



SOLAR FINANCING TOOLS

Fritz Ebinger, J.D.

Clean Energy Resource Teams (CERTs)

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How does CERTs help?



Hands-on assistance

For cities, counties, utilities, farmers, businesses, and other organizations looking to make a change



Practical steps to clean energy

Resources for getting started, moving forward, and completing projects



Learning opportunities

We host events, create resources, and highlight clean energy stories and jobs

CERTs
Partners

Regional Sustainable
Development Partnerships
UNIVERSITY OF MINNESOTA
EXTENSION



GREAT PLAINS
INSTITUTE



m1 **COMMERCE**
DEPARTMENT

How does CERTs work?



STAFF

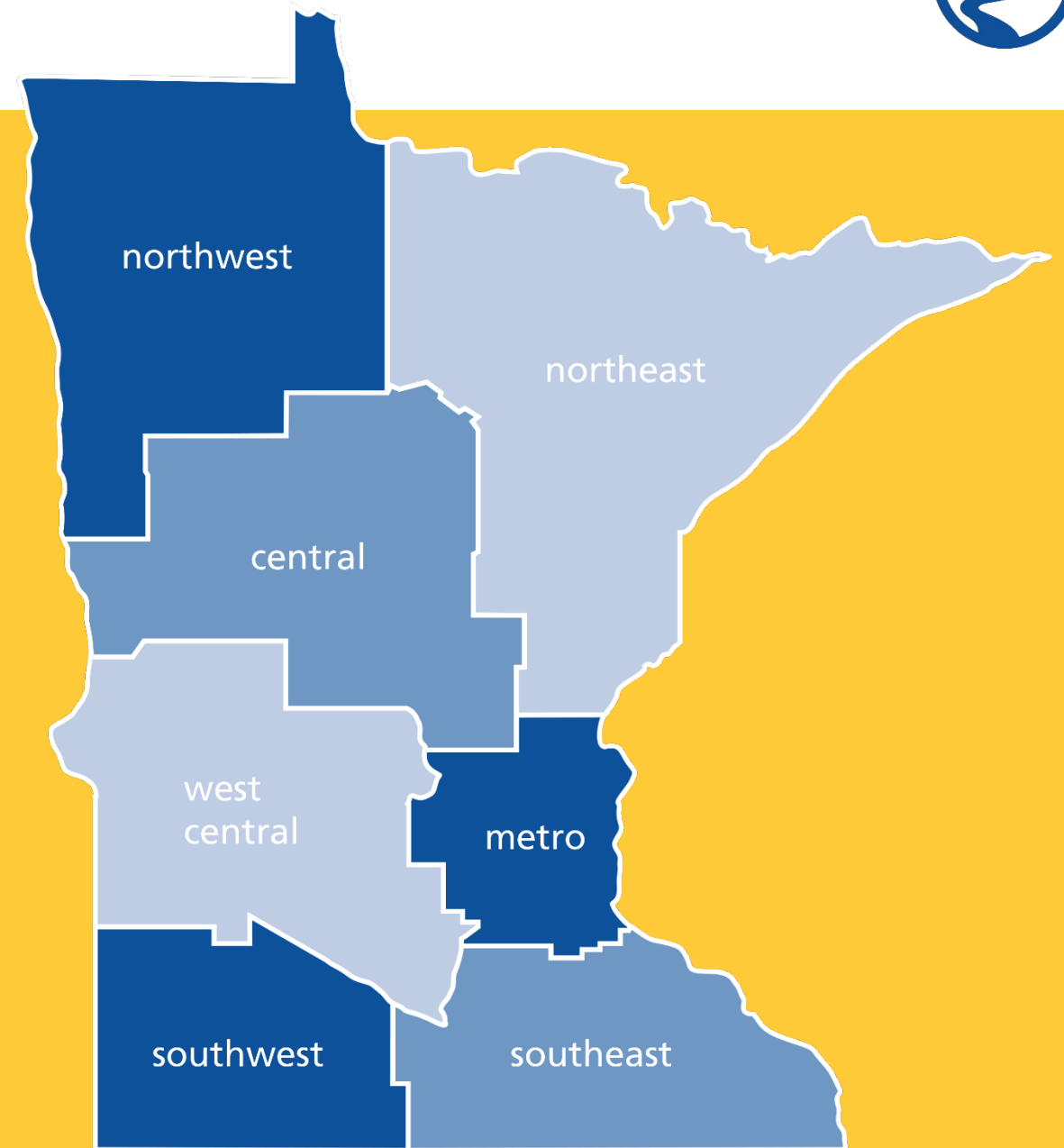
Regional coordinators and statewide support

