



General notes on interconnecting a distributed generation facility into the Eau Claire Energy Cooperative distribution system.

Safety and reliability are the overriding factors in determining if ECEC will allow the interconnection. ECEC reserves the right to refuse interconnection to any distributed generation facility if it is suspected that such interconnection will adversely affect the safety of Cooperative personnel or the public, distribution system operations, reliability, or service to other members.

If your system is 40 KW or less, ECEC will handle the approval and interconnection. If your system is over 40 KW, ECEC will have to coordinate the interconnection and rates through our power supplier, Dairyland Power Cooperative.

For residential customers on rate schedule 'A', the excess output of a system that is 40 KW or less, will be purchased by ECEC at the same retail rate that the member purchases energy from the Cooperative. This is 'net-metering'. Your regular electric meter will be replaced with a bi-directional meter that measures energy sales to you and also any excess energy flowing backwards through the meter that is put back on the grid.

For commercial or industrial customers on something other than rate schedule 'A', contact the Cooperative for more information.

The applicant needs to -

1. Fill-out and sign the Distributed Generation Interconnection Agreement and return it to our office.
2. Fill-out and sign the Distributed Generation Application Form and return it to our office. The installer also needs to sign this.
3. Provide ECEC with proof of the required amount of liability insurance.
4. Provide ECEC with a site plan showing the location of main pieces of equipment, and a schematic diagram of the entire system.
5. Provide ECEC with the technical specifications of the inverter and proof that it is UL 1741 or IEEE 1547 compliant.

Before the system can be interconnected to the ECEC distribution system, ECEC personnel need to inspect and approve the installation, and conduct an anti-islanding test. We need to verify that the generating system will shut down when grid power is lost.

If you presently have a dual-fuel or off-peak heat installation, you are allowed a maximum of two off-peak meters if we will be doing net metering. These meters must be wired in parallel such as through a double or triple meter socket. Subtractive off-peak metering cannot be done with net metering; however, there are options available. Contact ECEC for more information.

Much more information is available from the Focus on Energy website. The address is <http://www.focusonenergy.com/renewable/>.

Eau Claire Energy Cooperative

Your Touchstone Energy® Partner 
PO Box 368 Fall Creek, WI 54742-0368
715-832-1603 • 888-832-1604
www.ecec.com

DISTRIBUTED GENERATION APPLICATION FORM (Generation 40 kW or less)

1. Contact Information – The applicant is the party that is legally responsible for the generating system

Applicant's Last Name: _____ First: _____ Middle: _____

Applicant's Mailing Address:

Phone Number: _____ E-mail Address: _____

Emergency Contact Numbers for Responsible Party

Day Phone: _____ Evening Phone: _____ Weekend Phone: _____

Cell Phone: _____

2. Location of the Generation System

Street Address:

Latitude – Longitude (optional): _____ County _____
(i.e. 49° 32' 06" N – 91° 64' 18"W)

3. Electric Service Account Number

4. Applicant's Ownership interest in the Generation System

Owner Co-owner Lease Other

If co-owner or leased, list other parties involved: _____

5. Primary Intent of the Generation System

Onsite use of power, or net energy billing Commercial power sales

6. Electricity Use, Production and Purchases

- a. Anticipated annual electricity consumption of the facility or site: _____ (kWh)/yr
- b. Anticipated annual electricity production of the generation system: _____ (kWh)/yr
- c. Anticipated annual electricity purchased (i.e., (a) – (b)) _____ (kWh)yr*

*Value will be negative if there are net sales to the cooperative

7. Installing Contractor Information

Contractor's Last Name: _____ First: _____ Middle: _____

Name of Firm: _____

Phone Number: _____ E-Mail Address: _____

Contractors Mailing Address:

8. Requested In-Service Date

9. Provide One-Line Schematic Diagram of the System

Schematic is Attached Number of Pages _____

10. Generator/Inverter Information

Manufacturer: _____ Model Number: _____

Version Number: _____ Serial Number: _____

Generation Type (select one) Single Phase Three Phase

Generation Type (select one) Synchronous Induction Inverter Other _____

Name Plate AC Ratings (select one) _____ kW _____ kVa _____ volts

Primary Energy Source Wind Solar Biomass Manure Digester Other

Note: If there is more than one generator and/or inverter, attach an addition sheet describing each.

11. Site Plan Showing Location of the External Disconnect Switch (attach additional sheets as needed)

12. Liability Insurance

Carrier: _____ Limits: _____
(min \$300,00 if system is <20kW, \$1,000,000 if system is 20-40-kW)
Agent Name: _____ Phone Number: _____

The Applicant (Site Owner or Operator, if different) shall provide a Certificate of Insurance, both demonstrating that this liability insurance is in place.

13. Design Requirements

- a. Is the proposed distributed generation paralleling equipment as a meeting the testing requirements of UL1741 as stated in PSC 119.26? Yes No

If not certified, you will need to provide the cooperative an engineering design Showing that the installation meets the design requirements of the cooperative.

