Fuel Cell Guide

Version 3 / December 2018

Consolidated Edison Company of New York: Guide to Fuel Cell Interconnection

Introduction

This guide is for Con Edison Customers who are considering installing or upgrading fuel cell power generators less than 5 MW that are or will be connected to Con Edison's electric distribution system. This guide is intended for installations of less than 5 MW, which is the current per-premise cap for value stack credits in New York State. Projects above 5 MW should contact dgexpert@coned.com

This guide is intended to provide high level details of the electric interconnection process, typical steps, challenges, and technical solutions associated with fuel cell projects. In addition, this guide will provide general procedural knowledge of the gas service installation/upgrade process as well as some details that pertain particularly to fuel cell generation requests. This guide is not a design or technical specification.

Interconnection of all types of technology less than 5 MW are subject to the New York State Standardized Interconnection Requirements (SIR). All developers and applicants should read the SIR as the SIR will take precedence. This document is aligned to the October 2018 version of the SIR, and later revisions of the SIR will be integrated as expediently as possible**.**

Section 1: About Con Edison's Grid

<u>Electric Service</u>

Con Edison provides electric services to 3.4 million customers in New York City and portions of Westchester County. Electricity is delivered through approximately 94,000 miles of underground cable, and almost 37,000 miles of overhead cable.

The distribution system supplies power to the Company's low voltage network customers and radial customers from area substations at the 4kV, 13kV, 27kV, and 33kV primary service voltage levels. The majority of customers receive Low Tension (low voltage) service directly at the distribution system secondary voltage levels of 120/208V; 120/240V or 265/460V, while a small percentage of High Tension (high voltage) customers receive power at primary service voltage levels.

There are two types of electric distribution grid systems, radial grids and network grids.

Radial Grids traditionally have a single high voltage cable, often referred to as a feeder, sending energy from the substation to numerous distribution transformers tapped at various points along its length. The distribution transformers step the voltage down to low-voltage electricity and typically serve between 1-16 customers. These systems are called radial grids because the substation and feeders resemble a hub with spokes. Cables and transformers on radial grids are often above ground, seen predominantly in areas like Staten Island or Westchester.

Con Edison uses a reliable type of radial grid called an "auto-loop". An auto-loop typically has two feeders, two additional backup feeders, and automatic switches at various points along the feeder run.

This means that a problem on the feeder affecting one point on the auto-loop can be isolated quickly, minimizing the number of customers affected by a problem on their radial line.

Network grids have multiple primary feeders supplying several network transformers tied together in parallel on the secondary side to provide energy into a low voltage grid (area network type) or a local building bus (spot or isolated network) where the consumer is connected. Thousands of low voltage customers are served off the low voltage grid of an area network. Cables and transformers on network grids are typically below ground and are used in densely populated areas. Network grids are used extensively throughout Manhattan, Brooklyn, Queens, and the Bronx, in addition to several small network grid areas in Staten Island and Westchester.

The different grid configurations have different associated characteristics. Network grids are considered more reliable than radial grids as there are redundant sources of backup power in case of failures on the grid. Additionally, with cables and transformers mostly underground, network grids tend to be less prone to outages resulting from severe weather conditions than above ground radial grids. Network grids are more complex than radial grids due to the increased number of system components and the redundant cabling.

Spot networks are a special class of network grids where one or multiple transformers are dedicated to a single, large energy consuming building like a skyscraper. A spot network is essentially a small network grid that is implemented for a single large user.

Both the radial and network grids are represented in **Figure 1**, below:

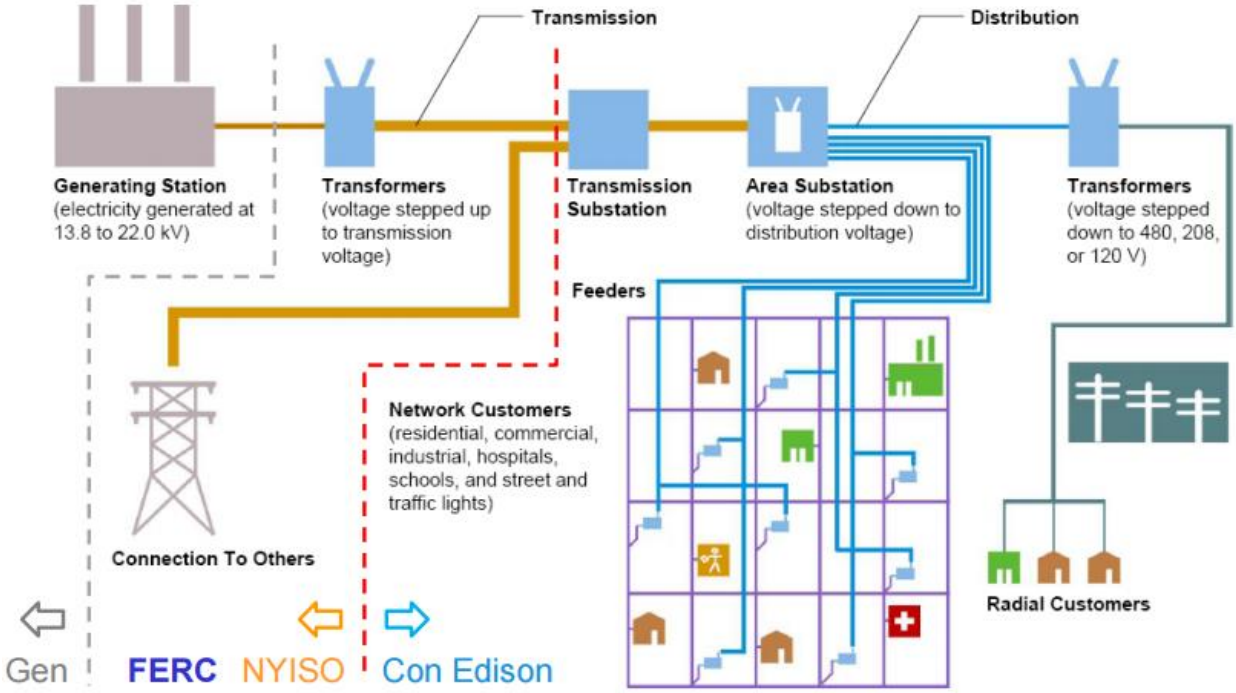


Figure 1 - Electric Distribution System

Gas Service

For more than 180 years, Con Edison has served the world's most dynamic and demanding marketplace – metropolitan New York -- while maintaining a safe and reliable natural gas supply to more than 1.1 million gas customers. Con Edison manages a large, complex underground natural gas transmission and distribution system. This system contains over 4,300 total miles of gas main with approximately 370,000 service pipes that transport more than 300 million dekatherms of natural gas each year. The more than 4,300 miles of gas mains consist of 92 miles of transmission mains operating at pressures greater than 125 psig and over 4,200 miles of distribution mains operating at pressures less than 100 psig. Over 600 miles are large-diameter distribution mains, greater than 12" that mostly connect the transmission mains to approximately 3,600 miles of smaller-diameter distribution mains. The distribution mains deliver natural gas to our customers at varied pressures: 33 percent at high-pressure; 11 percent at medium-pressure; 56 percent at low-pressure. Con Edison's low-pressure gas system supplies minimum pressure of 4 inches water column and a maximum pressure of 12 inches water column, medium pressure mains provide between 1 psig and 15 psig, and its high pressure gas system supplies a minimum pressure of 15 psig. Con Edison does not connect DG customers to gas transmission mains.

Section 2: Technical Interconnection Considerations for Fuel Cells

Con Edison manages the interconnection of fuel cell generators less than 5 MW in capacity under the most recent version of the Standardized Interconnection Requirements (SIR). Please note that net metering and Value Stack for fuel cells in New York State is limited to projects 5 MW (AC) and below. The SIR draws a distinction between projects greater than and less than 50 kW. Generally, fuel cells are larger than the 50 kW threshold that distinguishes large and small projects, so the less than 50kW process will not be covered in great detail.

Though a fuel cell is typically designed and operated to provide base load generation, at times operational changes in load can inadvertently cause power to export. The export of power can cause undesirable system impacts, such as voltage fluctuation or opening network protector relays. The technical configurations for accommodating fuel cells vary depending on the type of electrical distribution service (e.g., radial, network) and gas configurations at the point of interconnection as well as the surrounding loads.

Radial Electrical Service

As noted above, fuel cells that do not export may interconnect to any electric service type. In addition, a typical radial service can accommodate limited export of power from fuel cells, often without requiring utility upgrades. Interconnecting fuel cell generation with more significant, more frequent or longer durations of export to a radial service could result in local high voltage conditions, power quality issues, or relay coordination problems. The potential for oversized fuel cell generators to cause these interconnection challenges might result in the requested fuel cell capacity being reduced to less than the capacity of the local electrical service, the high-voltage primary feeder's ability to accept DG output, or the unit substation's ability to accept reverse power flow. The utility upgrades required to resolve

these constraints vary in complexity and cost, and typically require detailed engineering study by Con Edison in order to approve electrical interconnection.

Network Electrical Service

With network service, multiple high-voltage primary feeders supply power to local area network transformers which then feed the low-voltage network grid. If one of the primary feeders supplying a portion of the network grid was to experience an outage, the parallel connected secondary grid will try to provide power into the dead feeder. As such, these transformers are designed with an automatic switch, known as a network protector, which will open when energy feeds back from the low voltage bus toward the high-voltage feeder. This is the same condition as when a fuel cell system provides more power into the area network grid than there is load to serve. While Con Edison's dense network grid system typically has enough load to "soak up" the exported power, the electric system can be adversely affected by the back-feed of power.

For applicants connecting to Con Edison's secondary grid, the engineering review will determine if the service cable to the site is adequate to carry the export, in addition to determining if export into the network will cause network protector operation. If the service cable is not rated for the expected fuel cell export capacity, the customer will need to upgrade the existing service or put in an additional service. For those projects where local network protectors will be impacted, Con Edison has a solution called "Adaptive Network Protector (NWP) Relay Settings" where modifications are made to the relays of nearby transformers.

In addition, in some cases the export of power from the fuel cell can cause overvoltage and/or power quality issues. In these cases, Con Edison can deploy Communication Aided Tripping (described below) to help keep select NWP relays closed and provide greater voltage stability. However in some cases, Con Edison will also need to rely on the inverter itself to help regulate voltage. This generally requires the inverter to consume VARs at a fixed power factor, or utilize the "Advanced" inverter features as outlined in the draft IEE1547 specification (Volt-VAR and Volt-Watt Characteristics) with settings recommended by Con Edison. When the inverter is required to prevent overvoltage, the function shall be "supervised" by a utility grade overvoltage relay. Additionally, Con Edison requires communications be established to any inverter managing voltage by consuming VARs to ensure voltage is maintained within ANSI limits. These solutions would be determined via engineering study, and the cost of the solutions provided would be paid for by the applicant.

Spot or Isolated Networks

The design of a Spot or Isolated Network is comprised of multiple transformers and network protectors that are tied together on a common secondary voltage bus. For customers on dedicated spot or isolated networks, incidental export of power toward the common secondary bus will result in the opening of a network protector which could result in a total loss of power to the customer. Typically, interconnecting a fuel cell would require a reverse power relay to prevent that incidental export. This reverse power relay would trip the fuel cell inverter offline prior to reaching incidental export level in order to

eliminate the potential for spuriously opening a network protector and preventing a possible loss of power to the customer.

However, since 2012, Con Edison has been offering solutions to enable export across network protectors through pilot programs, making it the only utility in the nation to allow export on network service. This solution is called "Communications Aided Tripping" (CAT) and it involves the following:

1.) Reducing sensitivity on local network protector relays – Reprogramming network protector relays to an "insensitive" mode that allows back-feed of up to 50% of the transformer rating.
2.) Supervisory Control and Data Acquisition (SCADA) and anti-islanding – Installing equipment to monitor the performance of the fuel cell generator and the network protectors and allow for remote tripping in the event of system contingencies and/or outage risk to the customer.

