COMMONWEALTH OF PUERTO RICO
PUERTO RICO ENERGY COMMISSION

CASE NO. CEPR-IN-2017-0002

IN RE: INVESTIGATION REGARDING THE STATE OF PUERTO RICO'S ELECTRIC SYSTEM AFTER HURRICANE MARIA

NOVEMBER 20, 2017

COMMENTS OF NRG ENERGY, INC.

NRG Energy, Inc. ("NRG" or the "Company") provides the following comments to the Puerto Rico Energy Commission (the "Commission") in connection with Case No. CEPR-IN-2017-0002 and the implementation of regulatory actions to facilitate the tasks of restoring electric service and encourage the deployment of new technologies. NRG appreciates the Commission's interest in this urgent issue.

The outcome of this initiative will be pivotal to restoring reliable and cost-effective electric service to the Commonwealth of Puerto Rico. NRG supports the Investigation's approach to separating the work ahead into two phases: the first, to restore service and identify vulnerabilities to the electric grid, and the second, to conduct a medium- and long-term analysis with the aim of building a more resilient grid. NRG commends the Commission Staff for your efforts to leverage broad stakeholder input. NRG supports efforts to rebuild Puerto Rico's infrastructure, and is pleased to share its experiences building microgrids and other grid resources, as part of the Investigation.

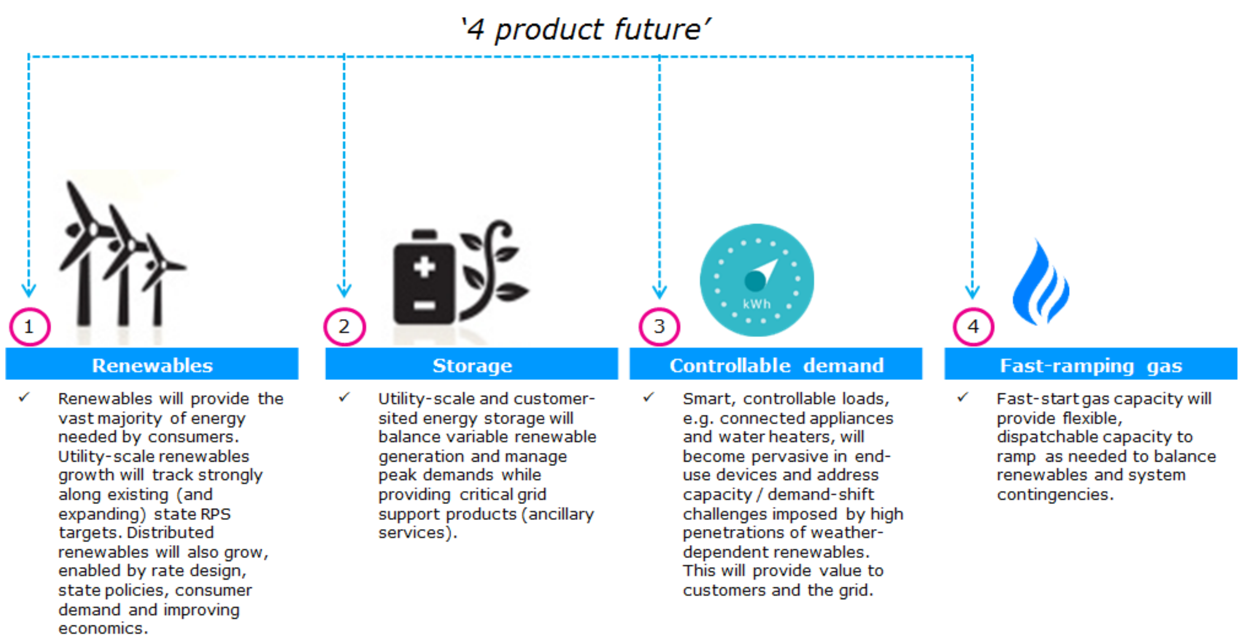
GENERAL COMMENTS

I. Introduction to NRG Energy

NRG is the leading integrated power company in the United States, built on the strength of the nation's largest and most diverse competitive electric generation portfolio and leading retail electricity platform. A Fortune 500 company, NRG creates value through best-in-class operations, reliable and efficient electric generation, and a retail platform serving residential and commercial businesses.

