A WHITE PAPER BY VEOLIA

Navigating Local Utility Requirements for Microgrids: Lessons from New York

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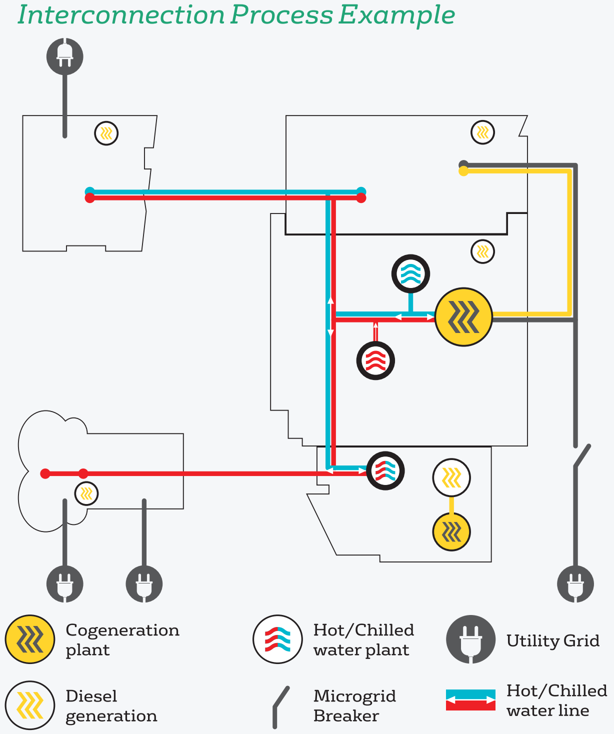
Introduction

Across the United States, cities and facilities with mission-critical energy requirements have begun a paramount shift from centralized energy generation to local, renewable, and flexible distributed energy resources. Distributed energy concepts like microgrids have become viable and sustainable energy strategies thanks to major technological advancements, rapidly falling equipment prices and an evolving regulatory environment. Compounding this, extreme weather events like Hurricanes Sandy, Harvey, Irma and Maria have made clear the risks to critical facilities and infrastructure inherent in traditional energy distribution systems. Microgrids present a reliable, resilient, and cost-effective alternative for major energy users.

Resiliency, Microgrids and Utility Reforms

A continuing challenge in implementing these rapid changes is ensuring that utility infrastructure and regulatory frameworks are prepared to keep pace with industry advancements. Requirements for electrical interconnection with the grid, utility rate tariffs, and franchise rights must be adapted to support microgrids and other distributed energy solutions; these resources are key to increasing grid reliability, resiliency, and efficiency.

Interconnection Process Example



In New York, for example, increased activity from the New York State Public Service Commission aims to keep pace with industry advancement. In 2014, New York launched its state energy policy framework "Reforming the Energy Vision" (REV) after Hurricane Sandy exposed vulnerabilities to the state's utility infrastructure. The campaign called for New York State to work directly with the private sector on energy policies that explore new technologies, pursue greater energy efficiency, address resiliency requirements, and educate the public on the benefits of clean energy to the community. With frameworks like REV providing guidance, real estate developers have begun implementing distributed energy solutions to better serve New York's communities. Across New York there are currently several examples of forward thinking electric and thermal microgrids, either planned or under construction. Once fully implemented, these microgrids will provide a highly efficient, resilient, and sustainable local energy supply - benefiting both tenants and the environment.

Forming a strong relationship with the local utility company and having experienced consultants is one of the keys to a project's success.

Realizing these projects has involved close collaboration with local utility distribution companies. This whitepaper will discuss the technical and economic implications of working with the host utility and how to navigate these requirements during project design and development. Specifically, it will explore how project owners and utilities like Con Edison, have partnered with companies like Veolia, and its energy consulting subsidiaries, to navigate hurdles and make these complex projects a reality.

Microgrid design requires careful focus on sustainability and resiliency while balancing cost, risk, and asset ownership when multiple parties are involved. In some cases, microgrids require modification or creation of new utility tariffs and technical specifications. Forming a strong relationship with the local utility company and having experienced consultants is one of the keys to a project's success.

What the Utility Needs

Microgrids include distributed energy resources (DER) that can be configured to both export and import power from the local utility, depending on the optimum dispatch of the facility. However, because utility system infrastructure has not traditionally been designed for this two-way power flow, the utility must be part of the design process to ensure that it can protect its system when multiple energy sources are connected to the grid.

"Traditionally, the infrastructure associated with the utility has been a one-way power flow from the large power plant through the transmission distribution system down to the customer," notes Colin Vorse, a Veolia project developer with experience on several distributed generation projects. "Now, as more DERs come online and are being used to solve capital infrastructure needs, the infrastructure has to become two-way. Utility rates and tariffs have also historically not existed for a DER-saturated environment. This is why utilities, especially in New York State, are moving toward net metering for solar and other renewable technologies. So, we are moving toward a rate structure that is better for all customers with the deployment of DER."