The solutions offered will be tailored to the specific service configurations. Costs for CAT will be project specific and determined by your CPM but very generally can be in the range of $100,000[1]. Generally speaking, the reduced sensitivity solution on local network protector relays is more suitable for interconnections to the low voltage grid, whereas the communication-aided tripping is more suitable for isolated or spot networks.

<u>Equipment Details</u>

The following list of equipment may be required (and installed as needed) for most Con Edison fuel cell projects, particularly those using the CAT solution. The exact requirements and specifications of the equipment will be determined during engineering review and site visits.

The customer is responsible for the cost of procuring and installing this equipment, regardless of whether the customer or Con Edison is installing it.

- **Supervisory Control and Data Acquisition (SCADA):** This equipment collects data from the customer's inverters and Con Edison's network protectors. In addition to providing communications, SCADA also allows for remote operations and controls of the network protectors.
- **Anti-islanding device**: This equipment is sometimes required, based on a case-by-case assessment of fuel cell system size and the type of service to the customer. The purpose of this device is to ensure that fuel cell generator export does not cause a customer outage if one or more feeders go out of service.
- **DNP3 Inverter or DNP3-enabled communications relay (ETI or other)**: DNP3 communications protocols are required in order to ensure reliable, consistent communications between the customer's inverters and the local network protectors. This can be achieved by either installing inverters that "speak" DNP3, or by installing a DNP3 enabled communications relay. Translators

[1] This is an estimate only. Project costs can be higher or lower depending on project specifics. Customers should not rely on this number for before they receive actual costs and written design approval from Con Edison.

from Modbus to DNP3 will not be allowed as they have not performed adequately in the field. The customer is responsible for providing either the inverter or the relay.

- **Network protector micro-processor relay and associated cabling**: A device to remotely monitor the operations of the network protector. This is required to enable two-way communications. Con Edison network protectors are typically installed with a standard non-communicating relay and must be upgraded for participation in this program. Con Edison will install the relays and any required cables.
- **Conduit/cable**: Cable and conduit will be run between the communications and protective equipment. The customer will be required to provide their own communications cable, specified by Con Edison. The *customer* will make the connections and bring the cable to Con Edison, who will then connect the fuel cell to the bus to complete the installation. Conduit may be required, depending on existing conditions at the site.
- **Metering and Gas Riser**: Residential customers served by Con Edison gas that qualify under the eligibility criteria of Rider J of the Con Edison Gas Tariff can use a single gas meter for both their fuel cell and residential gas use; however, due to the increased throughput of gas required to serve the fuel cell, the meter and/or gas service line may have to be upgraded. Commercial fuel cell customers that plan on taking advantage of the distributed generation gas rates under Rider H of the Con Edison Gas Tariff must have a dedicated meter and gas riser/piping exclusively for the fuel cell. This gas meter shall be located at the gas service entrance and not at the fuel cell. For more information, see the Gas Service section below.

Section 3: Interconnection Process

Interconnecting a fuel cell may require modifications to the interconnecting customer's gas and/or electric service. Generally speaking, the gas service request should precede the DG interconnection request. Gas service to a fuel cell often requires new gas mains or service laterals to be installed at the building – in many cases not at the same location as the existing electric or gas service. In the event a fuel cell electric interconnection request is submitted prior to receiving a Con Edison ruling that adequate gas service exists or can be established at the premises, the interconnection request will be put on hold pending the final service determination of the gas service case. The general procedures for submitting gas service and electrical interconnection requests are discussed below:

3A - Gas Service

Before submitting a formal DG electrical interconnection application, customers should submit a gas inquiry to their gas supplier (Con Edison or National Grid) to determine if their current gas service is sufficient to supply the proposed additional load, and if there will be costs associated with any required upgrades. Gas service requests are processed through the Company's Project Center portal. The Con Edison Customer Guide to Natural Gas Service Installation (a.k.a. the Yellow Book) and Con Edison Gas Operation Standard G- 2040-9 outline the overall gas service process and requirements for the installation of gas boosters and other protective devices. These should be reviewed by the Customer prior to making your gas service request on Project Center. Other steps to be taken in advance of

application submission include reading Gas Rider H and Rider J, which are the Commercial and Residential distributed generation tariffs, respectively, and registering with Project Center.

Con Edison also advises discussion with the New York City Department of Buildings (DOB), or the appropriate municipality, in the earliest stages possible to avoid delay. The DOB approval process can be complex and time-consuming. Air permits may also be required through New York City's Department of Environmental Protection (DEP) or through New York State's Department of Environmental Conservation (DEC).

Taking the following steps prior to and during the application submission will help speed up the review:

- Include accurate account (14 digit) and meter (7 digit) numbers
- Include accurate customer email address
- Include the Con Edison service (electric and gas) information in all drawings
- Include additional existing on-site Distributed Energy Resources (DER) in the application
    - Provide details in the scope of work and note other DG's location on drawings
- Enter the rating per inverter and number of inverters
- Ensure consistency in all forms and documents

The gas service application will progress through the following high level process steps:

Figure 2 - High Level Process of a Gas Service Request

A gas service request can be initially discussed with a Con Edison representative through an exploratory meeting. Within 15 days of the exploratory meeting, an order of magnitude cost estimate will be provided, for customer decision making. When a gas service application is ready for formal submission, the following documents must be collected and attached to the application in Project Center:

- Detailed load letter
- Any applicable easements, rights-of-way, permits (excepting street permits), consents and certificates necessary to give the Company or its representatives access to the installation and equipment or to enable service pipe connection
- Any required service engineering diagrams

The gas process then follows the workflow depicted in **Figure 3** below:

