2016

Missouri Microgrid Interconnection Requirements

PREPARED FOR THE MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT, DIVISION OF ENERGY

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Contents

I. Introduction

Missouri 's Comprehensive State Energy Plan promotes microgrids as a technology that can play an important role in transforming Missouri's electric grid by strengthening grid resilience and reducing impacts of emergency events.[1]

While there is no universally accepted definition for microgrids, the definition that is most commonly cited comes from the U.S. Department of Energy's (DOE's) Microgrid Exchange Group[2]:

A microgrid is a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected and islanded mode.

Microgrids are no longer a niche technology, but are poised to become an integral part of North America's energy transformation, according to a recent white paper from the International District Energy Association, Schneider Electric, and Microgrid Knowledge.[3] The paper identifies four reasons for this technology transformation:

1. Microgrids can spur economic growth by attracting high tech businesses, data centers, research centers, and similar industries that create sought-after jobs — and for whom energy security and business continuity are critical success factors.
2. Natural gas and solar prices, two common fuels for microgrids, have fallen dramatically in recent years. Lower fuel prices make microgrids increasingly cost-effective to operate. Prices also are declining for electric energy storage, allowing for more effective use of solar energy in microgrids.
3. New smart grid technology allows microgrids to perform in an increasingly sophisticated manner. Real time data displays, grid interfaces, and various software advances allow microgrids to maximize their use and timing of resources for greatest economy.
4. Industry and government officials are very concerned with ensuring grid reliability and security. Microgrids can keep the power flowing when the central grid faces threats from severe weather events or physical or cyber terrorism.

Distributed energy resources are essential to microgrids. As a result, the regulatory issues that affect these resources in general, also affect microgrids. These issues include interconnection processes and requirements, as well as tariff's applied to distributed energy resources. The resolution of these issues will have a direct impact on the viability of microgrids in the United

[1] Missouri Comprehensive State Energy Plan; Missouri Department of Economic Development, Division of Energy; October 2015
[2] "Microgrid Definitions," Microgrids at Berkeley Lab, 2015, https://building-microgrid.lbl.gov/microgrid-definitions
[3] Think Microgrid: A Discussion Guide for Policymakers, Regulators and End Users; Energy Efficiency Markets, LLC; 2014

States. If the interconnection process is too slow, cumbersome, and expensive; or if utility rates discourage distributed energy resource development, microgrids will not progress.

The Missouri Comprehensive State Energy Plan recommends actions that can be taken to encourage the development of microgrids in order to achieve significant improvements to Missouri's energy system. Recommendation 3.7: *Guiding the Development of Microgrids*, proposes the development of state policies for the development and deployment of microgrids.[4] The plan specifically makes the following recommendations:

1. Adopt standardized microgrid interconnection requirements and develop clear rules for how microgrid owners interact with utilities.
2. Develop tariff structures applicable to microgrids for Missouri utilities for review and approval by the PSC that would:
    a. Not be punitive or discriminating and appropriately price various types of standby power.
    b. Encourage microgrid development with an initial focus on areas of the grid that are congested or experiencing rapid demand growth.
3. Require that microgrid owners and operators provide utilities with information that could affect planning including information about capacity, system design, and location.

Missouri S&T recently formed a Microgrid Industrial Consortium for the purpose of advancing microgrid knowledge and opportunities for its members. Those members include investor-owned utilities, municipal utilities, high-energy-use industry members, microgrid equipment manufacturers, renewable energy consultants, the Missouri Department of Economic Development Division of Energy, and the U.S. Army. This report leverages the combined knowledge of the Microgrid Industrial Consortium members to respond to the above recommendations.

II. Benefits of Microgrids

A. Customer/Operator Benefits

Microgrids rely on integrated control systems to coordinate distributed generation with energy storage and demand response operations. Management of distributed energy resources as a microgrid allows for a single connection point with the distribution system. When a customer or microgrid operator acts as an aggregated single entity to the distribution system operator, this allows for innovations, efficiencies and custom operations.

One of the primary characteristics of a microgrid is the ability to island or disconnect from the area electric power system, and continue to provide power to its customers during events when the electric power system is down, or there is a fault condition on the local distribution feeder.

[4] Missouri Comprehensive State Energy Plan; Missouri Department of Economic Development, Division of Energy; October 2015

The microgrid control system coordinates energy storage and demand with generator output. This allows microgrids to provide reliable, lower cost electricity by decreasing the required peak and base-load capacity through effective utilization of intermittent renewable generation balanced with storage and demand modulation.

B. Utility Benefits

Microgrids can serve as a multi-function resource to the macro-grid, providing:

- A reliable, dispatchable energy resource;
- An ancillary service resource;
- A load shed resource; and/or,
- A consumption resource (to handle over generation)

To the extent that a microgrid, or the business entity representing the microgrid, can participate in wholesale markets, revenue streams can be associated with bulk electric system (BES) needs. A microgrid in a particular area can be designed and operated to address macro-grid conditions, at either the BES or local area power system, starting at low voltage levels in a particular area, while generating revenue streams that are associated with each of the services mentioned above.[5]

Per the whitepaper: *Think Microgrid - A Discussion Guide for Policymakers, Regulators and End Users*; Microgrid policies need to balance the market effectiveness of competition against the need to preserve utilities as a distribution backbone of the US electric system. The authors recommend an approach that marries the economic health of utilities and the deployment of microgrids with policies that allow the two industries to work jointly to strengthen the grid.[6]

III. States that are Developing Policies and Advancing the Use of Microgrids

Some states have begun to address the policy issues associated with microgrids, especially states in the northeastern part of the country, following the severe power outages associated with Superstorm Sandy in October of 2012.

A. Connecticut

Connecticut launched a 3rd round of funding for local microgrid projects in November of 2015. The 3rd round of funding will bring the total amount invested by the state to $53M. Previously, $23M had been allocated for two solicitations for microgrids that will support critical facilities such as police stations, hospitals, cell towers, fire departments, shelters, as well as a naval

[5] Microgrids: A Regulatory Perspective; California Public Utilities Commission, Policy and Planning Division; April 14, 2014
[6] Think Microgrid: A Discussion Guide for Policymakers, Regulators and End Users; Energy Efficiency Markets, LLC; 2014

submarine base, college campuses and schools. Bid winners for all three projects must support critical facilities when the utility grid fails. The state established the incentives as part of a storm emergency preparedness bill (Public Act 12-148) that became law in June 2012. In addition to offering financial incentives, Connecticut has fostered microgrid development through changes in utility franchise rules. Public Act No. 13-298, passed in July 2013, makes it possible to site microgrids that cross public streets without franchise infringement.

B. Maryland

Maryland's Governor Martin O'Malley directed the creation of a *Resiliency through Microgrids* Task Force to look at statutory, regulatory, financial, and technical barriers to microgrids. The Task Force published a final report in June of 2014 that included two major recommendations.[7]

The first recommendation was a short-term State focus on the deployment of utility-owned public purpose microgrids, those that serve critical community assets across multiple properties, through advocacy and incentives. Additionally, the Task Force recommended that the Maryland Energy Administration conduct a holistic analysis of tariffs that help define the value of distributed generation to the macrogrid as well as engage in a comprehensive review of siting, interconnection, and commissioning procedures.

For the longer term, the Task Force recommended that the State focus on reducing barriers to entry to third parties (non-utilities) wishing to offer public purpose microgrid services to multiple customers in Maryland, whether those services are offered in new developments or over existing electric distribution company assets. By authorizing competition for public purpose microgrid services, the Task Force believes the State can incent innovation, provide better reliability and resiliency to its citizens, and still allow traditional utilities to compete in this new business model.

C. Massachusetts

In June 2014, the Massachusetts Department of Public Utilities (DPU) issued an order requiring each Massachusetts utility to develop and implement a 10-year grid modernization plan. The Department determined grid modernization will provide several benefits including:

- Empowering customers to better manage and reduce electricity costs;
- Enhancing the reliability and resiliency of electricity service in the face of increasingly extreme weather;
- Encouraging innovation and investment in new technology and infrastructure, strengthening the competitive electricity market;
- Addressing climate change and meeting clean energy requirements by integrating more clean and renewable power, demand response, electricity storage, microgrids and electric vehicles, and providing for increased amounts of energy efficiency.

[7] Maryland *Resiliency through Microgrids* Task Force Report, June 23, 2014

Following the release of the Massachusetts' DPU Grid Modernization Proceedings, the Massachusetts Clean Energy Center sponsored a study entitled: "Microgrids – Benefits, Models, Barriers and suggested Policy Initiatives for the commonwealth of Massachusetts" to better understand the opportunities to promote and support the development of microgrids.[8]

One of the key recommendations from the study was to create a microgrid pilot project that could be used to test current processes and identify any exemptions from existing DPU regulations or special tariffs needed to implement the project. The study team recommend the pilot program approach because it was too early to anticipate all of the issues associated with microgrids and adopt a comprehensive framework at that time. By implementing a pilot program that identifies and resolves issues, Massachusetts would be able to advance the technology and processes more quickly than attempting to promulgate a comprehensive set of rules, which might end up being used by only a handful of projects.

D. New York

On March 16, 2016 the State of New York Public Service Commission issued regulations that will ease requirements for microgrids, and other distributed generation, to connect to the grid. The *order modifying standardized interconnection requirements*, which went into effect on March 18, 2016 changes regulations so that larger projects can undergo a standardized review that will speed-up the application process. The commission also lowered up-front application costs and streamlined steps. Other rule changes made by the commission include reducing upfront application costs to 25 percent. Previously, applicants had to pay 100 percent upfront. The commission also amended the rules so that utilities can more-easily process and analyze applications.

In addition, the state created ombudsman services to assist with the interconnection process and an Interconnect Working Group, made up of representatives from the Department of Public Services, New York State Energy and Research Development Authority, utilities, the New York Solar Energy Industry Association, and a few individual installers. The ombudsmen service will work on issues regarding individual installations, while the working group will work to solve technical interconnect problems that affect large numbers of projects.

