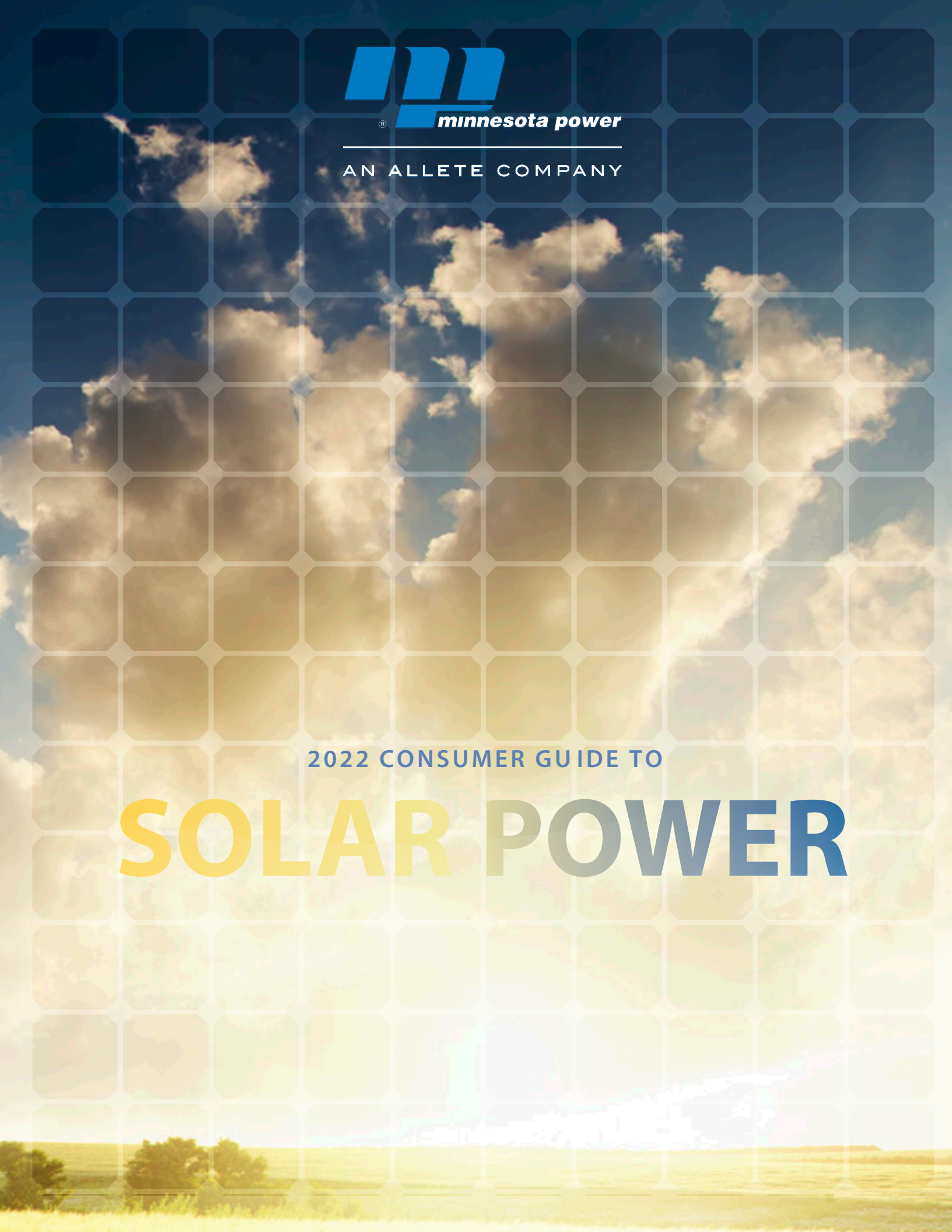

minnesota power
AN ALLETE COMPANY
2022 CONSUMER GUIDE TO
SOLAR POWER

minnesota power

AN ALLETE COMPANY

EnergyForward

mnpower.com/environment/EnergyForward

*Energy**Forward*** is how we are doing our part to provide safe, reliable and clean energy while helping to transform the way energy is produced, delivered and used. We're strengthening the electric grid that delivers energy to homes, businesses and industry. We're generating more power from renewable sources like the wind, water and sun. And we're helping customers find ways to understand, manage and reduce their energy use.

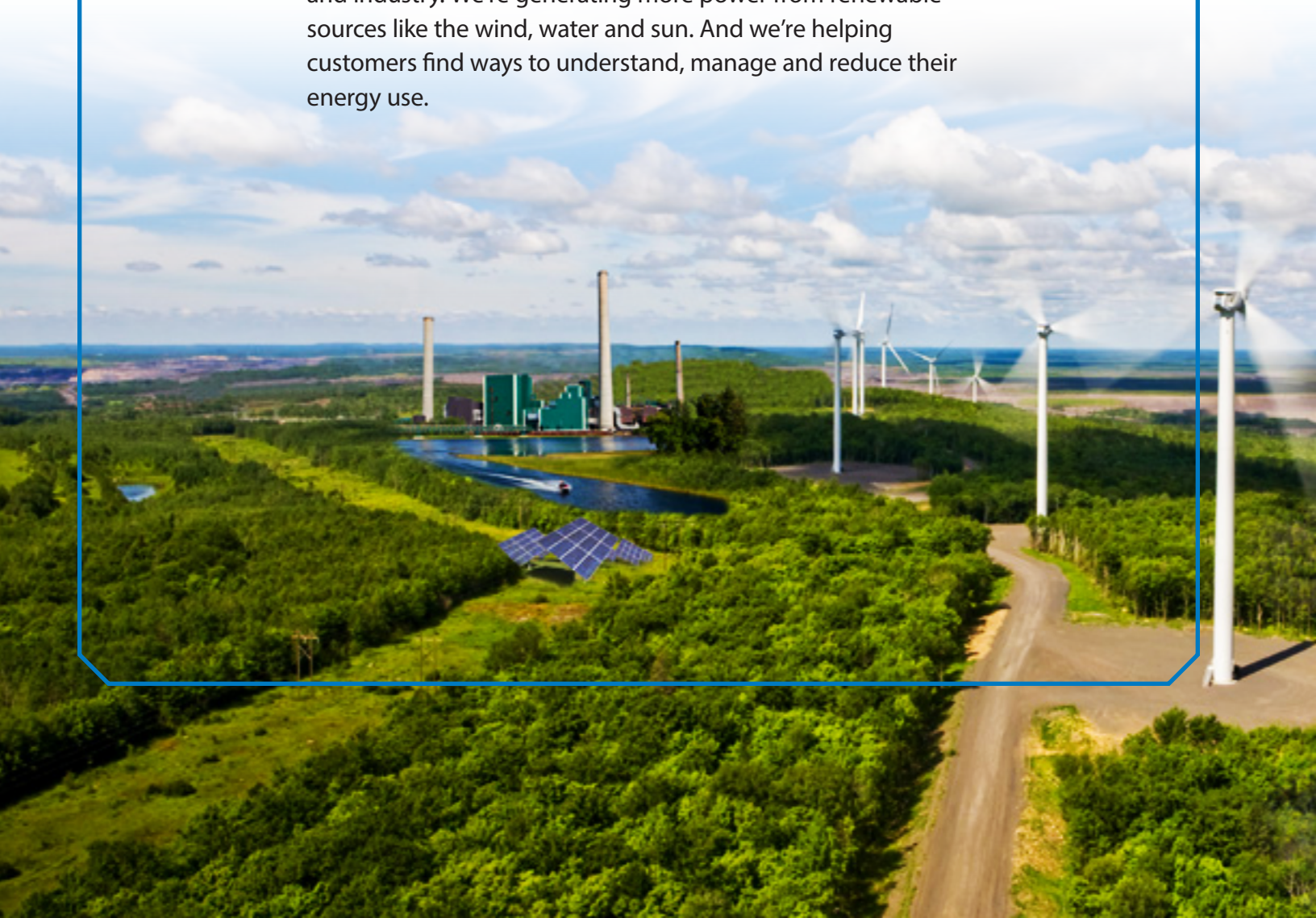


TABLE OF CONTENTS

This guide is intended for solar PV systems 40 kW and under. Contact Minnesota Power for information regarding systems larger than 40 kW, as there may be other considerations.

ENERGY FROM THE SUN

Minnesota Power has long encouraged the adoption of renewable energy such as solar. We began offering rebates for customer-owned solar energy systems through our SolarSense program in 2004. Today, as interest in capturing energy from the sun increases and the costs associated with solar power decrease, we continue to help customers understand how they use energy and how to get the most value from their energy investments.

This guide will help you learn how you can use the sun to power your home or business and walk you through the process of installing a solar photovoltaic system.

HOW DOES SOLAR WORK?

Solar power is energy harnessed from the sun's rays. We can make use of that energy in three main ways: passive, thermal, and photovoltaic, or PV, systems.

Passive solar energy systems use building design to maximize or minimize the energy found in sunlight for heating, cooling, and lighting. Solar thermal technologies use the heat energy from the sun to heat water or air. Solar PV systems generate electricity directly from sunlight by way of solar panels. While all of these are available in our region, this guide focuses on solar PV systems.

The panels used in PV systems are made up of solar cells that convert sunlight into electrical energy in the form of direct current, or DC. That energy is then routed into an inverter which converts the energy from DC to alternating current, or AC, that can be used to serve the electrical needs in your home or business.

There are three main types of solar PV systems: grid-tied, grid-tied with battery backup, and stand alone. Grid-tied and battery backup systems are by far the most commonly installed solar PV systems in the market today. Customers considering a stand-alone solar PV system should work with their solar installer to ensure that the system is sized and sited properly to meet their electrical needs. Costs and maintenance requirements vary among these three systems.

Grid-tied (PV) system

- Most common.
- Least expensive.
- Requires least maintenance.
- Connects directly to the electric distribution grid.
- Produces electricity used to power the loads in your home or business. Any excess energy is sent back into the utility grid to be used elsewhere.
- Automatically disconnects when there is an outage in order to prevent damage to equipment or personnel.

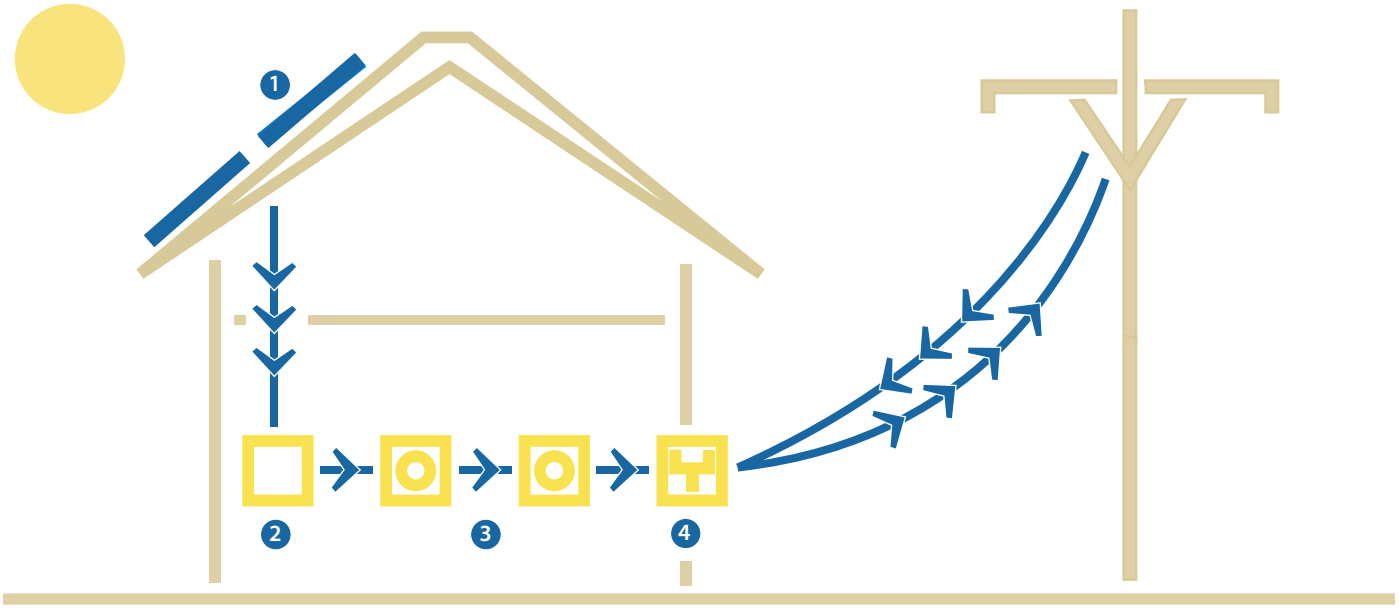
Grid-tied with battery backup system

- Less common than standard grid-tied systems.
- More expensive than standard grid-tied systems.
- Requires more maintenance.
- Has a battery component that allows it to continue functioning when there is a utility grid outage.
- Batteries aren't typically meant to power an entire home for a long period of time.
- Commonly installed when there is a need to back up critical loads.
- Has additional interconnection requirements.

