Solar Energy for Your Farm or Business



Fritz Ebinger

Clean Energy Resource Teams (CERTs)

July 21, 2018 – Minnesota Solar Congress





CERTs is a statewide partnership





UNIVERSITY OF MINNESOTA EXTENSION





What Does CERTs Do?



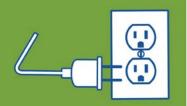


Write blog posts & case studies

Create educational guides

Manage diverse web-based tools





Host events, tours, and conferences

Help with community organizing

Connect people to technical resources





Provide seed grant funding and more

Deliver research-based campaigns

Spur other statewide programs

Outreach and Education Partnerships



CERTs partners with utilities and community groups to do outreach and education about farm and business programs for EE and RE

FARM ENERGY ASSESSMENTS

McLeod Cooperative Power Association proudly offers farmers special in-person energy services to help farms identify ways to address input costs associated with energy.











A farm energy assessment is an

AGRICULTURE PUMP & MOTOR EFFICIENCY

McLeod Cooperative Power Association aims to keep your farming operation running efficiently with the right pumps and motors.











To learn more about upgrading farm motors and pumps from our Energy

FARM 000 LIGHTING REBATES

McLeod Cooperative Power Association is proud to offer farming patrons LED lighting rebates through its LED Lighting Store and New Construction and Custom Rebate Program





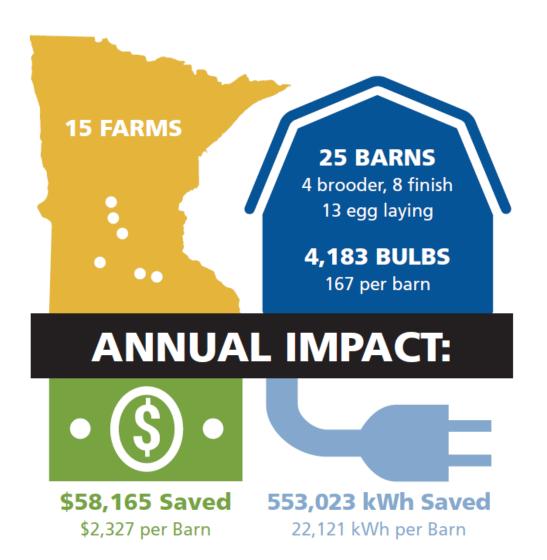


o learn more about upgrading farm lighting please call to discuss your options!

Gobbling Up Savings in Turkey Barns









- Reduce costs by \$1,000s each year
- Save up to 85% on lighting energy
- Pay for project in 3 yrs or less
- Reduce maintenance
- Federal & utility funding



Renewable Energy for Greater MN



We offer FREE assistance to Farmers and Small **Businesses for:**

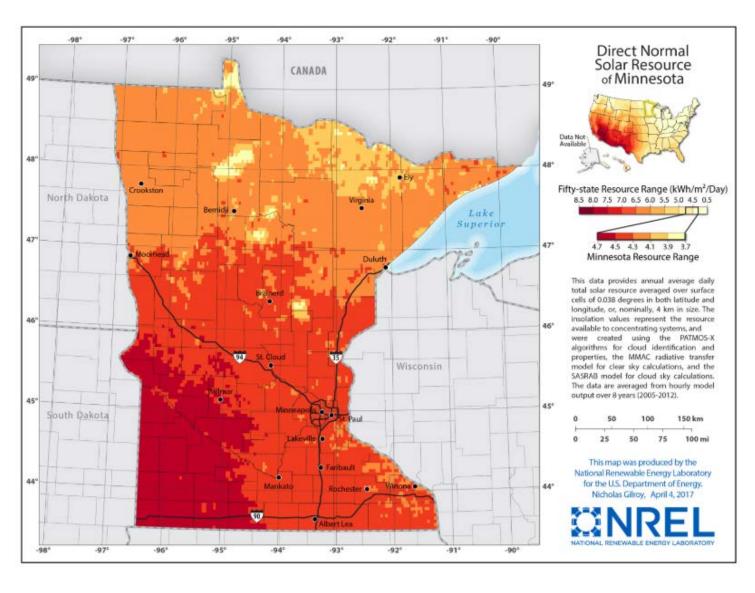
- Solar site assessments and financial modeling
- Application support for grants and loans
- Guidance on federal tax credits, depreciation
- Financing opportunities: Property-Assessed Clean Energy (PACE)