For item 13(a), if your answer is yes, please furnish details (e.g., copies of manufacturer's specifications). If you do not know the answer, it is recommended you contact the equipment manufacturer for the answer and provide the same with the completed application.

14. Other Comments, Specification and Exceptions (attach additional sheets if needed)

15. Applicant and Installer Signature

To the best of my knowledge, all the information provided in this Application Form is complete and correct.

Applicant Signature: _____ Date: _____

Installer Signature: _____ Date: _____

Distributed Generation Interconnection Agreement (40 kW or less)

Eau Claire Energy Cooperative

Your Touchstone Energy® Partner 
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www.ecec.com

Applicant Name and Address

This Distributed Generation Interconnection Agreement (the “Agreement”), is made and entered into this _____ (day) of _____ (month), _____ (year) by and between Eau Claire Energy Cooperative hereinafter called “ECEC” and _____ hereinafter called the “Applicant”. ECEC and the Applicant are hereinafter collectively referred to as the “Parties” and individually as a “Party”.

Recitals

- A. ECEC is the owner of the electric distribution system serving _____ (Insert legal description of property or address) (“ECEC’s Distribution System”).
- B. Applicant desires to install a Distributed Generation (DG) facility of energy storage device with a capacity up to 40 kW, including related interconnection equipment (the “DG Facility”) and to interconnect the DG Facility to ECEC’s distribution system.
- C. ECEC has previously reviewed and approved Applicants DG Interconnection Application form dated _____, and supporting materials (the “Application”). The completed Application is attached as Exhibit 1 and incorporated into this Agreement.
- D. Applicant wishes to interconnect the DG Facility to ECEC’s distribution system and ECEC is willing to permit such interconnection subject to the terms and conditions set for in: (1) Wisconsin Administrative Code Chapter PSC 119; (2) the completed Application approved by ECEC; and (3) this Agreement.
- E. No agency or partnership is created with the interconnection of the applicants DG Facility.

Agreement

NOW THEREFORE, in consideration of the foregoing Recitals and for good and valuable consideration, ECEC and Applicant agree as follows:

1. Design Requirements.

The DG Facility shall be installed and operated in compliance with Wisconsin Administrative Code Chapter PSC 119, and ECEC policy.

2. Applicant’s Representations and Warranties.

Applicant represents and warrants that:

- a. The DG Facility is fully and accurately described in the Application;
- b. All information in the Application is true and correct;
- c. The DG Facility has been installed to Applicant’s satisfaction;
- d. Applicant has been given warranty information and an operation manual for the DG Facility; and
- e. Applicant has been adequately instructed in the operation and maintenance of the DG Facility.

3. Interconnection Disconnect Switch.

ECEC does required that the Applicant furnish and install an interconnection disconnect switch that opens, with a visual break, all ungrounded poles of the interconnection circuit. The interconnection disconnect switch shall be rated for the voltage and fault current requirements of the DG Facility, and shall meet all applicable UL, ANSI, and IEEE standards, as well as applicable requirements of the Wisconsin Electrical Safety Code, Volume 2, Chapter Comm 16. The switch enclosure shall be properly grounded. The interconnection disconnect switch shall be accessible at all times, located for ease of access to ECEC personnel, and shall be capable of being locked in the open position.

4. Modifications to the DG Facility.

Applicant shall notify ECEC of plans for any material modification to the DG Facility by providing at least twenty (20) working days advance notice. A "material modification" is defined as any modification that changes the maximum electrical output of the DG Facility or changes the interconnection equipment (e.g., changing from certified to non-certified devices or replacement of any component with a component of different functionality or UL listing). The notification shall consist of a completed, revised Application and such supporting materials as may be reasonably requested by ECEC. Applicant agrees not to commence installation of any material modification to the DG Facility until ECEC has approved the revised Application. ECEC shall indicate its written approval or rejection of any revised Application within twenty (20) working days after it receives the completed application and all supporting materials.

5. Insurance.

Throughout the term of this Agreement, Applicant shall carry a liability insurance policy that provides protection against claims for damages resulting from (i) bodily injury, including wrongful death; and (ii) property damage arising out of Applicant's ownership and/or operation of the DG Facility under this Agreement. The limits of such policy shall be at least \$300,000 for installations less than 20 kW or \$1,000,000 for installations of 20-40 kW per occurrence or prove financial responsibility by another method acceptable, and approved in writing, to ECEC. The failure of the Applicant or ECEC to enforce the minimum levels of insurance does not relieve the Applicant from maintaining such levels of insurance or relieve Applicant of any liability. Prior to execution of this Agreement, applicant shall provide ECEC with a certificate of insurance containing a minimum 30-day notice of cancellation.