Stand-alone system

- Least common type of PV system.
- Most expensive of the three types of PV systems.
- Operates independently of the grid.
- Commonly used in remote areas where the cost of bringing utility power to a site is very high.
- Must be carefully planned to match the home's energy needs to the system's size and storage capabilities.

THE PARTS OF A SOLAR PV SYSTEM



Solar PV systems capture sunlight and convert it into electricity that can be used to power your home or business. Basic grid-tied solar systems consist of solar panels, inverters, racking, meters and disconnect switches. Optional components include monitoring systems and batteries.

1 Solar panels or modules. Individual solar cells are connected in groups called panels or modules. When the sun hits a solar panel, it allows photons, or particles of light, to knock electrons free, creating a DC flow of electricity. There are three main types of solar panels:

Monocrystalline. These panels have the highest efficiency due to the process of forming the silicon crystals. Because of their high efficiency, they are also more expensive than other solar panel technologies available today. This technology is ideal for roof-mounted systems because it is the most space efficient. You need fewer panels to produce the same amount of energy as other types of solar panels.

Polycrystalline. Polycrystalline solar panels are created using a less-intensive method of forming the silicon crystals. They tend to be slightly less efficient than monocrystalline panels but also cost less.

Amorphous or thin film: These panels are relatively inexpensive to produce but also have the lowest conversion efficiency of the solar panel technologies. Some amorphous panels are flexible and can be used in a variety of applications. This technology is suitable for large rooftops or open fields because it takes more thin-film panels to produce the same amount of electricity as traditional silicon panels.

2 Inverters. The DC electricity generated by solar panels is converted into AC by inverters. All grid-tied inverters are designed to disconnect from the utility grid when the utility experiences a disruption in power because of an unexpected outage or scheduled maintenance. Two main types of inverters are used in grid-tied solar applications:

String Inverter. String inverters are the most commonly used inverter for grid-tied PV systems. They allow the electricity output from multiple modules to be converted from DC to AC at the same time. Although they may be built to handle Minnesota's harsh weather, they are likely to last longer and perform better in a protected environment.

Microinverter. With these inverters, the conversion from DC to AC takes place at each individual solar panel. The inverters are affixed to the back of each panel and control only that panel. Microinverters can diminish the effects of shade on a PV system's total output because each solar panel has its own microinverter. If only one section of the solar array is shaded, it won't affect the rest of the system's output. Since these inverters are connected to the solar panel, easy access to the panels needs to be maintained.

3 **Meters.** Installing a solar PV system requires exchanging your current meter for a bidirectional meter and installing a second meter for measuring the production from your solar PV system.

Bidirectional meters record the energy that you purchase from Minnesota Power minus the energy that you sell to Minnesota Power to get your net usage. The net usage could be a positive number, meaning you used more energy than your solar system generated. Or, the net usage could be a negative number, meaning your system generated more energy than you used and the excess was sold to Minnesota Power. Information from this meter is used for billing and allows Minnesota Power to credit your account for excess generation that your system produces during the billing cycle.

Production meters track the actual amount of electricity produced by your solar PV system. It is not used for billing purposes. Minnesota Power will provide the production meter and meter socket to customers installing a grid-tied solar PV system. However, ownership of the meter socket will be transferred to the customer and any future meter socket maintenance will be the customer's responsibility. The production meter must be installed within 10' of the bidirectional meter.

4 **Disconnect Switches.** These switches are required on all grid-tied solar systems. One disconnect switch is located on the DC side of the inverter and is often integrated into the inverter. Another disconnect is required on the AC side of the inverter. The disconnect switches allow utility and fire safety personnel to verify that the system is safely disconnected from the utility grid while performing maintenance or responding to an emergency. Minnesota Power requires that a disconnect switch on the AC side of the inverter be a visible open, lockable disconnect located within 10 feet of the utility meter. This allows the disconnect switch to be readily accessible at all times.

Other Parts of a PV System

Racking. PV modules are attached to the roof of a building or to a ground-mounted structure with racking. Consider wind and snow loads when choosing the racking method for your system. Ground-mounted "tracking" systems also are available. They use motors to track the sun throughout the day and move the solar array for optimal sun exposure. While trackers do increase the production, they also increase the cost of the system and are more susceptible to malfunctioning parts.

Balance of System. Many small parts are needed to complete a PV system. This can include wires, conduit, junction boxes, and wire management. Costs for these components can range significantly and depend on the unique circumstances of each installation.

Monitoring Systems. An optional component, monitoring systems can usually be added to your solar PV system for a fee. These can typically be purchased through the inverter manufacturer, your installer, or a third-party vendor and allow you to see performance metrics of your system. Some of this information may also be available on your inverter's display screen. Many inverter manufacturers include monitoring as a part of the inverter purchase.

Batteries. In grid-tied systems, batteries may be used as optional backup power. During a power outage, basic grid-tied systems are designed to automatically disconnect from the grid, meaning the customer would be out of power. Battery backup systems allow the solar PV system to disconnect itself from the utility grid but continue to operate using energy stored in the batteries. Battery-based systems are more expensive and require more maintenance than basic grid-tied systems.

IS SOLAR RIGHT FOR ME?

Reasons for investing in solar energy are as individual as each customer. But whatever your motivation, you'll want to consider how much sun is available at your site and how much a solar installation will cost.

SOLAR RESOURCE

Solar resource refers to the amount of solar energy available in a given area and is measured in two ways: irradiance and insolation. Solar irradiance is the amount of instantaneous power that falls on a given area at a single point in time while solar insolation measures the irradiance over a defined period of time. Installers use solar insolation to help predict the output of a PV system.

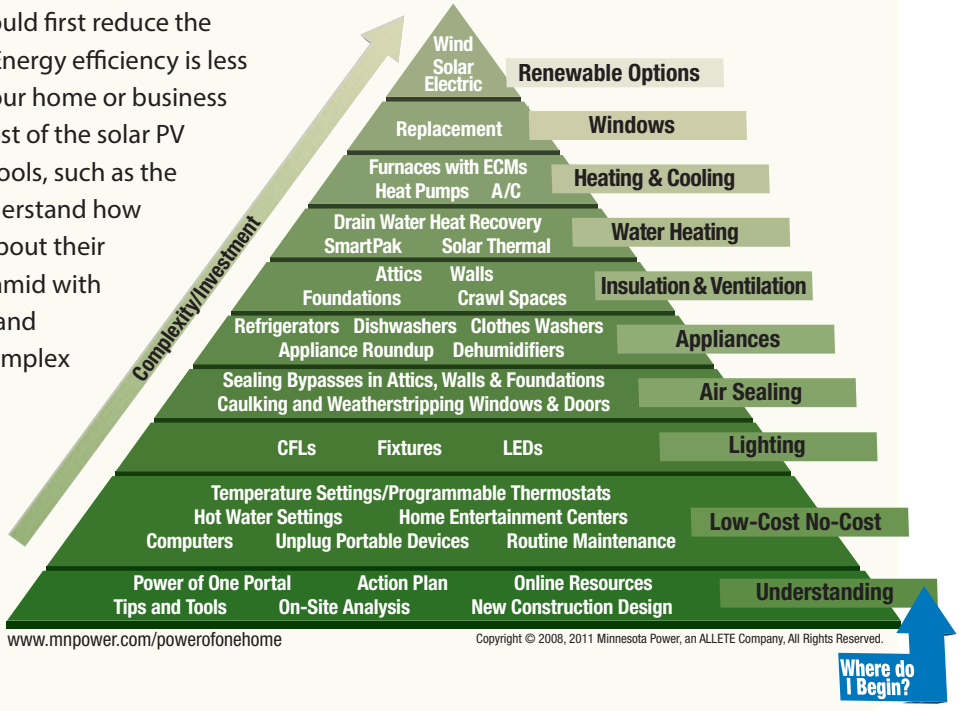
Many tools are available to help customers calculate how much electricity a PV system is expected to produce. PVWatts, for example, is an online tool developed by the National Renewable Energy Laboratory that allows customers to enter their location and the size of their proposed PV system. It then uses local weather data and information about the proposed system to determine estimated production and energy value. Find the calculator at **pvwatts.nrel.gov**

While it is true that Minnesota does not have the best solar resource in the country, you may be surprised to learn that we do have a solar resource similar to some areas in Texas and Florida. It is also important to note that solar PV systems can actually perform better in cooler climates like Minnesota.

ENERGY EFFICIENCY AND THE PYRAMID OF CONSERVATION

Before deciding to install a solar system, you should first reduce the amount of energy your home or business uses. Energy efficiency is less expensive than energy production so making your home or business more energy efficient will reduce the size and cost of the solar PV system that is needed. Minnesota Power offers tools, such as the Pyramid of Conservation, to help customers understand how they use energy and make informed decisions about their energy investments. Start at the base of the pyramid with low-cost or no-cost energy efficiency upgrades and work your way up to more expensive or more complex energy investments, such as renewable energy options like solar.

Learn more about energy efficiency and find tools for reducing your energy usage at: **www.mnpower.com/energyconservation**

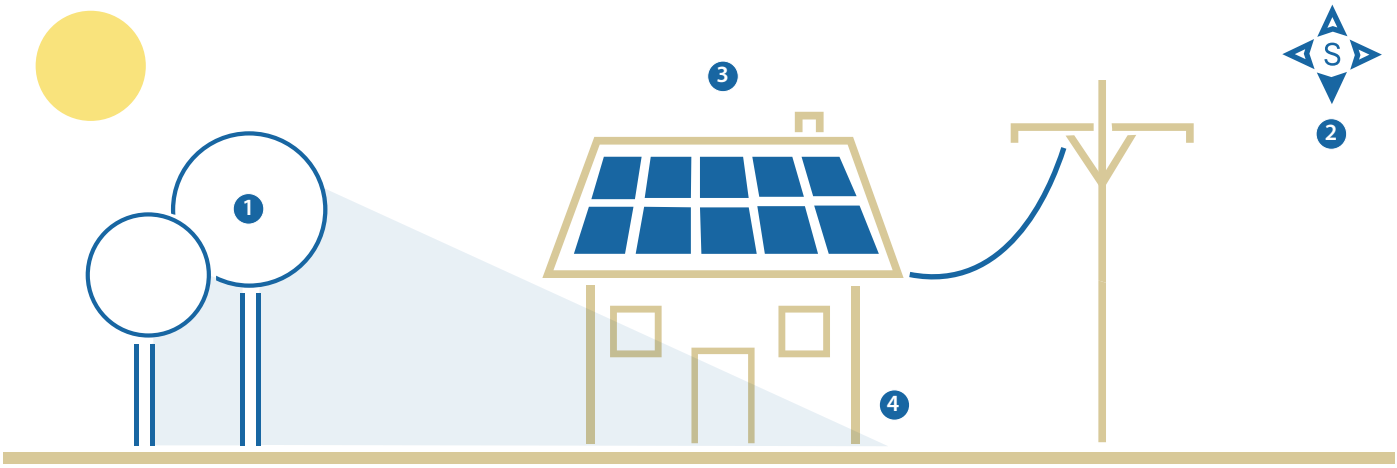


While it may seem logical that more sunshine means more solar power, this is not always the case. In some areas, such as the Southwest, the sun's intensity actually hinders the operation of rooftop solar panels. In fact, with the same amount of sunlight, solar panels in cooler areas generally produce more electricity than those in locations with intense heat.