Colin Vorse

Mr. Vorse adds, "We have seen some cases where a development with a microgrid has been disconnected from Con Edison's system and is looking to re-connect. And by doing so, they can export power into the system. Also, maintenance on the distributed generation equipment is easier because you're backed up by the grid."

Early and continued involvement of the utility during design, construction, and operation planning sets the developer up for success.

Developers and operators should be clear about business and long-term maintenance needs to ensure that the utility is prepared for the impacts on its system - for example, how much backup power is required from the grid. Construction and operation must be carried out per utility standards, allowing the utility to prepare for the implementation of new infrastructure that may replace existing assets. Early and continued involvement of the utility during design, construction, and operation planning sets the developer up for success.

What the Developer Needs

The owner needs to solicit requirements from the local utility early in the design process. Establishing these requirements allows the owner to accommodate the campus environment's unique interconnection with the utility.

In doing so, they can maintain the seamless dispatch of energy to their site under any conditions, along with the stability of their tenant's utility costs and service continuity during outages.

As the owner's representative on some of the most visible campus style microgrids in the region, Veolia has worked closely with customers to develop the design and interconnection agreements with the utility. Veolia has also been responsible for establishing start-up and commissioning procedures required to implement these projects. These deliverables provide key direction for the project's success.

Implementing large, multi-stakeholder microgrid projects requires coordination between the developer and the energy consultant, and the reason many plants have trouble early on is because of tough construction schedules. Having an end date for commissioning is therefore essential. Also, because many microgrids incorporate a combined heat and power (CHP) plant, allowing full functional testing of the microgrid sequence of operations is critical during the commissioning stage.

Navigating Utility Interconnection Specifications

When designing a microgrid there are local utility specifications for interconnection that need to be adhered to. In New York, for example, there are two main electrical specifications by Con Edison, allowing the utility company to provide power via uniquely designed microgrid isolation breakers. Certain progressive projects though have required introducing protocols to meet unique requirements such as delivering electricity across multiple buildings.

As more microgrid projects of this type and complexity are planned, utilities have had to leverage existing specifications and expand them, working collaboratively with their customers and partners like Veolia.

"A utility company typically has specifications and standards for on-site cogeneration applications, but microgrid developments require a solution that extends to complex campus style projects," explains Johanna Ghabour, a Senior Project Manager at Veolia's energy consulting subsidiary SourceOne, Inc. (SourceOne). "Some of the projects we are working on are unique in terms of where the power enters the campus, and how it isolates from the utility to create the development's own utility grid. Specifications must be written so the electrical feeders installed at the point of entry and throughout the campus are utility grade."

Johanna Ghabour

Additionally, fault current generated by CHP plants can affect the entire grid, which necessitates the installation of microgrid isolation breakers to interrupt this occurrence and protect the larger utility system. As more microgrid projects of this type and complexity are planned, utilities have had to leverage existing specifications and expand them, working collaboratively with their customers and partners like Veolia. "Safety and capital cost have been key focuses when implementing these new protocols, and we struck a balance between these and the solutions the utilities have already embraced," notes Ms. Ghabour.

Incoming utility medium-voltage feeders are typically encased in concrete to minimize the impact of a fault scenario, but concrete encasement work is expensive. In some cases, Veolia and the utility have discussed the feasibility of minimizing these encasements and constructing new feeders to utility standards that significantly reduce capital cost without compromising safety. The proposed design incorporated additional relaying to the switchgear so that a breaker would trip before anything went wrong.

To ensure communication between a microgrid and the utility, Veolia has worked with utilities to implement real-time systems. One method that has been successful is to install a T1 voice and data line to constantly send microgrid operational

The Benefits of CHP

Reduced GHG emissions

Reliable energy supply

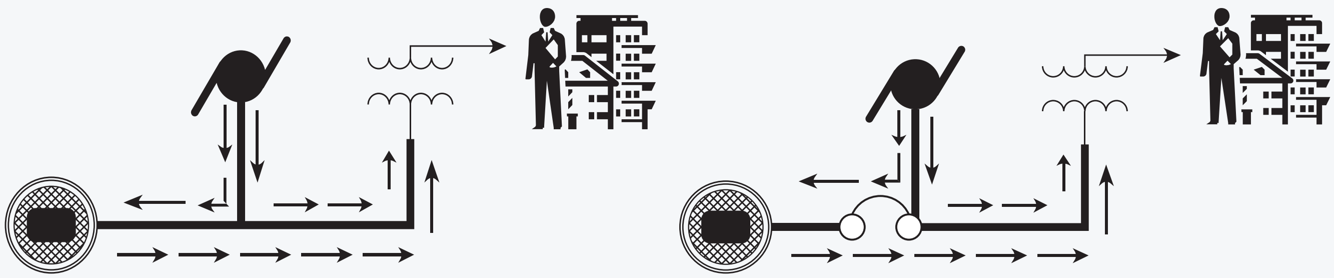
Valorized local energies

One-stop-shop

Reduced energy bill

Proposed Feeder Design

Feeder without Breaker *Feeder with Breaker*



data to and from the utility. The microgrid plant operator is required to call the utility district operator during any outages or abnormal changes in microgrid or utility operation. Ghabour explains, "During normal operation, the utility can trip a breaker in the microgrid plant in order to de-energize a particular feeder if utility safety is jeopardized."