IV. Interconnection Best Practices

When developing Interconnection policies, there are several "best practices" that the state can follow. Interconnection best practices vary, depending on the perspective of the agency that is

[8] Microgrids – Benefits, Models, Barriers and suggested Policy Initiatives for the commonwealth of Massachusetts; KEMA; Massachusetts Clean Energy Center; February 3, 2014

making the recommendations. The best practices provided below provide a framework for discussion on what practices should apply to the state of Missouri.

A. DOE Interconnection Best Practices

The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) and Office of Electricity Delivery and Energy Reliability (OE) jointly developed voluntary "best practices" for use by States in implementing interconnection requirements that allow for simple connection of distributed energy technologies to the electric grid.
Per these DOE Offices, State and non-State jurisdictional utilities should consider the following "best practices" in establishing interconnection procedures:

- The Energy Policy Act of 2005 (EPAct) requires that agreements and procedures for interconnection service "shall be just and reasonable, and not unduly discriminatory or preferential." As such, generators and utilities should be treated similarly in terms of State requirements.
- Create simple, transparent (1- or 2-page) interconnection applications for "small generators" (equal to or less than 2 MW), as noted in the FERC Order 2006.
- Standardize and simplify the interconnection agreement for "small generators" and, if possible, combine the agreement with the interconnection application.
- Set minimum response and review times for interconnection applications. Provide expedited procedures for certified interconnection systems that pass technical impact screens.
- Establish small processing fees for "small generators", otherwise the interconnection request must be accompanied by a deposit that goes toward the cost of the feasibility study, per FERC Order 2006.
- Set liability insurance requirements commensurate with levels typically carried by the respective customer class.
- Require compliance with IEEE 1547 and UL 1741 for safe interconnection.
- Avoid overly burdensome administrative requirements, such as obtaining signatures from local code officials, unless such requirements are standard practice in a jurisdiction for similar electrical work.
- Develop administrative procedures for implementing interconnection requirements on a statewide basis through a rulemaking or other appropriate regulatory mechanism for state-jurisdictional utilities to apply uniformly to all regulated electric distribution companies in the State. Where practical, State interconnection administrative procedures should reflect regional best practices and be comprehensive in scope. Administrative procedures should also be transparent to both small generators and electric distribution utilities.

B. Institute of Electrical and Electronics Engineers (IEEE) Interconnection Best Practices:

- Coverage of all distributed generation technologies (including CHP)
- Use of existing technical standards: IEEE 1547 and UL 1741
- System capacity limits for small systems up to at least 10 MW
- Screens for complexity and size, allowing fast-track processing for smaller, less expensive, less complex systems
- Standardized interconnection agreement forms
- Transparent, uniform and accessible application information and procedures
- Prohibition of unnecessary external disconnect switches
- Prohibition of requirements for additional insurance

The Institute of Electrical and Electronics Engineers (IEEE) Standard 1547 has been a foundational document for the interconnection of distributed energy resources (DER) with the electric power system or the grid.

C. Interconnection Best Practices identified in *Freeing the Grid 2015*[9]:

- All utilities (including municipal utilities and electric cooperatives) should be subject to the state policy.
- All customer classes should be eligible.
- There should be three or four separate levels of review to accommodate systems based on system capacity, complexity and level of certification.
- There should be no individual system capacity limit. The state standard should apply to all state-jurisdictional interconnections.
- Application costs should be kept to a minimum, especially for smaller systems.
- Reasonable, punctual procedural timelines should be adopted and enforced.
- A standard form agreement that is easy to understand and free of burdensome terms should be used.
- Clear, transparent technical screens should be established.
- Utilities should not be permitted to require an external disconnect switch for smaller, inverter-based systems.
- Utilities should not be permitted to require customers to purchase liability insurance (in addition to the coverage provided by a typical insurance policy), and utilities should not be permitted to require customers to add the utility as an additional insured.
- Interconnection to area networks should generally be permitted, with reasonable limitations where appropriate.

[9] Freeing the Grid 2015: Best Practices in State Net Metering Policies and Interconnection Procedures; http://freeingthegrid.org/

- There should be a dispute resolution process.

V. Review of Applicable Federal and State Interconnection Standards

The Database of State Incentives for Renewables and Efficiency (DSIRE) is operated by the North Carolina Clean Energy Technology Center at N.C. State University and is funded by the U.S. Department of Energy. DSIRE provides comprehensive information on incentives and policies that support renewable energy and energy efficiency in the U.S. The following summaries of Federal and State Interconnection Standards was provided by the DSIRE site.

A. Federal Energy Regulatory Commission (FERC)

FERC standards generally apply to all transmission-level interconnection while state standards generally apply to distribution-level interconnection.

Through its Orders 792 and 792-A, the Federal Energy Regulatory Commission (FERC) adopted new small generator interconnection standards for distributed energy resources up to 20 megawatts (20 MW) in capacity in November 2013 and September 2014, respectively. These standards made revisions to those promulgated by FERC in May 2005 through its Order 2006. The FERC's standards apply only to facilities subject to the jurisdiction of the commission; these facilities mostly include those that interconnect at the transmission level. Given that purely intra-state distribution grids are generally considered to not be in "interstate commerce", the FERC's standards generally do not apply to distribution-level interconnection, which is regulated by state public utilities commissions. However, FERC's standards tend to serve as a guidepost for a number of state-level standards.

Size Criteria

The standards apply for distributed energy resources up to 20 megawatts (20 MW) in capacity. A Fast Track process is available depending upon the generator type, the size of the generator, voltage of the line and the location of and the type of line at the Point of Interconnection. The chart below outlines the requirements for Fast Track Eligibility.

Fast Track Eligibility for Inverter-Based Systems		
Line Voltage	Fast Track Eligibility Regardless of Location	Fast Track Eligibility on a Mainline and ≤ 2.5 Electrical Circuit Miles from Substation
< 5 kV	≤ 500 kW	≤ 500 kW
≥ 5 kV and < 15 kV	≤ 2 MW	≤ 3 MW
≥ 15 kV and < 30 kV	≤ 3 MW	≤ 4 MW
≥ 30 kV and ≤ 69 kV	≤ 4 MW	≤ 5 MW

An interconnection customer can determine information about its proposed interconnection location by requesting a pre-application report from the utility.

Timeline for review

The new rules include other additional provisions intended to promote the efficiency of small generator interconnection, including, but not limited to:

- Allowing developers/customers to request a pre-application report that would allow for identification of issues that may delay or halt the interconnection process that must be issued within 20 days
- Revising the Fast Track process to ensure that the developer/customer does not wait more than 5 days for an initial determination, more than 30 days for a "supplemental study" if the initial determination is negative, or more than 10 days after a post-"supplemental study" determination
- The creation of three new standard technical screens for the "supplemental study"

Fees

The pre-application report fee is $300.00. Other fees dependent upon complexity of system and additional studies required.

Design and Operating Requirements

The Interconnection Agreement requires that the customer “construct, interconnect, operate and maintain its Small Generating Facility and construct, operate, and maintain its Interconnection Facilities in accordance with the applicable manufacturer's recommended maintenance schedule and, in accordance with this Agreement, and with Good Utility Practice”.

Notably, the FERC standards do not require systems to include an external disconnect switch. Energy storage systems qualify for interconnection under the new process.

Insurance

Customers must obtain liability insurance "sufficient to insure against all reasonably foreseeable direct liabilities given the size and nature of the generating equipment being

interconnected, the interconnection itself, and the characteristics of the system to which the interconnection is made." Additional liability insurance must be obtained "only if necessary as a function of owning and operating a generating facility".

B. Connecticut

In December 2007, the Connecticut Department of Public Utility Control (DPUC) approved new interconnection guidelines for distributed energy systems up to 20 megawatts (20 MW) in capacity. Connecticut's interconnection guidelines apply to the state's two investor-owned utilities: Connecticut Light and Power Company (CL&P) and United Illuminating Company (UI), and are modeled on the Federal Energy Regulatory Commission's (FERC) interconnection standards for small generators.

Size Criteria

Connecticut's interconnection guidelines, like FERC's standards, include provisions for three levels of systems:

- Certified, inverter-based systems no larger than 10 kilowatts (kW) in capacity (application fees: $100);
- Certified systems no larger than 2 megawatts (MW) in capacity (application fees: $500); and
- All other systems no larger than 20 MW in capacity. Note that the guidelines include "additional process steps" for generators greater than 5 MW (application fees: $1000, study fees will also apply).

Connecticut's guidelines include a standard interconnection agreement and application fees that vary by system type.

Design and Operating Requirements

Connecticut's guidelines are stricter than FERC's standards and customers are required to install an external disconnect switch and an interconnection transformer.

Fees and timelines

The guidelines address requirements for study fees and include technical screens for each level of interconnection. Utilities and customers must follow general procedural timelines.

Systems 10 kW or less: Interconnections are provided in a first-come, first-serve basis in a non-discriminatory manner. The interconnection requires approval from the Municipal Electrical Inspector and a witness from the utility. After completion of the interconnection request, the utility has 10 business days to respond to the request, or the commissioning test is waived. The interconnection must be in compliance with local, state, federal and utility safety rules including the IEE 1547. The customers are required to maintain a liability insurance of $300,000 per interconnection. Total application fee of $100 is required for the process.

Systems 10kW – 20MW: Interconnection process for systems greater than 10kW varies depending on the generation location, size, and customer requirements. Depending

where the customer wants to interconnect, the system could fall under either FERC jurisdiction or State jurisdiction.

Generators who want to interconnect to sell electricity the wholesale market fall under FERC jurisdiction and must submit an application to ISO NE, while customers under net-metering rules or under DUPC approved tariff are subject to State regulation and must submit application to their utilities. Systems smaller than 2MW that meet provided codes and standards have the option for fast track review process.

Insurance
Customers must indemnify their utility against "all causes of action," including personal injury or property damage to third parties and maintain liability insurance in specified amounts ranging from $300,000 to $5,000,000, based on the system's capacity.

C. Maryland

In April 2007, Maryland enacted legislation requiring the Maryland Public Service Commission (PSC) to form a small generator interconnection working group to develop interconnection standards and procedures that are "consistent with nationally adopted interconnection standards and procedures," and to revise the state's interconnection standards and procedures on or before November 1, 2007. Final rules were adopted in March 2008 and became effective June 9, 2008.