Edison Electric Institute, www.eei.org

COMMUNITY SOLAR GARDEN — ANOTHER CUSTOMER OPTION

Minnesota Power's first community solar garden, is generating electricity and is a simple way for customers to participate in solar without the need to install a system on their own home or business. It's a safe, flexible and convenient choice for customers who want to go solar but either rent or don't have a location that is well-suited to generating electricity from the sun. You can learn more about this option on our website at: **www.mnpower.com/CommunitySolar**



SITE ASSESSMENT

When planning the location and design of your solar PV system, it is important to conduct a site assessment to identify specific conditions that can affect energy production and overall system design. Shade, orientation, roof characteristics, utility interconnection, aesthetics and accessibility all play a role in the design and cost of the system and should be identified by your installer upfront.

1 Shade

Shade can make a big difference in how much energy a PV system produces. The shade cast by trees, nearby houses or buildings, chimneys and even power lines should all be considered when deciding where to locate your solar system. Tools such as the Solmetric SunEye and Solar Pathfinder can identify where shade will occur at different times throughout the year and are used by installers during a site assessment to develop a shade analysis. In addition to existing obstructions, it's important to think about the possibility of developments or structures that could shade your PV system in the future. Generally, an ideal site for producing solar power should be free of almost all shade from 9 a.m. to 3 p.m.

2 Orientation

Whether your system is roof or ground mounted, you will need to consider the orientation of your solar PV system. Orientation refers to the azimuth, or direction that the modules face, and the tilt, or angle of the modules. In our region, the ideal orientation for maximum output is when the array faces south, or at a 180 degree azimuth, with a tilt angle of 45 degrees.

3 Roof Condition

For roof-mounted systems, you will want to consider your roof's condition and structural integrity before installation. Solar PV systems will add a variety of stresses to your roof, including additional weight. Any necessary roof maintenance should be done before or in conjunction with the installation to avoid having to remove the system later to make repairs.

4 Accessibility

Locate your PV system in such a way that it is easily accessible for routine maintenance such as removing snow or cleaning modules, troubleshooting performance issues or replacing worn or damaged parts. Roof installations also must meet all clearance requirements in order to avoid potential hazards.

SOLAR ENERGY ANALYSIS PROGRAM

A Solar Energy Analysis (SEA), free for Minnesota Power customers, is a great way to get more information about whether solar power is a good fit for you. During an SEA, a representative from Minnesota Power will visit with you about your home or business, analyze your site, help you understand the interconnection process and point out site-specific conditions that could affect an installation.

Contact Minnesota Power at **218-355-3720** or renewableprograms@mnpower.com to schedule a Solar Energy Analysis. For more information about the Solar Energy Analysis program and a sample SEA summary, see Appendix page 30.

UTILITY INTERCONNECTION

In a grid-tied system, you must apply for connection to the utility's distribution grid. The application should be submitted early in the process to ensure that utility requirements are incorporated into the system design. In addition, your interconnection application must be approved by Minnesota Power before the system is installed. Systems installed prior to obtaining approval from Minnesota Power are done at the risk of the customer.

COST

The costs of solar PV systems vary depending on technology, system type, and size, and are typically referred to as hard costs and soft costs. Hard costs are the actual PV system components such as solar modules, inverters, disconnect switches, wires, conduit and meters. The soft costs refer to the customer acquisition costs, installation time and labor, travel and local permitting or application fees. These two figures together represent the total installed cost of the system which is typically expressed as $/watt.

The cost to install solar has dropped dramatically over the last decade, making solar more cost effective than ever. According to the Lawrence Berkeley National Laboratory, the cost of a solar PV system in Minnesota has dropped from more than $9/watt to an average of $3.20/watt today.[1]

Despite the declining costs, solar PV systems remain a large investment and usually require a sizeable upfront payment. We encourage you to consult multiple installers and explore different manufacturers and products in order to ensure that you are getting the most competitive price for your system.

[1] Tracking the Sun 10: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States, Sept. 2018.

WHERE DO I START?

Installing a solar PV system is a collaborative process. The customer, installer, electrician, local inspector and Minnesota Power should work together to ensure that the PV system operates safely and reliably. Involving Minnesota Power early in the process will help you understand the interconnection process, as well as the standards and requirements for installing a solar PV system connected to Minnesota Power's electric grid. Ensuring that these requirements are incorporated into the design of the system before construction will help you save time and money on your investment.

INTERCONNECTION REQUIREMENTS

To ensure safe installations, all grid-tied PV systems must meet relevant provisions of the National Electrical Code (NEC), the Institute of Electrical and Electronics Engineers (IEEE 1547), Minnesota Statute 216B.164, Minnesota Rules Chapter 7835 and electric utility requirements. Installations must also comply with all local permitting and zoning codes, fire codes, building codes, safety codes and local and federal laws, rules and requirements. The customer is responsible for ensuring that the installer follows all applicable rules and codes, including Minnesota Power's interconnection process and requirements.

For more information about specific interconnection requirements, visit **www.mnpower.com/distributedgeneration**

5 STEPS TO SOLAR

Contact Minnesota Power as soon as possible after you decide to go solar. We'll help you start the important interconnection process and identify some key factors to keep in mind as your installation gets underway. Follow these steps to install and connect your system and you'll be on your way to generating your own clean energy!

1 Select an installer

Hiring a qualified solar installer is key to getting an efficient system and the most value from your investment.

Installing a solar system should be treated the same as any major construction project: get multiple bids to ensure a competitive price, request references from past customers and review systems already installed to gauge the installer's experience. In addition, review your energy consumption and talk with your installer about your usage. Understanding trends in your energy consumption may affect the design of the system you choose to install.

Solar installers typically conduct a site assessment that includes a visit to your home to analyze potential shade issues, orientation of the system, size and pitch of your roof and other factors. The assessment may be offered as a free service or you may be charged a fee. Installers may provide other services, such as facilitating the application process and securing permits, as part of their offer. Some installers may also include a warranty on their workmanship. Be sure to ask what types of warranties are available when comparing installers and what post-installation factors may affect the warranty.

Questions to ask your installer:

- *Are you certified with the North American Board of Certified Energy Practitioners (NABCEP) or do you hold any other nationally recognized solar installer certifications?* Minnesota Power requires a NABCEP or UL certified installer to qualify for rebates under its SolarSense program.
- *Do you have any experience working with local building officials and utility representatives?*
- *Can you provide references from previous customers?*
- *Do you offer a warranty on the installation?*
- *What is the expected output of the system and who is responsible if the expectations are not met?*
- *What is the cost per watt on this proposal?* Be sure to get quotes from multiple installers to compare.
- *What is the warranty period of the equipment and the installation?* There are equipment warranty requirements to participate in Minnesota Power's SolarSense program but you should also be sure that your installer has a warranty on the installation of the system.
- *What type of down payment or deposit is required and under what terms (refundable, non-refundable)?*

2 Submit an Interconnection Application

Once you have selected a solar installer and designed a system that meets your needs, the next step is to submit an application to Minnesota Power for connecting your system to the distribution grid.

Make sure your application is complete, including a one-line diagram of the planned system, site drawing, equipment specification sheets, and any other required information in order to ensure a timely review. Installers often will complete the interconnection application for you but because the interconnection agreement is between you and Minnesota Power, it's important that you understand the requirements and what is being submitted. You must submit a MnDIP application for all interconnections. If you are applying for SolarSense rebates, a supplemental application is also required. A $100 application fee applies for each application and may be submitted to Minnesota Power by check to: Renewable Programs 30 W Superior Street, Duluth, MN 55802.

3 Preliminary Review

Once you have submitted a complete interconnection application, Minnesota Power will conduct a preliminary review.

A Minnesota Power representative will come to your site to assess the planned system and your current service to identify site-specific conditions that may affect the installation. During the preliminary review, equipment from the utility transformer to the customer's service equipment will be evaluated. This evaluation includes, but is not limited to, meter sockets, transformers, weather heads and clearance issues. If any hazards are identified, you will be notified at this time. Minnesota Power will work with you to understand the hazards, evaluate ownership and cost details of the issues in question, and identify possible solutions.

The preliminary review process allows Minnesota Power to ensure that all distributed generation systems are installed in a safe, consistent and reliable manner. It is important that you do not begin construction of your system until the preliminary review is completed and approved.

4 Installation

You can begin building your PV system after receiving approval from Minnesota Power.

All solar PV systems must be inspected by a state or local inspector after they are completed and before being energized. After the system has passed an electrical inspection, contact Minnesota Power to schedule the final commissioning test. This test allows Minnesota Power to verify that the system was installed as planned and that there are no safety concerns relative to the interconnection.

If there are any changes to the system components or design during the installation process, notify Minnesota Power prior to installation. Changes may require you to submit a new interconnection application and restart the process. It is important for changes to be approved to ensure the system passes the commissioning test and timely interconnection can occur.

5 Connect to Minnesota Power

The final step is to connect your system to Minnesota Power's distribution grid.

Once your system meets all commissioning requirements, your existing meter will be exchanged with a bidirectional meter, a production meter will be installed, and your rate will be changed, generally to a net energy metering rate. The bidirectional and production meters will not be installed until all commissioning requirements are met.

We encourage customers to be cautious about installing solar systems in the fall and winter because snow and frost can complicate the process and even increase installation costs. Be sure to give yourself plenty of time in order to avoid weather-related issues.

A typical solar module comes in two sizes, 60 or 72 cell. They are about 18–22 square feet, weigh about 45-55 pounds, and are rated to produce about 300-400 watts.

NET ENERGY METERING

Depending on the size of the system that you choose to install, you may be eligible for net energy metering, also called NEM. NEM is a rate offered to Minnesota Power customers that credits the customer's account for any excess electricity that the PV system generates.