for Greater Minnesota

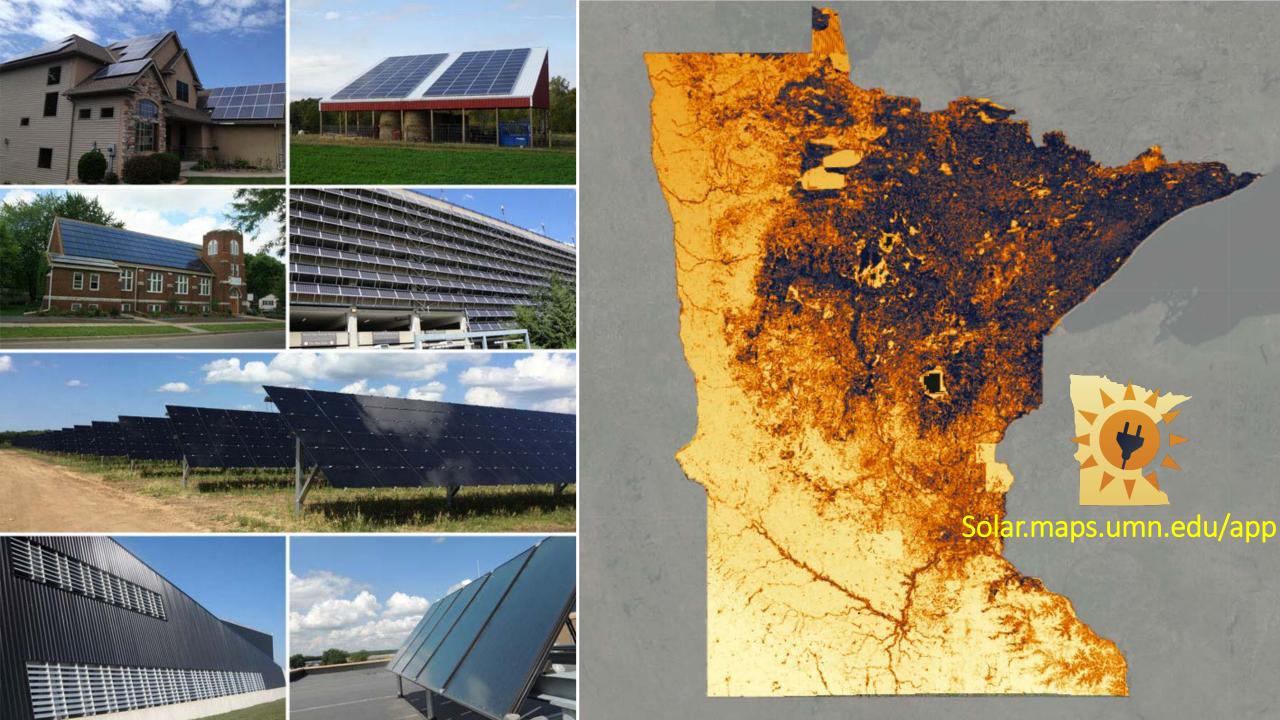
mncerts.org/greatrenewables

SOLAR FOR FARMS & SMALL BUSINESS



Annual Average Range of 4.7 to 3.7 Sun Hours per Day





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







serage installed costs of 2014 and 2015 Made in Minno

rispelling the myths

There is a myth that it takes more energy to make a PV ystem than it produces over its lifetime. "Energy psylack" sthe term used to describe the amount of energy it takes

Solar Electricity for the Home,

Building and Site Assessment

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

. Do you have a south-facing roof?

(modules) need to face south for maximum performance. This full advantage of the sun's path in he sky. The sun shines longest on a building's south side. Southeast and southwest-facing panels will perform about 5 percent less ☐ Yest - More to Question #2



□ No — Options: PV panels can be used as structure such as a purch cores or window mings. They can also be ground-mounted or pole-mounted. If you cannot place PV pomels to face south, a solar electric system will likely not be an 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

Panels can be mounted on come or west facing roofs to face south, but they stick up and are highly visible, and car be penarived by some as unartractive. Architects and builder can address this by designing "solar ready" buildings and integrating solar technology components into their designs.