Size Criteria
The rules apply to interconnections of all types of distributed generation systems of less than 10 MW to the electric distribution system for all types of utilities: investor-owned utilities, rural cooperatives and municipal utilities.

The Maryland PSC Standard Interconnection Agreement employs a four-tiered approach to determine the level of review required before a system may be connected to the grid. Different levels of review are subject to specific technical screens, review procedures, and time lines. Generally speaking, the review process becomes more extensive and time consuming with increasing system size.

Basic criteria for determining the level of review required for a prospective project:

- Level 1: Lab certified, inverter-based systems of 10 kW or less.
- Level 2: Lab certified or field approved systems of 2 MW or less connected to a radial distribution circuit or to a spot network serving one customer.
- Level 3: Only applies to systems that will *not* export power to the grid and which do not require new facility construction by the utility. Systems being located on an area network must be inverter-based, use lab certified equipment, and have a capacity of 50 kW or less. Systems located on a radial network must have a capacity of 10 MW or less and not be served by a shared transformer. These systems are also subject to additional

criteria dealing with the aggregate capacity of interconnected systems on a given network.

- Level 4: Systems 10 MW or less that cannot be approved or do not meet the criteria for review under a lower tier.

Design & Operating Requirements

Lab certified equipment is defined to mean equipment tested and approved by a nationally recognized testing laboratory (NRTL) as being in accordance with IEEE 1547, UL 1741, and the National Electric Code (NEC). Field approved systems are generally non-certified systems that have been tested and approved under a prior review by a utility, subject to certain other restrictions. All interconnected systems must be equipped with a utility accessible "lockable isolation device" or alternately, a "draw-out type circuit breaker with a provision for padlocking at the draw-out position". This requirement is equivalent to "lockable external disconnect switch" frequently specified in other jurisdictions.

Fees

Utilities may not charge any processing fees to Level 1 applicants and processing fees are limited to $50 plus $1/kilowatt (kW) of capacity for Level 2 requests and $100 plus $2/kW of capacity for Level 3 and 4 requests. Utilities are also required to designate a contact person and provide assistance materials on their website for use by prospective applicants. Standardized interconnection agreements are available on the PSC renewable portfolio standard website for all levels of interconnection request. The regulations also contain provisions for dispute resolution and utility reporting requirements.

Insurance

The issue of insurance additional insurance requirements is not addressed by the regulations. However, the standard Level 1 interconnection agreement specifically states that applicants are not required to obtain general liability insurance as a condition of interconnection approval. For Levels 2, 3 and 4 the interconnection agreement requires liability insurance of at least $2 million per occurrence and $4 million in aggregate for systems of 1 MW or larger. It also specifies that the policy must name the utility as an additional insured party. A separate standard agreement exists for Maryland state and local government entities, which among other things contains modifications to liability insurance requirements that accommodate self-insured entities.

D. Massachusetts

In September 2012, the Massachusetts Distributed Generation Interconnection Working Group submitted its final report recommending changes to the state's interconnection standards. The Massachusetts Department of Public Utilities (DPU) incorporated changes from comments submitted in Docket 11-75, and adopted the report those changes in March 2013. Massachusetts' interconnection standards apply to all forms of distributed generation (DG), including renewables, and to all customers of the state's three investor-owned utilities (Unitil, Eversource, and National Grid).

Size Criteria

Massachusetts requires investor-owned utilities to have standard interconnection tariffs. There are three basic paths for interconnection in the state:

- The **Simplified** interconnection process applies to IEE 1547.1-certified, inverter-based facilities with:
    1. A power rating of 15 kW or less for single-phase systems located on a radial distribution circuit,
    2. A power rating of 25 kW or less for three-phase systems located on a radial distribution circuit (where the facility capacity is less than 15% of the feeder/circuit annual peak load, and if available, line segment),
    3. A power rating of less than 1/15 of the customer's minimum load and located on a spot network, or
    4. A power rating of less than 1/15 of the customer's minimum load and 15 kW or less and located on an area network.
- The **Expedited** interconnection process applies to:
    - 1) Inverter-based facilities 15 kW or greater for single-phase systems,
    - 2) Inverter-based facilities 25 kW or greater for 3-phase systems, and
    - 3) Other systems of all sizes that are served by radial systems and meet certain other requirements.
- The **Standard** process is for all other facilities that do not meet the specifications of the Simplified or Expedited process, including systems on all networks.

If a project fails the Simplified and Expedited screens, it must pass three supplemental review screens, otherwise it must go through the full standard review process. Massachusetts uses a 100% of minimum load penetration screen in the supplemental review process. If the generating capacity is less than 100% of minimum load, it may not require a detailed study. In addition to these different paths, for all systems 500 kW or greater, facility owners must request and receive a pre-application report from the utility. The pre-application report is optional for facilities less than 500 kW; no fee is charged for this report.

Design and Operating Requirements

For the simplified and expedited interconnection paths, technical requirements are based on the IEEE 1547 and UL 1741 standards. A manual external disconnect switch may be required at the discretion of the utility (project-specific, not required in the tariffs). Utilities must collect and track information on the interconnection process. This information will be used in revising and updating the standards.

Insurance

Five million dollars ($5,000,000) if over five (5) MW;

Two million dollars ($2,000,000) if greater than one (1) MW and less than or equal to five (5) MW;

One million dollars ($1,000,000) if greater than one hundred (100) kW and less than or equal to one (1) MW;

Five hundred thousand dollars ($500,000) if greater than ten (10) kW and less than or equal to one hundred (100) kW.

E. New York

On March 2016, the NY Public Service Commission (PSC) modified the Standard Interconnection Requirements (SIR) increasing the maximum threshold for interconnection capacity of distributed generation projects from previous 2 MW to 5 MW. New York first adopted uniform interconnection standards in 1999. Amendments were made to the SIR in March 2013 in order to simplify and expedite the interconnection application and review process, and to adopt changes made to net metering law in 2012.

The Standard Interconnection Requirements rules apply to systems up to five megawatts (5 MW) in capacity connected in parallel with the distribution system located in the service area of one of New York's six investor-owned local electric utilities: Central Hudson Gas and Electric, Consolidated Edison (Con Edison), New York State Electric & Gas, Niagara Mohawk (d/b/a National Grid), Orange and Rockland Utilities, and Rochester Gas and Electric.

Generation facilities that are not designed to operate in parallel with the utility's electrical systems are not subject to these requirements.

Size Criteria

Expedited Process: As amended in 2013, systems up to 50 kW are eligible for a simplified or expedited six-step process. Systems up to 300 kW may be eligible for this provided that the inverter based system is UL 1741 certified and tested. Systems proposed to be installed in underground network areas may be required to submit additional information and may be subject to a longer review process. Systems of 50 kW or less are not charged an application fee.

Basic Process: This process applies to all systems larger than 50 kW up to 5 MW, and systems between 50 kW and 300 kW that have not been certified and tested in accordance with UL 1741, applicants must use the basic 11-step process for interconnection as detailed in the SIR.

Both processes cover the initial inquiry to final utility acceptance for interconnection and include interconnection timelines, responsibility for interconnection costs, and procedures for dispute resolution. The appendices contain a standard contract and standard application forms. Utilities are also required to maintain a web-based system for providing information on the status of interconnection requests to customers and contractors. The SIR contain minimum content requirements for this information system, and also require that utilities offer a web-based application process for systems of 25 kW or less.

Design and Operating Requirements

A current list of type-tested equipment is available on the PSC's DG web site. Certified, inverter-based systems up to 25 kW are not required to have an external disconnect switch.

Insurance

The requirements specifically state that utilities are not permitted to require customers to purchase general liability insurance; however, the PSC does encourage distributed generation owners to purchase insurance for their own protection.

F. North Carolina

Legislation enacted by North Carolina in August 2007 (S.B. 3) required the North Carolina Utilities Commission (NCUC) to establish interconnection standards for distributed generation systems up to 10 MW in capacity. The law stated that the commission "shall adopt, if appropriate, federal interconnection standards."

The NCUC approved revised interconnection standards in May 2015. The new standards used the FERC most recent Small Generator Interconnection Procedures as their basis, but with some modifications.

The current NCUC standards govern interconnection to the distribution systems of the state's three investor-owned utilities: Duke Energy Progress, Duke Energy Carolinas, and Dominion North Carolina Power. The standards apply to all state-jurisdictional interconnections (including interconnection of three-phase generators) regardless of the capacity of the generator, the voltage level of the interconnection, or whether the customer intends to offset electricity consumption or sell electricity.

Size Criteria

The NCUC standards, like the FERC standards, use a three-tiered approach to simplify the interconnection process:

- Inverter Process: Systems up to 20 kilowatts (kW)
- Fast Track Process: Systems larger than 20 kW that meet the eligibility criteria in the table below
- Study Process: Systems that fail to qualify for the Fast Track Process

Line Voltage	Fast Track Eligible Regardless of Location	Fast Track Eligibility on a Mainline and less than 2.5 Electrical Circuit Miles from Substation
Less than 5 kV	Less than or equal to 100 kW	Less than or equal to 500 kW
Between 5 kV and 15 kV	Less than or equal to 1 MW	Less than or equal to 2 MW

Between 15 kV and 35 kV	Less than or equal to 2 MW	Less than or equal to 2 MW
Greater than or equal to 35 kV	*Not eligible*	*Not eligible*

Design and Operating Requirements

Utilities are authorized to require an external disconnect switch, but must reimburse owners of systems smaller than 10kW for the cost of the switch. Interconnection agreements are not transferrable; new owners must secure an agreement by filing an interconnection request and submitting a fee of $50. (However, the interconnection will not need to be re-studied.) The standards include a provision for mutual indemnification and a weak process for dispute resolution.

Fees

The NCUC established a fee structure for interconnection applications: $100 for generators up to 20 kW; $250 for generators larger than 20 kW but not larger than 100 kW; and $500 for generators larger than 100 kW but not larger than to 2 MW. The FERC fee structure applies to the interconnection of systems over 2 MW. Additionally, systems in the Study Process must pay a deposit of $20,000, plus $1 per kW-AC, not to exceed $100,000.