NRG envisions the electric grid of the future as comprising four major elements, depicted in the graphic below. While Puerto Rico's grid is unique, it also includes many features that are compatible with this four-product future. First, the foundation of the clean energy grid is renewables, such as wind and solar, to provide the vast majority of the energy needs of the system with no emissions. Second, storage -- both at grid scale and in distributed applications --

will store renewable energy when renewable production exceeds that needed to serve demand, and to serve demand when renewable energy production is not sufficient. Third, pervasive load management at the end-user level, in the form of dispatchable, behind-the-meter generation as well as load-shifting and other load-shaping strategies will greatly enhance the ability to match demand to variable supply. Finally, a complement of flexible and fast-responding peaking and intermediate plants will provide the additional balancing capability for short-term ramping and contingency needs.



NRG is a leading owner and operator of distributed generation technologies, particularly microgrids. Our new headquarters in Princeton, New Jersey, is powered by a microgrid that integrates solar photovoltaic panels, wind turbines, a solar thermal system, a combined heat and power ("CHP") plant, back-up generation and energy storage. NRG decided to construct this headquarters after Hurricane Sandy in 2012 to create a safe, reliable workspace that can endure the most extreme weather conditions and support critical 24/7 business operations. This 130,000 square-foot LEED Platinum building represents the intersection of our business and sustainability objectives by showcasing a variety of cleaner, versatile, and highly efficient energy and water technologies we offer our customers.

Having faced powerful hurricanes this year and in many other years during our history, NRG acknowledges the enormous challenges facing Puerto Rico at this time. Drawing from our own experience, NRG believes that now is the time for the Commonwealth to ensure that new technologies are deployed as the Puerto Rico Electric Power Authority ("PREPA'") replaces damaged and/or aging parts of the power system following Hurricane Maria.

II. Recommendation Summary

NRG respectfully offers six overarching recommendations to the Commission. Additional detailed recommendations in responses to questions can be found in the following section.

1. **Solicit opportunities for competitive investment**. Whether traditional or distributed generation, the Commission should support immediate investment in new construction, replacement, and upgrades. These investments should transition the grid to a flexible system that can respond to future technologies, support clean energy integration and minimize outages during major storms and events.
2. **Prioritize smart grid enabled technology**. An updated grid should seamlessly monitor end use, distributed generation, large central power, and transmission and distribution systems. To maximize the storm-resiliency benefits of on-site generation, it must be located appropriately and protected against damage during major weather events. A smart grid with sectionalizing switches and connections to multiple substation supplies would make it possible to restore portions of the neighborhood by using the switches to change power sources. The Commission and PREPA should work to incorporate additional automatic switching and sectionalizing of equipment across the grid. On the customer-side, advanced metering infrastructure ("AMI") can promote better management of the system and manage costs, while fostering more rapid restoration of service after an event. AMI can also help prevent grid emergencies by enabling load curtailment. For instance, in New York, NY, Con Edison implemented the CoolNYC Program, which worked with building owners and tenants in large apartment buildings to install smart air conditioning controls. The plan calls for Con Edison to install controls on at least 10,000 air conditioners, leading to a 5 MW demand reduction -- enough to power 5,000 homes. When needed during peak load periods, Con Edison will directly adjust the unit's temperature to reduce usage.[1]
3. **Eliminate regulatory barriers for distributed resources**. The Commission should identify and work to reform PREPA policies and practices that hinder the development of distributed resources. In particular, demand-side resources -- including demand response and energy efficiency -- should be recognized and compensated for their load-offsetting capabilities, as well as their abilities to defer transmission and distribution upgrades. Requirements on distributed resources must be revisited to ensure they are

[1] NYS 2100 Commission, *Recommendations to Improve the Strength and Resilience of the Empire State's Infrastructure*, page 98, available at: https://www.scribd.com/document/119825569/NYS-2100-COMMISSION

consistent with a highly distributed grid. Rules that shut down interconnected distributed resources during outages to prevent back-feeding into the grid should be reexamined; such requirements are meant to protect utility workers when restoring power, but islanding technology exists to allow the system to continue powering the customer during outages without back-feeding to the grid. Throughout the electricity system, greater competition must be encouraged to leverage private investment beyond PREPA, as a means to increase the velocity of investment and rebuilding, add local generation to provide flexibility and resiliency, and ease the financial burden on the utility.