One can read more about these guidelines in "Solar Ready



Building Design Guidelines for the Twin Cities, Minneson

2 Does your roof have enough space for PV panels's The rule of thumb for PV panels is 100 square ferr 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 Option



Collection Orientation

Is your roof unshaded?

Photovoltaic panels are very sensitive to shading. Any shading will dramarically reduce electricity generation. uaring was aramamanay resture estercionsy generologic availlers use a Solar Parhimder device to determine if there are shading concerns from trees (consider mature height), chimneys, nearby buildings, etc. In Minnesota, people ing solar can enter their address into the Minneson e Suitability Analysis to get a sense for whether or not es, mas, prase a doord soyat ester tesper trade to proper the contracts keep in mind the sun's path changes throughout the year. mum electricity production, make rate penels will e unshaded year-round (expectally from 9 or 10 am until 3

 Options: If the slude is from landscaping, consider removing the planes. Check local and state codes regarding "solar access" rights if a neighbor might produce shade on any solar system you are considering. See the Pro-Installation section of Factsheet 7. If some shade is inevitable, ask the installer about microinveness

hat is the angle of your roof?

illers typically mount panels directly (flush) on an ag south-facing roof for aesthetics. To maximize ly generated year-round, mount modules at an qual to or close to your sire's laritude (44 degrees shexter; 47.5 degrees for Bemidji). Installers can tilt gle best for your site, system type, and electricity its a rule of thumb, the ideal pitch for a PV system in is is between 35-37 degrees. aummer electricity production, tile at latitude legrees to 15 degrees; for more winter product

adjustments where you answered no, your building or site is a good solar electric system candidated A system supplier or installer can provide a more detailed assessment. Next, consider how conservation and officiency measures can result in an efficient and affordable system; then, loan about



Flat Roots: Panels can be angled on flat 100th often found! rear ruotes vanue cut ne angreu na ton muse torre trans-on commercial, industrial, and institutional buildings, but should not be placed that (horizonral) because of snow build-

5. Is your roof in good condition?

 is your root in good condition;
 Most roofs can safely support PV panels and mounting system weight. The rule of thumb is 2 to 5 pounds per square system weight, are rule of thumb is 2 to 3 pounds per square loor depending on the punel type and installation method. For example, a 230 watt crystalline punel (3,5 for x 5,5 feet) weighs about 50 pounds. An invaller should determine if the gis anone 30 pountes, can uneasser surrant occasions a suc-distructure can handle the added static weight. Innovative mounting systems can make panel temoval care, but because panels can liss 30+ years, it may be less expensive and labor intensive to make needed roof repairs before installing panels. J Yes! -- Move to What's Next?

□ No — Options: Complete any needed repairs first. If considering a new root, contact a PV system installer/contractor for roof options: recommendations that might make para! installation easier or less expensive.

on answered yes to every question or can make



mncerts.org/solar

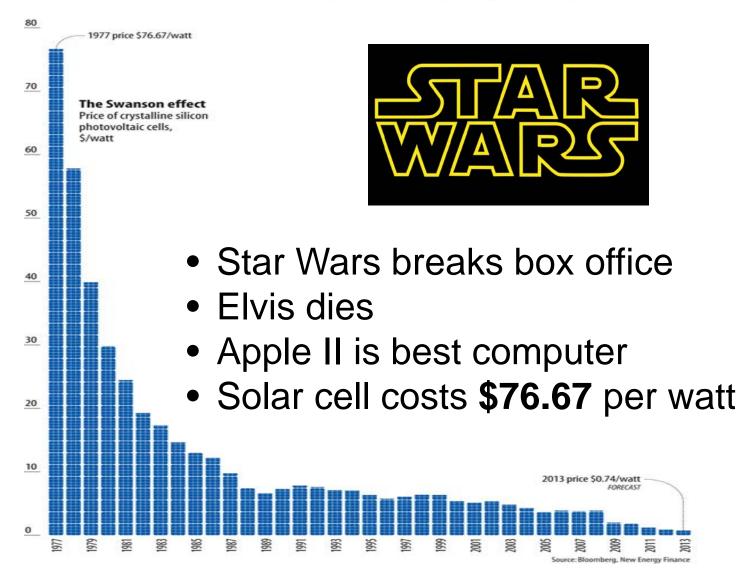
YOU: ME: SOLAR - WHAT DO WHAT DOES YOU MEAN BY "IT"?