Insurance

Utilities may not require residential customers to carry liability insurance beyond the amount required by a standard homeowner's policy ($100,000 minimum). Non-residential generators proposing to interconnect a system no larger than 250 kW are required to carry comprehensive general liability insurance in the amount of at least $300,000. Non-residential generators proposing to interconnect a system that is larger than 250 kW are required to carry comprehensive general liability insurance in the amount of at least $1,000,000. Customers that meet certain eligibility requirements are allowed to self-insure.

G. Summary of State Policies

Federal and State Interconnection Standards	Size Limit for Standard Process	Size Limit for Expedited Process	Interconnection Application Processing Fees	Design and Operating Requirements	Insurance Requirement
FERC orders 792 and 792-A (standards apply only at transmission level, but provide a guide for distribution-level inteconnection standards)	20 MW	Up to 5 MW depending upon type and location	$300 for pre-application report; other costs vary depending upon requirements placed upon provider	No disconnect switch required.	"sufficient to insure against all reasonably foreseeable direct liabilities given the size and nature of the generating equipment"
Conneticut (2007)	20 MW	10kW	10 kW or less = $100; 2 MW or less = $500; 20 MW or less = $1,000 + study fees	Customers are required to install an external disconnect switch and an interconnection transformer.	$300 k - $5 million in liability insurance required, based on system size/capacity
Maryland (2008)	10 MW	10kW	Level 1 = $0; Level 2 = $50 + $1/kW; Levels 3 and 4 = $100 +$2/kW	Must meet IEEE 1547, UL 1741, and the National Electric Code (NEC). Lockable external disconnect switch required.	Levels 2, 3 and 4 = $2 million per occurance up to $4 million aggregate for systems greater than 1 MW
Massachusetts (2013)	no limit identified	15kW single phase 25kW 3 phase	$3/kW, with a $300 minimum and $2,500 maximum fee	Must meet IEEE 1547 and UL 1741 standards. A manual external disconnect switch may be required at the discretion of the utility (project-specific, not required in the tariffs).	General liability insurance required at amounts listed below 100kW = $500,000 1 MW = $1,000,000 5 MW = $2,000,000 Over 5 MW = $5,000,000
New York (2016, 2013)	5 MW	50kW	50 kW or less = $0 all other systems = $750	A current list of type-tested equipment is available on the PSC's DG web site. Certified, inverter-based systems up to 25 kW are not required to have an external disconnect switch.	Not required but is encouraged.
North Carolina (2015)	2 MW	20kW	20 kW or less = $100 100 kW or less = $250 2MW or less = $500 Study Process = $20,000 deposit plus $1/ kW not to exceed $100,000.	Utilities are authorized to require an external disconnect switch, but must reimburse owners of systems smaller than 10kW for the cost of the switch.	residential = $100,000 non residential and less than 250kW = $300,000 non residential and larger than 250kW = $1M minimum

VI. Missouri's Net Metering and Easy Connection Act

Missouri enacted legislation in June of 2007 requiring all electric utilities—investor-owned utilities, municipal utilities, and electric cooperatives—to offer net metering to customers that generate electricity using sources of energy certified as renewable by the Missouri Department of Natural Resources.

The Missouri Public Service Commission (PSC) adopted administrative rules for investor-owned utilities that included simplified interconnection standards[10], and electric cooperatives and

[10] Missouri Revised Statutes: 386.890. 1. "Net Metering and Easy Connection Act"; August 28, 2015

municipal utilities adopted their own rules, including an all-in-one document that includes a simple interconnection request, simple procedures, and a brief set of terms and conditions.[11]

Interconnection Requirements under the Missouri Net Metering and Easy Connection Act:

1. Systems to be interconnected must be intended primarily to offset part or all of a customer's own electrical energy requirements, have a capacity up to 100 kilowatts (kW), and be located on a facility owned, operated, leased or otherwise controlled by the customer.
2. Applications for interconnection must be accompanied by a plan for the customer's system, including a wiring diagram and specifications for the generating unit. Utilities must review and respond to the customer within 30 days for systems up to 10 kW, and within 90 days for systems greater than 10 kW.
3. Systems to be interconnected must meet all applicable safety, performance, interconnection and reliability standards established by any local code authorities, the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the Institute of Electrical and Electronics Engineers (IEEE), and Underwriters Laboratories (UL) for distributed generation. Prior to interconnection, a customer must furnish the utility with certification from a qualified professional electrician or engineer that the installation complies with the established safety and operating requirements.
4. Utilities may require customers to provide a switch, circuit breaker, fuse or other easily accessible device or feature that allows the utility to manually disconnect the system.
5. Utilities must offer a net-metering tariff or contract that is identical in electrical energy rates, rate structure, and monthly charges to the contract or tariff that the customer would be assigned if the customer were not an eligible customer-generator. Utilities may not charge the customer any additional standby, capacity, interconnection, or other fee or charge that would not otherwise be charged if the customer were not an eligible customer-generator.

Because the Net Metering and Easy Connection Act only applies to generating units with a capacity of 100kW or less, interconnection of generating units above 100kW must be negotiated on a case-by-case basis with the impacted utility.

VII. Recommendations for the State of Missouri

A. Missouri Standard Microgrid Interconnection Process (MSMIP)

The enclosed Missouri Standard Microgrid Interconnection Process (MSMIP) provides a recommended process for interconnecting microgrids in Missouri. A first draft of this document was prepared and delivered to members of the Missouri S&T Microgrid Industrial Consortium

[11] MPUA Sample Net Metering Policy http://www.mpua.org/_lib/files/MPUA_Sample_Net_Metering_Policy.pdf

on April 6, 2016. Comments were gathered and an on-campus review meeting was held on April 19, 2016. Attending that meeting were: Brent McKinney, City Utilities, Springfield; Rodney Bourne, Rolla Municipal Utilities; and Marc Lopata, President, Azimuth Energy. Additional comments and recommendations from the review meeting were gathered and incorporated into a 2nd draft document that was sent to consortium members on May 4th. Comments and recommendations were again gathered via email and a meeting with consortium members and representatives from the Missouri Division of Energy was held on the S&T campus on May 20, 2016. Attending that meeting were: Andy Popp and Barb Meisenheimer, Division of Energy; Chris Yates, Springfield City Utilities; Rodney Bourne, Rolla Municipal Utilities; George Mues, Ameren; and Chris Neaville, Doe Run. The document was updated to include comments and recommendations from that meeting and a 3rd draft was sent to consortium members on May 31, 2016.

Throughout the process, the consortium members shared the document within their organizations, which provided expertise at a very broad level. Ameren, as an Investor Owned Utility, was able to contribute a wide variety of knowledge toward the draft process, and the impacts that would apply to their operations. The participation of the municipal utilities through the Missouri Public Utility Alliance (MPUA) brought a very key perspective on the process requirements that could impact their operations, including the impacts to smaller utilities that are staffed at a minimal level. Doe Run, as a future microgrid owner, was able to bring the customer perspective; and Azimuth Energy was able to review the draft process with an eye to the constraints that the process might place on a microgrid consultant trying to grow their business in this market.
The below list identifies the contributors to the process:

Ameren:
Michael S. Abba, P.E., Director, Smart Grid Integration & System Improvement
Bill Davis, Economic Analysis and Pricing Manager
Kim Gardner, P.E.
Rodney B Hilburn, Manager, Technology Applications Center, Smart Grid Integration & System Improvement Department
Jeff Hynds, Interconnections Engineer, Transmission Connection Agreements
Wade Miller, Regulatory Consultant
George Mues, Principal Engineer
Joseph Wokurka, P.E., Supervising Engineer, System Protection
Arindam Maitra, Senior Project Manager, Electric Power Research Institute (EPRI)

Missouri Public Utility Alliance (MPUA):
Rodney Bourn, General Manager, Rolla Municipal Utilities
Floyd Gilzow, Chief Operating Officer and Director of Member Relations & Public Affairs, MPUA

Brent McKinney, Manager, Electric Transmission, City Utilities, Springfield
Chris Yates, P.E., Manager, Electric T&D, Electric Substations, City Utilities, Springfield

The Doe Run Company: Chris Neaville, Asset Development Director

Azimuth Energy: Marc Lopata, President

Division of Energy, Missouri Department of Economic Development:
Andy Popp, Manager, Energy Efficiency
Barbara Meisenheimer, Manager, Energy Policy & Resources
Barbara J. Meyer, Energy Engineer

The final proposed Missouri Microgrid Standard Interconnection Process, included with this report, provides guidelines for the interconnection of microgrids that have a total combined generation capacity of no more than 5MW and that are operating in parallel with the utility.

Areas of concern to the reviewers included:

- The proposed size limitation of the microgrid for this process
- Clarifying that additional requirements may be required of a microgrid owner that is operating as an independent power producer and selling the energy from the microgrid to other customers
- Time required for the utility to process the interconnection application
- Design and Operational Requirements
- Appropriate application fees
- The interrelationship between the process and Missouri's current Net Metering laws

Each of these areas of concern is addressed below:

Size limitation:
The 5MW size limitation was proposed because this was the size identified in the most recently developed interconnection process for the state of New York. This was provided as a starting point for discussion, and final decision was to use 5MW with the understanding that it could be revisited after more microgrids had been installed in the state of Missouri. The comment was added to the paragraph that, while these guidelines could be used for larger microgrids, additional negotiations might be required with the utility.

Microgrid Owner as Independent Power Producer:
This topic may become a key issue as opportunities arise for community microgrids in the state of Missouri. There is still much discussion at the national level about the requirements that should be placed on microgrid owners that desire to sell the power that is produced by their microgrid to other customers. Again, the statement was added that the proposed process

could be used in this case, but additional negotiations with the utility would be required. This issue will become clearer with the publication of the revised IEEE 1547 standard.

Time to Process Microgrid Application:
The originally recommended time was based on the New York Standard Microgrid Interconnection Process. A wide variety of times were proposed by reviewers, ranging from the originally recommended 20 business days up to 120 business days from several of the Ameren reviewers. The 40 business day review period in the final document was a compromise between processing within a reasonable time that would not dissuade future microgrid developers, and not placing a huge burden on the utilities. It was pointed out that, many of the smaller utilities would not have the expertise on staff to analyze and approve the application, and would be required to hire a consultant to do this – further increasing costs to the potential applicant.