4. **Create and expand incentive programs specifically for distributed generation resources to serve critical facilities**. These programs should provide funding for behind-the-meter resource development, including sufficient emergency fuel supply to serve as a resource in times of emergency. Give preference to critical facilities such as schools, universities, hospitals and municipal buildings that are designated as safe havens during storms. Private end-users such as large housing complexes, big box stores and shopping malls should be allowed to compete for these so long as they are capable of serving as a safe haven. For example, Florida Gov. Rick Scott recently set new emergency requirements mandating that nursing homes and assisted-living facilities have supplies and power to sustain operations for at least 96 hours after a power outage. In Florida, these facilities must have ample resources, including a generator and the appropriate amount of fuel to maintain comfortable temperatures over the same timeframe.[2]
5. **Simplify regulation on microgrids at the commercial and industrial level**. Given PREPA's precarious financial state, private investment must play a greater role throughout the electricity system. Private investors are able to structure microgrid deals and projects that meet customers' specific needs in an efficient manner. NRG strongly encourages the Commission to avoid protocols that require every microgrid project to satisfy a rigid set of business terms or other standardized design requirements, as those are antithetical to the inherent local flexibility and customization necessary for such projects to be successful.
6. **Enable injection to leverage full use of distributed resources in case of emergency**. The Commission should create straight-forward protocols for interconnection and reasonable cost allocation for distributed resources and their components. In particular, distribution system upgrade costs that enable distributed resources to inject onto the grid should be borne by ratepayers, rather than only one customer, to enable greater deployment of these resources.

[2] Fink, Sheri and Matt Stevens, *New York Times*, September 16, 2017, available at: https://www.nytimes.com/2017/09/16/us/nursing-homes-florida-scott.html

RESPONSES TO QUESTIONS

APPENDIX I

Microgrids in Unserved Areas

1. Microgrid Organization.

1.2. What are the advantages and disadvantages of alternative microgrid ownership structures (e.g., third-party, customer co-op, anchor load)? Consider such factors as reliability, economics, and accountability.

Microgrid ownership structures generally derive from the end user or groups of end users the microgrids support. These projects can be structured as non-for-profit entities when they are set up at schools, universities or hospitals; they can be owned directly by manufacturing or industrial facilities; or they can be owned by third parties. Often ownership boils down to economics. Most institutions or companies have finite resources, and invest their money in projects that supply the highest returns. Often microgrid projects are not those projects. Third-party ownership structures -- including not-for-profit ownership structures -- enable the end users to enjoy microgrid benefits, such as reduced energy costs, increased system reliability and resiliency, without having to make the investment. Reliability is a function of design and economics. Generally the higher the cost of electricity from the grid, and the relatively lower the costs of fuel, the better the economics are for microgrids. One of the exciting things that could really drive microgrid advancement in Puerto Rico is the burgeoning development of a containerized liquefied natural gas distribution system, which compared to traditional fuels such as diesel, heavy fuel oil, kerosene and propane, has become a very cost-effective alternative. This, coupled with cost-effective solar and battery technologies, demonstrates that microgrids can be very cost-effective alternatives in many situations.

1.2.1. For each possible ownership structure, what actions by the owners, users and customers should be guided, constrained or rewarded through regulatory actions? What regulatory actions are necessary? What regulatory actions might be unnecessary or problematic?

First and foremost, the regulatory environment needs to be structured in a manner that does not penalize microgrid development. This is especially true of microgrid development by well-funded owner-operators. Historically, Utilities view microgrids as competition, stealing kWh from their sales, and imposing project killing tariffs to disincentive microgrid development. Examples include departing load charges, expensive and at times unnecessary equipment, such as extremely high speed transfer trip technology, the inability of a third party generator to distribute electricity to more than one customer, even if the energy associated with a microgrid can be sold to multiple customers.

1.4. What financing sources are available to support various ownership forms? Consider private investment (both independent investors and commercial entities like large stores), government investment, and foundation and other non-profit sources.

Financing is a key component to microgrid deployment. In the open marketplace there are many financing sources available to microgrids. Third-party owner/operators will invest in microgrids with financially qualified offtakers. There are structures that exist that enable a not-for-profit to own microgrids, which are developed, designed, constructed and operated by for-profit entities. In these not-for-profit structures, money is often raised in municipal bond markets. For universities and hospitals, alumni and endowment funds have taken part in energy projects, which could also be structured to include microgrid infrastructure. "Green Banks" -- both privately held as well as state-sponsored -- actively invest in microgrids. Infrastructure funds are also active players in this marketplace.

1.5. What types of expertise (e.g., planning, engineering, customer education, other) are necessary to make the planning, development and operation of microgrids a success? What are current examples of success and failure?

