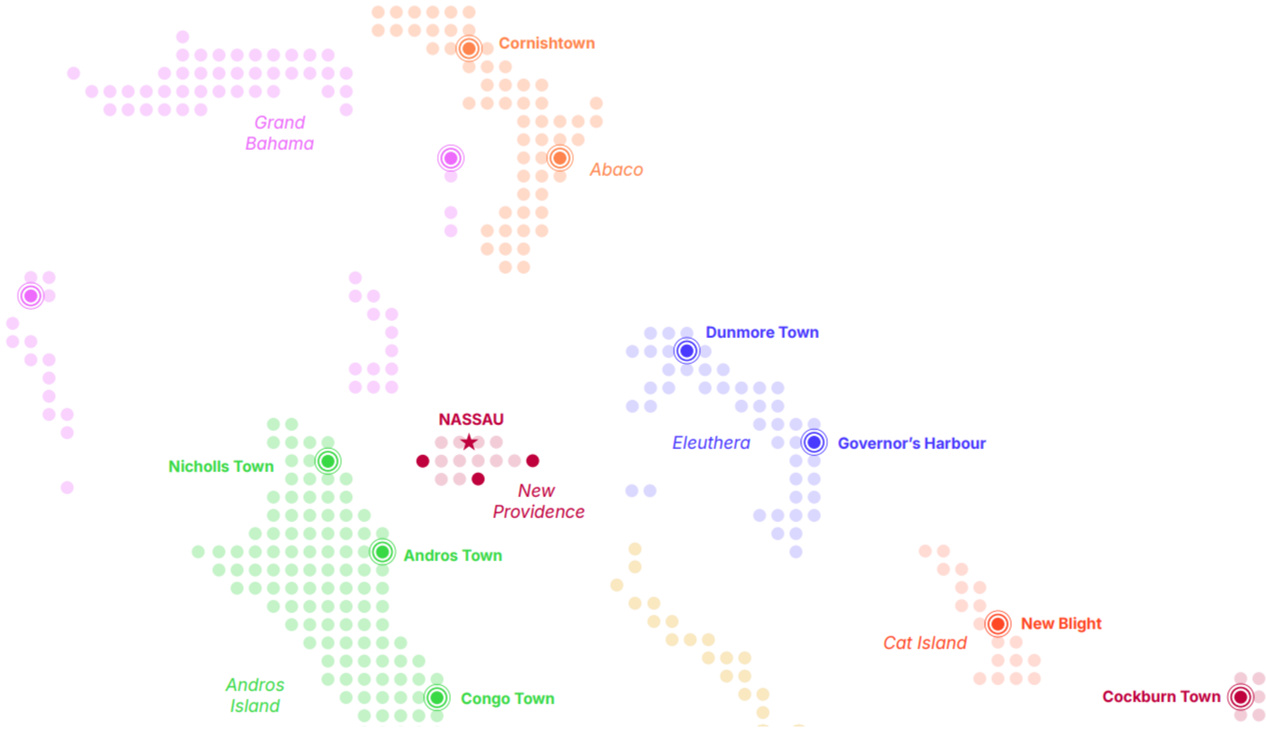
INTRODUCTION: THE BAHAMAS CHALLENGE

The Bahamas consists of 271 islands, many of which are extremely small and most unpopulated. BPL provides energy services to 17 populated islands with 29 existing power stations. The overarching goal for BPL today is to meet the Paris Accord's target of 30% clean energy generation by 2030.

BPL cannot reach its Paris Accord targets alone. It must rely upon private sector partners collaborating in an intelligent and strategic way. BPL is relying upon independent power producers (IPPs) to reduce project development risk and protect its ratepayers as it seeks to develop new renewable and cleaner fossil fuel power generation facilities to replace aging and inefficient energy supply infrastructure.

BPL has chosen the following IPPs – the majority of which are based in the Bahamas ---- for an initial 18 projects located on 10 islands served by BPL (see map below): Compass Solar; INTI; Renuegen (Canada); Providence Advisors; EA Energy (Turkey); Eco Energy Bahamas; Outlier Energy (Texas, U.S.).

BPL Current Generation Sites in the Bahamas



Source: Encorp

All told, a mix of 52 megawatts (MW) of liquified natural gas (LNG) generators, 48 MW of solar photovoltaics (PV) and 35 MW of battery energy storage systems will replace aging diesel generators, some of which are more than 30 years old.