Appropriate Application Fees:
Many of the current interconnection processes across the country provide various levels of review and associated fees. These interconnection processes, however, apply to all levels of distributed energy resources. They may range from an individual resident placing solar panels on their roof, up to a large combined heat and power project. Because this process applies specifically to microgrids, which are by their nature going to be more complex than a simple solar panel project, we recommend only two levels of review, based on the service voltage of the microgrid. Application fees for interconnection in other states range from no fee for projects less than 50kW up to $2,500 for larger systems. Many states utilize a “per kW” approach for interconnection application fees.

Collection of Utility’s Costs for Interconnection:
The first draft of the process document recommended that that applicant pay 50% of the utility’s estimated cost of the interconnection prior to start of modifications to the utility’s system. Some reviewers recommended that the full estimated cost be paid up-front by the applicant, and the utility reconcile estimated with actual cost at the end of the project. One reviewer commented that a lack of historical data on costs of interconnection will make estimating difficult, and for the first several projects, actual costs should be gathered to create a data base for future reference. The document is intentionally vague on what percentage of the utility’s costs should be paid up-front, but it was agreed that some amount must be provided before the utility invests their resources in modifying for the interconnection. The PSC will make the final decision on how Investor-Owned Utilities recover these costs.

Design and Operational Requirements:
Design and operational requirements addressed in interconnection processes developed by other states either reference or reiterate the requirements outlined in IEEE 1547 (2003 and

2014 Amendment 1): *Standard for Interconnecting Distributed Resources with Electric Power Systems*. We simplified the process document by referencing this standard throughout.

Microgrid Interconnection and Net Metering:
Reviewing representatives from the utilities felt strongly that the Missouri Standard Microgrid Interconnection Process should not include references to net metering, because of the complexities associated with combining a process with a rate making activity. However, the ability of a microgrid owner to partner with the utility to provide dispatchable energy, ancillary services, and load shed capability provides potential benefits to the utility. By creating a rate structure that encourages microgrid owners to partner with the utility to allow for load leveling and peak demand shaving, the utility may be able to delay or even avoid future capital investments. The full revision of IEEE Standard 1547 that is currently underway will address the integration of interoperability, communications, and information technology functions into interconnection systems that will drive new business models and value propositions for both utilities and customers.

B. Full Revision of IEEE Standard 1547

The Institute of Electrical and Electronics Engineers (IEEE) Standard 1547 has been a foundational document for the interconnection of distributed energy resources (DER) with the utility grid. It was cited in the U.S. Federal Energy Policy Act of 2005, under Section 1254 *Interconnection Services*, stating "Interconnection services shall be offered based upon the standards developed by the Institute of Electrical and Electronics Engineers: IEEE Standard 1547 for Interconnecting Distributed Resources With Electric Power Systems, as they may be amended from time to time".[12]

IEEE SCC21, the Standards Coordinating Committee on Fuel Cells, Photovoltaics, Dispersed Generation, and Energy Storage released the original IEEE 1547 *Standard for Interconnecting Distributed Resources with Electric Power Systems* in 2003 and issued Amendment 1 in 2014. A full revision of IEEE 1547 is currently underway that will address interconnection and interoperability, including associated interfaces. The title of the revised standard is: IEEE P1547 (full revision) Draft Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Power Systems Interfaces. Per IEEE mandate, the revision must be completed by 2018. The full revision of the 1547 standard and the subsequent full revision of 1547.1 (conformance testing) will provide the widely accepted engineering consensus for ensuring that grid performance and reliability levels are maintained, or even increased, when interconnecting Distributed Energy Resources (DER) with the grid. The revised standards will:

[12] IEEE 1547 and 2030 Standards for Distributed Energy Resources Interconnection and Interoperability with the Electricity Grid, Thomas Basso, National Renewable Energy Laboratory (NREL) Technical Report, NREL/TP-5D00-63157, December 2014

- Enable high penetration of distributed energy resources, including clean solar technologies, at levels approaching, or exceeding, 100% peak load.
- Reduce interconnection approval time for advanced distributed energy projects.
- Reduce interconnection costs for projects.
- Accelerate conformance validation of state of the art interconnection systems for the future grid.

The integration of interoperability, communications, and information technology functionalities into interconnection systems will also:

- Enable the success of new business models and valuations for utilities and customers.
- Support transactive roles of customers.
- Help improve grid awareness of interconnected DER, including helping mitigate concerns about intermittency and dispatchability of renewable energy technologies.[13]

C. Conclusion

The draft Missouri Standard Microgrid Interconnection Process proposed with this report provides a first step toward advancing the use of microgrids in the state. As IEEE finalizes IEEE P1547 (full revision) Draft Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Power Systems Interfaces, those guidelines should be incorporated into the standard process to further accelerate the use of microgrids. Given the complexity associated with the interconnection of microgrids, recommend the Missouri Department of Economic Development, Division of Energy, consider providing a data base of consultants who have been vetted to demonstrate their expertise in this area. The Missouri S&T Microgrid Industrial Consortium can also be a resource for information and expertise.

[13] IEEE 1547 and 2030 Standards for Distributed Energy Resources Interconnection and Interoperability with the Electricity Grid, Thomas Basso, National Renewable Energy Laboratory (NREL) Technical Report, NREL/TP-5D00-63157, December 2014

2016

Missouri Standard Microgrid Interconnection Process

PREPARED FOR THE MISSOURI DEPARTMENT OF ECONOMIC DEVELOPMENT, DIVISION OF ENERGY

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Contents

I. Introduction

This document provides a framework for the process of interconnecting microgrids, not operated as an independent power producer, with a combined generating capacity of 5 MW or less. Microgrids operating as an independent power producer and/or with a combined generating capacity in excess of 5 MW may use this framework, but additional negotiation with the utility may be required. This process applies only to microgrids designed to operate in parallel with the utility's electrical system, until intentional islanding is employed. In intentional islanding operation, the interconnection will permit the microgrid to continue operating autonomously during outages on the main grid. The microgrid must be able to connect safely to the utility's system at the correct frequency and phase, inject electricity of sufficient quality to meet utility requirements, disconnect quickly and safely from the grid when going into islanded mode, and reconnect (either automatically or with operator intervention) when it is safe to do so. This document outlines the process by which a customer will request approval to interconnect a microgrid with the local utility, and the responsibilities of the utility in responding to the request. Design and operating requirements are addressed, with emphasis placed on the use of IEEE standard 1547: *Standard for Interconnecting Distributed Resources with Electric Power Systems*.

A. Applicant Responsibilities

This document will provide microgrid interconnection applicants with an understanding of the process and information required to allow utilities to review and accept their interconnection request in a reasonable and expeditious manner. It is the applicant's responsibility to follow the process outlined in this document. While the time required to complete the process will reflect the complexity of the proposed project, a detailed application and all necessary supporting documentation will allow the utility to process the application more quickly. The applicant is responsible for payment of a non-refundable application fee, and all costs incurred to the utility for the interconnection of the microgrid.

B. Utility Responsibilities

Utilities must offer the application process and attendant services on a non-discriminatory basis. Utilities must process microgrid applications within the timelines set forth in this document. Utilities must clearly identify their incremental costs related to the interconnection request, specifically those costs that the utility would not have otherwise incurred without the applicant's microgrid interconnection. Utilities must keep a log of each microgrid interconnection application. For approved applications, the utility will document the anticipated timeline for completion, the specific milestones met or not met, and the justification for failing to meet milestones (whether incurred by applicant, utility, or unforeseen circumstances). This information should be maintained by the utility for a minimum of five (5) years after project completion.

II. Microgrid Interconnection Application Process

Step 1: Potential Applicant initiates initial Microgrid Interconnection inquiry

Communication could range from a general inquiry to a detailed application.

Step 2: Inquiry is reviewed by the Utility to determine the scope of the project

Technical staff from the utility will discuss the scope of the interconnection with the potential applicant (either by phone or in person) and will provide general guidance based on size and location of proposed microgrid. Basic utility information that will assist the customer in preparing an application will be provided in this step, as well as access to any utility-specific technical specifications. If the proposed project meets the basic guidelines of 5MW or less, operating in parallel with the Utility's system technical staff will direct the applicant to an internet site that contains the Missouri Standard Microgrid Interconnection Process (MSMIP).

Step 3: Applicant files an application

The applicant submits an application package to the utility. A non-refundable processing fee in the amount of $_____ for microgrids served at 480 volts or below, and in the amount of $_____ for microgrids served at over 480 volts will be included with the application package. (The Public Service Commission (PSC) approves the charge structure for investor-owned utilities in the state of Missouri and will make the final decision on the fees that they can charge.)

A complete application package, sealed by a Missouri licensed Professional Engineer, will consist of:

1. Letter of authorization, signed by the applicant, to allow contractor to act as the applicant's agent, if necessary
2. Completed standard application form (Appendix A) that includes:
    a. A narrative description of the proposed microgrid
    b. A list of all equipment that will be included in proposed microgrid
    c. A site plan for the proposed microgrid
    d. A safety and emergency response plan that will be furnished to the local Fire Marshal

Step 4: Utility reviews application and provides a report and interconnection cost estimate to the applicant

The utility will review the application to determine if it is complete and will notify the customer within 10 business days of any deficiencies in the application. Within 40 business days of application receipt, the utility will provide the following in a report to the applicant:

1. Utility system impacts, if any
2. A detailed description of any design modifications to the applicant's microgrid and any utility system upgrades and associated equipment deemed necessary for interconnection of the microgrid
3. An estimate of the total cost of the utility system upgrades required for completion of the interconnection of the proposed microgrid
4. A statement of cost responsibility for all required interconnection equipment and system upgrades. Utility cost estimates shall be detailed and broken down by specific requirements identified in the report.