Typically, the most successful microgrids are those designed, owned and operated by companies who specialize in such infrastructure.

2. Microgrid Placement and Availability.

2.1. What are the advantages and disadvantages of focusing microgrid development on specific types of customer loads (e.g., large industrial loads, urban loads, rural loads, residential neighborhood loads)? Are some types of load profiles, or some geographic areas, better suited than others? What data exist to support your answer?

Load profile is a key starting point for identifying the best sites. Microgrids need load and become more economical when there are stable load profiles, particularly when coupled with thermal loads such as hot water, chilled water or steam which are often byproducts of electrical generation. Microgrids favor load density, such as industrial loads, commercial loads, or mixed-use loads. The microgrids that provide the most value require power, or co-locate loads to provide a collective power requirement, that is stable and predictable 24/7 with limited periods of low usage. Generation technology is more efficient when being used at full capacity; thus, clustering loads that keep equipment running at maximum efficiency is key to the economic and technical success of a microgrid.

Datasheets by any generation equipment manufacturer will demonstrate that power generation equipment performs best and is most economical to run when it is running at high capacity. When microgrids have to service loads that are geographically disparate, the cost of connecting those loads electrically and thermally outweigh the cost, reliability and resiliency benefit that microgrid infrastructure is intended to provide. The primary benefits of having a microgrid are load control, generation control and overall system optimization. Having a high load factor enables generating units to run at peak performance but through proper equipment sizing, component selection, system integration and operational optimization, most load profiles can be managed to ensure reliable operation.

2.2. Regardless of the possible priorities to place on different types of loads, what are the most cost-effective paths to getting microgrid service universally available to all customers regardless of their locations?

Microgrids are inherently not designed to be universally available to all customers, regardless of their location. Doing so makes microgrids cost prohibitive.

2.3. What level of financial assurance will microgrid developers reasonably require before investing their own funds in Puerto Rico microgrids?

Distributed generation focused on meeting the demands of load clusters would prove to be most cost-effective as opposed to integrating far-flung customers that would mimic a centralized generation model. The size and complexity of the microgrid should be assessed on a micro-level taking into account the loads, geographic locations and economics. Though economies-of-scale play a critical role, the simplest arrangements of a microgrid may be solar+battery+demand management systems.

Developers seek a reasonable level of financial assurance to invest their own funds in Puerto Rico microgrids. One solution is to allow developers to directly charge end users, as opposed to be backed by simply the government or PREPA. When microgrids have access to multiple customers, owners realize a portfolio effect that serves to maximize return and minimize risk.

3. Microgrid Regulation

3.2. What technical standards should apply to islanded microgrids?

3.2.1. What safety standards should apply?

3.2.1.1. Are the existing standards-IEEE Standard 1547 for design; UL Standard 1703, UL Standard 1741, or IEEE Standard 1547 for equipment; and the 2011 National Electric Code-sufficient? Why or why not?

Microgrid developers are attuned to the engineering standards that currently exist or are under development. IEEE 2030 is used for interoperability of energy technology and information technology. UL3001 can be used for microgrids in tandem with the National Electrical Codes of 2017 to ensure safe operation of distributed generation. These are underway currently and it would be good to keep an eye on the requirements they impose.

3.2.2. What are the advantages and disadvantages of requiring inspections? If the Commission requires inspections, what types of professionals and entities should be responsible for conducting them and certifying them. Consider registered engineers (working for the developer, forthe Commission or for some other independent entity, municipal construction permit inspectors, others). What technical specifications should apply to the process of interconnecting a microgrid to PREPA's transmission or distribution system?

As to technical specifications, microgrids are fundamentally constructed to ensure reliability of energy service. The design process should identify and quantify risks associated with product design parameters, long-term maintenance strategies and weather-induced outages to the system. Further, they should consider mechanisms to integrate the microgrid with the utility. All these factors drive the need for standardizing implementation and therefore inspections upon completion. The inspections would also support insurance policies required for microgrids, verify that the system adheres to safety standards and meets high-level performance targets. The products used in the microgrid should meet such standards as UL, CSA, ETL, TUV, etc.

3.2.3. Based on what factors should the Commission determine whether microgrids be interconnected only to PREPA's distribution system vs. to PREPA's transmission or sub-transmission system?