The success of these collaborative design approaches between Veolia and local utilities have also yielded new operational data specifications, which in some cases have to be written from scratch in order to detail the exact sequence of operation for day to day operation. These specifications form the basis for the Utility Interconnection Agreement, a contract between the project owner and the local utility, which sets the standard for all the operation protocols.

Commissioning an interconnected system should be conducted hand-in-hand with the utility, testing feeders and scheduling shutdowns.

Microgrids are an evolving market both commercially and technically, and there can be substantial benefits of working with partners that have the ability to work effectively with the local utility.

Navigating Utility Testing & Commissioning Requirements

Testing and commissioning (Cx) is one of the most important stages of any construction project, especially when building a microgrid that is interfacing with a utility. That's why it is critical to have a Cx agent that has an understanding of the plant's design in addition to knowledge of how private energy resources need to work with the public utility.

Ghabour explains, "There are multiple modes of operations for these plants. For example: normal, blackout, semi-blackout, and emergency. Each sequence of operation has to be developed and tested. Although the blackout mode may not happen very often, we can have confidence of the operation sequence because it is thoroughly tested during commissioning." By testing – and therefore troubleshooting – the many sequences prior to commercial operation, the Cx agent assures the developer that the sequence works.

It is important that the sequence of operations has been thoroughly reviewed with all stakeholders during the design phase. Then, all that needs to be done is troubleshoot during commissioning. This allows the Cx agent to manage the testing and commissioning process with a detailed Method of Procedures, and focus on troubleshooting any deficiencies that are identified. By the time the project is turned over for beneficial use, the utility will also have vetted the sequence with all stakeholders – vendors, operations, and the Cx team. Commissioning an interconnected system should be conducted hand-in-hand with the utility, testing feeders and scheduling shutdowns.

For example, on a recent microgrid project, Veolia worked with the utility to coordinate all the microgrid equipment testing, and their personnel were present to witness this testing. The utility also reviewed the National Electrical Testing Association (NETA) testing reports on the breakers, relays, and other equipment. Each party needed to make sure that the breaker settings match the settings in the distribution, and the relays and breakers all need to be checked off by utility personnel.

The commissioning process also serves as a phase wherein potential operational and tariff impacts are identified and resolved.

Navigating Utility Tariffs for DER

"Tariffs" are schedules where the utility company sets forth rates and terms of service under which it provides electric, gas, and steam service. They are filed with the New York State Public Service Commission (PSC), which regulates the state's electric, gas, and steam utilities, and reviews and approves their rates and terms of service.

While a utility may have a tariff for a single meter at a single building, it may have a different tariff for sites that supply their own power generation, and another one for sites that sell power back to the grid. As these multiple tariffs can quickly produce a complicated situation, developing a reliable process for navigating them is essential for project success.

Projects must involve careful coordination between the developer, utility and the developer's energy consultant to ensure a successful outcome.

New York has several tariffs. For example. there is a standby tariff where the utility is on standby in case a single building loses power, in this case, the utility then provides back-up power. There is also a campus offset tariff where the aggregate load across multiple utility meters is offset from the utility. Then, there is a buyback tariff where a utility customer sells power back to the grid. The service classification depends on multiple factors, including a building's type, electric demand, and service voltage.

The offset tariff was pushed forward in 2012 by the New York PSC, but, there are only two to three systems in operation that use this tariff, so there is a huge learning curve in applying it. A 2015 working group proposed a tariff that covers gross versus net kilowatt-hour charges. A reliability credit giving developers the ability to earn a credit based on performance has given developers more flexibility.

On recent projects, Veolia and the customer have provided tariff calculations to the utility, and their rate engineering team reviewed the assumptions and provided detailed feedback. One challenge to working with a utility on implementing a new tariff is getting all parties to understand the complexity of constructing and commissioning a plant that is unique and complex. It is important to have tools in place to evaluate the process and respond.

Conclusions and Best Practices

Microgrids represent a relatively new concept that requires adapting existing frameworks. Because of that, projects must involve careful coordination between the developer, utility and the developer's energy consultant to ensure a successful outcome. Though utilities are invested in advancing these types of solutions, they need to know what a project like this entails, and what to look out for. As such, it is critical to have an experienced energy consultant that knows how to collaborate with the utility, helping to find a "middle ground" and produce an acceptable solution. Says Ms. Ghabour, "We strongly recommend engaging an owner's representative who understands microgrid design, and who can also commission the plant. It's important to engage the owner's representative early. Make sure they understand who owns the commercial model and that all the requirements are clear. This will save the developer a lot of headaches later on."

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