With such a wide array of companies on so many disparate island sites, BPL needs a single point of control and accountability. These microgrids are not only designed to meet sustainability goals, but they are also designed to provide resiliency to respond to extreme weather conditions such as the recent hurricane Oscar and other tropical storms that regular punish Caribbean Islands. Over 20 hurricanes have impacted the Bahamas to date, underscoring the need for resiliency and real-time data to orchestrate and optimize BPL's power supply portfolio.

THE SOLUTION: MICROGRID FOR THE MASSES

What's the best path forward? The heart of any microgrid is the controls platform. It determines performance and is the single most important technology that can be leveraged to the benefit of a utility as well as its customers when developing a decentralized energy system.

The majority of microgrid control platforms have been acquired by genset OEMs, BESS suppliers and multi-product line multinationals. As a result, microgrid end users, independent project developers, solar developers and electrical contractors wishing to "mix and match" energy storage and generation assets to optimize commercial and application-specific needs for projects such as the 18 now moving forward in the Bahamas have previously had their hands tied. The resulting rigidly bundled offerings offered by these microgrid vendors is a study of compromises. What's needed is a more curated approach.

BLP has adopted a decarbonization strategy which Encorp – the company entrusted to integrate and control the DERs across each of the previously identified islands – has dubbed "Microgrid for the Masses™" Under this cross-cutting program, BPL is pioneering the development of microgrids in a fleet that can capture economies of scale, reduce overall costs and streamline the development process. It is a model that can be replicated by utilities across the world, especially those seeking to tap both local vendors and global expertise to the greatest extent possible. It also allows utilities flexibility in adding future DERs. This agnostic approach to DER vendor selection allows for innovation during the development process and at each layer of control once assets are placed into service.

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INVENTORY OF CONTROLS PROVIDED BY ENCORP

Encorp will provide the following systems and services for BPL:

1. **Egility Microgrid Platform**
    - Advanced energy management platform designed to optimize microgrid operations.
    - Facilitates integration of various DERs for enhanced grid stability, efficiency, and resilience.
2. **Switchgear**
    - Provided by Encorp.
    - Retrofitting options available for integrating existing switchgear into the microgrid system.
3. **BPL Generator Control Modifications**
    - Updates and modifications to existing generator sets for seamless integration into the microgrid.
    - Ensures compatibility with modern control systems for improved performance and reliability.
4. **Integration & Control Systems Support**
    - Comprehensive support for integration and control systems to ensure smooth operation across all participating sites.
    - Ongoing system management to optimize performance and ensure reliable, seamless microgrid operation.

WHY ENCORP?

Encorp is a US-based independent energy technology firm based in Fort Collins, Colorado specializing in its Egility microgrid controls platform with over 30 years of successful project implementation. Its credentials include the following milestones, capabilities and customer types:

- ✓ 500+ projects in 12 countries, including Sweden, India, Scotland, Africa and throughout the U.S.
- ✓ Large reciprocating and natural gas turbine expertise
- ✓ Integration of solar, wind and battery energy storage assets
- ✓ 100+ year microgrid engineering experience
- ✓ Low-voltage, medium-voltage and relay technology offerings
- ✓ Clients include data centers, health care campuses, large and small utilities, and ultra-secure military bases and other U.S. government sites.

These offerings are designed to ensure a robust, reliable, and scalable microgrid solution for The Bahamas, enabling the country to meet its sustainability goals while enhancing its energy infrastructure.

The core value proposition embedded in the Microgrid for the Masses™ fleet revolves around use of a single microgrid controller platform – Encorp's Egility– even if projects involve multiple private developers. If each IPP were to rely upon its own controls' platforms, BPL would not have a unified view and a common understanding of operations across the fleet. Like most utilities, BPL preferred a homogenous control architecture that allows for better performance now – and into the future. As is the case with most energy infrastructure, a fast roll-out is key when modifications are required whether due to integration of new assets or in response to extreme weather events. Though each IPP's Engineering, Procurement and Construction (EPC) partners bring benefits to utilities – expertise and risk reduction – they can also pose legal challenges if there are gaps in performance data and a lack of visibility into the chain of command in operational decision making. Encorp can provide 6 levels of required controls and communication, whereas IPPs themselves may only be able to provide one.