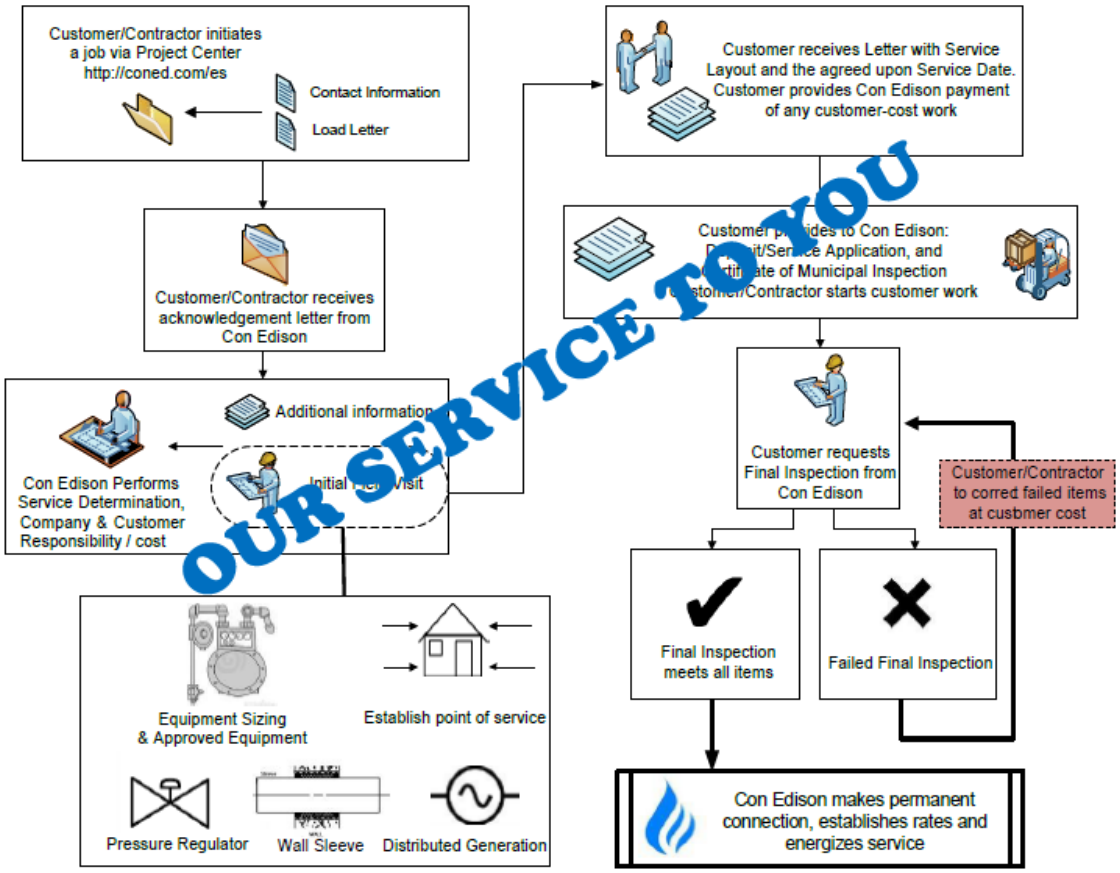


Figure 3 - Gas Work Request Flow Process

To provide additional guidance in preparing for gas service inspections, Con Edison has prepared checklists for the interim and final inspections:

- Interim Gas Inspection Checklist
- Final Gas Inspection Checklist

3B - Electric Interconnection

As noted above, Con Edison follows the New York State SIR to review and approve all fuel cell projects under 5 MW. Prior to application submittal, please read the SIR thoroughly to familiarize yourself with application process and timelines, technical and operating requirements, and required contracts and forms.

Other resources to review in advance of application submission include Rider R, which is the Phase One net metering and value stack tariff for Con Edison (discussed further in Section 4), and registering with

Power Clerk. The Small DG portal should be used for Interconnection requests less than or equal to 50kW. The Large DG portal should be used for Interconnection requests greater than 50kW – 5MW.

When an application is ready for submission, the Applicant should upload the documents listed in Appendix F of the SIR. The applicant should also include any additional rate application forms (Form G or Community DG Appendices A and B as applicable). If the applicant intends to operate the fuel cell in an Isolated Mode during grid outages, this should be clearly documented in the application package scope of work to facilitate the technical review.

Additional technical information, may be required if the application progresses to a Coordinated Electric System Interconnection Review (CESIR). Applicants who plan on operating their fuel cell in Isolated Mode or as part of a Microgrid should expect that additional documentation, engineering review time and a more detailed testing plan will typically be required.

To provide additional guidance in preparing materials for fuel cell interconnection applications, Con Edison has prepared checklists for three-line diagrams. These checklists provide Con Edison requirements for system diagrams, as well as consistency in reviews from project to project. These checklists can be found on the Con Edison DG website and provide Con Edison requirements for system diagrams and verification tests, as well as consistency in reviews from project to project.

Examples of some of the features that should be called out on the three-line diagram are shown in **Figure 4** below:

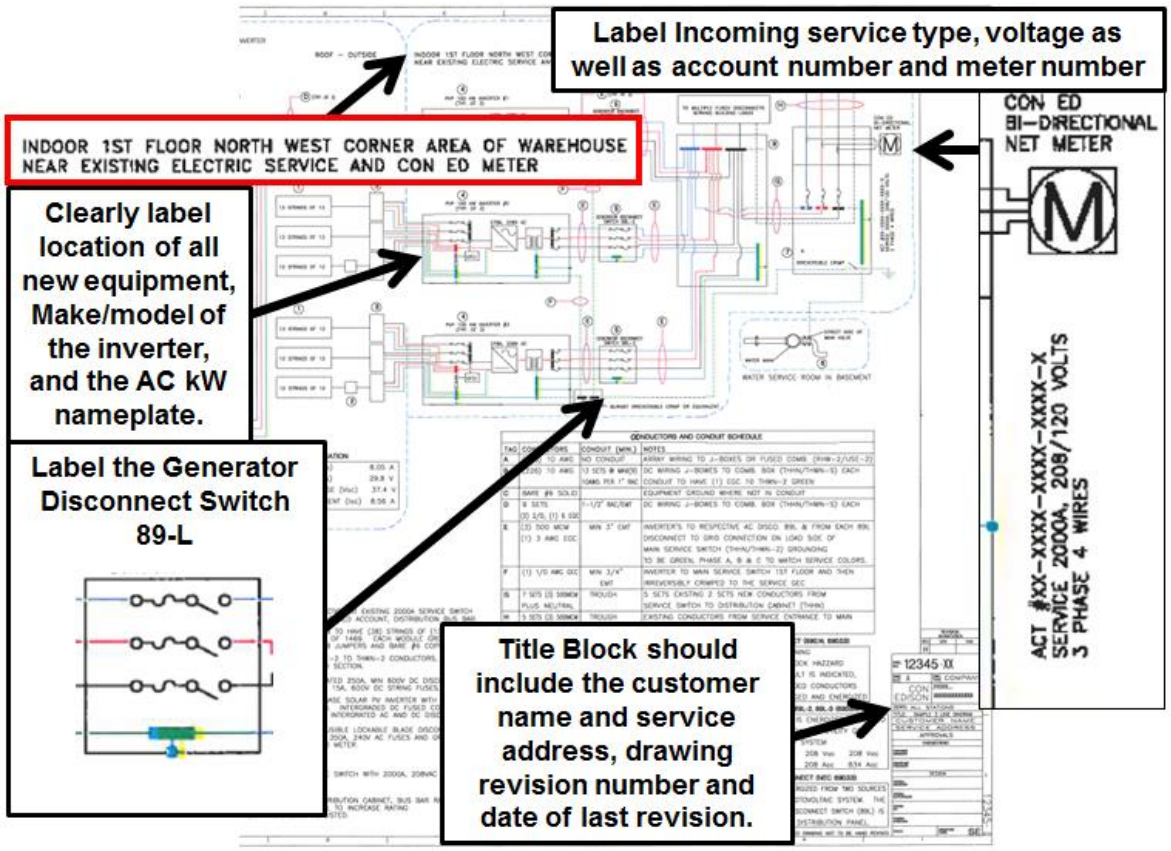


Figure 4 – Required elements of an acceptable drawing.

Applications are initiated through Power Clerk, our online application portal for distributed generation systems. The Small DG portal should be used for Interconnection requests less than or equal to 50kW. The Large DG portal should be used for Interconnection requests greater than 50kW – 5MW. After logging into the portal the relevant customer and project information should be entered with the documents described above and attached when prompted. Once all information is entered or attached and submitted, the application will be routed to the appropriate Con Edison Energy Services personnel and the application review will begin. At this time, the SIR process is different for small (< 50 kW) and large (>= 50 kW) projects.

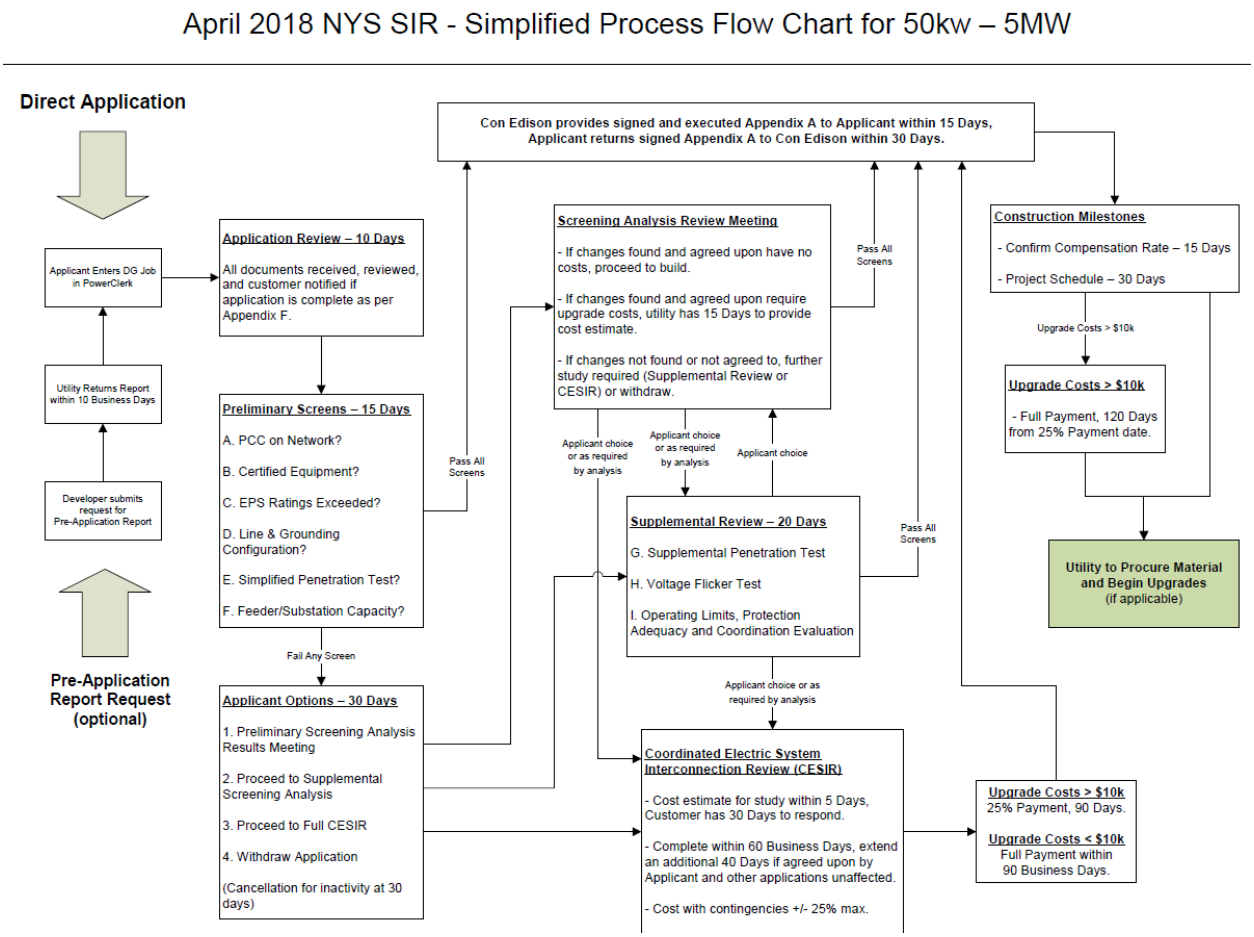


Figure 5 -Interconnection application process for > 50 kW SIR projects

The general steps in the process include:

1.) Applicant submits a Pre-Application Report request (Optional)
2.) Con Edison returns the Pre-Application Report
3.) Applicant submits an application
4.) Con Edison reviews the application for completeness
5.) Con Edison performs preliminary screening analysis
    a. If application passes the six preliminary screens, Applicant proceeds to construction
6.) Applicant selects additional review/meeting option (Note: this can be an iterative process)
    a. Preliminary Screening analysis results meeting to explain the screening process and identify any simple changes that could lead to the project being approved.
    b. Supplemental Screening Analysis, at customer choice of this option, to perform three additional screens, which if passed progress the application to construction.
    c. CESIR, at customer choice of this option, to perform in depth analysis of the proposed DG system to determine the system changes and cost estimates needed to accommodate interconnection. CESIR costs generally range up to $20,000 for inverter-based systems and $27,000 for rotating machines. Cost is dependent upon size,

operation, type of electric distribution service, and type of equipment. Numbers may vary slightly for high-tension service but are in a similar range.

d. Withdraw/cancel – the applicant has the option to withdraw or cancel their application at any time.

7.) Con Edison performs requested review
8.) If applicable, Applicant commits to construction costs and provides full payment within 120 business days
9.) Applicant and Con Edison complete their respective constructions
10.) Con Edison performs field verification testing
11.) If applicable, Applicant addresses any issues emerging from the field verification testing and Con Edison issues final acceptance letter
12.) Con Edison performs project closeout

Note on fuel cell projects that will require an outage to interconnect their project:

If you cannot connect your fuel cell's electrical interconnection point to an existing breaker and have to connect directly to a live bus, please work with your assigned Energy Services Customer Project Manager (CPM) to coordinate disconnecting electric service to the building, commonly referred to as an "outage." Please note: no electrical connections or customer current transformers (CT's) are permitted within Con Edison's revenue metering cabinet, also known as the CT Cabinet. Please coordinate where connections can be made to existing customer switchgear with your CPM prior to finalizing the outage request.

It is also important to note that Con Edison crews will be available to provide a customer requested outage at no charge during regular business hours: Monday-Friday, 7:00am – 3:00pm excluding holidays. However, if you request an outage outside these normal working hours, or if an outage extends beyond 3:00pm, you will be responsible for full payment of the cost for time spent outside working hours, including overtime.

Roles and Responsibilities

Throughout the interconnection process, applicants will interact with a number of Con Edison personnel with various roles and responsibilities, including:

- **Energy Services CPM** – Handles communication and overall process oversight for your project
- **Distribution Engineering** – Performs all engineering reviews, studies, and inspections
- **Distributed Generation** – Provides guidance on rules, tariffs, general information, and provides pre-application reports
- **Customer Care Group**– Handles billing and post-installation billing question

Section 4: Rates and Service Classifications

Typical Gas Service Classifications

The two gas service classification riders that typically apply to fuel cell customers are Rider H and Rider J. The primary distinction between the two is that Rider H applies to non-residential customers, while Rider J applies to residential customers. Under both Riders, a customer must maintain a 50 percent annual load factor, which means that usage must be greater than or equal to half of the maximum winter period gas load. Also under both riders, separate meeting is required, unless the Rider J customer is a small residential customer with fewer than five dwellings. The riders are structured similarly with a minimum charge for the first 3 therms (or approximately 300,000 BTUs), and a variable charge for each therm used beyond the minimum. Additional charges may apply, depending on whether the customer is taking firm gas service.

Typical Electric Service Classifications (SC-2, SC-8, SC-9)

The electric service classifications for customers typically installing fuel cell generation include the following. Con Edison assigns the service class based on the customer characteristics.

- **Service Class 2 (SC2) – General – Small:** This rate is for small commercial customers with demand less than 10kW. It is also volumetric billing based on energy usage (kWh). SC-2 customers have no demand charge.
- **Service Class 8 (SC8) – Multiple Dwellings:** This rate is for master-metered residential customers. It includes energy usage (kwh) billing with a variable demand charge (kW), adjusted monthly based on the highest 30 minutes of demand
- **Service Class 9 (SC9) – General Large:** This rate is for large commercial customers with demand 10kW or larger. It is energy usage (kwh) billing with a variable demand charge (kW), adjusted monthly based on the highest 30 minutes of demand

In addition to the electric service class, Rider R of the electric tariff also applies to customers with fuel cell generators for Value Stack tariff instead Standby Service. Fuel cell generators can also exempt from Standby rates while taking Standby Service via Designated Technology Exemption. Designated Technologies refer to distributed generators that are based on renewable energy sources (fuel cell, wind, solar thermal, photovoltaic, biomass, tidal, geothermal, and methane waste), and certain cogeneration technologies (Combined Heat and Power or "CHP") that meet minimum efficiency criteria. As a rider to the customer's base Service Classification, Rider R allows for net metering and value stack credits to fuel cell generators without any change to the underlying rates of the individual service classification. In addition, Rider R lays out the applicability requirements for technologies on certain types of service classifications, details how net export of power for the billing cycle is treated, and specifies which technologies can participate in Remote Net Metering or Community Distributed Generation programs as well as the credit reconciliation process for these programs.

In conjunction with Rider R, these service classification distinctions will determine how the net metering and value stack credits are applied.

Value of Distributed Energy Resource (VDER)

On March 9, 2017 the New York State Public Service Commission (PSC) released an order to transition away from net energy metering (NEM) to VDER.

Grandfathered and Mass Market Phase 1 NEM

If you have a fuel cell for which an interconnection application was completed by July 17, 2017, all excess kilowatt hours of energy sent to the grid are "cashed out" after every billing cycle. We do this by multiplying the excess kilowatt hours by the avoided cost of energy. The avoided cost of energy is determined by the average wholesale price of energy for the year, increased by 6.6 percent. The resulting dollar value is applied to your account as a credit and your kilowatt-hour bank is reset to zero.

Existing NEM customers may opt in to Value Stack rates.