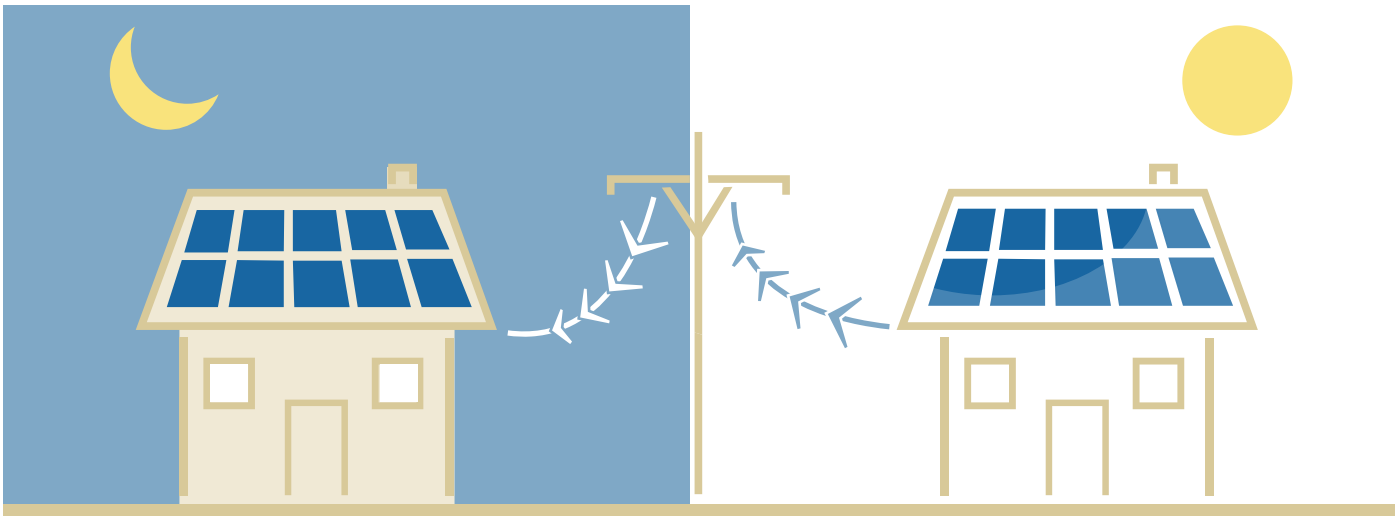
A solar PV system may produce more or less electricity than is needed in your own home or business at any given time during the month. When your system produces more energy than you need to meet your own needs, the excess energy is sent to Minnesota Power. If you produce more than you use in a billing month, you receive a credit for the excess production. Likewise, if your system does not produce enough electricity to serve your needs, you will be able to take energy from the grid at the current rate.

Because you could be taking electricity from the grid and sending electricity to the grid, you will need a special meter that can track energy forward and backward. This bidirectional meter must be installed by Minnesota Power before your solar PV system is energized so your system's production can be properly credited.

WHY IS THE GRID IMPORTANT?

The grid refers to the poles and wires that deliver electricity to your home or business. All customers must pay to build, operate and maintain the grid infrastructure to ensure a safe and reliable energy supply.

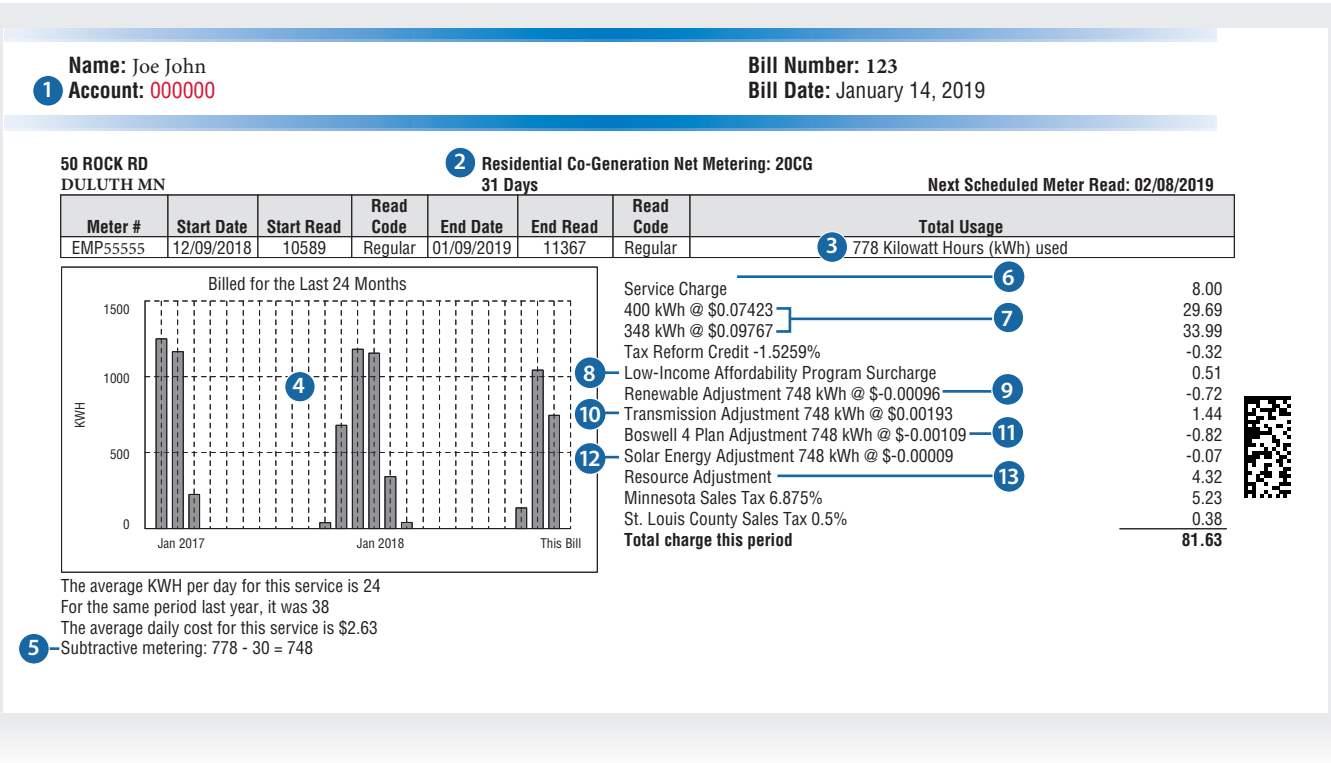
Customers with grid-tied solar PV systems use the grid 24 hours per day, whether they are using it to purchase electricity or using it to sell excess electricity through net energy metering.



Production from a PV system rises and falls with the sun. During the night when solar panels aren't generating, you're meeting your power needs by drawing electricity from the grid. During the day, as electricity production increases, there may be times when your system produces more than enough electricity to meet your needs and excess power is sent onto the grid. Either way, a grid-tied solar system uses the grid 24 hours per day.

UNDERSTANDING YOUR BILL

Installing a solar PV system will mean a change in how you are billed. Under NEM, you will continue to purchase electricity from Minnesota Power at your current retail rate. You will also be credited at the average retail rate if your solar system produces more energy than you consume during the month. Based on whether you're using more energy than you're producing or vice versa, your bill may look slightly different. The sample bill below depicts how your bill will look if you are using more energy than you are producing during the month. Please contact Minnesota Power with any questions about your bill at **218-355-3720**.



Name: Joe John
1 **Account:** 000000

Bill Number: 123
Bill Date: January 14, 2019

50 ROCK RD
DULUTH MN

2 **Residential Co-Generation Net Metering: 20CG**
31 Days

Next Scheduled Meter Read: 02/08/2019

Meter #	Start Date	Start Read	Read Code	End Date	End Read	Read Code	Total Usage
EMP55555	12/09/2018	10589	Regular	01/09/2019	11367	Regular	3 778 Kilowatt Hours (kWh) used

Billed for the Last 24 Months

Service Charge (6)	8.00
400 kWh @ $0.07423 (7)	29.69
348 kWh @ $0.09767 (7)	33.99
Tax Reform Credit -1.5259%	-0.32
8 Low-Income Affordability Program Surcharge	0.51
Renewable Adjustment 748 kWh @ $-0.00096 (9)	-0.72
10 Transmission Adjustment 748 kWh @ $0.00193	1.44
Boswell 4 Plan Adjustment 748 kWh @ $-0.00109 (11)	-0.82
12 Solar Energy Adjustment 748 kWh @ $-0.00009	-0.07
Resource Adjustment (13)	4.32
Minnesota Sales Tax 6.875%	5.23
St. Louis County Sales Tax 0.5%	0.38
Total charge this period	**81.63**

The average KWH per day for this service is 24
For the same period last year, it was 38
The average daily cost for this service is $2.63
5 Subtractive metering: 778 - 30 = 748

1. Your personal **account number**.
2. Your Minnesota Power **rate**. This example is of a residential net metered customer.
3. **Total kilowatt hours** (kWh) used during the billing period.
4. This graph depicts your **energy usage history**. Please note that this graph DOES NOT show production from your PV system.
5. **Subtractive Metering** shows the amount of energy that you used from Minnesota Power minus the amount of energy that you sold to Minnesota Power to get your monthly net usage. The net usage is the energy that your Minnesota Power bill is based on.
6. **Service Charge** is the fixed monthly fee to cover the cost of connection to our system.
7. The **amount you are charged per kWh** varies depending on your monthly usage. There are four separate rate blocks; the more electricity you use, the more you will pay per kWh. The fee for your monthly energy usage is the Total Energy Charge.
8. The **Affordability Surcharge** recovers the costs of a rate affordability discount program for income-qualified residential electricity customers.
9. The **Renewable Adjustment** charge includes the costs for additional renewable energy and transmission to deliver this energy to our system. We are investing in renewable energy projects as economically as possible to meet Minnesota's Renewable Energy Standard of 25 percent renewable energy by 2025.
10. The **Transmission Adjustment** charge includes costs for new transmission facilities that are necessary for reliable delivery of the electricity to customers.
11. The **Boswell 4 Plan Adjustment charge** recovers the cost of Minnesota Power's Mercury Emission Reduction Plan (BEC4 Plan). The BEC4 Plan addresses the Mercury Emission Reduction Act of 2006, the Mercury and Air Toxics Standard Rule, as well as new state and federal emission control regulations.
12. The **Solar Energy Adjustment** is a charge asscoiated with the cost and benefits of Minnesota Power solar projects.
13. The **Resource Adjustment** is a combination of two charges. The first portion of this charge is applied to the cost of our state mandated Conservation Improvement Program which promotes energy conservation. The second is fuel and purchased energy based on the fluctuating cost of fuel used in our generating stations and power purchased from other energy providers as needed. Due to the varying costs of fuel, this line item will vary from month to month.

INCENTIVES

The cost to install solar at homes and businesses has dropped significantly in the past decade, but many customers still rely on financial incentives to make going solar affordable. Talk with Minnesota Power, your solar installer, or your tax professional to learn more about how you can qualify for rebates or tax credits.

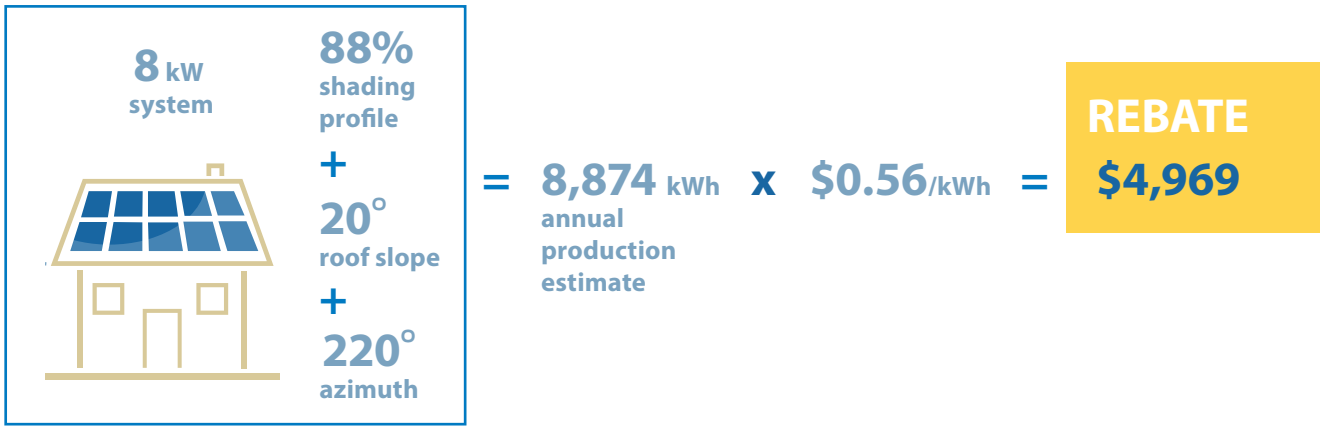
SOLARSENSE

Minnesota Power's SolarSense program provides rebates to customers who install solar at their home or business. The rebates reduce the upfront costs of installing a solar PV system, making solar a more affordable option for more people.