STEERING COMMITTEES

One per region; governing body for regional team

REGIONAL TEAMS

Anyone can join; broad range of skills, interests, and backgrounds



Sharing farm case studies

MN ENERGY
STORIES

mncerts.org/blog



Zumbrota Farm
harvesting solar power
to reduce energy costs



Ronningen Dairy Farm
adds solar PV to their
West Concord
operation



Jorgenson Hog Farm in
Westbrook, MN cashes
in with wind, solar PV



Family farm invests in
renewable energy,
saves barn



Learning about solar
energy at Featherstone
Farm



Solar exceeds
expectations at
Guentzel Family Farms
in Eagle Lake



Hoffman Farms near
Chatfield saves money
with utility rebates



The Popps are
harvesting solar and
wind energy on their
farm



Turkey farmers learn
about solar air and LED
lighting technologies



Langmo Bros. Farm
pilots LED lighting for
turkey barns

Solar PV Curriculum & Simple Steps



UNIVERSITY OF MINNESOTA EXTENSION

E³A: Solar Electricity for the Home, Farm, and Business

By Susan Bilo, Sarah Hamien, Mike Vogel, Milton Geiger. Updated by Lisa Pawlisch.

Introduction

Most of Minnesota's electricity is generated by coal-fired power plants. An alternative is to use the sun's energy to fuel to produce electricity. This is accomplished using photovoltaic (PV) technology. The letters PV stand for "Photo" = light and "Volts" = electricity. PV technology can potentially be used anywhere the sun shines.

Solar electricity is produced through the PV effect: when sunlight hits a solar cell, electrons are released and flow as electricity through wires to your building or equipment. Solar cells are constructed together to form a panel (also called a module). Panels are wired together to form an array.

PV technology is used to power everything from calculators and outdoor lighting devices to buildings and satellites. What's ever is powered by electricity (appliances, machinery, etc.) is called the electrical "load." The sun can provide electricity for your home, greenhouse, and barn. It can also electrically freeze and pump water.

In addition to the PV panels, a solar electric system (also called a PV system) includes an inverter, meter, and safety equipment. It may include batteries and a charge controller. These systems contain no moving parts, are silent, very durable and reliable, and are low maintenance. Once installed, they only use the sun's energy and their operation produces no emissions. Solar electric systems can produce all or a portion of the electricity needed. PV panels can be added to an existing system over time.

Steps in the Solar Electricity Series

1. Building and Site Assessment
2. Conservation and Efficiency
3. System Components
4. System Sizing
5. Costs
6. Installation
7. Electricity Use Worksheet

Exploring Energy Efficiency & Alternatives

E³A

Education & Decision-making Toolkit
PRINCIPLES • TECHNOLOGY • APPLICATIONS
WWW.E3A.UMN.EDU

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STEP 1: Building and Site Assessment

Answering these questions will help you determine if a solar electric system will work for your building or site.

1. Do you have a south-facing roof?

Because Minnesota is in the northern hemisphere, PV panels (modules) need to face south for maximum performance. This placement allows panels to take full advantage of the sun's path in the sky. The sun shines longest on a building's south side. Southeast- and southwest-facing panels will perform about 5 percent less efficiently.

Yes — Move to Question #2
 No — Options: PV panels can be used as structure such as a porch cover or window awnings. They can also be ground-mounted or pole-mounted. If you cannot place PV panels to face south, a solar electric system will likely not be an efficient investment. You may choose to participate in a community solar garden (CSG), also known as a community shared solar (CSS) program if your utility offers one. Find out if your utility offers a CSG program at cleanenergyminnesota.org/energylink.