Remote Net Metering and Community DG

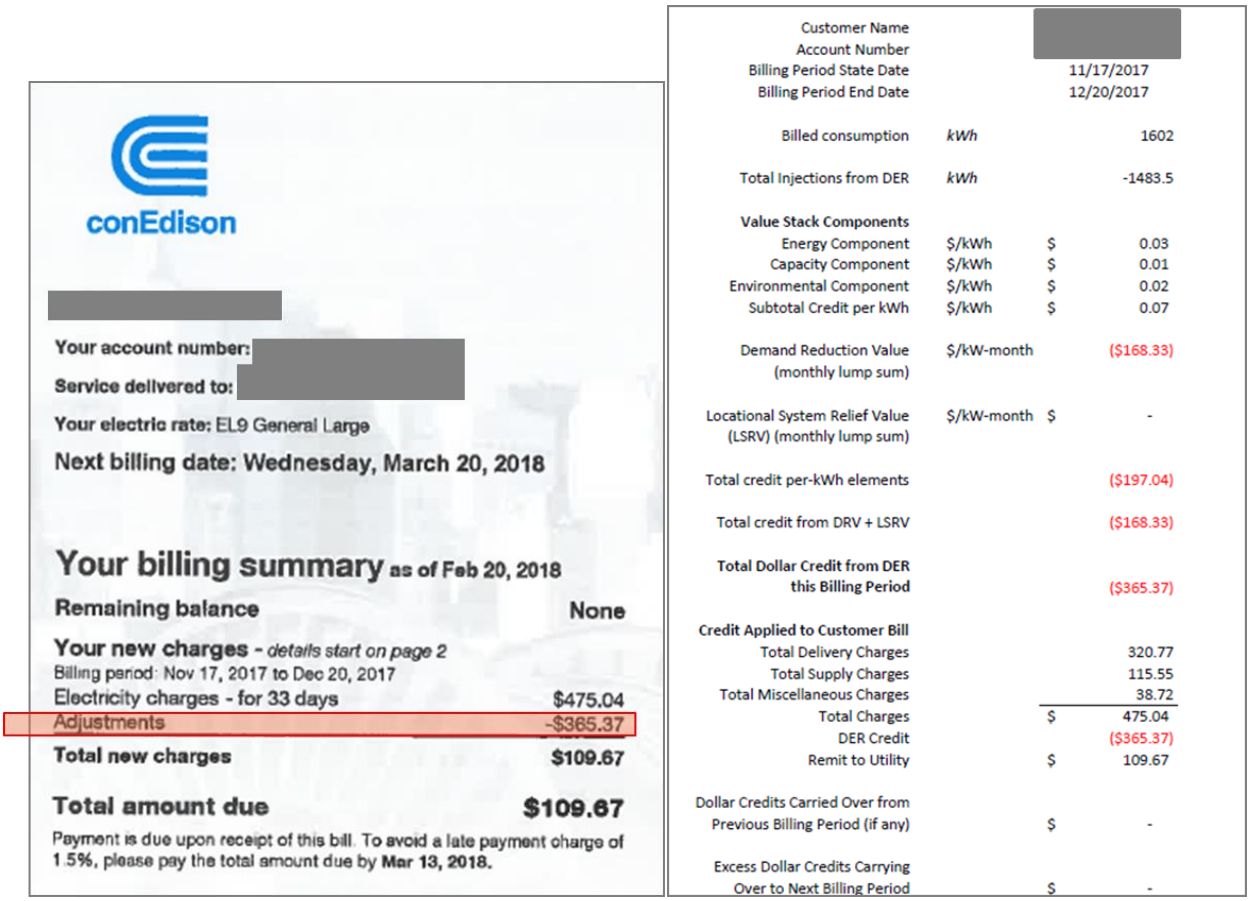
While Remote Net Metering and Community DG are available to fuel cell projects, presently the economics of these programs prevent projects from being developed for these purposes, so these programs will not be discussed further in this guide. If interested in pursuing a fuel cell RNM or CDG project, please contact Con Edison's DG office at dgexpert@coned.com.

Value Stack

Unlike traditional NEM, VDER Value Stack compensation is not based only on volumetric metering; the energy produced and exported to the grid will not be credited on the customer's utility bill at the same kWh rate at which energy is consumed. Instead, the Value Stack consists of six potential components and converts energy production into monetary credits that can vary by location and time.

Value Stack credits are based on export into the utility grid. Fuel Cell generation that instantaneously reduces customer load will reduce the customer bill; generation that exceeds a customer's load behind the meter is exported to the grid and credited according to the Value Stack rates.

For more information about VDER, including a description of all of the components of the Value Stack, please visit our Private Generation Tariffs webpage.



conEdison

[redacted]

Your account number: [redacted]

Service delivered to: [redacted]

Your electric rate: EL9 General Large

Next billing date: Wednesday, March 20, 2018

Your billing summary as of Feb 20, 2018

Remaining balance	**None**
Your new charges - *details start on page 2*	
Billing period: Nov 17, 2017 to Dec 20, 2017	
Electricity charges - for 33 days	$475.04
Adjustments	-$365.37
Total new charges	**$109.67**
Total amount due	**$109.67**

Payment is due upon receipt of this bill. To avoid a late payment charge of 1.5%, please pay the total amount due by **Mar 13, 2018.**

Customer Name			[redacted]
Account Number			
Billing Period State Date			11/17/2017
Billing Period End Date			12/20/2017
Billed consumption	*kWh*		1602
Total Injections from DER	*kWh*		-1483.5
Value Stack Components			
Energy Component	$/kWh	$	0.03
Capacity Component	$/kWh	$	0.01
Environmental Component	$/kWh	$	0.02
Subtotal Credit per kWh	$/kWh	$	0.07
Demand Reduction Value (monthly lump sum)	$/kW-month		($168.33)
Locational System Relief Value (LSRV) (monthly lump sum)	$/kW-month	$	-
Total credit per-kWh elements			($197.04)
Total credit from DRV + LSRV			($168.33)
Total Dollar Credit from DER this Billing Period			($365.37)
Credit Applied to Customer Bill			
Total Delivery Charges			320.77
Total Supply Charges			115.55
Total Miscellaneous Charges			38.72
Total Charges		$	475.04
DER Credit			($365.37)
Remit to Utility		$	109.67
Dollar Credits Carried Over from Previous Billing Period (if any)		$	-
Excess Dollar Credits Carrying Over to Next Billing Period		$	-

Figure 6 - Example Demand Customer Value Stack bill

<u>Important Net Metering Considerations</u>

When evaluating your net metering options, there are several concepts that apply that you should be familiar with: level billing, time of use, net meter vs. fuel cell production meters, and demand customers.