SolarSense rebates are awarded on a first-come, first-served basis. Customers will receive a rebate reservation letter detailing the rebate parameters and estimated amount once an approved interconnection application is obtained. If more applications are received than funds available, names will be placed on a reserve list. Annual budgets for the SolarSense program are approved through 2024. Please refer to our website for up-to-date information about how much funding is available.

The SolarSense rebate is based on how much energy a customer's PV system is expected to produce. Calculating the rebate depends on the design of the solar system—including tilt, orientation and shading profile. These parameters are used to create an estimate of annual energy production from PV Watts, a publicly available tool developed by the National Renewable Energy Laboratories (NREL) to estimate energy output from PV systems. To calculate the SolarSense rebate for 2021, a PV system's estimated energy output is multiplied by $0.56/kWh.

Here's an example: An 8 kW system is installed on a rooftop in Duluth, Minnesota. The roof has a slope of 20 degrees and the modules face southwest at an azimuth of 220 degrees. The Solar Pathfinder shade analysis performed by the installation company and confirmed by Minnesota Power determined the site has a yearly shading profile of 88 percent. According to PV Watts, the average annual production estimate is 8,874 kWh. This estimate is multiplied by $0.56/kWh, resulting in a total rebate of $4,969.



Solar PV systems must be installed by a certified solar installer to qualify for SolarSense rebates. A sample interconnection application in the Appendix includes a full list of eligibility requirements for the SolarSense program. More information is available on at: **www.mnpower.com/SolarSense/**

It took us 40 years to get to one million installations, and it will take us only two years to get to two million. This is a time to mark when the solar industry started to accelerate at warp speed.

Dan Whitten, Vice President of Communications, Solar Energy Industries Association (SEIA)

FEDERAL TAX CREDIT

Customers who install a solar PV system on their home or business may be eligible for a federal investment tax credit, or ITC, which helps to reduce the installed cost of the system. Eligible equipment includes solar panels, solar water heaters, small wind systems, and fuel cells. The ITC is available through December 2022. Contact your tax professional to determine if you qualify for this credit or any other credits that might be available.

For more information, visit:
energy.gov/savings/residential-renewable-energy-tax-credit

GLOSSARY OF COMMONLY USED TERMS

Alternating Current (AC) - AC is the form of electricity that is delivered to your home or business by an electric utility. Solar systems produce DC, which must be converted to AC by an inverter.

Array - A group of connected solar PV modules or panels providing a single electrical output.

Azimuth - Azimuth is the direction measured in degrees from North that the solar installation is oriented.

Bidirectional Meter - The bidirectional or net meter is a specific meter that measures the energy used from Minnesota Power minus the energy sent to Minnesota Power. A bidirectional meter must be installed before the solar system is energized.

Direct Current (DC) - DC is the type of electricity produced by a solar PV system and must be converted to AC prior to being used in a home or business.

Grid - A network of power stations, transmission circuits, substations and power lines that conduct electricity and provide it to homes and businesses for their use.

Grid-tied PV System - A PV system connected to the electric grid. It produces electricity to power your home and any excess energy is sent back to the utility grid. These systems are designed to automatically disconnect from the grid when Minnesota Power is experiencing an outage.

Grid-tied with Battery Backup - A PV system connected to the grid with energy storage capability. These systems have the ability to operate when the utility is experiencing an outage. However, they are not typically designed to power all of your electric needs for a long period of time.

Interconnection Application - An interconnection application must be completed to notify Minnesota Power of your intent to install a solar PV system connected to Minnesota Power's electric grid.

Interconnection Process - The steps that customers must follow in order to connect their system to the electric grid. Minnesota Power's interconnection process is in place to ensure safety, consistency and reliability.

Inverter - A device that converts DC electricity produced by a solar system into AC electricity that can be used in a home or business.

Investment Tax Credit (ITC) - Federal investment tax credit available through December 2019 at 30 percent. It will taper off in 2020, 2021 and 2022.

Kilowatt or kW - A unit of electrical power equal to 1,000 watts, which constitutes the basic unit of electrical demand.

Kilowatt Hour or kWh - A unit of electrical energy equivalent to the use of one kW of electricity for one full hour. Minnesota Power measures customers' electric energy usage based on kWh, and electricity rates are expressed in cents per kWh.

Megawatt or MW - A unit of electrical power equal to 1,000 kW or 1 million watts.

Modules or panels - Groups of solar cells that convert sunlight into electrical energy in the form of direct current, or DC.

North American Board of Certified Energy Practitioners (NABCEP) - A certification available to solar professionals for PV sales, PV installers or solar heating installers. While Minnesota Power does not require that customers use a NABCEP certified installer, we strongly encourage it.

Net Energy Metering (NEM) - NEM is a rate offered to Minnesota Power customers that tracks and credits production from the solar system. This rate is also known as the Rider for Parallel Generation and can be found in the rate book on the Minnesota Power website.

Orientation - A term used to describe the direction that the modules face.

Passive Solar - A form of solar energy that uses building design to maximize or minimize the energy found in sunlight for heating, cooling, and lighting.

Photovoltaic (PV) - A technology that uses a semiconductor (such as silicon) to convert sunlight directly into electricity.

Preliminary Review - An integral step in the interconnection process where a Minnesota Power representative visits your home or business to identify site-specific conditions that may affect your proposed installation. Solar PV systems may not be installed until you have received preliminary review approval from Minnesota Power.

Production Meter - A production meter is used to record the production of your solar system and is not used for billing purposes.

Renewable Energy Credit (REC) - RECs represent the environmental attributes of the power produced from renewable energy projects. As the generator, you are the owner of the RECs associated with your system unless otherwise agreed to in a contract or rate. SolarSense and MiM customers must reassign REC ownership to Minnesota Power.

SolarSense - A solar rebate program available to Minnesota Power customers installing a solar PV system.

Solar Energy Analysis (SEA) - Minnesota Power pilot program available to help customers determine if solar is right for them.

Solar Thermal - Solar technology that uses the heat energy from the sun to heat water or air.

Stand-alone system - Solar PV system that operates completely independently from the electric grid using energy storage technology.

System Size - The nameplate capacity of the solar PV system.

Watt - A unit of measurement of electric power.

RESOURCES

GENERAL RESOURCES

Minnesota Power
mnpower.com/solar

PV Watts Calculator
pvwatts.nrel.gov

EPA Building Solar Ready Guide
energystar.gov/index.cfm?c=rerh.rerh_index

Minnesota Power Interconnection Guidelines
mnpower.com/Company/DistributedGeneration

INSTALLERS

Hiring a Renewable Energy Contractor
mn.gov/commerce-stat/pdfs/hiring-renewable-energy-installer.pdf

North American Board of Certified Energy Practitioners (NABCEP)
www.nabcep.org

CERTS Clean Energy Builder Database
thecleanenergybuilder.com

mn.gov/commerce-stat/pdfs/solar-directory.pdf

INCENTIVES

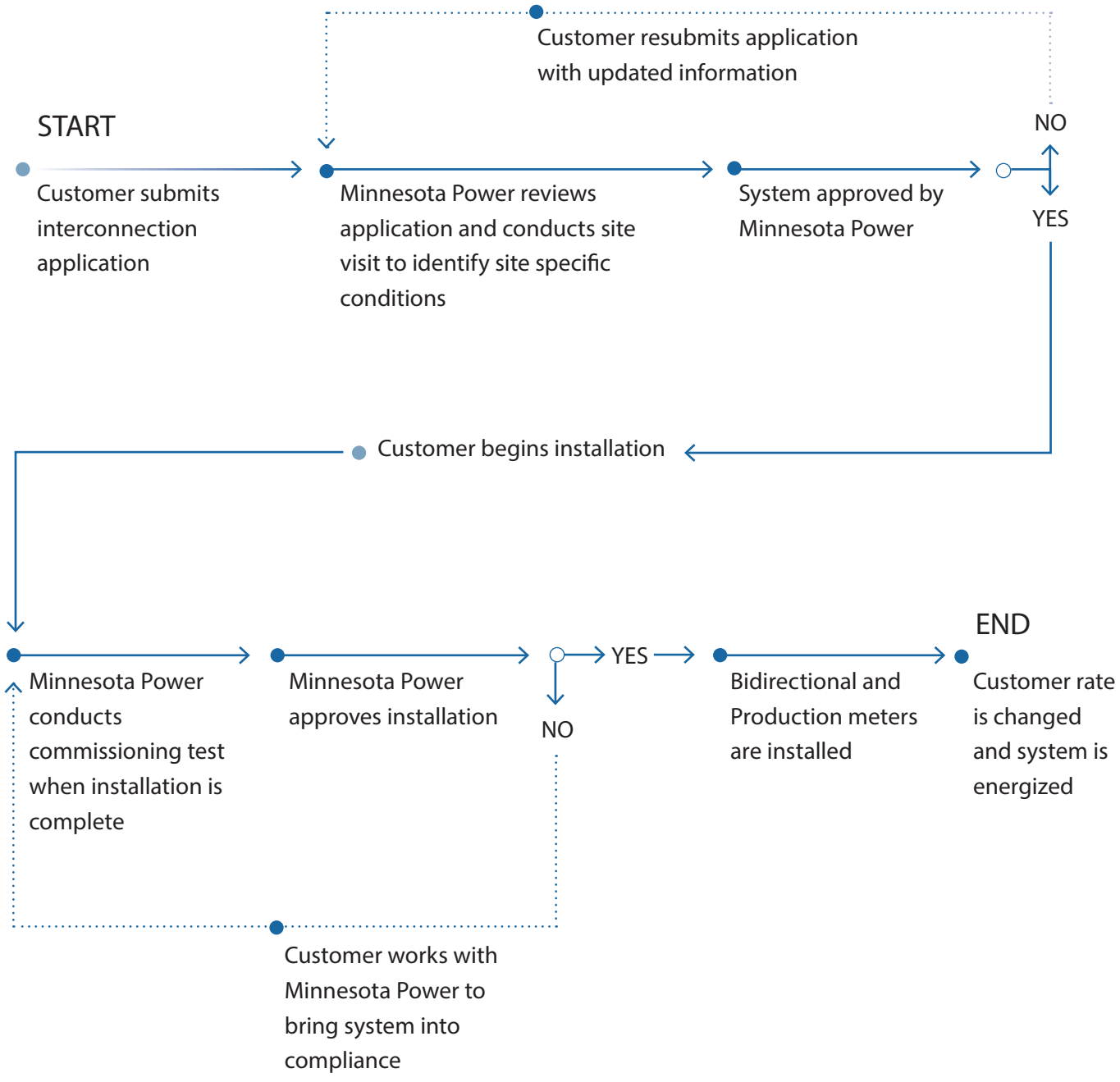
Database of State Incentives for Renewables & Efficiency
dsireusa.org

Minnesota Power's SolarSense
www.mnpower.com/environment/SolarSense

Federal Investment Tax Credit
energy.gov/savings/residential-renewable-energy-tax-credit

APPENDIX

MINNESOTA POWER INTERCONNECTION PROCESS – 40 KW AND UNDER



INTERCONNECTION PROCESS – 20 KW AND UNDER

Application

1. Customers seeking rebates through SolarSense must submit applications to Minnesota Power. Verify that your system meets all of the requirements of Minnesota Power's SolarSense program (if applicable). Rebates are awarded on a first-come, first-served basis.

2. Applicants should submit a complete interconnection application to Minnesota Power's Renewable Programs. A $100 application fee applies for each application and may be submitted to Minnesota Power by check to: Renewable Programs 30 W Superior Street, Duluth, MN 55802.

   Minnesota Power offers two interconnection applications: a simplified application for solar interconnections 20 kW and under, and an interconnection application for solar systems larger than 20 kW and above (See Attachment 3 "Interconnection Application Form").