THE HARDWARE COST OF THE SOLAR CELL

(a.k.a. The major driver in cost reduction over the years)

Hardware: 1977



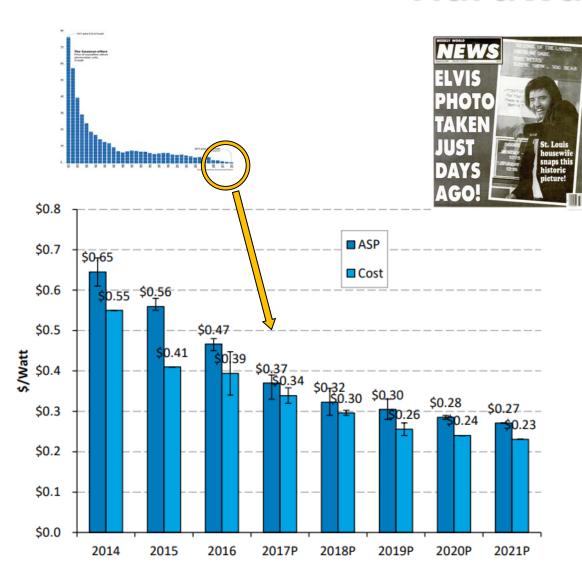






Hardware: 2018









- Star Wars: The Last Jedi on Netflix
- Apple iPhone X is best seller
- Elvis lives!
- Solar cell costs \$0.34 per watt

Source: NREL, Q4 2017 / Q1 2018 Solar Industry Update May 2018

THE WHOLESALE PACKAGE COST YOU FOUND ON THE WEB

(A.K.A. DO-IT-YOURSELF SOLAR PACKAGE WITH BONUS VISIT TO THE E.R.)

SOLAR D.I.Y. PACKAGE COST

\$1.00 - \$1.50 per watt

Hardware and Shipping Cost: \$1.00 - \$1.50 per watt

Re-order cost because you accidentally destroyed some panels:

Emergency Room Visit: \$5.00 - \$10.00 per watt

THE INSTALLED COST PER WATT

(A.K.A. THE TURNKEY COST)

TURNKEY COST



"Installed cost per watt"

Commercial Rooftop Fixed Tilt: \$2.40 - \$2.60 per watt

• Ground-mount Commercial Fixed Tilt: \$1.90 - \$2.40 per watt

• Ground-mount Commercial Tracking: \$5.10 - \$5.30 per watt

Residential Rooftop Fixed Tilt: \$2.50 - \$4.00 per watt

CAVEAT: Non-scientific data!!! These are just recent quotes to cross my desk





noun

an amount of money that can be offset against a tax liability.



Financial Tool: Federal Income Tax Credit



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

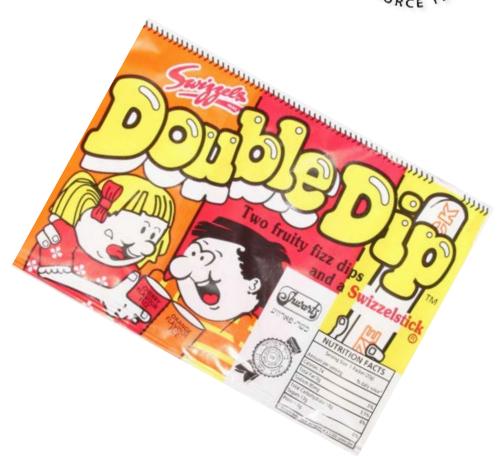
www.mncerts.org/taxcredits



Accelerated Depreciation (MACRS)



- Cost of doing business expense taken as a tax credit
- 5-year Property Schedule (IRS Pub. 946)
- Depreciable <u>adjusted basis</u> is 85% of total cost (not 70% after the 30% ITC, hmmm...)**