6. Indemnification.

Subject to the limitations set forth in this Section, and to the extent allowable by law, each Party to this Agreement shall indemnify, hold harmless and defend the other Party, its officers, directors, employees and agents from and against any and all claims, suits, liabilities, damages, costs and expenses (including without limitation, reasonable attorneys and expert witness fees) for damage to property, or injury to, or death of, any individual, including the employees, officers, directors and agents of the indemnified Party or any other third parties, to the extent caused wholly or in part by the negligence or the intentional wrongdoing of the indemnifying Party. Notwithstanding anything in this Section or in any other provision of the Agreement to the contrary, the liability of each Party to this Agreement shall be limited to direct actual damages, and all other damages at law or in equity are hereby waived. Under no circumstances shall a Party be liable to the other Party, whether in tort, contract or other basis in law or equity for any special, indirect, punitive, exemplary, or consequential damages, including lost profits. Applicant's and ECEC's indemnification obligations under this Section and the limits upon their respective liability shall continue in full force and effect notwithstanding the expiration or termination of this Agreement with respect to any event or condition giving rise to an indemnification obligation that occurred prior to such expiration or termination.

7. DG Facility Commissioning Testing.

Applicant shall notify ECEC in writing that installation of the DG Facility is complete and that the interconnection equipment is available for testing by ECEC at least fifteen (15) working days before Applicant interconnects the DG Facility with ECEC's Distribution System. ECEC shall thereupon have the right to test the DG Facility. ECEC shall also have the right to witness any testing by Applicant of the DG Facility. Any ECEC testing of the DG Facility shall be completed within ten (10) working days. If ECEC waives its right to test the installed DG Facility by notifying Applicant in accordance with this Section, Applicant may interconnect the DG Facility to ECEC's Distribution System upon the earlier to occur of the following: (a) notification by ECEC; or (b) fifteen (15) working days after Applicant has notified ECEC that installation of the DG Facility is complete.

8. Access to DG Facility

Applicant shall permit (and, if the land on which the DG Facility is located is not owned by Applicant, cause such land owner to permit) ECEC's employees and agents to enter the property on which the DG Facility is located at any reasonable time for the purposes of inspecting and/or testing Applicant's DG Facility to insure its continued safe and satisfactory operation and the accuracy of ECEC's meters. Such inspections shall not relieve Applicant from its obligation to maintain the DG Facility and any related equipment owned by Applicant in safe and satisfactory operating condition.

ECEC shall have the right to witness any testing by Applicant of the DG Facility.

9. Disconnection of a DG Facility to Permit Maintenance and Repairs.

Upon reasonable notice by ECEC, Applicant shall disconnect the DG Facility to permit ECEC to perform routine repairs and maintenance to ECEC's Distribution System, or to install modifications thereto.

10. Disconnection of a DG Facility without Notice

When ECEC so requests, Applicant shall discontinue operation of the DG Facility and ECEC may isolate the DG Facility from ECEC's Distribution System, upon any of the following:

- a. Termination of this Agreement;
- b. If, in ECEC's reasonable judgment, the DG Facility fails to comply with the Design Requirements specified in Wisconsin Administration Code §§ PSC 119.20 and PSC 119.25;
- c. In the event of an emergency on ECEC's Distribution System; or
- d. Upon any other breach of this Agreement by Applicant (a "Default"), that Applicant fails to remedy within ten (10) working days after receipt of written notice from ECEC.

In the event of such disconnection, pursuant to b, c, or d above, the DG Facility shall remain isolated from ECEC's Distribution System until, in the reasonable judgment of ECEC, the DG Facility meets the Design Requirements, Applicant has cured any Default, and ECEC Distribution System is functioning in a safe manner. If Applicant fails to cure a Default within sixty (60) working days, ECEC shall further have the right to terminate this Agreement without liability for such termination.

11. Amendments; Non-Waiver.

Any amendment or modification to this Agreement must be in writing and executed by Applicant and ECEC. The failure of Applicant or ECEC to insist on performance by the other Party of any provision of this Agreement shall not waive the right of the Party who failed to insist on performance to enforce the same provision at a later time.

12. Term of Agreement

This agreement shall become effective immediately upon the execution, by the Parties, and shall continue in effect until terminated by any of the following:

- a. Mutual written agreement of the Parties;
- b. Abandonment or removal of the DG Facility by Applicant;
- c. By ECEC pursuant to Section 10 of this Agreement;
- d. By Applicant upon thirty (30) working days prior written notice given to ECEC.

13. Successors and Assigns.

- a. Assignment by applicant. Applicant shall not assign its rights and obligations under this Agreement in whole or in part without the prior written consent of ECEC, which consent shall not be unreasonably withheld or unduly delayed. ECEC may withhold its consent to any proposed assignment if the proposed assignee fails to assume the obligations of Applicant under this Agreement in writing.
- b. Assignment by ECEC. ECEC shall have the right to assign this Agreement in whole upon written notification to the Applicant.
- c. Successors. This Agreement shall be binding upon the personal representatives, heirs, successors, and permitted assigns of the respective Parties.