The question of whether the Commission should determine whether microgrids are interconnected only to PREPA's distribution system vs. to PREPA's transmission or sub-transmission system depends upon the priority functions of the microgrid. Ideally, customer load serving microgrids should be connected at distribution levels. Utility service supporting systems (required for voltage stability, frequency regulation etc.) should be connected to the transmission/ sub-transmission system. Microgrids, by definition, are comprised of tools that inherently support load centers at the distribution levels. Supervisory control between multiple microgrids has the potential to support overall utility function, but the equipment, control strategies and development tools currently available for microgrids support distribution-level loads.

3.3. How should the location of microgrids be determined?

3.3.1. Should the Commission establish limits on the size of a microgrid? On what factors should that limit be based (geographic extent, capacity, number of customers, other)?

The size of a microgrid should be allowed to develop organically through the facilitation of regulatory and permitting processes. Microgrids should be defined by their function and not the size of loads or number of customers. A District Energy model could serve as a good example to showcase the viability (economic, operational and environmental) and sizing of a system. Reliability, Operational Efficiency and Economies-of-Scale all support aggregation of loads (electrical and thermal) through connection of multiple customers to the extent where there is a balance between first cost and operational cost for a specified period of time. A feasibility study should help determine the boundaries of the microgrid.

3.3.2. Should the Commission issue franchise rights for microgrids? What conditions should be applied for a franchisee to maintain franchise rights?

The Commission should issue franchise rights for microgrids for both electrical and thermal delivery.

3.4. What consumer protections are required, and how should those vary with the ownership of the microgrid?

3.4.1 Prices and costs.

3.4.1.1. Assuming (for purposes of this question) that microgrid owners can sell their output directly to retail customers, what are the advantages and disadvantages of different pricing methods (including traditional cost-based pricing, price caps based on reasonable projected cost, and allowing market forces to set prices)? Is it reasonable for there to be an administrative charge to cover the Commission's oversight costs?

Pricing should be independently negotiated between owners and customers. Successful structures include a capital recovery so investors can make a risk-adjusted return of and upon their investment, coupled with an ability to pass-through operations, maintenance and fuel at cost. Owners should guarantee some sort of system efficiency and availability. Such structures allow investors security and protect consumers from inefficiently run systems. There should also be options to share fuel risk through appropriate hedging structures.

3.4.2. Contract terms.

3.4.2.1. *<u>What are the advantages and disadvantages of the Commission establishing standard contract terms for retail and wholesale (to PREPA) sales?</u>*

Standard contract terms serve to hinder investment, especially among large users. Certain financing structures require custom terms, project tenor and offtakers. Imposing standard contract terms on the market inhibits owners from financing systems.

3.4.2.2. *<u>How does the answer to the preceding question vary by group? For example, should standard terms be required only for residential and small-commercial customers?</u>*

Residential and small-commercial customers would be the only group that would possibly benefit from state-imposed terms and conditions.

3.4.2.3. *<u>Should the standard terms be required only for microgrids owned or operated with the main purpose of selling energy at retail?</u>*

Only for small residential and commercial customers.

3.4.2.4. *<u>Should contract provisions be subject to Commission review?</u>*

Contract provisions should not be subject to Commission review when contracts are between an owner/operator and a mid- to large-size business or institution.

3.4.2.5. *<u>Should the Commission set limits on contract duration?</u>*

No. In our experience, limits on contract duration can impede microgrid development. Microgrid development requires long-term (10-20 year) contracts to obtain financing. Having the Commission impose limits on contract duration could significantly limit microgrid development.

3.4.2.6. *<u>How should the Commission address customers who decide they no longer wish to be part of a microgrid?</u>*

This is a contractual issue between the customer and the owner. Fair contracts will allow customers the ability to leave a contract, and owners to recover their return of and upon their investment. The commission could require owners to have efficiency and availability guarantees to the customers, to protect customers on the microgrid from inefficient operation.

3.4.2.7. *<u>Should the development of microgrids require unanimous approval of customers within the area to be served by microgrids?</u>*

The development of microgrids should require unanimous approval of customers within the area to be served by microgrids in cases of large commercial and industrial users. Microgrids should provide a clear value proposition that should justify customer approval.

3.4.3. What types of pre-payment or deposits are appropriate? How does the answer vary by customer group?

In cases of residential developments pre-payment may work, but for commercial and industrial customers, payment terms should be negotiated between the offtakers and owners.

3.4.4. Are non-discrimination rules necessary?

For residential developments non-discriminatory rules may be necessary, but such rules may initially inhibit investment.

