



# Interconnection Guide for Distributed Generation

This guide provides information on the Massachusetts interconnection process for customers and developers. This process is an essential step when installing solar, small wind, and other on-site generation technologies classified as **distributed generation** (DG). Each distributed generation installation must be reviewed and approved for interconnection to the distribution system by the local electric utility and appropriate local municipal inspectors. This guide explains the basics of distributed generation and how the electric grid works, and it provides detailed information on the interconnection process.

## Section 1: Introducing Distributed Generation

### What is Distributed Generation?

Distributed generation is any electricity generating technology installed by a customer or independent electricity producer that is connected at the **distribution system** level of the electric grid. This includes all generation installed at sites owned and operated by utility customers, such as photovoltaic systems serving a house or a cogeneration facility serving an office. It also covers any commercial-scale or net-metered generation that is connected to the grid at the distribution level versus the transmission level.

### How Does the Electric Grid Work?



**Bulk Power System  
(Wholesale Electricity)**

**Local Distribution System  
(Retail Electricity)**

Image from ISO New England

The conventional electric grid is a web of interconnected circuits that move electricity from generators (power plants that produce electricity) to customers. These parts are as follows:

- **Generator:** Produces electricity, typically at large, central power plants.
- **Transmission System:** Transmits large amounts of electricity from the generator over high-voltage wires to the distribution system.
- **Distribution System:** Reduces the voltage of electricity from the transmission system through **substations** and distributes it over lower-voltage wires to individual customers within a region. A local utility (Unitil, Western Massachusetts Electric Company, National Grid, NSTAR, or a municipal utility) owns and operates these wires.
- **Customer:** At the customer site, electricity is stepped down again through a transformer. A meter measures how much electricity each customer is using.

With the advent of small generation technologies that can be installed by a utility customer, a reversal of sorts occurs. A generator installed on a customer site, or **behind the meter**, can be interconnected with the distribution system to ensure reliable power from the utility when the generator is not in service. Additionally, some developers connect generators directly to the distribution system rather than the transmission system. This is becoming more common with the advent of more liberal net-metering rules in Massachusetts. Both types of installation are known as distributed generation.

### How Do I Know Whether My System is Considered Distributed Generation?

If you are a customer installing a generation system on your home, business, or other privately-owned property, you are installing distributed generation. If you plan to connect this system to the utility, you will need to follow that utility's interconnection process.

Larger systems installed by developers may also be considered distributed generation if they are connected to the distribution system rather than the transmission system. In these cases, the developer will need to engage in discussion with the utility to determine whether this type of interconnection is appropriate for the project.

### Why Install a Grid-Connected System?

The main benefit of installing a grid-connected distributed generation system is the assurance of receiving power from the utility when your system is not running. This is essential for many renewable technologies like solar and wind, which produce intermittent power and for other technologies that may need to be shut down for periodic maintenance.

While some customers install distributed generation as a primary source of power, others may install it as backup generation for critical electric loads when the utility is not able to provide power due to storms, blackouts, or other unexpected events.

An additional benefit for small generators is the ability to sell power back to the utility. In Massachusetts, generators that produce up to 2 MW\* are eligible for net metering, where the customer receives payment for unused power that is fed back into the distribution system. In some cases, larger generators may also establish power purchase agreements with their utility.

\* Eligibility varies by technology and project owner. For public entities installing wind or solar systems the cap is 2 MW *per unit*. For private entities installing wind or solar the cap is 2 MW per project. For more information on net metering see the [Net Metering Frequently Asked Questions and Answers](#).

## What Are My Other Options?

The alternative to a grid-connected system is an **off-grid system**, where the generator serves all or an isolated part of the electric load on site. Off-grid systems can make economic sense for sites that are far from existing utility lines. An off-grid system connected to an isolated load may also be necessary if the site is located on a utility's area network, where interconnection is challenging.

A second option is to interconnect a system to the transmission level of the grid. However, this process typically is longer and requires more documentation than interconnection to the distribution system. It is typically only considered by large generators, who may also need to go through outside reviews.

## Section 2: Introducing Interconnection

### What is the Interconnection Process?

The interconnection process is the process of getting approval from your local utility (or distribution company) to connect a distributed generation system to their electric grid (or distribution system). This process is used by the four investor-owned utilities in Massachusetts (National Grid, NSTAR, Western Mass Electric, Until). Municipally-owned utilities are not required to follow this process and may use different criteria for review. When you apply to an investor-owned utility for interconnection, the utility reviews your project to make sure there are no negative impacts on the grid. If potential impacts are identified, the utility will request additional review and in some cases will require you to pay for new equipment to protect the grid. Additional reviews and equipment generally do not apply to small renewable generation, but may apply to larger projects, more complex projects, or generation that is located on a network system in a high density or high-load area where power flows through a complex web of power lines that connect to individual customers through multiple paths.