14. Applicant and ECEC Signature.

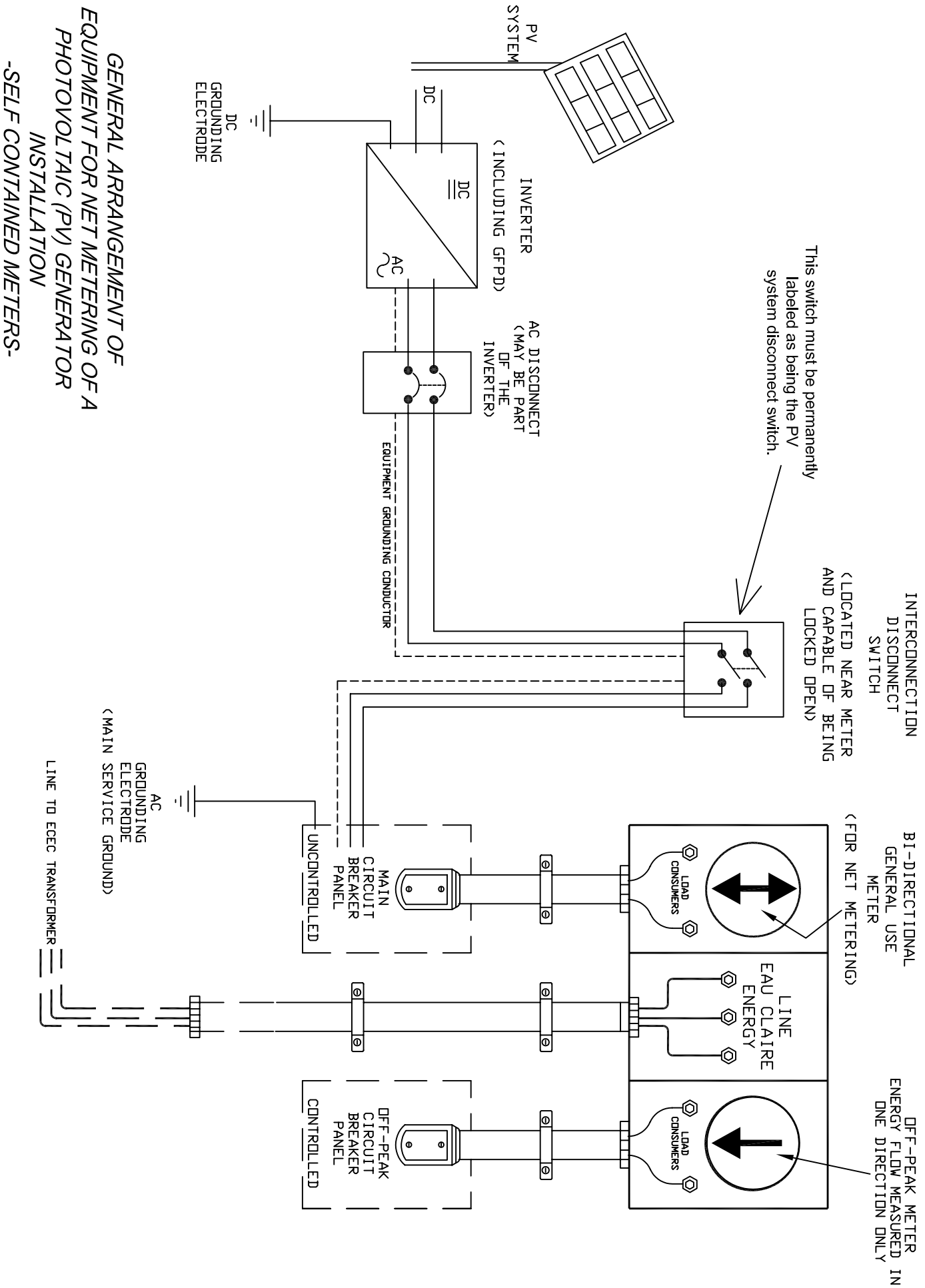
**IN WITNESS WHEREOF, Applicant and ECEC have executed this Agreement
As of the year and date first set forth above.**

Applicant Signature _____

Title _____ Date _____

ECEC Signature _____

Title _____ Date _____



GENERAL ARRANGEMENT OF
 EQUIPMENT FOR NET METERING OF A
 PHOTOVOLTAIC (PV) GENERATOR
 INSTALLATION
 -SELF CONTAINED METERS-



Capital Cost Recovery Analysis For a Small Wind or PV Installation

As interest in renewable energy grows, some cooperative member-consumers are considering the purchase of a small wind generating system or PV system. If you are interested in installing one of these systems to replace all or some of the electricity that your cooperative provides, talk with a cooperative representative about your plans.

Before you decide to buy a system, however, you should consider the economics to determine whether such a system will lower your monthly electricity costs. This capital cost recovery analysis, prepared by the Association of Illinois Electric Cooperatives (AIEC),* will enable you to determine the annual operating cost of a small wind or PV system and compare that cost to the cost of the electricity that you purchase from your cooperative.

Another source of information to help you determine the annual operating cost of a PV system is The Energy Matters Web site - <http://www.solar-estimate.org>

(Note: This calculation form does not factor in any net excess generation payments. It compares the cost of electricity—in kilowatt-hours—from a member-owned generator to the cost of electricity from the cooperative.)