The utility will also review the application to confirm that the applicant's proposed microgrid meets the technical requirements outlined in Section III, Microgrid Interconnection Design Requirements. The utility will include in the report notification of whether the proposed system meets the criteria and, if applicable, a description of where the proposed system is not in compliance with these requirements. Smaller municipal utilities and electric cooperatives may be required to hire a consultant to conduct the technical review if they do not have a professional engineer on staff. The requirement for consultant fees will be identified by the utility in Step 2 of the process, and the estimated consultant costs will be provided in the report from the utility.

Step 5: Utility executes Microgrid Interconnection and Operating Agreement

Upon confirmation by the utility that the applicant's proposed system meets the technical requirements outlined in Section III, Microgrid Interconnection Design Requirements, the utility will return an executed Missouri Standard Microgrid Interconnection and Operating Agreement to the applicant (Appendix B).

Step 6: Applicant returns signed Interconnection and Operating Agreement and provides advance payment of Utility's estimated costs

The applicant will sign the Missouri Standard Microgrid Interconnection and Operating Agreement and will return it to the utility along with an advance payment of the utility's estimated costs as identified in Step 4 before the utility can begin its construction. The PSC approves the charge structure for investor-owned utilities in the state of Missouri.

Step 7: Utility system modifications and Microgrid project construction

The utility shall commence construction/installation of system modifications and metering requirements as identified in Step 4. Utility system modifications will vary in construction time depending on the extent of work and equipment required. The schedule for this work is to be discussed and agreed upon with the applicant in Step 4.

The applicant will install the microgrid according to the utility-accepted design and the equipment manufacturer's requirements. If there are substantive design variations from the originally approved application diagram, a revised diagram shall be submitted by the applicant for the utility's review and acceptance. Upon completion of construction, the applicant will notify the utility, and request a verification test.

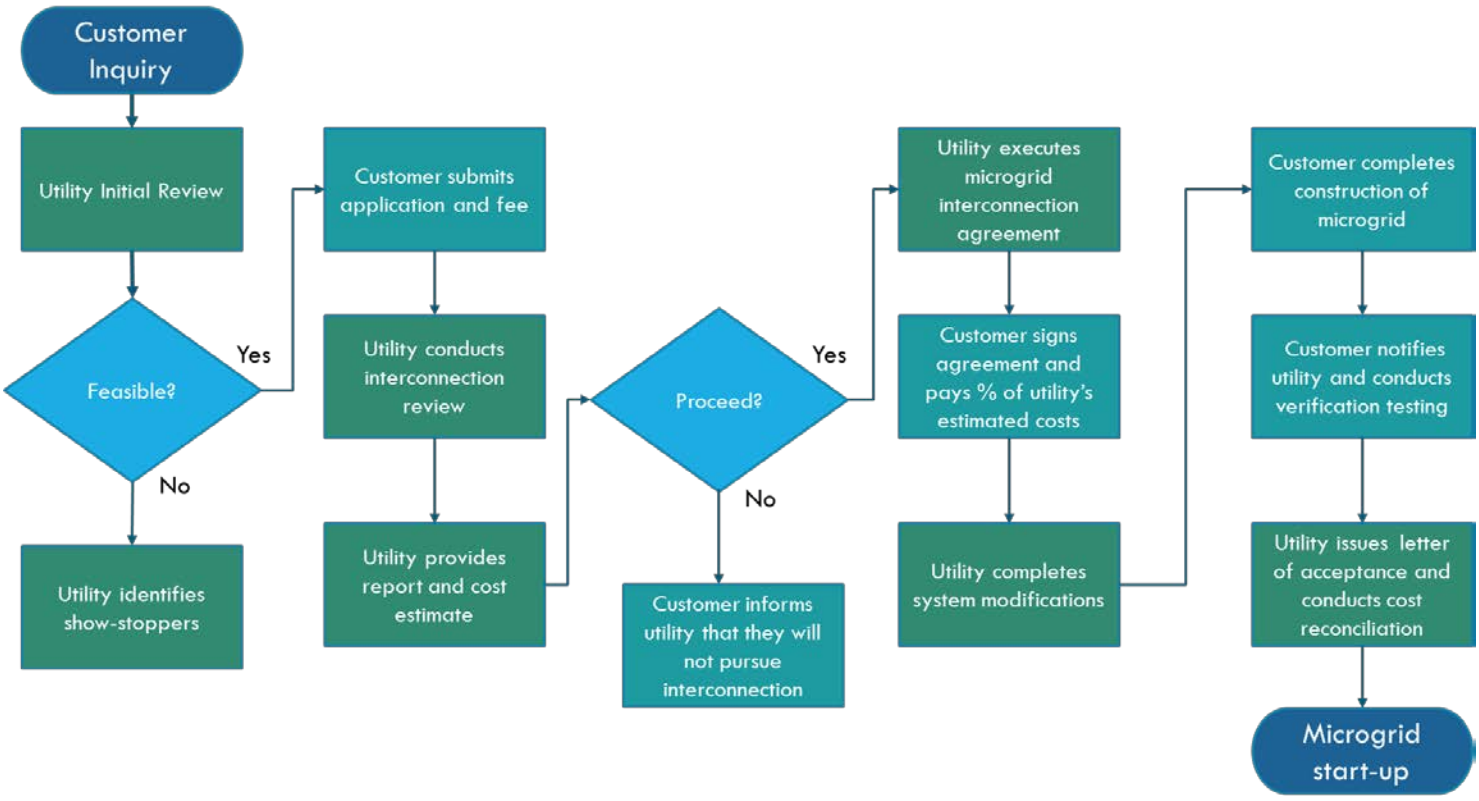
Step 8: Microgrid verification testing

Verification testing will be performed by the applicant in accordance with the interconnection agreement. Upon successful completion of the verification test, the applicant shall provide the utility with written certification that the microgrid has been installed and tested in compliance with the MSMIP, the utility-accepted design, and the equipment manufacturer's instructions.

Step 9: Final acceptance and Utility cost reconciliation

Within five (5) business days of receipt of the written certification, the utility will issue to the applicant a formal letter of acceptance for interconnection. The applicant will be allowed to commence parallel operation of the microgrid upon receipt of the final acceptance letter. At this time, the utility will also commence reconciliation of its actual costs related to the applicant's project against the application fee and advance payment made by the applicant. The applicant will receive either a bill for any balance due or a reimbursement for overpayment of the estimated costs. The utility's final reconciliation invoice shall be paid within thirty (30) business days or the utility reserves the right to lock the microgrid offline. The applicant may contest the reconciliation with the utility, and if the applicant is not satisfied with the utility's response, may file a formal complaint with the Missouri Public Service Commission (PSC) or the governing authority under which the utility operates.

III. Microgrid Interconnection Application Flow Chart



IV. Microgrid Interconnection Design Requirements

A. General Design Requirements

The requirements set forth in this document are intended to be consistent with those contained in the most current version of IEEE Standard 1547, Standard for Interconnecting Distributed Resources with Electric Power Systems. The requirements in IEEE Standard 1547, above and beyond those contained in this document, shall be followed and any other Standards included in or referenced in IEEE Standard 1547 shall be adhered to.

B. Voltage Response

The required voltage operating range for microgrids shall be from 88% to 110% of nominal voltage magnitude. In addition, the microgrid shall not cause the system voltage at the PCC to deviate from a range of 95% to 105% of the utility system voltage. For excursions outside these limits the protective device shall automatically initiate a disconnect sequence from the utility system as detailed in the most current version of

IEEE Standard 1547. Clearing time is defined as the time the range is initially exceeded until the microgrid ceases to energize the PCC and includes detection and intentional time delay. Other static or dynamic voltage functionalities shall be permitted as agreed upon by the utility and the microgrid owner.

C. Frequency Response

The required operating range for microgrids shall be from 59.3 Hz to 60.5 Hz. If deemed necessary due to abnormal system conditions, the utility may request that the microgrid operate at frequency ranges below 59.3 Hz in coordination with the load shedding schemes of the utility system. For excursions outside these limits the protective device shall automatically initiate a disconnect sequence from the utility system as detailed in the most current version of IEEE Standard 1547. Clearing time is defined as the time the range is initially exceeded until the microgrid's equipment ceases to energize the PCC and includes detection and intentional time delay. Other static or dynamic frequency functionalities shall be permitted as agreed upon by the utility and the microgrid owner.

D. Reconnection to the Utility System

If the microgrid is disconnected as a result of the operation of a protective device, the microgrid shall remain disconnected until the utility's service voltage and frequency have recovered to acceptable voltage and frequency limits as defined in the most current version of IEEE Standard 1547, for a minimum of five (5) minutes.

E. Minimum Protective Function Requirements

Protective system requirements for microgrids result from an assessment of many factors, including but not limited to:

a) Type and size of the generation equipment within the microgrid
b) Voltage level of the interconnection
c) Location of the microgrid on the circuit
d) Distribution transformer
e) Distribution system configuration
f) Available fault current
g) Load that can remain connected to the microgrid under isolated conditions
h) Amount of existing distributed generation on the local distribution system

The need for additional protective functions shall be determined by the utility on a case-by-case basis. If the utility determines a need for additional functions, it shall notify the microgrid owner in writing of the requirements. The notice shall include a description of the specific aspects of the utility system that necessitate the addition, and an explicit justification for the necessity of the enhanced capability. The utility shall specify and provide settings for those functions that the utility designates as being required to

satisfy protection practices. Any protective equipment or setting specified by the utility shall not be changed or modified at any time by the microgrid owner without written consent from the utility.

A failure of the microgrid's protective devices, including loss of control power, shall open the automatic disconnect device, thus disconnecting the microgrid from the utility system. A microgrid's protection equipment shall utilize a non-volatile memory design such that a loss of internal or external control power, including batteries, will not cause a loss of interconnection protection functions or loss of protection set points.

F. Metering

If a customer's existing metering equipment is not capable of measuring both the amount of electricity delivered by the utility to the applicant and the amount of electricity delivered by the applicant to the utility, then the customer must pay for the cost of new metering equipment that meets these requirements.