Please see the [Interconnection Tariff](#), which was updated in 2009, for the details of the process and the requirements for interconnection. The Tariff includes information regarding technical operating requirements, metering and billing options.

### Why Do I Need to Apply for Interconnection?

Whether you are selling power back to the utility or using it all on-site, a distributed generation system will alter your electric load and the one-way flow of electricity from utility to customer. This presents potential risks to the safety of utility workers, performance of the grid and power quality for other customers. To ensure these risks do not exist or are sufficiently mitigated for a specific project, the local utility must review and approve each proposed distributed generation project before it is installed.

The interconnection standards implemented by the Massachusetts Department of Public Utilities (DPU) require every customer installing distributed generation to obtain approval from the local utility before installing and turning on this generation. If you are planning to interconnect, it is essential that you go through this process - installing an interconnected system without utility approval is illegal.

### How Does the Process Work?

It is the customer's responsibility to start the review process by requesting an application from the local utility serving the planned generator site. Once you send in a complete application and fee, the utility will begin its review. The utility may contact you at different points throughout the process for additional information or to notify you that the project has passed or failed one of the review steps.

A project will follow one of three review paths (simplified, expedited, or standard) based on its generation type and size, customer load, and the characteristics of the grid where the generator is to be located. Each track has specific timeframes and fees. It is essential to submit all application materials, additional information, and fees in a timely manner as the review timeframe does not include periods where the utility is waiting for additional information.

At any point in this process, the customer may elect to withdraw from the review and not pursue the installation. If the project fails all possible review avenues or if the customer is unwilling to make required modifications, the utility may deny approval to interconnect. However, projects greater than 2 MW applying for interconnection to 13 kV circuits may require additional analysis and may take longer.

### **Who is Involved?**

You, your local utility, town and local inspectors, and often the contractor installing your system all play a role in the interconnection process. Your local utility is the distribution company that serves the site where you are installing a distributed generation facility. The contractor may be needed, even for small systems, to provide technical information on your system required by the utility. The timeframe for each step of the review pauses whenever the utility requests additional information on the project, so it is essential to respond to these requests as quickly as possible.

### **When Do I Need to Start the Process?**

It is ideal to begin the application process as soon as possible after you have all the information required for the application form. Because the application requires a certain level of technical detail, this will typically occur at the end of the project's design phase. If you are learning about the process after beginning construction, it is still possible to apply for interconnection, though additional costs may be incurred. By no means should you interconnect and start a generator before receiving approval to interconnect. If you have done so, you must contact the utility immediately to determine the steps that need to be taken to disconnect the system and apply for interconnection.

Although you do not need to formally apply for interconnection until the end of the design phase, you may wish to contact your utility much earlier in the process in order to identify any unique circumstances which could affect interconnection feasibility and cost.

## **Section 3: The Interconnection Process**

### **Step 1: Determine Your Utility**

Massachusetts is served by four investor-owned utilities that serve 304 communities and 40 municipal utilities that serve part or all of 50 communities. The Massachusetts interconnection standards are used only by the investor-owned utilities. Use the following maps to determine which utility serves your area:

Northeast Gas Association: Regional Natural Gas Systems Map – For natural gas projects

Massachusetts Electric Utility Providers – For all other renewable energy projects

If you are served by a municipal utility, you will need to contact them directly to determine what their interconnection process is. A list of contacts for municipal utilities can be found on the [Massachusetts Municipal Wholesale Electric Company \(MMWEC\)](#) website.

### Step 2: Review Rules and Tariff Documents

Once you have determined your utility, you will need to review your utility’s interconnection tariff. Each of the utility tariffs is based on the uniform statewide standards approved by the Department of Public Utilities (DPU), and is largely identical to the statewide standards. However, each utility's tariff should be used as the source for formal documents for all projects in that utility territory, including application forms and standard contract terms. The tariffs also include charts showing the time frames for different steps in the interconnection process, and potential fees.

See your utility’s tariff or contact your utility representative for the most up to date interconnection information and application forms:

	National Grid	NSTAR	WMECO	Unitil
<b>Tariff</b>	<a href="http://www.nationalgridus.com/masselectric/non_html/rates_tariff.pdf">http://www.nationalgridus.com/masselectric/non_html/rates_tariff.pdf</a>	<a href="http://www.nstaronline.com/business/rates_tariffs/interconnections/">http://www.nstaronline.com/business/rates_tariffs/interconnections/</a>	<a href="http://www.wmeco.com/aboutwmeco/ratestariffs.aspx">http://www.wmeco.com/aboutwmeco/ratestariffs.aspx</a>	<a href="http://services.unitil.com/mass/electric_tariff.aspx">http://services.unitil.com/mass/electric_tariff.aspx</a>
<b>Web Site</b>	National Grid Interconnection Web Site	NSTAR Interconnection Web Site	Residential Business Customers	Unitil Interconnection Web Site
<b>Contact</b>	Alex Kuriakose 781-907-1643 <a href="mailto:Alex.Kuriakose@us.ngrid.com">Alex.Kuriakose@us.ngrid.com</a>  Serge Khalife 781-907-2235 <a href="mailto:Serge.Khalife@us.ngrid.com">Serge.Khalife@us.ngrid.com</a>  Distributed.Generation@us.ngrid.com	Joe Feraci 781-441-8196 <a href="mailto:Joseph.Feraci@nstar.com">Joseph.Feraci@nstar.com</a>	Cindy Janke 413-585-1750 <a href="mailto:jankecj@nu.com">jankecj@nu.com</a>	Tim Noonis 603-773-6533, <a href="mailto:noonis@unitil.com">noonis@unitil.com</a>

### Step 3: Determine the Review Process

Once you have reviewed your utility’s specific interconnection tariff, you must determine the review process to which you should apply. The process, forms, fees, and timeframes will differ significantly based on the characteristics of your distributed generation technology and its proposed location on the electric grid so you will need to determine which review process is appropriate for your project. The three review options are:

<b>Simplified</b>	<b>Expedited</b>	<b>Standard</b>
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For PV and other inverter-based technologies served by radial systems, 10 kW or less 1-Phase or up to 25 kW 3-Phase	For inverter-based systems greater than 10 kW 1-Phase or greater than 25 kW 3-Phase, and other systems of all sizes that are served by radial systems and meet additional requirements	All projects not eligible for simplified or expedited review, including all systems on area networks
<b>Typical projects:</b> small photovoltaics, demonstration or homeowner wind	<b>Typical projects:</b> certified large renewables, cogeneration, and other turbines or engines of any size	<b>Typical projects:</b> uncertified large projects, unusually complex projects, or projects of any size located on area networks

The simplified process is the shortest, least expensive, and most straightforward review. This is followed in complexity by the expedited review and then the standard review.

Knowing the following information about your project will help determine which review process to apply for and which forms to fill out:

- **System Characteristics:** generator type, inverter type (where applicable), location, transformer, circuit, protective relay, equipment locations
- **Permitting Requirements:** A variety of permits are required for distributed generation beyond the interconnection process. In particular, the utilities require you to note on your application whether air permits have been received.
- **Location on Network System:** One factor that determines which process you go through is whether your system is on a radial system, spot network, or area network on the electric grid. While it is not possible to determine whether your exact location is on a network before applying, the box below lists the cities and towns where area networks are located within each utility region.

<b>AREA NETWORKS</b>			
<i>Portions of the following cities are served by area networks. To determine whether a specific project is served by the area network system, you must contact your utility.</i>			
<b>Western Massachusetts Electric Company (Northeast Utilities)</b>	<b>Fitchburg Gas &amp; Electric (Unitil)</b>	<b>Massachusetts Electric Company &amp; Nantucket Electric Company (National Grid)</b>	<b>NStar</b>
Greenfield Pittsfield Springfield West Springfield	Fitchburg	Brockton Lynn Worcester	Boston – substantial areas New Bedford Cambridge – Inman Square, Harvard Square, Arsenal Square, Peabody Terrace, Garfield Davenport, Fresh Pond, City Hall, Central Square, Tech Square, 3 <sup>rd</sup> and Cambridge

**Step 4: Fill out the Interconnection Application**

Although you may choose to contact your utility earlier on in the process, you should begin your formal application at the end of the project's design phase, when you have the specific details of the project. Since the interconnection application requires detailed technical information, a specialized engineer should fill out the application.

### **Step 5: Execute the Interconnection Agreement**

Following approval of an interconnection, you will be required to sign an interconnection agreement with the utility. Your system must be installed within 12 months of this agreement's execution, and if it is installed after this period you will need to submit a new application.

### **Step 6: Resolve A Dispute If It Occurs**

If there is a dispute over an application, the interconnection standards released by the Massachusetts Department of Public Utilities (DPU) include a dispute resolution process with required steps for bringing disputes between interconnecting customers and their local utilities to resolution. This is a multi-stage process beginning with negotiation, then mediation, followed by non-binding arbitration (DPU), and then adjudication.

The dispute resolution process is described in full in Section 9.0 of the [Interconnection Standards](#) released by the DPU.

## **Additional Resources:**

[DOER Massachusetts DG and Interconnection Main Page](#) - Provides detailed interconnection information on interconnection as well as notice of workshops and other events

[SEBANE Renewable Generator Certificate Trading Handbook](#)

[Wind Interconnection & Net-Metering in MA - NSTAR & National Grid Presentation](#)