Modules can be mounted on east- or west-facing roofs to face south, but they stick up and are highly visible, and can be prohibited by some municipalities. Architects and builders can address this by designing "solar ready" buildings and integrating solar technology components into their designs. One can read more about these practices in "Solar Ready Building Design Guidelines for the Twin Cities, Minnesota."

2. Does your roof have enough space for PV panels?

The rule of thumb for PV panels is 100 square feet of space is needed for every kilowatt (kW) of electricity produced.

Yes — Move to Question #3
 No — Options: If your roof does not have enough space, review the Options section under the previous question.

Dispelling the myths

There is a myth that it takes more energy to make a PV system than it produces over its lifetime. "Energy payback" to develop/manufacture a system means it takes less energy to produce a system than it takes to produce the energy it generates.

Photovoltaic panels are very sensitive to shading. Any shading will dramatically reduce electricity generation. Inverters use a Solar Pathfinder device to determine if there are shading concerns from trees (consider mature heights), chimneys, nearby buildings, etc. In Minnesota, people considering solar can enter their address into the Minnesota Solar Suitability Analysis to get a sense for whether or not they may have a good solar site. www.mn.gov/energy/energylink is a good step to find the sun's path changes throughout the year, for maximum electricity production, make sure panels will be unshaded year-round (especially from 9 am to 3 pm).

3. Is your roof unshaded?

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Yes! — Move to Question #3
No! — Options: If the shade is from landscaping, consider removing the plants. Check local and state codes regarding "solar noisies" rights if a neighbor might prohibit shade on any solar system you are considering. See the "The Installation section of FactSheet 2. If more shade is unavoidable, ask the installer about microinverters.

What is the angle of your roof?

Modules typically mount panels directly (flush) on an existing south-facing roof for aesthetics. To maximize energy generated year-round, monocrystalline modules are equal to or close to your site's latitude (34 degrees elsewhere 47.5 degrees for Burlington). Inverters can tilt the angle for your site, system type, and electricity use. A rule of thumb, the ideal pitch for a PV system in your northern electricity production, tilt at latitude (0 degrees to 15 degrees for more winter production, steeper pitch 15 degrees.

Collection Orientation

Angle equal to latitude

What's Next?

If you answered yes to every question or can make adjustments where you answered no, your building or site is a good solar electric system candidate. A system supplier or installer can provide a more detailed assessment. Next, result in an efficient and affordable system, then learn about system options.

Next Steps

1. Get Educated
2. Start Planning
3. Seek Advice
4. Get Bids
5. Install Solar
6. Tell Your Story

Simple Steps to Solar

Steps to start powering your farm or business with solar energy!

Before you begin...

Energy efficiency is the cleanest energy of all. Before adding solar energy production, limit your need for additional energy by making your farm or business as energy efficient as possible. All of our utilities have incentives for efficiency improvements, so be sure to ask your utility. The MN Department of Commerce provides a wealth of resources, as well (mn.gov/commerce). CERIs also offers energy-saving resources on our website (mncerts.org/greatrenewables).

1: GET EDUCATED

Understand what sort of system is right for you. Solar technologies come in differing models. A photovoltaic (PV) system offsets electric energy use. A solar thermal hot water system reduces demand for fuels needed to heat water. A solar thermal air heat system lowers demand for fuels needed to heat buildings. Any one of these technologies might be right for you depending on your energy use and the solar resource available at your site. You can learn more about solar technologies from the Clean Energy Resource Teams solar page (mncerts.org/solar).

2: START PLANNING

Consider your sun exposure, budget, and roof life and structure.

Sun Exposure: It is important to consider the solar resource at your site. A solar site assessor can help you decide which technologies are the best fit for your home or business. Assessments will provide insight on the solar resource and potential structural issues. **Tip:** Using a third party to get an unbiased opinion for your site assessment can be helpful. Clean Energy Project Builder (cleaneenergyprojectbuilder.org) provides a directory of assessors who can provide this information. You can get a sense for the solar resource at your site using the Minnesota Solar Suitability App (mn.gov/solarapp). Solar installers that you consider working with can also provide you with a detailed site assessment.