G. Dedicated Transformer

The utility reserves the right to require a microgrid to connect to the utility system through a dedicated transformer. The transformer shall either be provided by the connecting utility at the microgrid owner's expense, purchased from the utility, or conform to the connecting utility's specifications. The transformer that is part of the normal electrical service connection of a microgrid owner's facility may meet this requirement if there are no other customers supplied from it. A dedicated transformer is not required if the installation is designed and coordinated with the utility to protect the utility system and its customers adequately from potential detrimental net effects caused by the operation of the microgrid.

If the utility determines a need for a dedicated transformer, it shall notify the microgrid owner in writing of the requirements under Section IID, Step 4 of the application process. The notice shall include a description of the specific aspects of the utility system that necessitate the addition, the conditions under which the dedicated transformer is expected to enhance safety or prevent detrimental effects, and the expected response of a normal, shared transformer installation to such conditions.

H. Disconnect Switch

Microgrids shall be capable of being isolated from the utility system by means of an external, manual, visible, gang-operated, load-break disconnecting switch. The disconnect switch shall be installed, owned, and maintained by the microgrid owner, and located between the generating equipment and its interconnection point with the utility system.

The disconnect switch must be rated for the voltage and current requirements of the installation, conform to NFPA, and labeled per ANSI Z535.The basic insulation level (BIL) of the disconnect switch shall be such that it will coordinate with that of the utility's equipment. Disconnect devices shall meet applicable requirements of the most current revision of UL, ANSI, and IEEE standards, and shall be installed to meet all applicable local, state, and federal codes.

I. Power Quality

The maximum harmonic limits for electrical equipment shall be in accordance with the latest version of IEEE Standard 519: *IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems* to limit the maximum individual frequency voltage harmonic to 3% of the fundamental frequency and the total harmonic distortion (THD) to 5% on the utility side of the PCC. In addition, any voltage fluctuation resulting from the connection of the microgrid owner's equipment to the utility system must not exceed the limits defined by the maximum permissible voltage fluctuations border line of irritability curve contained in IEEE Standard 519.

J. Islanding

The interconnection will be designed to permit the microgrid to continue operating autonomously and provide uninterrupted service during outages on the main grid. Protective devices must be automatically configured when transitioning between islanded and grid-connected modes. In addition, microgrids must include provisions to shed load that exceeds the local generation capacity when operating in islanded mode.

V. General Provisions and Requirements

A. Equipment Certification

In order for the microgrid to be acceptable for interconnection to the utility system, the interface equipment shall be tested by a Nationally Recognized Testing Laboratory (NRTL) recognized by the United States Occupational Safety and Health Administration (OSHA) and in compliance with the most current revision of UL 1741. If equipment is UL 1741 certified by an NRTL, and compliance documentation is submitted to the utility, the utility shall accept such equipment for interconnection in Missouri. All equipment certified to the most current revision of UL 1741 by an NRTL shall be deemed "certified equipment". Utility grade relays need not be certified per the requirements of this standard.

B. Verification Testing

Prior to initial parallel operation of the microgrid, or any time interface hardware or software is changed, a verification test must be performed. A qualified individual must perform all verification tests prescribed by the equipment manufacturers in accordance

with the manufacturers' published test procedures. Qualified individuals include professional engineers, factory-trained and certified technicians, and licensed electricians with experience in testing protective equipment. Verification testing shall be performed at least once every four years, and verification documentation maintained for inspection by the utility.

C. Microgrid Interconnection Inventory

The utility will manage the queue of microgrid interconnection applications in their inventory in the order in which they are received and according to the timelines set forth in this document.

Utilities shall maintain a microgrid interconnection inventory, including the current queue, for a minimum of 5 years. The following information shall be provided in the inventory:

1. Microgrid Customer Name and Location
2. System Type
3. System Capacity
4. Protective Equipment
5. Application Review Start and End date
6. Utility Interconnection Costs
7. Verification testing date
8. Final Letter of Acceptance date

VI. Glossary of Terms

Applicant: means a person or entity that has filed an Application to interconnect a Microgrid to an Electric Delivery System. For a Microgrid that will offset part or all of the load of a Utility customer, the Applicant is that customer, regardless of whether the customer owns the Generating Facility or a third party owns the Generating Facility.

Applicant's agent: means an individual (usually a contractor or consultant) designated by the applicant to act on the applicant's behalf.

Automatic disconnect device: means an electronic or mechanical switch used to isolate a circuit or piece of equipment from a source of power without the need for human intervention.

Business Day: means Monday through Friday, excluding Federal and State Holidays.

Contractor: means an individual working under contract to the Microgrid Interconnection Applicant.

Customer: means the entity that receives or is entitled to receive Distribution Service through the Utility's Electric Delivery System or is a retail customer of the Utility.

Disconnect: means to cease the transfer of power.

Disconnect Switch: means a mechanical device used for isolating a circuit or equipment from a source of power.

Electric Delivery System means the equipment operated and maintained by a Utility to deliver electric service to end-users, including but not limited to transmission and distribution lines, substations, and transformers.

Independent Power Producer: means a non-utility company that generates and sells energy to one or more customers.

Island or Islanding: means the condition in which a portion of the Utility grid (in this case, the Microgrid) becomes temporarily isolated from the main grid but remains energized by its own distributed generation resources. Islanding capabilities are fundamental to the function of a Microgrid.

Microgrid: means a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected and islanded mode.

Microgrid Interconnection Agreement: means a standard form agreement between an Interconnection Customer and a Utility governing the interconnection of a Microgrid to a Utility's Electric Delivery System, as well as the ongoing operation of the Microgrid after it is interconnected.

MSMIP: Missouri Standard Microgrid Interconnection Process

Point of Common Coupling (PCC): means the point in the interconnection of a Microgrid with an Electric Delivery System at which the harmonic limits are applied and shall have the same meaning as in IEEE Standard 1547.

Protective Device: A device that continuously monitors a designated parameter related to the operation of the Microgrid and engages if preset limits are exceeded.

PSC: Public Service Commission

Utility: means an operator of an Electric Delivery System in Missouri. This includes all investor-owned and public utilities, including cooperatives, municipal utilities and public utility districts.

Verification Test: A test performed upon initial installation of the Microgrid and repeated periodically to determine that there is continued acceptable performance.

APPENDIX A: Missouri Standard Microgrid Interconnection Application Form

APPENDIX B: Missouri Standard Microgrid Interconnection Agreement

MISSOURI STANDARD
MICROGRID INTERCONNECTION APPLICATION

Interconnection Customer Information:

Name: _____

Contact Person: _____

Mailing Address: _____

City: _____ State: _____ Zip: _____

Microgrid Facility Location: _____

_____

Telephone (Day): _____ Telephone (Evening): _____

Fax: _____ E-Mail Address: _____

Alternate Contact Information (if designated to act on behalf of Interconnection Customer)

Contact Name: _____

Title: _____

Address: _____

_____

Telephone (Day): _____ Telephone (Evening):_____

Fax: _____ E-Mail Address: _____

Utility Contact Information:

Utility: _____

Designated Contact Person: _____

Address: _____

Telephone Number: _____

Fax: _____

E-Mail Address: _____

Application is for: _____New Microgrid Facility

_____Capacity addition to Existing Microgrid Facility

1. Describe the proposed microgrid. Identify the location and purpose of the microgrid and outline the minimum load requirements. Identify how the proposed microgrid will operate under normal (in parallel with the utility) and islanded conditions, and under what conditions the proposed microgrid will operate in islanded mode. If applicable, explain energy distribution across premise boundaries.

2. Identify all proposed microgrid components as follows:
   1) List all distributed energy generation technologies included in the microgrid; include capacity of each generation type in AC kW:

   2) Energy storage manufacturer, type (e.g. lead acid, Li Ion, etc.), and capacity in AC kWh:

   3) Site controller manufacturer and type:

   4) Proposed metering configuration:

3. Attach the following to this application document:
   1) Site plan and equipment layout diagram that identifies locations of all distributed energy resources and utility interconnection points. Identify new and existing infrastructure that will be part of the microgrid. A single-line diagram is sufficient for designs proposed on single-phase systems and on three-phase systems if the phase loads, connections, and wiring are identical among the phases. If the loads, connections, or wiring are not identical among the phases, submit a three-line diagram. Submittal shall include detailed information on the wiring configuration at the PCC and an exact representation of existing utility service.

   2) Copies of the manufacturer's data sheets or certificate of compliance referencing UL 1741 for each piece of generation, storage, and interface equipment that will be included in the proposed microgrid.

   3) Copy of a safety and emergency response plan that will be furnished to the local Fire Marshal.

MISSOURI STANDARD
MICROGRID INTERCONNECTION AGREEMENT
INTENDED FOR MICROGRIDS 5 MW OR LESS, CONNECTED IN PARALLEL WITH UTILITY DISTRIBUTION SYSTEMS

Owner Information:

Name:

Address:

Telephone:

Fax:

Email:

Microgrid Application/File Number:

Utility Account Number:

Utility Information:

Utility Name:

Address:

Utility Contact Name:

Telephone:

Fax:

Email:

I. TERM AND TERMINATION

A. **Term:** This Agreement shall become effective when executed by both Parties and shall continue in effect until terminated.

B. **Termination:** This Agreement may be terminated as follows:

1. The Owner may terminate this Agreement at any time, by giving the Utility sixty (60) days' written notice.

2. Failure by the Owner to seek final acceptance by the Utility within twelve (12) months after completion of the utility construction process described in the Missouri Standard Microgrid Interconnection Process (MSMIP) shall automatically terminate this Agreement.

3. Either Party may, by giving the other Party at least sixty (60) days prior written notice, terminate this Agreement in the event that the other Party is in default of any of the material terms and conditions of this Agreement. The terminating Party shall specify in the notice the basis for the termination and shall provide a reasonable opportunity to cure the default.

4. The Utility may, by giving the Owner at least sixty (60) days prior written notice, terminate this Agreement for cause. The Owner's non-compliance with an upgrade to the MSMIP, unless the Owner's installation is "grandfathered," shall constitute good cause.

C. **Disconnection and Survival of Obligations:** Upon termination of this Agreement the Microgrid will be disconnected from the Utility's electric system. The termination of this Agreement shall not relieve either Party of its liabilities and obligations, owed or continuing at the time of the termination.

D. **Suspension:** This Agreement will be suspended during any period in which the Owner is not eligible for delivery service from the Utility.