Avoided Cost vs. Retail Cost

A critical distinction with how net metering credits are applied for fuel cells relative to solar PV and wind systems is that fuel cells receive the wholesale avoided cost rate for excess generation, whereas solar PV and wind systems receive the full retail rate.

Level Billing

Level billing is an option offered by Con Edison which allows a customer to spread their total expected annual energy costs over twelve equal monthly payments throughout the year. After installing a fuel cell system, your total expected annual energy costs will be reduced by the fuel cell output. It will take some time for your level payment plan to adjust to this lower energy use, and in the interim you will be putting more money toward your total expected annual energy costs than would actually be required.

For this reason, upon completing your fuel cell project you should call Con Edison (1-800-75-CONED) to be removed from the level billing plan. After a year off the program, you will have established your new lower total expected annual energy cost and can call us to re-join the level billing plan. Additional information on level billing can be found here.

Time of Use Rates

Electric Time of Use rates generally do not apply to fuel cell only customers as the steady, flat output does not lend itself well to ramping up or down to take advantage of the varying electric rates. For fuel cell installations that plan to have a significant amount of exported power during low load times (typically off-peak), time of use rates may not be beneficial either as the excess generation off-peak is held in an off-peak "bucket" and cannot be transferred to defer on-peak usage. Customers combining fuel cells with battery energy storage, however, may find value in storing excess production during off-peak hours to be discharged during peak hours. Additional information on time of use rates can be found here.

Net Meters vs. Production Meters

A Net Meter records the in-and-out flow of energy at the facility to be used by Con Edison to create your monthly bill. The fuel cell production meters that are typically provided by developers are for quality assurance purposes to show the amount of power produced by the fuel cell, but do not account for the energy drawn from the grid or the overall consumption of the facility. Con Edison personnel or automated systems will not read or interpret the fuel cell production meter readings, and these readings are not used to determine your monthly bill. For questions regarding your fuel cell production meter, contact your fuel cell system installer.

Additional Resources

For more information on any topics related to Fuel Cell Generation or the relevant billing structures, please visit:

- Con Edison Gas Yellow Book
- Distributed Generation Guide
- Con Edison Energy Services Page

Section 5: Fuel Cell Paired with Other Technologies

Fuel Cells paired with Value Stack eligible technology

As discussed earlier, monthly fuel cell excess generation is credited at Value Stack rates. Therefore fuel cells can be paired with any other Value stack eligible technology (such as solar PV). When applying for such systems, separate applications should be submitted for each generator, referencing the master case numbers of other systems in the "Project Overview" field as they are generated. These parallel projects should be highlighted to the Customer Project Manager as well. Even if all technologies are

being installed by separate developers, a single combined system diagram may be required to enable engineering evaluation.

Fuel Cell paired with Value Stack considerations with Battery Storage

Currently, battery energy storage that charges from the grid is Value Stack eligible but compensation for hybrid system which pairs energy storage with other technologies is still being determined. As such, fuel cells that plan to export excess energy must provide engineering controls that ensure that the exported energy is only from the fuel cell and not the battery's inverter. This can either be achieved through segregation of the technologies on separate meters or through the use of reverse power relaying that will trip off the battery's inverter just prior to export. The set points for reverse power relays will be determined as part of the Con Edison Distribution Engineering CESIR study.

When applying for Fuel Cell plus battery energy storage, a single hybrid application should be submitted for both technologies. This is different from the standard application in PowerClerk. Start this application by choosing "New – All Other Requests, click here!" from the PowerClerk home screen. Then choose the "Apply to interconnect a Hybrid System, i.e. a DG system that includes an Energy Storage System (ESS)" option and hit submit." This will then initiate a project and move you to a status where you are able to complete the "Hybrid Technology Interconnection Application." You will be asked on the initial application in PowerClerk to enter all information related to the battery in order to complete SIR Appendix K "Energy Storage System (ESS) Application Requirements / System Operating Characteristics / Market Participation."

Value Stack considerations with CHP plants

Fuel Cells paired with non-eligible Value Stack technologies (like CHP or energy storage) can be accommodated behind separate Con Edison meters or behind the same Con Edison meter provided that reverse power relaying is provided.

For CHP specifically, the more prudent approach to putting fuel cell and CHP behind the same meter might be to configure the relay to make the CHP technology trip offline or curtail power output when power nears export levels. Unfortunately, experience has shown that while CHP is better at curtailing power or stopping and restarting than fuel cells, the CHP's overall efficiency is greatly affected by repeated curtailment or stop/restart cycles. Installers should be aware that some state or federal funding programs, as well as some Con Edison electric tariff requirements, are driven by the overall efficiency of the CHP, which may make this option impractical over the long run.

Section 6: Contacts for Further Questions

If you have questions about your specific project application, please contact your Energy Services Customer Project Manager. You will receive their contact information when you submit your application in Power Clerk.

For general questions regarding DG interconnection, please contact the Distributed Generation group at dgexpert@coned.com.

For residential billing questions, please contact netmetering@coned.com or 212-780-6600. For large/commercial customers please e-mail dl-CCGNet-metering@coned.com

In addition, New York State Department of Public Service and the New York State Energy Research and Development Authority have dedicated "DG Ombudsmen" who can help answer questions. Their contact information is available here.

Section 7: Definitions and Acronyms

Acronym	Definition
SIR	Standardized Interconnection Requirements
SCADA	Supervisory Control and Data Acquisition
DNP3	Distributed Network Protocol
RNM	Remote Net Metering
CDG	Community Distributed Generation
DER	Distributed Energy Resources
CESIR	Coordinated Electric System Interconnection Review
DOB	Department of Buildings
DEP	Department of Environmental Protection
DEC	Department of Environmental Conservation
VDER	Value of Distributed Energy Resources