Planning and Zoning: It's important to check in with your local city/town about ordinances that might be in place that would impact your solar project. Some require setbacks or structural assessments, for instance.

Budget: Installers should be able to provide a good cost estimate for a project you're considering, and incentives can make solar more affordable. A federal tax credit can cover up to 30% of the project cost, and USDA REAP provides grants for up to 25% and loans for up to 75% of the cost for farms and small businesses. Check dcreusa.org for info about potential utility rebates.

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Find more resources for solar energy at mncerts.org/greatrenewables

mncerts.org/solar



Renewable Energy for Greater MN

We offer FREE assistance to Farmers and Small Businesses for:

- Solar site assessments and financial modeling
- Application support for grants and loans
- Guidance on federal tax credits, depreciation
- Financing opportunities: Property-Assessed Clean Energy (PACE)



Renewable Energy
for **Greater Minnesota**

mncerts.org/greatrenewables



Commercial Turnkey Cost in MN?

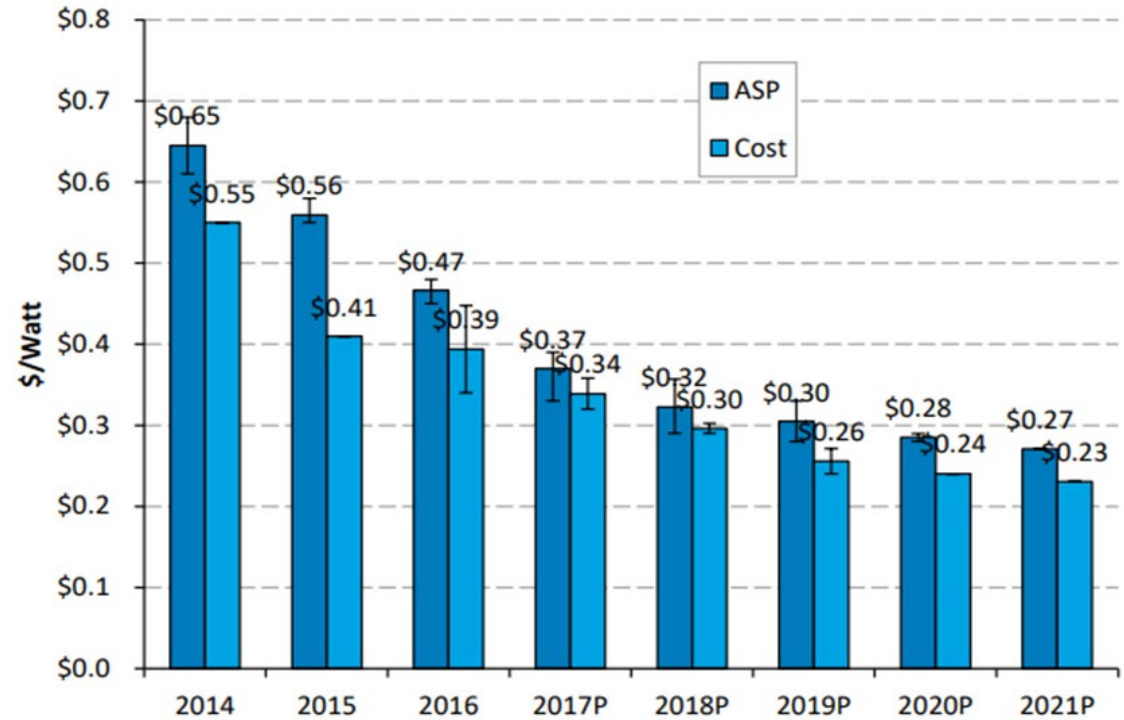
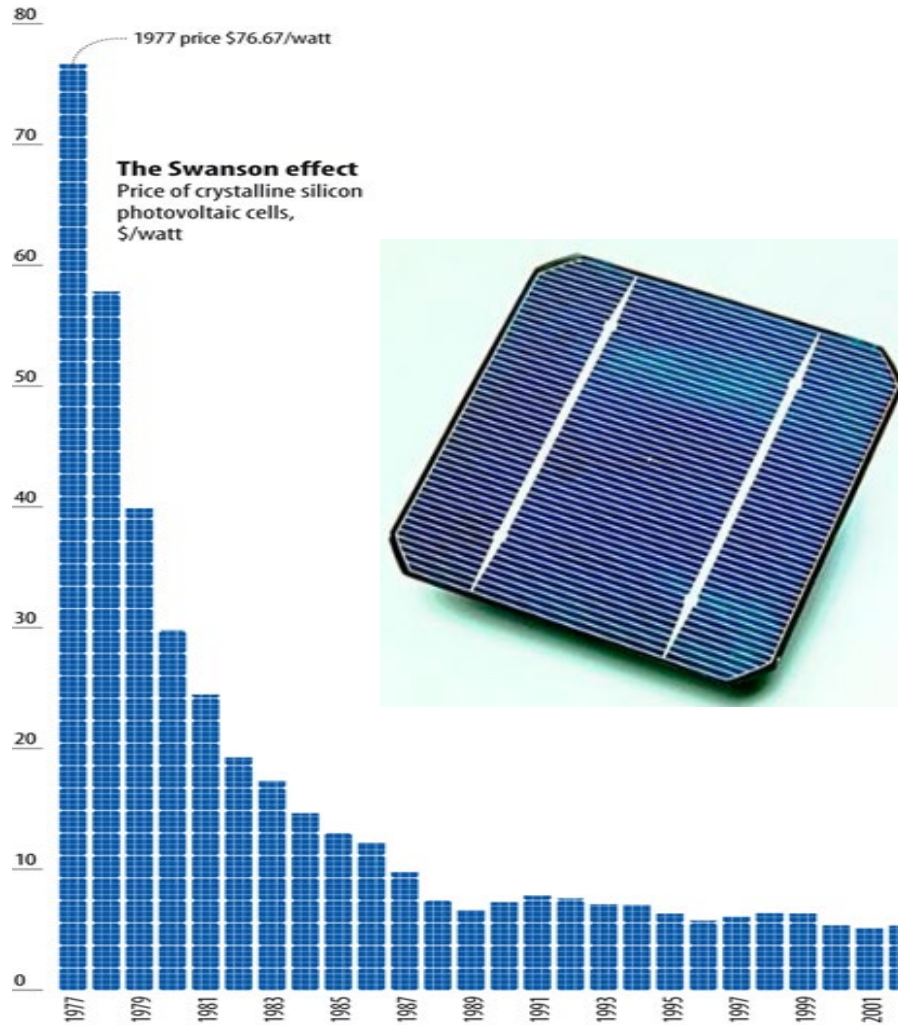


“Installed cost per watt”

- **Ground-mount Fixed Tilt: \$2.20 - \$2.40 per watt**
- **Building – Rack/Ballast: \$2.95 - \$3.15 per watt**
- **Building – Flush-mount: \$2.65 - \$2.85 per watt**

Sources: St. Paul Port Authority PACE Loan amounts Jan. 2019 – June 2019; REAP Projects

Solar Cell Cost: 1977 - Present



Sources: Bloomberg New Energy Finance; NREL, Q3/Q4 2018 Solar Industry Update May 2018