II. SCOPE OF AGREEMENT

A. **Scope of Agreement:** This Agreement relates solely to the conditions under which the Utility and the Owner agree that the Microgrid may be interconnected to and operated in parallel with the Utility’s system.

B. **Electricity Not Covered:** The Utility shall have no duty under this Agreement to account for, pay for, deliver, or return in kind any electricity produced by the Microgrid and delivered into the Utility’s System unless the system is net metered as described in Missouri Revised Statutes: 386.890. 1. "Net Metering and Easy Connection Act".

III. INSTALLATION, OPERATION AND MAINTENANCE OF MICROGRID

A. **Compliance with Missouri Standard Microgrid Interconnection Process (MSMIP):** Subject to the provisions of this Agreement, the Utility shall be required to interconnect the Microgrid to the Utility's system, for purposes of parallel operation, if the Utility accepts the Microgrid as in compliance with the MSMIP. The Microgrid Owner shall have a continuing obligation to maintain and operate the Microgrid in compliance with this agreement.

B. **Microgrid Construction:** The Owner shall ensure that the Microgrid is constructed in accordance with the utility-accepted design and the equipment manufacturer's requirements as outlined in the MSMIP. The Utility may, in its discretion and upon reasonable notice, conduct reasonable on-site verifications during the construction of the Microgrid. Upon completion of construction, the Owner shall provide formal notification to the Utility.

C. **Verification Testing:** A verification test must be performed by a qualified individual prior to parallel operation of the microgrid. The verification test shall be conducted as prescribed by the equipment manufacturers in accordance with the manufacturers' published test procedures. The Owner shall provide the Utility with written certification that the verification was successfully performed. The Utility reserves the right to witness verification testing. If the Utility chooses to observe the verification testing, Utility shall coordinate a mutually agreeable time with the Owner, not to exceed ten (10) business days after receiving formal notification of Microgrid construction completion.

D. **Letter of Acceptance for Interconnection:** Within five (5) business days of receipt of formal notification certifying that the Microgrid has been verification-tested in compliance with the MSMIP, the utility-accepted design, and the equipment manufacturers' instructions, the Utility shall issue to the Owner a formal Letter of Acceptance for Interconnection. The Owner shall be allowed to commence parallel operation of the Microgrid upon receipt of the formal Letter of Acceptance for Interconnection.

IV. DISCONNECTION OF THE MICROGRID

A. **Emergency Disconnection:** The Utility may disconnect the Microgrid, without prior notice to the Owner (a) to eliminate conditions that constitute a potential hazard to Utility personnel or the general public; (b) if pre-emergency or emergency conditions exist on the Utility system; (c) if a hazardous condition relating to the Microgrid is observed by a Utility inspection; or (d) if the Owner has tampered with any protective device. The Utility shall notify the Owner of the emergency if circumstances permit.

B. **Non-Emergency Disconnection:** The Utility may disconnect the Microgrid, after notice to the responsible party has been provided and a reasonable time to correct, consistent with the conditions, has elapsed, if (a) the Owner has failed to make available records of verification tests and maintenance of his protective devices; (b) the Microgrid system interferes with Utility equipment or equipment belonging to other Owners of the Utility; (c) the Microgrid adversely affects the quality of service of adjoining Owners.

C. **Disconnection by Owner:** The Owner may disconnect the Microgrid from the Utility's system at any time.

D. **Utility Obligation to Cure Adverse Effect:** If, after the Owner meets all interconnection requirements, the operations of the Utility are adversely affecting the performance of the Microgrid or the Owner's premises, the Utility shall immediately take appropriate action to eliminate the adverse effect. If the Utility determines that it needs to upgrade or reconfigure its system the Owner will not be responsible for the cost of new or additional equipment beyond the point of common coupling between the Owner and the Utility.

V. ACCESS

A. **Access to Premises:** The Utility shall have access to the disconnect switch of the Microgrid at all times. At reasonable hours and upon reasonable notice consistent with Section III of this Agreement, or at any time without notice in the event of an emergency, the Utility shall have access to the Microgrid Premises.

B. **Utility and Owner Representatives:** The Utility shall designate, and shall provide to the Owner, the name and telephone number of a representative or representatives who can be reached at all times to allow the Owner to report an emergency and obtain the assistance of the Utility. For the purpose of allowing access to the premises, the Owner shall provide the Utility with the name and telephone number of a person who is responsible for providing access to the Premises.

VI. DISPUTE RESOLUTION

A. **Good Faith Resolution of Disputes:** Each Party agrees to attempt to resolve all disputes arising hereunder promptly, equitably and in a good faith manner.

B. **Mediation:** If a dispute arises under this Agreement, and if it cannot be resolved by the Parties within ten (10) business days after written notice of the dispute, the parties agree to submit the dispute to mediation by a mutually acceptable mediator, in a mutually convenient location in Missouri. The Parties agree to participate in good faith in the mediation for a period of up to 90 days. If the Parties are not successful in resolving their disputes through mediation, then the parties may refer the dispute for resolution to the Public Service Commission or to the governing authority under which the utility operates.

C. **Escrow:** If there are amounts in dispute of more than two thousand dollars ($2,000), the Owner shall either place such disputed amounts into an independent escrow account pending final resolution of the dispute in question, or provide to the Utility an appropriate irrevocable standby letter of credit in lieu thereof.

VII. INSURANCE

The Owner is not required to provide general liability insurance coverage as part of this Agreement, however, due to the risk of a Microgrid incurring damages it is recommended that every Microgrid Owner protect itself with insurance. The inability of the Utility to require the Owner to provide general liability insurance coverage for operation of the Microgrid is not a waiver of any rights the Utility may have to pursue remedies at law against the Owner to recover damages.

VIII. MISCELLANEOUS PROVISIONS

A. **Beneficiaries:** This Agreement is intended solely for the benefit of the Parties hereto, and if a Party is an agent, it's principal. Nothing in this Agreement shall be construed to create any duty to, or standard of care with reference to, or any liability to, any other person.

B. **Severability:** If any provision or portion of this Agreement shall for any reason be held or adjudged to be invalid or illegal or unenforceable by any court of competent jurisdiction, such portion or provision shall be deemed separate and independent, and the remainder of this Agreement shall remain in full force and effect.

C. **Entire Agreement:** This Agreement constitutes the entire Agreement between the Parties and supersedes all prior agreements or understandings, whether verbal or written.

D. **Waiver:** No delay or omission in the exercise of any right under this Agreement shall impair any such right or shall be taken, construed or considered as a waiver or relinquishment thereof, but any such right may be exercised from time to time and as often as may be deemed expedient. In the event that any agreement or covenant herein shall be breached and thereafter waived, such waiver shall be limited to the particular breach so waived and shall not be deemed to waive any other breach hereunder.

E. **Applicable Law:** The interpretation and performance of this Agreement shall be in accordance with and controlled by the internal laws of the State of Missouri.

F. **Amendments:** This Agreement shall not be amended unless the amendment is in writing and signed by the Utility and the Owner.

G. **Force Majeure**:

1. For purposes of this agreement, a Force Majeure Event shall mean "any act of God, labor disturbance, act of the public enemy, war, insurrection, riot, fire, storm or flood, explosion, breakage or accident to machinery or equipment, any order, regulation or restriction imposed by governmental, military or lawfully established civilian authorities, or any other cause beyond a Party's control. A Force Majeure Event does not include an act of negligence or intentional wrongdoing."

2. If a Force Majeure Event prevents a Party from fulfilling any obligations under this Agreement, the Party affected by the Force Majeure Event (Affected Party) shall promptly notify the other Party, either in writing or via the telephone, of the existence of the Force Majeure Event. The notification must specify in reasonable detail the circumstances of the Force Majeure Event, its expected duration, and the steps that the Affected Party is taking to mitigate the effects of the event on its performance. The Affected Party shall keep the other Party informed on a continuing basis of developments relating to the Force Majeure Event until the event ends. The Affected Party will be entitled to suspend or modify its performance of obligations under this Agreement (other than the obligation to make payments) only to the extent that the effect of the Force Majeure Event cannot be mitigated by the use of Reasonable Efforts. The Affected Party will use Reasonable Efforts to resume its performance as soon as possible.

H. **Assignment:** Neither Party shall assign, pledge or otherwise transfer this Agreement or any right or obligation under this Agreement without first obtaining the other Party's written consent, which consent shall not be unreasonably withheld, conditioned or delayed. Any assignment or transfer of this Agreement or any rights, duties or interests hereunder by either Party without the written consent of the other Party shall be null and void and of no force and effect.

I. **Permits and Approvals:** Owner shall obtain all environmental and other permits lawfully required by governmental authorities prior to the construction and for the operation of the Microgrid during the term of this Agreement.

J. **Limitation of Liability:** Neither by inspection, if any, or non-rejection, nor in any other way, does the Utility give any warranty, express or implied, as to the adequacy, safety, or other characteristics of any structures, equipment, wires, appliances or devices owned, installed or maintained by the Owner or leased by the Owner from third parties, including without limitation the Microgrid and any structures, equipment, wires, appliances or devices appurtenant thereto.

ACCEPTED AND AGREED:

Owner Signature:

Printed Name:

Title:

Date:

Utility Signature:

Printed Name:

Title:

Date:

An equal opportunity institution

Office of Sustainable Energy and Environmental Engagement (OSE3)

203 Centennial Hall | 300 West 12th Street | Rolla, MO 65409
573-341-7500 | rolufsa@mst.edu | ose3.mst.edu

June 17, 2016

Kristy Manning
Division of Energy, Director
Missouri Department of Economic Development
301 West High Street
P.O. Box 1766
Jefferson City, MO 65102

RE: Recommended Microgrid Interconnection Requirements, Missouri

Dear Ms. Manning:

I am happy to submit the enclosed report investigating best practices and providing recommendations for Microgrid Interconnection Requirements for Missouri.

Members of the Missouri S&T Microgrid Industrial Consortium played an invaluable role in reviewing draft documents and providing recommendations toward this final version.

Thank you for the opportunity to contribute toward this important endeavor.

Sincerely,

Angela B. Rolufs
Director