Preliminary Review

3. During the preliminary site visit, equipment from the utility transformer to the customer's service equipment will be evaluated including but not limited to meter sockets, transformers, weather heads, and clearance issues.

   If any safety hazards are identified at a customer's site, they will need to be addressed by either Minnesota Power or the customer, with details dependent on the specific hazard. If unsafe conditions exist, customers will be notified after the preliminary review and options will be discussed.

4. Minnesota Power will conduct a review of complete interconnection applications within 15 business days of submission. This includes an engineering review of the application, one-line diagram and site drawing and a preliminary site visit. If additional information is requested, the 15 business day review period will restart once Minnesota Power has received all requested information.

5. Some installations may require a detailed engineering study. If an engineering study is required, the customer will be notified at this time. The customer will need to confirm that they would like Minnesota Power to complete the study and agree to pay any costs identified during the study, including the study itself.

6. Upon review completion and approval, Minnesota Power will send the customer an approval packet consisting of a formal approval letter, including a SolarSense rebate reservation, if applicable. Customers will also have MN interconnection agreement (MnDIA) or the Uniform Statewide Contract that must be signed and returned to Minnesota Power as well as other important documents. All required documentation must be signed and returned to Minnesota Power prior to system installation.

System Installation

7. Once all required documentation has been received and approvals made, the system installation may begin.

8. The applicant must notify Minnesota Power when the installation is complete and submit any final documentation including an invoice of the actual installed costs, certificate of completion, M-RETs form and proof of liability insurance (if not already submitted).

Connecting the System

9. Upon receiving all applicable documents, Minnesota Power will schedule a commissioning test within 5 business days to verify that the system is installed as was approved in the application.

10. If the Minnesota Power representative identifies discrepancies between the installation and the application, updated information will be requested at this time. Any additional information or updates will need to be completed before the meter exchange can occur.

    If the system is approved, the net meter and production meter installation will occur at this time. Minnesota Power requires that all distributed generation customers install a production meter within 10 feet from the existing service meter to measure the solar system production (as stated in Minnesota Power construction manual, DCS 4800) unless otherwise agreed upon. Minnesota Power will supply the bidirectional meter, production meter and production meter socket at no direct cost to the customer.

    Once the appropriate meters have been installed, Minnesota Power will adjust the customer's current rate to the applicable distributed generation rate. The customer will be notified at this time that the system may be energized for use.

11. SolarSense customers will receive their rebate check within six (6) weeks of system completion.

    All communication regarding the solar interconnection process or requirements and the SolarSense program should be directed to Minnesota Power Renewable Programs at (218) 355-3720 or renewableprograms@mnpower.com.

Attachment 2: Simplified Application Form

MINNESOTA DISTRIBUTED ENERGY RESOURCES

SIMPLIFIED PROCESS APPLICATION

The Simplified Process is available only for certified, inverter-based Distributed Energy Resources (DER) no larger than 20 kW that meet the requirements of Attachment 4 and Attachment 5.

This Application is deemed complete when it provides all applicable and correct information required below. The following additional information must be submitted with an application:

- ○ Single Line Diagram
- ○ Site Plan with site owner signature if different than Interconnection Customer
- ○ Specification Sheet(s)
- ○ Insurance Document

A DER with an energy storage component must additionally complete Exhibit B - For Energy Storage.

A non-refundable processing fee of $100 must accompany this Application.

Interconnection Customer/Owner

Name: _____

Account Number: _____ Meter Number: _____

Mailing Address: _____

Telephone: _____ Email: _____

Application Agent / Company: _____

Telephone: _____ Email: _____

Distributed Energy Resource Information

Location (if different from above): _____

The Distributed Energy Resource is a single generating unit or multiple? ☐ Single ☐ Multiple

The Distributed Energy Resource is or includes energy storage? ☐ Yes (Complete Exhibit B - For Energy Storage) ☐ No

Type: ☐ Solar ☐ Wind Other: _____

Inverter Manufacturer: _____

Model: _____

AC Rated Nameplate Rating: _____(kWac)_____(kVAac) ☐ Single Phase ☐ Three Phase

Export Capability Limited (e.g., through use of a control system, power relay(s), or other similar device settings of adjustments): ☐ Yes ☐ No

If yes, describe: _____

DER capacity (as described in MN DIP 5.14.3): _____ (kWac)

Is equipment certified (i.e. UL 1741 Listed)? ☐ Yes (Certification is a Simplified Process requirement)

Installed DER System Cost (before incentives):_____

Estimated Installation Date: _____

Interconnection Customer Signature [This Section must be completed by the Customer]

The simpler Uniform Statewide Contract replaces the longer Interconnection Agreement (MN DIA) if the conditions of MN DIP 1.1.5 are met. A qualifying customer signing a Uniform Statewide Contract may elect to be additionally provided the MN DIA. Request a MN DIA?: ☐ No ☐ Yes

Disclaimer: Minnesota Power shall notify the Interconnection Customer with an opportunity to request a timeline extension (See MN DIP Section 1.8.2 and 5.2.2.) Failure by the Interconnection Customer to meet or request an extension for a timeline outlined in the MN DIP could result in a withdrawn queue position and the need to re-apply. INITIAL: _____

I designate the individual or company listed as my Application Agent to serve as my agent for the purpose of coordinating with Minnesota Power on my behalf throughout the interconnection process (see MN DIP 1.3.2.) INITIAL:_____

I hereby certify that, to the best of my knowledge, the information provided in this Application is true, and that I have appropriate Site Control in conformance with the MN DIP. I agree to abide by the Terms and Conditions for Interconnecting an Inverter-Based Distributed Energy Resource No Larger than 20 kW (Simplified Process) (see Exhibit A) and return the Certificate of Completion (see Exhibit C) when the DER has been installed.

Interconnection Customer Signature: _____

Name (print): _____ Date: _____

Send a completed and signed copy of this form with attachments to Minnesota Power at renewableprograms@mnpower.com or the address listed below. Send application fee to:

Minnesota Power
Attn: Renewable Programs
30 W. Superior St.
Duluth, MN 55802

Attachment 2: Simplified Application Form (cont'd)
Exhibit A – Terms and Conditions for Interconnecting an Inverter-Based DER No Larger than 20 kW

1.0 Construction of the Facility

The Interconnection Customer (the "Customer") may proceed to construct (including operational testing not to exceed two hours) the Distributed Energy Resource(s) when Minnesota Power (the "Company") approves the Interconnection Application (the "Application").

2.0 Interconnection and Operation

The Customer may operate Distributed Energy Resource(s) and interconnect with the Company's electric system once all of the following have occurred:

2.1 Upon completing construction, the Customer will cause the Distributed Energy Resource(s) to be inspected or otherwise certified by the appropriate local electrical wiring inspector with jurisdiction, and

2.2 The Customer returns the Certificate of Completion to the Company, and

2.3 The Company:

2.3.1 Shall have the opportunity to witness test as described in Minnesota Technical Requirements, but takes no liability for the results of the test. Completes its inspection of the Distributed Energy Resource(s) to ensure that all equipment has been appropriately installed and that all electrical connections have been made in accordance with applicable codes and standards. All inspections must be conducted by the Company, at its own expense, within ten Business Days after receipt of the Certificate of Completion and shall take place at a time agreeable to the Parties. The Company shall provide a written permission to operate authorization that the Distributed Energy Resource(s) has passed inspection or shall notify the Customer of what steps it must take to pass inspection within three (3) Business Days.

or

2.3.2 Does not schedule an inspection of the Distributed Energy Resource(s) within ten business days after receiving the Certificate of Completion, in which case the witness test is deemed waived (unless the Parties agree otherwise).

or

2.3.3 Waives the right to inspect the Distributed Energy Resource(s).

2.4 The Company has the right to disconnect the Distributed Energy Resource(s) in the event of: 1) improper installation or failure to return the Certificate of Completion, or 2) does not meet any of the requirements of this Agreement or, 3) if applicable, refusal to sign Uniform Statewide Contract.

2.5 Revenue quality metering equipment must be installed and tested in accordance with applicable Minnesota Technical Requirements.

2.6 If the Distributed Energy Resource(s) either: 1) does not use default IEEE 1547-2018 functions and settings; or 2) is not yet subject to a developed national standard or national certification, then at the option of the Company there needs to be in place an operating agreement to document and govern the operation of the Distributed Energy Resource(s).

3.0 Safe Operations and Maintenance

The Customer shall be fully responsible to operate, maintain, and repair the Distributed Energy Resource(s) as required to ensure that it complies at all times with the interconnection standards to which it has been certified.

4.0 Access

The Company shall have access to the disconnect switch, if required by the Company, and metering equipment of the Distributed Energy Resource(s) at all times as described in Minnesota Technical Requirements. The Company shall provide reasonable notice to the Customer when possible prior to using its right of access.

5.0 Disconnection

The Company may temporarily disconnect the Distributed Energy Resource(s) upon the following conditions:

5.1 For scheduled outages upon reasonable notice.

5.2 For unscheduled outages or emergency conditions.

5.3 If the Distributed Energy Resource does not operate in the manner consistent with these Terms and Conditions.

5.4 The Company shall inform the Customer in advance of any scheduled disconnection, or as is reasonable after an unscheduled disconnection.

5.5 If the Customer is in Default it may be disconnected after a 60-day written notice is provided and the Default is not cured during this 60-day notice. This provision does not apply to disconnection based on outages or emergency conditions.

6.0 Treatment Similar to Other Retail Customers

6.1 The Customer may be disconnected consistent with the rules and practices for disconnecting other retail electrical customer.

7.0 Indemnification

7.1 This provision protects each Party from liability incurred to third parties as a result of carrying out the provisions of this Agreement.

7.2 The Parties shall at all times indemnify, defend, and save the other Party harmless from, any and all damages, losses, claims, including claims and actions relating to injury to or death of any person or damage to property, demand, suits, recoveries, costs and expenses, court costs, attorney fees, and all other obligations by or to third parties, arising out of or resulting from the other Party's action or inactions

of its obligations under this agreement on behalf of the indemnifying Party, except in cases of gross negligence or intentional wrongdoing by the indemnified Party.

7.3 This indemnification obligation shall apply notwithstanding any negligent or intentional acts, errors or omissions of the indemnified Party, but the indemnifying Party's liability to indemnify the indemnified Party shall be reduced in proportion to the percentage by which the indemnified Party's negligent or intentional acts, errors or omissions caused the damages.

7.4 Neither Party shall be indemnified for its damages resulting from its sole negligence, intentional acts or willful misconduct. These indemnity provisions shall not be construed to relieve any insurer of its obligation to pay claims consistent with the provisions of a valid insurance policy.

7.5 If an indemnified person is entitled to indemnification under this article as a result of a claim by a third party, and the indemnifying Party fails, after notice and reasonable opportunity to proceed under this article, to assume the defense of such claim, such indemnified person may at the expense of the indemnifying Party contest, settle or consent to the entry of any judgment with respect to, or pay in full, such claim.

7.6 If an indemnifying party is obligated to indemnify and hold any indemnified person harmless under this article, the amount owing to the indemnified person shall be the amount of such indemnified person's actual loss, net of any insurance or other recovery.

8.0 Promptly after receipt by an indemnified person of any claim or notice of the commencement of any action or administrative or legal proceeding or investigation as to which the indemnity provided for in this article may apply, the indemnified person shall notify the indemnifying party of such fact. Any failure of or delay in such notification shall not affect a Party's indemnification obligation unless such failure or delay is materially prejudicial to the indemnifying party.

9.0 Insurance

The Parties agree to follow all applicable insurance requirements imposed by Minnesota. All insurance policies must be maintained with insurers authorized to do business in Minnesota. See MN DIP Section 5.10.