2013 price \$0.74/watt FOR FAST
Source: Bloomberg, New Energy Finance



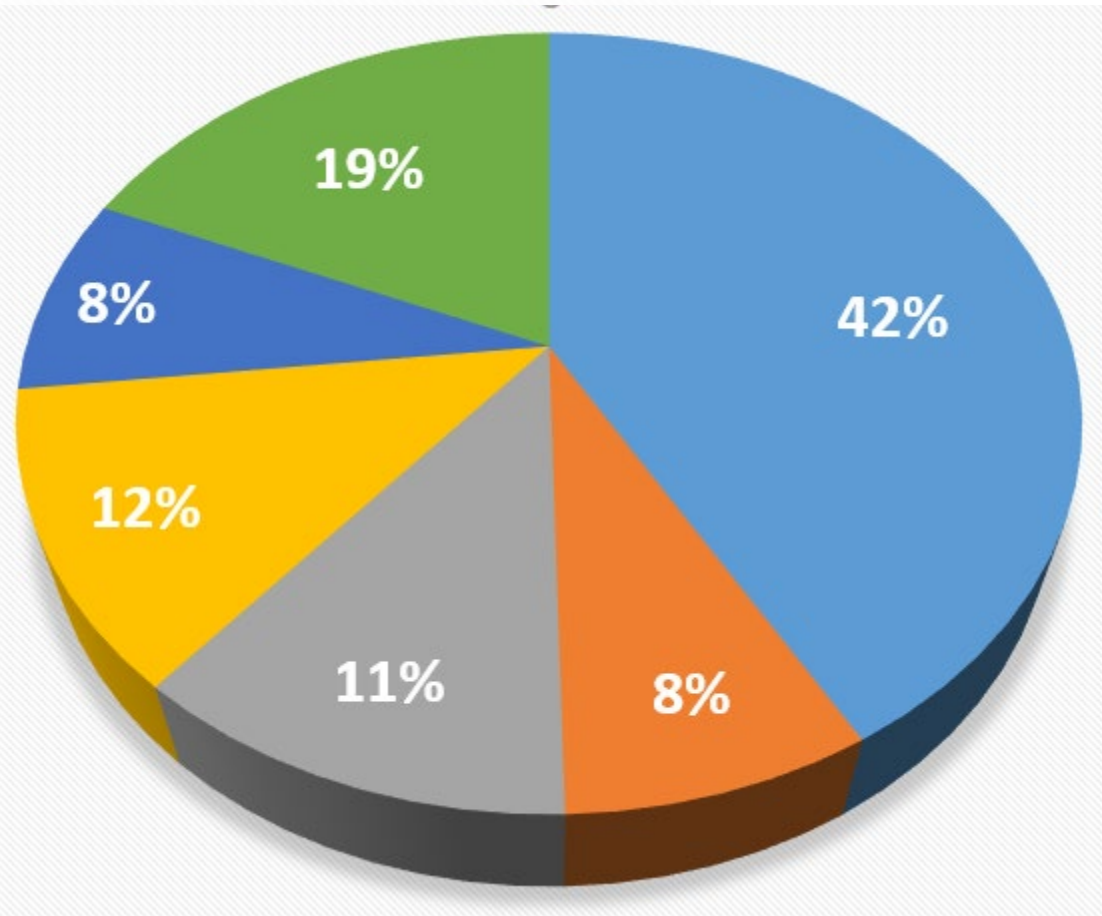
TURN-KEY COST BREAKDOWN



- 42% -- \$1.06 Overhead, Net Profit, Marketing, Inspection & Permitting
- 8% -- \$0.20 Installation Labor
- 11% -- \$0.29 Supply Chain Costs
- 12% -- \$0.31 Balance of System
- 8% -- \$0.21 Inverter
- 19% -- \$0.47 Module

**Based on a \$2.54/watt

Source: NREL, U.S. Solar Photovoltaic Cost Benchmark Q1 2018 (Nov. 2018)





Financial Tool: Federal Income Tax Credit

- 30% Fed. Energy Investment Income Tax Credit (the 30% ITC)
- 1 year carry-back, 20 year carry-forward period (26 U.S.C. §39)
- Extended at 30% through **2019**, then tapers to 26%...22%...10%

www.mncerts.org/taxcredits





Accelerated Depreciation (MACRS)

- Cost-of-doing-business expense taken as a tax credit over the life of the equipment
- 5-year Property Schedule (IRS Pub. 946)
- Depreciable adjusted basis starts at 85% of total cost
- Trump Tax Bill allows for 100% bonus depreciation in year placed in service!