INFORMATION REQUIRED FOR THE CAPITAL COST RECOVERY ANALYSIS

1. ENTER THE TOTAL COST OF PURCHASING AND INSTALLING THE GENERATING EQUIPMENT INCLUDING ANY INTERCONNECTION AND SYSTEM UPGRADE COSTS:	\$ _____
2. ENTER THE AMOUNT OF GRANTS, TAX CREDITS, OR OTHER FUNDING NOT REQUIRED TO BE REPAYED BY THE MEMBER FOR THE PURCHASE AND INSTALLATION OF THE GENERATING EQUIPMENT:	\$ _____
3. SUBTRACT LINE 2 FROM LINE 1 TO DETERMINE THE NET COST OF THE EQUIPMENT:	\$ _____
4. ENTER THE ESTIMATED AMOUNT OF ANNUAL MAINTENANCE COST OF THE GENERATING EQUIPMENT (INCLUDE ANY ANNUAL OPERATION COSTS, INCLUDING INSURANCE PREMIUMS IF ANY):	\$ _____



Capital Cost Recovery Analysis For a Small Wind or PV Installation

Table 1

YEARS	7.5 %	6.5 %	5.5%	4.5 %	3.5 %
	CAPITAL RECOVERY FACTOR	CAPITAL RECOVERY FACTOR	CAPITAL RECOVERY FACTOR	CAPITAL RECOVERY FACTOR	CAPITAL RECOVERY FACTOR
1	1.0750	1.0650	1.0550	1.0450	1.0350
3	0.3845	0.3776	0.3707	0.3638	0.3569
5	0.2472	0.2406	0.2342	0.2278	0.2215
10	0.1457	0.1391	0.1327	0.1264	0.1202
15	0.1133	0.1064	0.0996	0.0931	0.0868
20	0.0981	0.0908	0.0837	0.0769	0.0704
25	0.0897	0.0820	0.0745	0.0674	0.0607
30	0.0847	0.0766	0.0688	0.0614	0.0544
35	0.0815	0.0713	0.0650	0.0573	0.0500
40	0.0794	0.0707	0.0623	0.0543	0.0468

5. ENTER FROM TABLE 1 EITHER: (A) THE INTEREST RATE OF BORROWED FUNDS TO PURCHASE THE GENERATING EQUIPMENT, OR (B) THE INTEREST RATE THAT WOULD BE RECEIVED ON THE MONEY USED TO PURCHASE THE GENERATING EQUIPMENT:

(Pick the closest interest rate from the table)


6. ENTER FROM TABLE 1 THE NUMBER OF YEARS THE GENERATING EQUIPMENT CAN BE EXPECTED TO OPERATE OR THE NUMBER OF YEARS FOR THE LOAN:

(Pick the closest number of years from the table)

7. ENTER THE CAPITAL COST RECOVERY FACTOR FROM TABLE 1 ABOVE:

\$ _____

(Locate the interest rate in the top row of table 1 that you entered on line 5. Proceed down that column to the number of years corresponding to the entry on line 6. Enter the capital recovery factor indicated in that box on line 7.)



Capital Cost Recovery Analysis For a Small Wind or PV Installation

8. ENTER THE ESTIMATED PERCENT OF TIME THE GENERATING EQUIPMENT WILL OPERATE (ENTER AS A WHOLE NUMBER) :

_____ %

(A wind turbine may operate 25% to 40% of the time depending upon your geographic location. But you should confirm by independent analysis the percent your specific generating equipment is likely to operate.)

9. MULTIPLY (8) x 8760/100 = THE NUMBER OF HOURS PER YEAR OF OPERATION

10. ENTER THE RATED CAPACITY OF THE GENERATING EQUIPMENT IN KILOWATT (kW)

_____ kW

11. MULTIPLY (9) x (10) = KILOWATT-HOUR (kWh) PER YEAR (GENERATED)

12. ENTER YOUR COOPERATIVE'S AVERAGE COST PER KILOWATT-HOUR FOR THE ENERGY YOU PURCHASED DURING THE LAST 12 MONTHS (\$/kWh) :

\$ _____/kWh

(Excluding any monthly facility charge or consumer charge.)

CALCULATION OF ANNUAL OPERATING COST OF EQUIPMENT

The total annual operating cost (TOC) of equipment is calculated by:

13. MULTIPLY THE NET COST OF THE GENERATING EQUIPMENT (LINE 3) BY THE CAPITAL RECOVERY FACTOR FROM LINE 7

\$ _____

14. ADD THE ANNUAL MAINTENANCE COST OF THE EQUIPMENT (LINE 4) :

\$ _____

15. TO DETERMINE THE TOC OF THE EQUIPMENT, ADD LINES 13 AND 14:

\$ _____

16. DIVIDE LINE 15, THE TOC OF THE EQUIPMENT, BY LINE 11, THE KILOWATT-HOURS TO BE GENERATED EACH YEAR:

\$ _____/kWh

(Line 16 is the TOC for the generating equipment per kilowatt-hour.)

17. COOPERATIVE AVERAGE COST PER KILOWATT-HOUR FROM LINE 12:

\$ _____/kWh



10 Steps to a PV System

Ten Steps to a PV System

Is a PV system right for you? These 10 steps will help you to decide.