10.0 Limitation of Liability

Each party's liability to the other party for any loss, cost, claim, injury, liability, or expense, including reasonable attorney's fees, relating to or arising from any act or omission in its performance of this Agreement, shall be limited to the amount of direct damage actually incurred. In no event shall either party be liable to the other party for any indirect, incidental, special, consequential, or punitive damages of any kind whatsoever, except as allowed under paragraph 6.0.

11.0 Termination

The agreement to operate in parallel may be terminated under the following conditions:

11.1 By the Customer

By providing written notice to the Company

11.2 By the Company

If the Distributed Energy Resource(s) fails to operate for any consecutive 12 month period or the Customer fails to remedy a violation of these Terms and Conditions.

11.3 Permanent Disconnection

In the event this Agreement is terminated, the Company shall have the right to disconnect its facilities or direct the Customer to disconnect its Distributed Energy Resource.

11.4 Survival Rights

This Agreement shall continue in effect after termination to the extent necessary to allow or require either Party to fulfill rights or obligations that arose under the Agreement.

12.0 Assignment/Transfer of Ownership of the Facility

This Agreement shall survive the transfer of ownership of the Distributed Energy Resource(s) to a new owner when the new owner agrees in writing to comply with the terms of this Agreement and so notifies the Company.

Attachment 3: Interconnection Application Form

MINNESOTA DISTRIBUTED ENERGY RESOURCES

INTERCONNECTION APPLICATION

This form is for Distributed Energy Resources (DERs) that meets the eligibility of the Minnesota Interconnection Process (see Section 1.1) and are not eligible for consideration under the Section 2 Simplified Process.

This Application is considered complete when it provides all applicable and correct information required below. Additional technical data may be necessary prior to the system impact study process as described in 4.3.3, if applicable, but is not relevant to application completeness. The following additional information must be submitted with an application:

○ Single Line Diagram ○ Proof of Site Control (see Section 1.7) and Site Diagram ○ Specification Sheet(s)

A DER with an energy storage component must additionally complete Exhibit B For Energy Storage.

Application is for:

☐ New DER(s)

☐ Capacity addition or Material Modification to Existing DER (see MN DIP Glossary of Terms)

Select Review Process:

○ Fast Track Process

Confirm eligibility requirements at MN DIP Section 3.1

[For Certified Equipment, the processing fee shall be $100 + $1/kW. For non-certified DER, the processing fee shall be $100 + $2/kW.]

○ Study Process

Confirm eligibility requirements at MN DIP Section 4 Study Process.

[The processing fee shall be a deposit not to exceed $1,000 plus $2.00 per kW towards the cost of the first study under Section 4 Study Process.]

Additional fees or deposits shall not be required, except as otherwise specified in the MN DIP.

Interconnection Customer/Owner

Name: _____

Account Number: _____ Meter Number: _____

Mailing Address: _____

Telephone: _____ Email: _____

[If different,] Application Agent/Company: _____

Telephone: _____ Email: _____

30

If capacity addition or Material Modification to existing facility, please describe:

Will the DER be used for any of the following?

Net Metering? Yes ☐ No ☐

To Supply Power to the Interconnection Customer? Yes ___No ___

To Supply Power to Area EPS? Yes ____ No ____

Requested Point of Common Coupling (at a minimum, provide: 1) an address or nearest cross-section and 2) GPS coordinates or an annotated aerial map):

Installed DER System Cost (before incentives): _____

Interconnection Customer's Requested In-Service Date: _____

Distributed Energy Resource Information

Data applies only to the Distributed Energy Resource not the Interconnection Facilities.

Energy Source:

☐ Solar ☐ Wind ☐ Storage ☐ Hydro Type (e.g. Run-of-River):

☐ Diesel ☐ Natural Gas ☐ Fuel Oil ☐ Other (state type, e.g. solar + wind + storage):

Prime Mover:

☐ Photovoltaic ☐ Microturbine ☐ Reciprocating Engine ☐ Fuel Cell

☐ Gas Turbine ☐ Steam Turbine ☐ Wind Turbine ☐ Other (state type):

Type of Generator: ☐ Inverter ☐ Synchronous ☐ Induction

DER Nameplate Rating (in kW*ac*): _____ DER Nameplate kVAR: _____

Interconnection Customer or Customer-Sited Load (in kW, if none, so state): _____

Typical Reactive Load (if known):_____

Maximum Physical Export Capability Requested (in kW): _____

Export Capability Limited (e.g., through use of a control system, power relay(s), or other similar device settings of adjustments): ☐ Yes ☐ No

If yes, describe: _____

List components of the Distributed Energy Resource Certified Equipment:

	Equipment Type	Certifying Entity
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

Is the prime mover compatible with the certified protective relay package? ☐ Yes ☐ No

Distributed Energy Resource Manufacturer, Model Name & Number: _____

Version Number: _____

Nameplate Rating in kW: (Summer): _____ (Winter): _____

Nameplate Rating in kVA: (Summer): _____ (Winter): _____

Individual Generator Power Factor

Rated Power Factor: Leading: _____ Lagging: _____

Total Number of Distributed Energy Resources to be interconnected pursuant to this Interconnection Application: _____ ☐ Single Phase ☐ Three Phase

Inverter Manufacturer, Model Name & Number (if used): _____

32

List of adjustable set points for the protective equipment or software: _____

Note: A completed power systems load flow data sheet must be supplied with the Interconnection Application.

Distributed Energy Resource Characteristic Data (for inverter-based machines)

Max design fault contribution current: _____ Instantaneous or RMS? _____

Harmonic characteristics: _____

Start-up requirements: _____

Distributed Energy Resource Characteristic Data (for rotating machines)

RPM frequency: _____ *Neutral Grounding Resistor (if applicable): _____

Synchronous Generators:

Direct Axis Synchronous Reactance, $X_{d:}$		Zero Sequence Reactance, $X_{0:}$	
Direct Axis Transient Reactance, $X'_{d:}$		KVA Base:	
Direct Axis Subtransient Reactance, $X''_{d:}$		Field Volts:	
Negative Sequence Reactance, $X_{2:}$		Field Amperes:	

Induction Generators:

Motoring Power (kW):		Exciting Current:	
I22t or K (Heating Time Constant):		Temperature Rise:	
Rotor Resistance, Rr:		Frame Size:	
Stator Resistance, Rs:		Design Letter:	
Stator Reactance, Xs:		Reactive Power Required In Vars (No Load):	
Rotor Reactance, Xr		Reactive Power Required In Vars (Full Load):	
Magnetizing Reactance, Xm:		Total Rotating Inertia, H:	Per Unit on kVA Base

Short Circuit
Reactance, Xd'': _____

Note: Please contact Minnesota Power prior to submitting the Interconnection Application to determine if the specified information above is required.

Excitation and Governor System Data for Synchronous Generators Only
Provide appropriate IEEE model block diagram of excitation system, governor system and power system stabilizer (PSS) in accordance with the regional reliability council criteria. A PSS may be determined to be required by applicable studies. A copy of the manufacturer's block diagram may not be substituted.

Interconnection Facilities Information

Will a transformer be used between the DER and the Point of Common Coupling? ☐ Yes ☐ No

Will the transformer be provided by the Interconnection Customer? ☐ Yes ☐ No

Transformer Data (If Applicable, for Interconnection Customer-Owned Transformer):

Is the transformer: ☐ Single Phase ☐ Three Phase

Size (kVA): Transformer Impedance (%): on kVA Base:

If Three Phase:

Transformer Primary: Volts: _____ Delta: _____ Wye: _____ Wye Grounded: _____

Transformer Secondary: Volts: _____ Delta: _____ Wye: _____ Wye Grounded: _____

Transformer Tertiary: Volts: _____ Delta: _____ Wye: _____ Wye Grounded: _____

Transformer Fuse Data (If Applicable, for Interconnection Customer-Owned Fuse):

(Attach copy of fuse manufacturer's Minimum Melt and Total Clearing Time-Current Curves)

Manufacturer: _____ Type: _____ Size: _____ Speed: _____

Interconnecting Circuit Breaker (if applicable):

Manufacturer: _____ Type: _____

34

Load Rating (Amps): _____ Interrupting Rating (Amps): _____ Trip Speed (Cycles): _____

Interconnection Protective Relays (If Applicable):

If Microprocessor-Controlled:

List of Functions and Adjustable Setpoints for the protective equipment or software:

	Setpoint Function	Minimum	Maximum
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____

If Discrete Components:

(Enclose Copy of any Proposed Time-Overcurrent Coordination Curves)

Manufacturer:_____	Type:____	Style/Catalog No.:_____	Proposed Setting:_____
Manufacturer:_____	Type:____	Style/Catalog No.:_____	Proposed Setting:_____
Manufacturer:_____	Type:____	Style/Catalog No.:_____	Proposed Setting:_____
Manufacturer:_____	Type:____	Style/Catalog No.:_____	Proposed Setting:_____
Manufacturer:_____	Type:____	Style/Catalog No.:_____	Proposed Setting:_____

Current Transformer Data (If Applicable):

(Enclose Copy of Manufacturer's Excitation and Ratio Correction Curves)

Manufacturer:

Type: _____ Accuracy Class: _____ Proposed Ratio Connection: _____

Manufacturer: _____

Type: _____ Accuracy Class: _____ Proposed Ratio Connection: _____

Potential Transformer Data (If Applicable):

Manufacturer: _____

Type: _____ Accuracy Class: _____ Proposed Ratio Connection: _____

Manufacturer: _____

Type: _____ Accuracy Class: _____ Proposed Ratio Connection: _____

General Information

Enclose copy of site electrical one-line diagram showing the configuration of all DER equipment, current and potential circuits, and protection and control schemes. The one-line diagram shall include:

- Interconnection Customer name.
- Application ID (or, if applicable, Customer account number)
- Installer name and contact information.
- Install address- must match application address.
- Correct positions of all equipment, including but not limited to panels, inverter, and DC/AC disconnect. Include distances between equipment, and any labeling found on equipment. See Minnesota Technical Requirements.

This one-line diagram must be signed and stamped by a Professional Engineer licensed in Minnesota if the DER is larger than 50 kW (if uncertified) and 250 kW (if certified.)

Is One-Line Diagram Enclosed? ☐ Yes ☐ No

Enclose copy of any site documentation that indicates the precise physical location of the proposed Distributed Energy Resource (e.g., USGS topographic map or other diagram or documentation). Is Available Documentation Enclosed? ☐ Yes ☐ No

Proposed location of protective interface equipment on property (include address if different from the Interconnection Customer's address)_____

Enclose copy of any site documentation that describes and details the operation of the protection and control schemes. Is Available Documentation Enclosed? ☐ Yes ☐ No

Enclose copies of schematic drawings for all protection and control circuits, relay current circuits, relay potential circuits, and alarm/monitoring circuits (if applicable).
Are Schematic Drawings Enclosed? ☐ Yes ☐ No

Enclose copies of documentation showing site control (MN DIP Section 1.7)
Is Available Documentation Enclosed? ☐ Yes ☐ No

36

Disclaimer: Minnesota Power shall notify the Interconnection Customer with an opportunity to request a timeline extension (See MN DIP Section 1.8.2 and 5.2.3.). Failure by the Interconnection Customer to meet and request an extension as described in MN DIP Section 5.2.3 for a timeline outlined in the MN DIP could result in a withdrawn queue position and the need to re-apply. INITIAL: _____

Interconnection Customer Signature

I hereby certify that, to the best of my knowledge, all the information provided in this Interconnection Application is true and correct.

Interconnection Customer: _____ Date: _____

SolarSense Expected Performance Based Incentive Application (40 kW and under)

minnesota power
AN ALLETE COMPANY

WHO SHOULD FILE THIS APPLICATION: Anyone expressing interest to participate in Minnesota Power's SolarSense Expected Performance Based Incentive program. This application should be completed and returned to Minnesota Power in order to begin processing the request.