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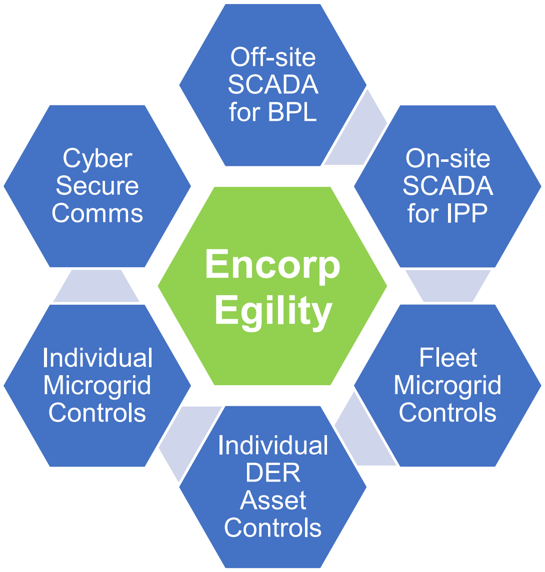
Encorp Egility Services for BPL



Source: Pathfinder Communications

CONCLUSION: REAL-TIME DATA VISUALIZATION A GAME CHANGER

Along with its Egility microgrid controls platform, Encorp will also provide visual touchscreen dashboards, allowing BPL utility to monitor real-time performance of all its 29 power stations. Using live, real-time data, the interactive touchscreens can showcase each energy resource controlled by the Egility platform and their relative contributions to the power supply of an individual microgrid -- as well as to the entire new microgrid fleet.

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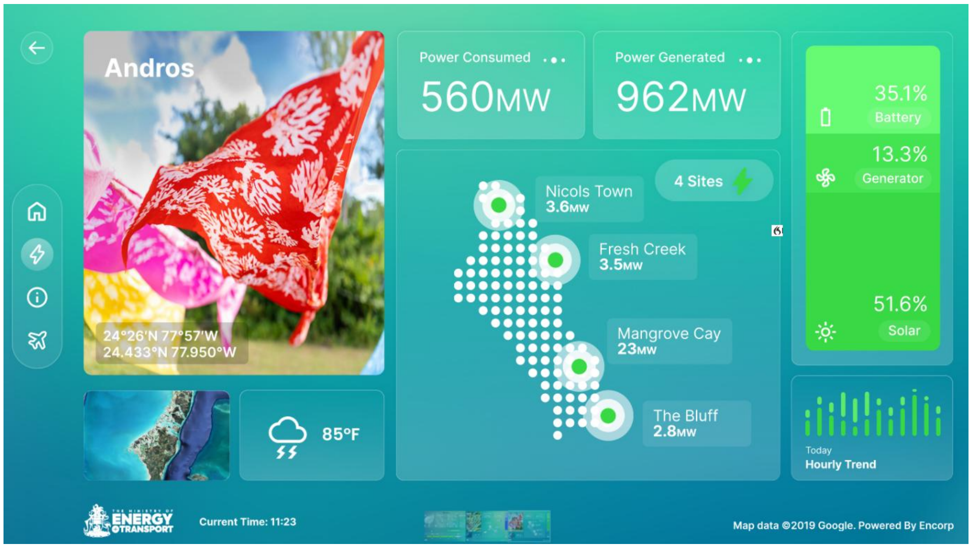
The first step in this process is for Encorp to perform an energy data audit to determine what actions, if any, are required to support information feeds to the discrete interactive visualization touchscreens installed at pre-determined locations. Curated additional outputs can be incorporated via client negotiations. For example, progress toward compliance with the Paris Accord climate change reduction goals of a 30% reduction in fossil fuel use by 2030 will be featured in the dashboards installed for BPL. In addition to centralized core screens, additional individualized screens (see example below) will provide details and data specific to each microgrid location, informing local stakeholders of where their power is coming from at any single point in time.

Andros Island Visual Dashboard Screenshot



With the augmentation of real-time data visualization, the Microgrid for the Masses™ program is a game-changer for The Bahamas' energy future. By offering a curated, flexible solution that breaks free from the constraints of traditional, rigid microgrid offerings, this program ensures that BPL can meet its sustainability goals while empowering local developers and partners to contribute to the energy transition. All the while, the ability to witness real-time operations for both experts and citizens alike help democratize the energy transition.

THREE TAKEAWAYS

To sum it all up, BPL's microgrid fleet program will accomplish the following tasks:

- Help BPL meet its sustainability target of generating 30% of its energy from sustainable energy resources.
- Improve the resiliency of BPL's disaggregated distribution network by diversifying its energy resource mix within the context of a series of microgrids.
- Educate BPL staff and the public at large with visual dashboards highlighting real-time data in an intuitive and compelling way.

***Peter Asmus** is **President** of **Pathfinder Communications** and has been covering, informing and shaping energy markets for almost 40 years.*

A journalist, analyst, book author and consultant, he specializes in tracking global trends in microgrids, virtual power plants, data centers and distributed energy resource management systems: www.peterasmus.com.

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