www.mncerts.org/macrs

**26 U.S.C. §50(c) (2018)

GRANT: USDA-REAP



- **Rural Small Business - town with less than 50,000 people**
- **Farmer – derive more than 50% of your income from agricultural production (crops, livestock, timber, etc.)**

Tangletown Gardens / Wise Acre Farm – Plato, MN

GRANT: USDA-REAP



- 25% of project cost
- Two deadlines:
 - October 31, 2019
 - April 30, 2020
- Start project after application is submitted

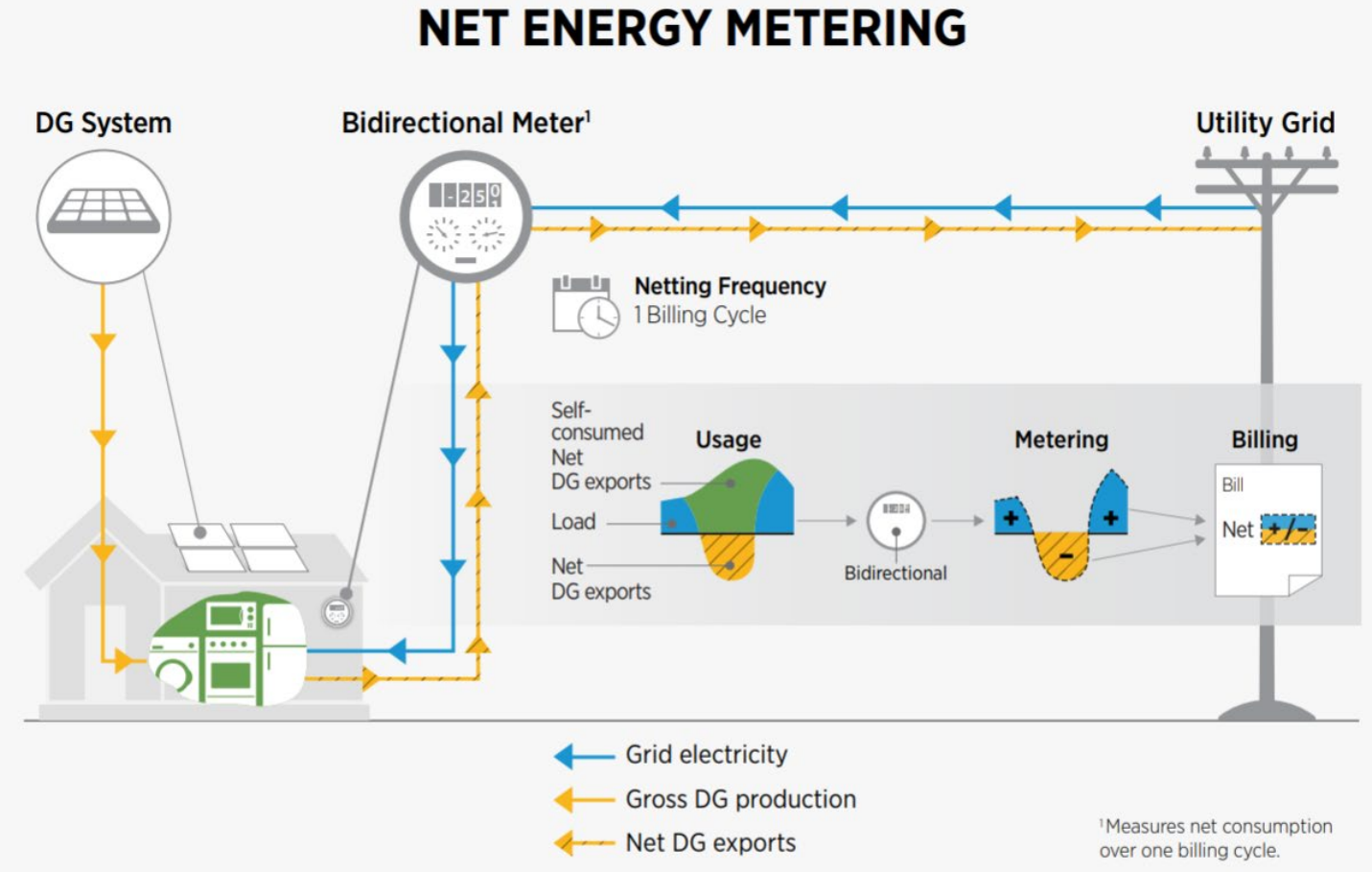


Turkey Farm by CB Solar – Washington, IA

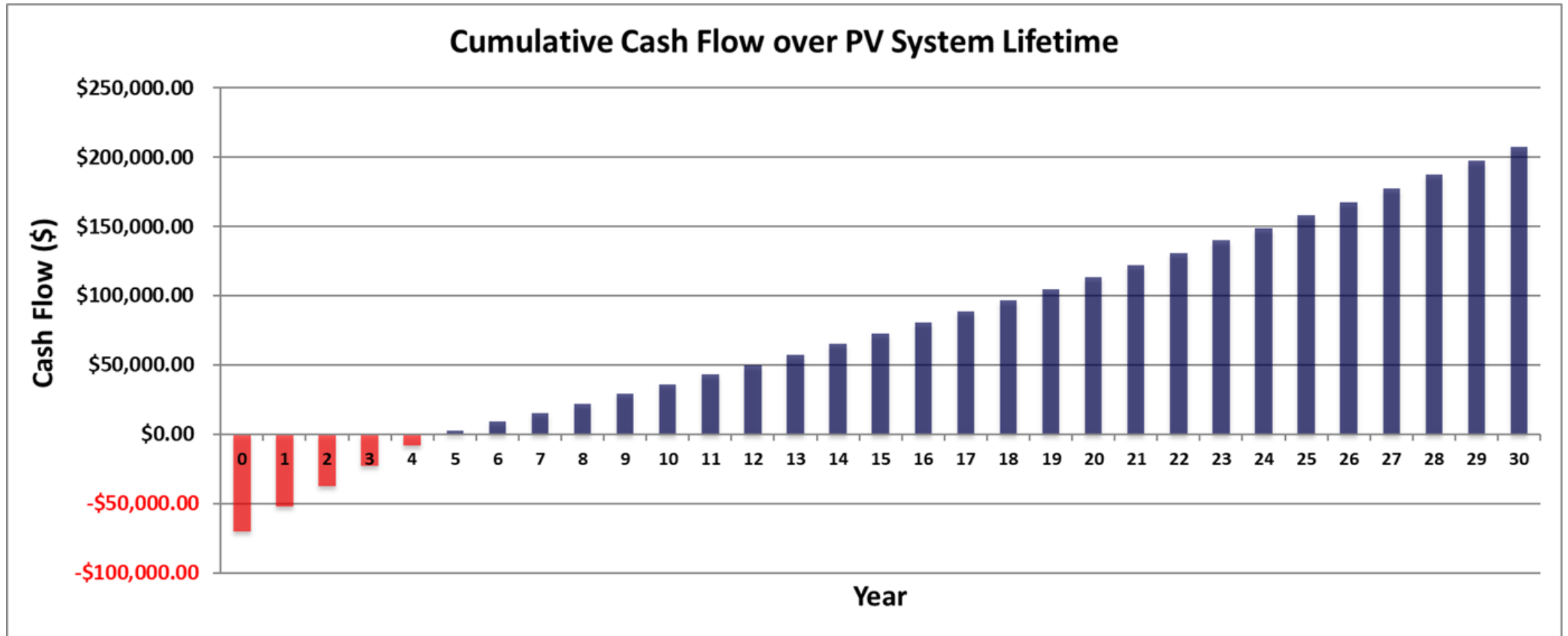
Net Metering



- Solar offsets consumption “behind the meter”
- Excess production is credited at the “average retail cost of energy” rate
- Grid Access Fee over 3.5 KW – depends on co-op



30% Tax Credit ⚡ 5-Year Depreciation ⚡ 10¢ kWh Rate ⚡ 40 kW DC array ⚡ \$2.50/Watt



Want to Follow Up?



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