INFORMATION: This application is used by Minnesota Power to determine eligibility in the SolarSense program and establish waitlist queue, if applicable. The Applicant will be contacted if additional information is required to process the application. The response may take up to 15 business days after receipt of all the required information.

For further details regarding Minnesota Power's interconnection processes and standards, refer to the "State of Minnesota Distributed Energy Resources Interconnection Process for Minnesota Power", the "State of Minnesota Distributed Generation Interconnection Requirements for Minnesota Power", the terms and conditions outlined in this application and other interconnection information. These documents can be found on Minnesota Power's website at: www.mnpower.com/DistributedGeneration

SOLARSENSE PROGRAM: The SolarSense incentive is based on the expected performance of the PV array. The annual average energy production is calculated using a number of variables including tilt, azimuth and shading profile in the PV Watts tool provided by the National Renewable Energy Laboratory (NREL): https://pvwatts.nrel.gov/

SOLARSENSE ELIGIBILITY REQUIREMENTS:

- Be a Minnesota Power retail customer installing a grid-tied solar PV system. Customers exempt from the Solar Energy Standard are not eligible to apply.
- Rebates are generally limited to one per customer, per year based on market activity and dollar availability. Customers may not apply for a SolarSense rebate if they have installed a solar PV system within the past 12 months.
- Be in good standing with Minnesota Power.
- Get preapproval of the project prior to purchase and installation of equipment.
- Install new components, including all major system components.
- Own the PV system and the property/building where the system will be installed.
- Complete the installation within six months of receiving system approval and a signed uniform statewide contract.
- You must have completed an energy analysis within the immediately preceding 24 months.
- You may not install a system with kWh generation capacity of more than 120% of the premise's twelve months energy consumption.
- You must install a system with a nameplate capacity of 40 kW or less.
- The installer must submit system design specifications to Minnesota Power in order to calculate the incentive estimate.
- PV modules must come with a 20-year or greater manufacturer's performance warranty. All inverters must come with a minimum 10-year manufacturer's performance warranty. Installers must offer a minimum 2 year workmanship warranty.
- You must submit the final installation costs to Minnesota Power.
- Complete and submit the Renewable Energy Credit (REC) Contract once the installation is complete.
- Use a certified installer (NABCEP or UL certified).
- All production needs to be measured through the production meter before going through any other device.

SolarSense Expected Performance Based Incentive Application (40 kW and under)

CUSTOMER INFORMATION:	
Customer Name	
Address	
Phone	
Email	
INSTALLER INFORMATION:	
Installation Company	
Representative	
Phone	
Email	
SOLAR ARRAY INFORMATION:	
Size DC/AC	
Roof/Ground	
Tilt	
Azimuth	
Shade (% unshaded)	

SIGN OFF AREA:	
MP Customer Signature:	Date:
Installer Signature:	Date:

Send this completed & signed application and attachments to:

Minnesota Power
Renewable Program
30 West Superior Street
Duluth, MN 55802-2093

Or send via email to SolarProgram@mnpower.com

Please attach the following documents:

- Completed interconnection application including all required attachments
- Shade analysis from an industry standard tool such as Solar Pathfinder, Solmetric SunEye, Aurora, Helioscope, or others.
- Current photos of the site

Exhibit C – Certificate of Completion

Distributed Energy Resource Certificate of Completion

MN DIP Simplified Process Interconnection

Customer:_____

Account Number: _____ Meter Number: _____

Application ID number: _____

Address of Distributed Energy Resource (DER):

_____

City: _____ State: MN Zip: _____

Is the DER owner-installed? Yes No If no: Install

Company:_____

Contact:_____

Phone: _____ Email: _____

Electrician Name / License#: _____

The DER has been installed and inspected in compliance with the local electrical permitting authority as verified by the signature below or the additionally attached document.

Inspector Signature: _____

Print Name: _____ Date: _____

Authority Having Jurisdiction (city/county): _____

As a condition of interconnection, email a completed copy of this form to

_____ at _____.

Electronic submission of this form through email to Minnesota Power's renewableprograms@mnpower.com email address shall be an alternative means to satisfy the Certificate of Completion submission requirements.

If you prefer to mail the form, please mail to:

Minnesota Power
Attn: Renewable Programs
30 W. Superior St.
Duluth, MN 55802

SOLAR ENERGY ANALYSIS PROGRAM

OVERVIEW

A Solar Energy Analysis (SEA) is a free tool available to Minnesota Power customers interested in learning more about solar energy. An SEA helps customers determine if a solar energy system is the right fit for their home or business, understand the interconnection process and learn about customer conditions that may affect a solar installation. Understanding all of these factors upfront will help to ensure a straightforward and timely interconnection should you choose to install solar.

During an SEA, a Minnesota Power representative will discuss your goals for your home or business and suitability for solar. The representative will identify site-specific conditions that could affect an installation, and help you understand the process for connecting a system to Minnesota Power. This includes shading from nearby trees or buildings, existing service details, current energy consumption trends and expectations, and more.

Once the SEA is completed, Minnesota Power will provide you with a summary detailing insights gained during the consultation. This summary will include customer information, site details identified, an electrical load analysis, solar assessment and next steps. This summary is an invaluable tool to help customers understand the basic components affecting a solar installation and identify questions to ask when searching for or working with a solar energy installer. To gain a better understanding of the information that will be included in an SEA summary, see Appendix pages 31 and 32.

GETTING STARTED

How to sign up

- Complete an application online or by telephone.
- Minnesota Power will contact you to schedule an on-site visit.

What's required of me?

- You must be a Minnesota Power customer.
- Conduct phone, email, and possibly an on-site analysis.
- If a site visit is required, you must be on-site during the analysis. Allow up to one hour to complete the analysis.

Solar Energy Analysis Summary

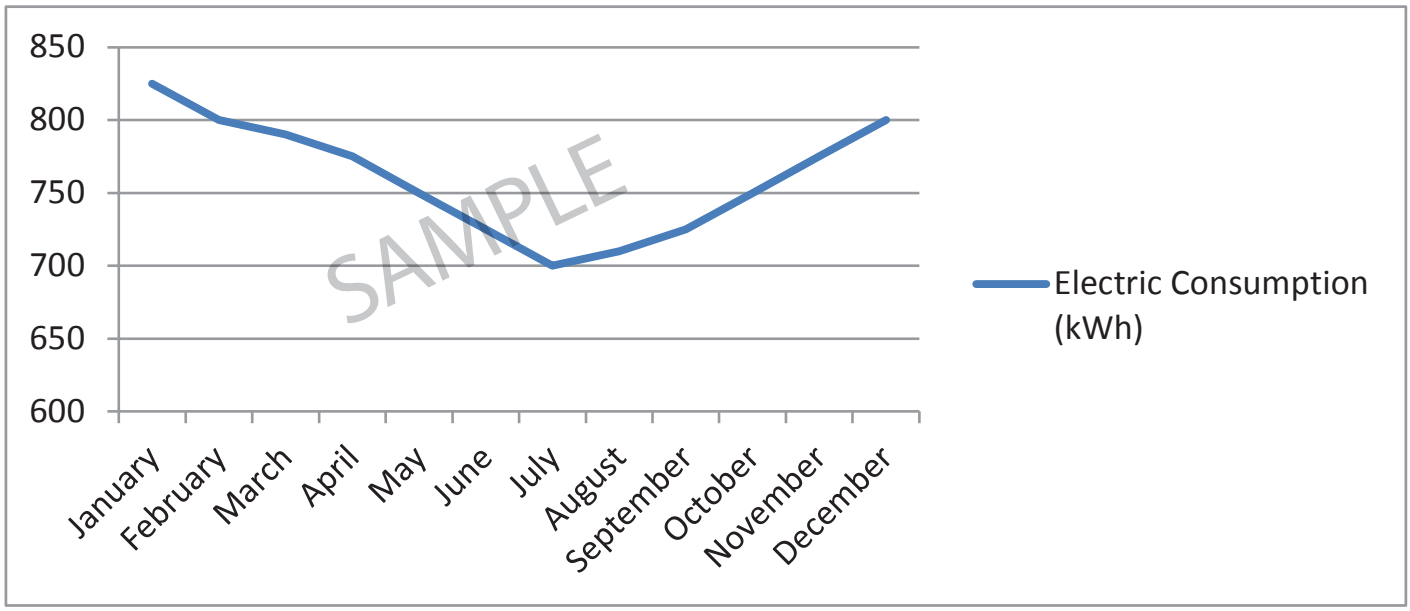
While each site is unique, there are some common factors that all customers should consider when deciding whether solar energy is the right fit. Here is some basic information that will be reviewed during a Solar Energy Analysis and included in the SEA summary.

- Energy usage history
- Suggested solar system sizing
- Installer contact information
- Guide to hiring a renewable energy installer
- Average csots of installations
- Customer-specific questions and concerns

Electrical Load Analysis

This section describes the customer's electric consumption trends. This information will help the customer understand if their electric usage is high, medium or low compared to other Minnesota Power customers. This information is also important for installers to consider when designing a system.

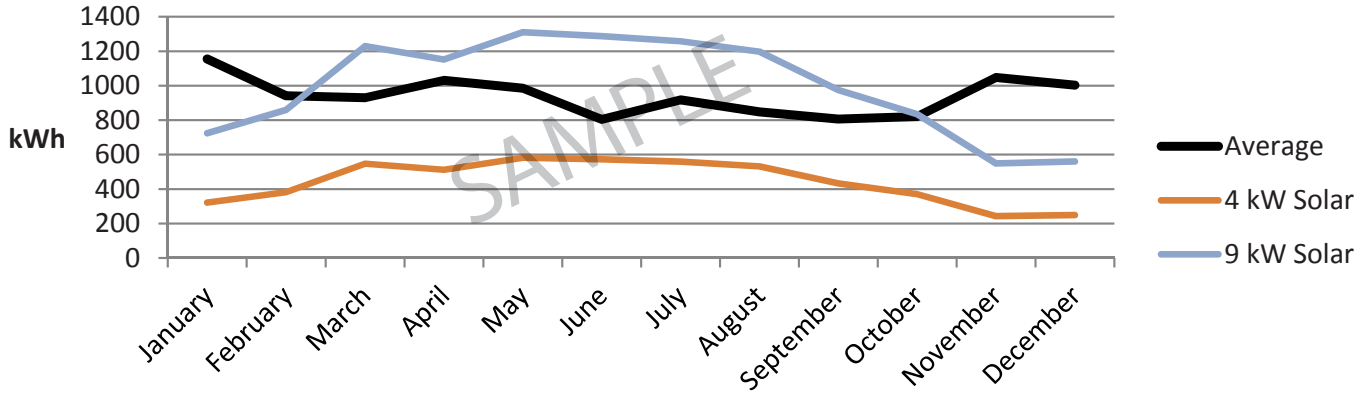
Electric Consumption (kWh)



Solar Assessment

The solar assessment section describes the customer-specific details identified during the analysis and explains how they could affect a solar installation. In addition, this section will include information about solar systems including size, general cost estimates and estimated production. Minnesota Power will provide graphs to compare consumption to solar production to help customers understand the relationship between the two.

Electric Consumption vs. Solar Production



Next Steps

This section will outline the customer's solar energy goals and provide the customer with information about how to achieve those goals.

It is important to note that the Solar Energy Analysis is not to be used in place of a shading analysis or detailed system design. If the customer chooses to move forward with a solar installation, they will need to contact a solar installer to perform a full shade analysis and system design.

minnesota power

AN ALLETE COMPANY

mnpower.com/solar | renewableprograms@mnpower.com | 218-355-3720
Minnesota Power | Renewable Programs | 30 W. Superior St. | Duluth MN 55802

21004 | 01.13.21