1. Determine how much electricity you use and what it costs, both annually and by the kilowatt-hour. Then find ways to make your home more efficient and reduce your energy use.

Start by calculating your average electricity bill. Then conduct an energy audit of your home to identify ways of using energy more efficiently and reducing energy use. Implementing energy efficiency opportunities will almost always speed up the rate of return on your PV investment and additionally may enhance the viability of a PV system project by giving you the lower capital expense associated with a smaller system that will satisfy the new lower energy load. This could lower your electricity bill significantly. The National Rural Electric Cooperative Association (NRECA) recently reviewed several Web sites that host online energy audits. The review identified one Web site—Home Energy Saver—as among the best (<http://hes.lbl.gov>).

A home energy audit may be a good idea. It does not make sense to spend a significant amount of money on a PV system that will produce electricity to power inefficient lights, appliances, and electronics.

2. Determine your solar resource.

The solar resource is the average amount of sunlight that reaches a given site. The greater the solar resource, the more electricity a PV system will generate.

A qualified PV installer can provide information on your solar resource. Alternatively, you can evaluate it using an online tool, such as PVWATTS Version 1 from the National Renewable Energy Laboratory, available at http://rredc.nrel.gov/solar/codes_algs/PVWATTS.

Several site conditions can influence PV performance—shade, roof condition, space required, orientation, and tilt. Shade is likely to have a greater impact on PV system performance than less-than-optimal PV module orientation and tilt (see below).



10 Steps to a PV System

A qualified PV installer can use software tools to assess the degree of shading a proposed array will experience throughout the year and determine the best PV design.

3. Determine your site's suitability.

If your PV system is to be roof-mounted, the condition of the roof is important. The cost of repairs or a complete re-roofing will be substantially greater once the PV array is in place.

Another consideration is the space available for an array sized to meet your needs. In bright sunlight, a square foot of a PV module will produce approximately 10 watts of electricity. That's a helpful rule of thumb for estimating how much area you will need. A 1,000 watt (1 kW) PV system, for example, is likely to need 100–200 square feet of area, depending on the type of module used.

PV modules should be oriented geographically to maximize the amount of daily and seasonal solar energy. In general, the optimal orientation for a PV module in the northern hemisphere is true south. However, your modules can face up to 45° east or west of true south without significantly decreasing their performance. Orienting a system to face more to the west will benefit the utility. It does not help the homeowner, however, whose annual output will be lower. If the utility wants a strategic benefit from PV, it needs to compensate the homeowner for the value of the lost kilowatt-hours. Strategically designed solar programs may encourage siting to make a greater impact on the late-afternoon summer peak.

Most PV modules are mounted flat on the roof and so have the same tilt as the roof. The optimal tilt angle for maximizing annual energy production of PV modules is an angle equal to your latitude. Because most roofs are pitched at an angle less than the latitude, you and your installer will need to factor your roof angle into the performance calculations when sizing your system. Some roof-mounted systems can be adjusted for the sun's higher position in the sky in the summer and lower position in the winter.

Although most PV systems are roof-mounted, pole- and ground-mounting also are options. Both have more opportunities for incorporating tracking to maximize electricity production than do roof-mounted systems. A tracking device can increase the output by 25–40% over a stationary-mounted system. In addition, a pole-mounted system can be located far from shading and the array can be tilted



10 Steps to a PV System

and oriented in the best position. However, adjusting the tilt of a pole-mounted array for summer and winter sun may require at least two people.

Talk with a qualified PV installer about the best mounting option for your site.

4. Determine the size of the PV system.

Realistically, the size of your system is likely to be determined more by cost than by desired output. It makes sense, however, to estimate the amount of electricity that you want your PV system to produce. If cost is a constraint, the system could be installed in two phases.

Before determining the size of your PV system, it is advisable to adopt energy efficiency measures that will reduce your annual energy use and thus maximize the value of your PV system.

You can ask your PV installer to help determine the size of your system. You also can begin by calculating your electricity usage and the annual average peak solar hours at your site. A peak sun hour is the average amount of sunlight—summer and winter—available at your site. NREL publishes solar radiation resource maps that provide data on peak sun hours at http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/atlas/.

Divide your annual electricity usage (in kWh) by the number of peak sun hours to determine the wattage needed for your system.

Alternatively, you can calculate your average daily electricity usage (in kWh) and refer to a chart that estimates the system size needed to reduce your electricity use by 25%, 50%, 75%, or 100%. See <http://www.thesolarenergycompany.com/images/sizingPV/SizingChart.pdf> for more information.

DOE provides an estimate of the area needed for variously sized PV systems—including 1 kW, 2 kW, 4 kW, and 10 kW systems—for various module efficiency, available at http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10840.



10 Steps to a PV System

5. Find out what incentives—rebates, tax credits, and loans—are available.

The Emergency Economic Stabilization Act of 2008 includes a residential solar investment tax credit provision. The provision extends the 30% investment tax credit (ITC) for residential solar property for eight years, through December 31, 2016. The provision also removes the cap on qualified solar electric property expenditures (previously \$2,000) for a system placed in service after December 31, 2008.