3.4.5. Are other protections necessary?

Other protections that may be necessary include efficiency and availability protections.

3.5. Must all microgrids (at least those serving multiple customers) charge for services by metering delivered energy, or are other pricing structures acceptable?

When it comes to charging for services by metering delivered energy, not only are other pricing structures acceptable, but they are usually desirable. As microgrids are capital intensive, owners should be charging for the ability to deliver up to a finite quantity of energy to a customer at a defined efficiency. It is in essence a conversion service: Converting one form of energy into another form of energy in a predetermined geographical area. Metered energy is required, to determine quantity of fuel to be passed through to an end user and for a portion of operation and maintenance cost to be distributed, but the major form of capital recovery should be a capacity charge.

3.6. To ensure that a microgrid project is cost-effective, safe and reliable, what information should the Commission receive from a microgrid developer prior its connecting customers? For example, should the Commission require developers to specify?

Flexibility is preferable rather than a one-size-fits-all approach. Requiring project developers to submit a standard set of information may not accomplish the goals of the Commission in terms of ensuring projects are cost-effective, safe, and reliable. Each microgrid is distinct. Microgrids have the potential to deliver electrical energy, store electrical energy, deliver thermal energy, store thermal energy, and deliver a wide variety of levels of reliability, redundancy and resiliency. Gathering data would be useful for information and research purposes, but would be less useful for providing guidance to consumers, particularly around costs and pricing. It is anticipated that consumer need will drive the generation mix, storage and distribution capacity. Comparing microgrid cost and pricing may not deliver comparable results.

3.7. *What timing requirements, in terms of the development process, must the Commission take into account, when determining how long it will take to approve or reject a microgrid proposal?*

In project development, dependability and certainty are more important than timing. If a process takes 90 days, it is important that it never exceeds 90 days. Of course, shorter timelines are better than longer ones, but clear deadlines and a transparent process are more important. If it can be planned for, it can be communicated and budgeted around. If decisions are unpredictable, and timing uncertain or unreliable, projects will not come to fruition.

5. Restoring operation of existing industrial generation using combined heat and power (CHP) systems.

5.5. What regulatory actions would be required to allow a CHP to sell excess power to PREPA?

In general, CHP systems often rely on capacity payments to serve in a state of readiness and provide back-up services to the grid. New CHP facilities that are expected to serve both customer and local grid loads can be incentivized to be built with clear revenue streams. These may take the form of capacity payments, net metering or feed-in tariff regulation. CHP sizing reflects direct customer needs and most customers with CHP serve critical loads that must be continued to be met in case of an emergency. It is not reasonable therefore to assume that CHP can serve the grid unless clear incentives exist.

APPENDIX II – Distributed Resources to Augment Northern Supply.

3.4. *Section V, Article B (10) of Regulation No. 8915 states that the cost of any required upgrades to PREPA's distribution system in order for the distributed generation facility to be interconnected are the client's responsibility.*

3.4.1. *How should this provision be amended, if at all, to reflect the current process of reconstruction of much of the distribution system?*

PREPA has a unique and vital role in implementing a more resilient grid. NRG works as a partner with publicly owned utilities across the United States to implement microgrids and behind-the-meter resources. As technology evolves and users demand more distributed resources, often utilities need new forms of distribution planning and scenario analysis. Users of behind-the-meter resources should be studied before interconnection when they are planning to inject power onto the grid; however, such studies should only determine what is sufficient to manage a reliable system and no more. Utilities should be closely reviewed to maintain that such studies are done without prejudice. Utility ratemaking is generally moving toward the concept that the utility should be incentivized to interconnect more third-party owned microgrids and distributed energy resources. As part of this, distribution studies on distributed resources must be kept at a reasonable expense, otherwise, development of these resources will fail. Based upon this experience, NRG supports the Commission's detailed investigation of whether current rules on distributed generation, peak loads by feeder, expedited study processes and other rules require update to build the grid of the future.

Finally, many small resources that are capable of providing black-start capabilities cannot afford to interconnect to the bulk power system when upgrades are needed, and therefore may only exist as a customer-reliability solution. These resources are then built for back-up power only, but in cases of extreme emergency, these resources can also play vital role to the grid. To spur development, the Commission should develop a method to share the cost of upgrades with other customers, for instance, all customers on a node.

CONCLUSION

Thank you for the opportunity to submit these comments. NRG hopes the Commission will give them every consideration as you work restore and re-envision Puerto Rico's energy system.

Respectfully submitted,

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