The Database of State Incentives for Renewables & Efficiency (DSIRE) provides detailed information on each state's incentives that apply to renewable energy systems, including PV. You can access the database at <http://www.dsireusa.org>.

A few states offer generous incentives for PV systems, some offer more limited incentives, but many offer none. These incentives can reduce the installed cost of a PV system significantly. The DSIRE database, available at <http://www.dsireusa.org/>, provides detailed information on renewable energy tax incentives, loans, grants, and rebates available in each state.

6. Determine the estimated installed cost of the system and calculate return on investment.

PV systems are rated in kilowatts of DC generating capacity (kWdc), and tend to range in size from less than 1 kW to 10 kW. The average cost of an installed residential PV system typically ranges from \$8/watt to \$10/watt, depending on the size of the system, the region of the country, and the size and maturity of the PV market in that region. A recent study by DOE's Lawrence Berkeley National Laboratory identified a range of \$7.60/watt to \$10.80/watt. An average 2 kW system is likely to cost between \$16,000 and \$20,000. As a rule of thumb, the larger the system, the lower the per watt cost.

If you are considering the purchase of a battery bank, the cost will be higher. For a pole- or ground-mounted PV system, installation costs will be greater. In addition, a tracking device on a pole-mounted system will boost the cost of your PV system. You can compare the cost-effectiveness of fixed mount and a single- or dual-axis tracking for your site at <http://rredc.nrel.gov/solar/calculators/PVWATTS>.



10 Steps to a PV System

The payback for a PV system is the amount of time it takes for the system to pay for itself in energy savings. Depending on the level of government incentives, the payback period can range from fewer than 10 years to more than 20 years, depending on the cost of the system, the amount of electricity produced, and the retail price of electricity that you buy from your co-op.

You can calculate the simple payback of a PV system using the following formula:

Total of Life Cycle Costs (capital costs + finance costs + O&M costs - federal and state incentives) / Average Value of Energy Generated per Year (kWh generated * cost of power).

In addition, an online calculator is available at <http://www.solar-estimate.org>.

Note: The payback may be overestimated by using either the formula or the solar-estimate.org calculator if the system is dual-metered but not net metered.



10 Steps to a PV System

7. Determine what zoning regulations apply to the installation of a PV system, if any, and what building and electrical permits are required. Talk with your neighbors about your plans.

Local zoning laws may restrict where you can place PV panels on your home. Check with your city or county to find out about any restrictions.

You may need to obtain a building permit to install a PV system. Building and electrical codes also may apply. Contact your local building department or ask your PV installer to include the cost of permits in the cost estimate.

After your PV system is installed, it must be inspected and approved by the local permitting agency (usually a building or electrical inspector) and your cooperative. Inspectors may require your installer to make corrections. A copy of the building permit showing the final inspection sign-off may be required to qualify for a solar rebate program, if that type of incentive is available in your area.

Fees for building permits for PV systems range from \$200 to \$500. If a fee seems inappropriate or excessive, you may be able to get it reduced or waived. Find out what you are being charged for and offer to provide documentation or information that may make the fee unnecessary.

At this stage, talk with neighbors about your plans and listen to any of their concerns. If there are any other PV system owners in your area, talk with them about any concerns their neighbors had and how they dealt with these concerns. Many states have “solar access” laws, which protect homeowners from the most common (aesthetic) complaints.

8. Ask your cooperative about its interconnection requirements, including costs and liability insurance.

If you have not already talked with your cooperative about your plans, do so now. Discuss the steps you have taken to get to this point and provide information on the PV system you are considering. You need to make sure that the system meets the cooperative’s criteria for interconnection.

Most cooperatives have interconnection agreements, which often are posted on their Web sites. Your cooperative can provide information on its interconnection process and policies, as well as a sample interconnection agreement, and can answer any questions that you may have.



10 Steps to a PV System

9. Find a PV system installer (if you haven't already done so).

Using a professional, licensed PV installer is the best way to avoid installation problems with your system. A qualified, experienced installer will design a system that meets your needs and site conditions. The installer also can help you with the paperwork for tax credits and rebates.

You might want to start looking for an installer by asking current PV system owners in your area for references. Several Web sites also provide listings of qualified installers. Among them are the American Solar Energy Society, at <http://www.findsolar.com/>; Home Power magazine, at http://www.homepower.com/view/?file=HP116_pg102_IPP; Energy Matters' Solar-Estimate at <http://www.solar-estimate.org/index.php?verifycookie=1&page=solar-installer&subpage=>; and the North American Board of Certified Energy Practitioners (NABCEP), at <http://www.nabcep.org>. NABCEP, considered the most respected solar certification organization in the United States, has a certification program for PV installers. To be certified as a PV installer under NABCEP, an individual must have several years of installation experience and training and also take an examination.

Another option is to ask your state's renewable energy organization or energy office about installers. DOE's EERE Web site provides contact information for state energy offices, available at http://www.eere.energy.gov/state_energy_program/seo_contacts.cfm. Regional organizations, such as the Midwest Renewable Energy Association (MREA—<http://www.the-mrea.org>) may also be able to help. Also, check the local chapter of the Solar Energy Industries Association (SEIA) to find PV installers.

Both finding the installer who is right for you and establishing a good working relationship with that individual are essential to a successful PV project. Your cooperative can provide you with a PV information packet that includes a list of questions to ask prospective installers.

Once you have a short list of installers, contact at least two of them for quotes for the equipment and installation. Question any quote that appears to be too high or too low.



10 Steps to a PV System

Some states link installation requirements to incentives. Check the DSIRE database for the requirements in your state, available at <http://www.dsireusa.org/solar/index.cfm?ee=1&re=1&spv=1&st=0>.

10. Contract for installation of your PV system.

Before actually placing an order, ask the installer for the names of consumers who have installed a similar PV system. Contact those consumers to ask about system performance, reliability, and support from the installer. Also ask if the system is meeting their expectations.

Ensure that the PV panel manufacturer offers at least a 20-year limited warranty and the inverter manufacturer offers a five-year limited warranty. The panels and inverter should be Underwriters Laboratories (UL) listed. Also ask the installer about a warranty for the work.



Questions to ask a PV Installer

Cooperative member-consumers interested in installing a PV system should ask installers or contractors the following questions:

1. What are your credentials? How long have you been in business? How many grid-connected PV systems have you installed?

Look for installers that have been in business for at least five years. Installers certified by NABCEP must pass a rigorous examination and demonstrate that they possess a high degree of experience or education related to PV system design and installation.

In addition, you should ask the installer for a portfolio of recent residential projects and the names of at least two people who have had a PV system installed that is the same as, or similar to, the one you are considering.

2. What is the estimated total installed cost? What do the panels cost? What does the inverter cost? What is the estimated installation cost?

It is important to know the total installed cost of a PV system to ensure sufficient budgeting for the system. Budget for installation labor expenses, as well as the cost of equipment rental, construction materials, electrical components, shipping, and sales tax.

3. How long is the warranty? What does it cover? Parts? Labor? Can it be extended? If so, what will it cost?

The PV panel manufacturer should offer a 25-year warranty for crystalline modules and 20 years for thin films. Warranties for inverters should be for five years. Make sure the warranty covers all aspects of the removal, shipping, repair, and reinstallation of components. Cooperative member-consumers should ask owners of PV systems purchased from the same installer about performance and reliability before making a decision on an extended warranty, if it is available.

4. Are the PV panels and inverter UL-listed?

Both the PV panels and the inverter should be UL-listed. Most utilities require that an inverter have a UL 1741 certification for interconnection with the grid. As part of the certification, the inverter is required to fail open in the absence of power on the grid.



Questions to ask a PV Installer

5. Does the installer offer packaged systems?

Packaged systems, which include everything needed to generate electricity, can facilitate the interconnection process for the cooperative. Cooperative member-consumers should look for systems that are UL-listed and have been pre-certified. The cost of a grid-tied packaged system, uninstalled, depends on the system size. A 1 kW system is likely to cost between \$6,000 and \$8,000, while a 4 kW system can be expected to cost between \$20,000 and \$25,000.

6. If the system is to be roof-mounted, how will the installer mount it?

The performance of PV panels mounted flush on the roof will decrease during the winter if the roof is at a shallow pitch. Some installers may address this issue by adding one or two panels to the array. While the additional panels will compensate for the decreased winter performance, they also will significantly increase heat gain during the summer, reducing output.

Consumers may wish to consider alternatives, such as mounting panels at a greater angle on the roof or mounting the array on the ground or a pole.



Questions to ask a PV Installer

7. What are the advantages and disadvantages of adjustable rack mounts and tracking devices?

Adjustable rack mounts—both ground and roof—can be repositioned seasonally to optimize energy output but they will increase the cost of a PV system. Consumers should ask the installer to estimate the improved performance of a system with adjustable rack mounts and then weigh the higher output against the increased cost.

Tracking devices—PV mounting devices that follow the sun—can increase the output of a PV system by 25% to 40%, compared with a fixed-mounted array. They are either electrically or thermally operated and usually are mounted on a pole. Trackers are most effective at sites with dawn-to-dusk sun, and provide a great increase in output in the summer. Because of their moving parts, trackers may require increased maintenance.

Although trackers increase the cost of a PV system, the total cost of a tracked system may be less than that of a fixed system because a smaller tracked system can produce more electricity. For example, a 3 kW tracked system can produce as much electricity as a 4 kW fixed system. The higher output of a tracked system makes it possible to scale down the size—and thus the cost—of the PV system.

Consumers should ask the installer to evaluate their site with a tool such as the Solar Pathfinder (available at <http://www.solarpathfinder.com>) to determine if a tracker makes sense.



PV System Information

Legal Notice:

The Consumer Handout Packet was created for the benefit of NRECA members and their consumer-members as part of the CRN's Cooperative PV System Guide. Some of the contents of the Consumer Handout Packet is specific to Eau Claire Energy Cooperative.

This work contains findings that are general in nature. Readers are reminded to perform due diligence in applying these findings to their specific needs.

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