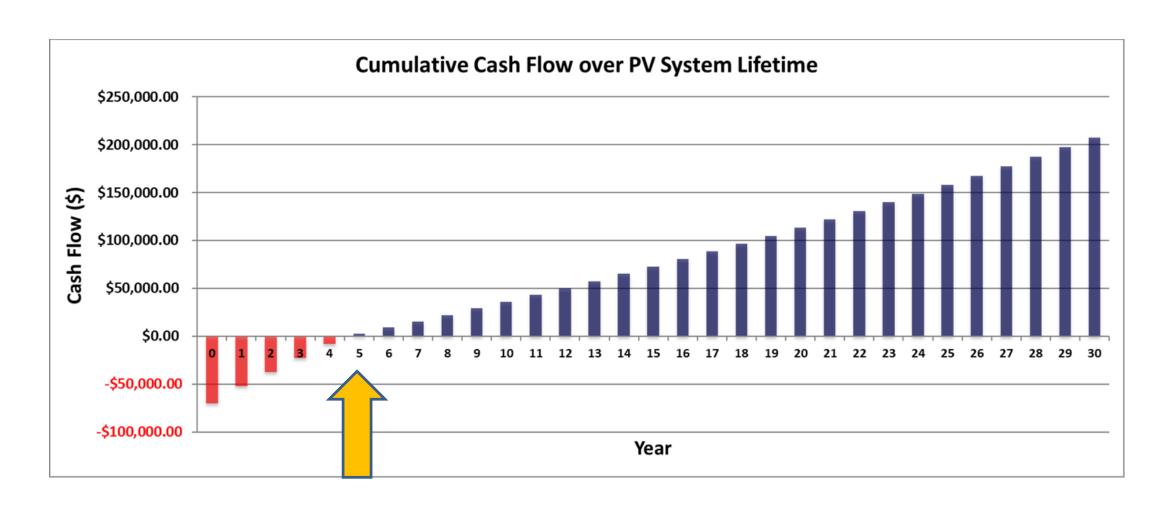
www.mncerts.org/macrs

**26 U.S.C. §50(c) (2018)

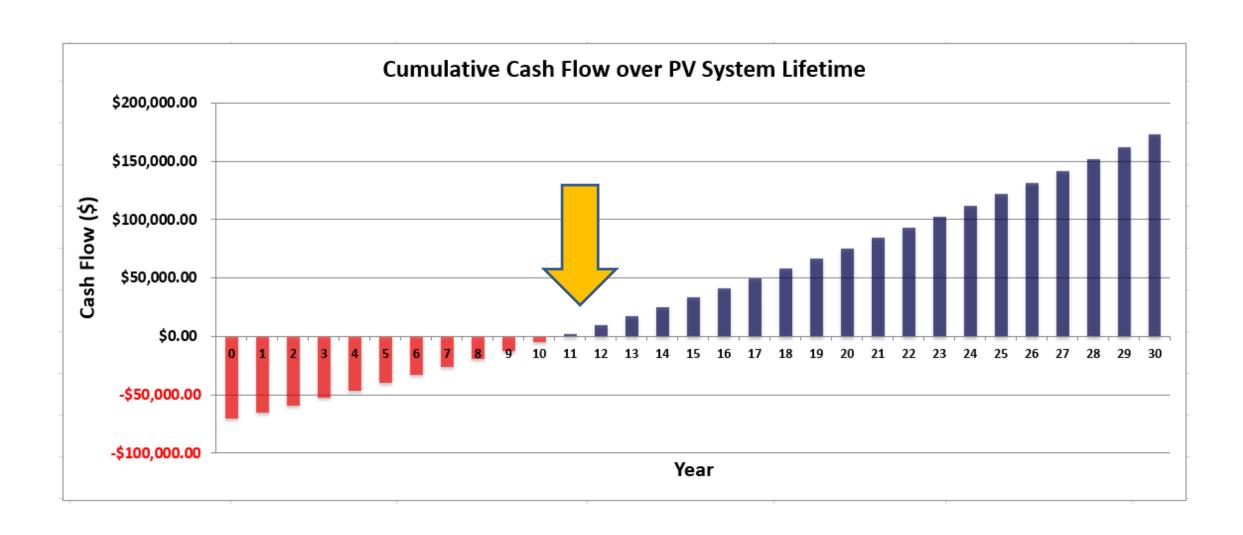
Example: 40 kW Array at \$2.50/Installed Watt with \$0.11 kWh utility rate

Initial Cost	of PV System (Without Incentives)	\$100,000.00	
	Total Incentives	\$30,000.00	(The 30% tax credit)
Net Cost of PV System After Incentives		\$70,000.00	
	First Year Utility Bill Savings	\$5,682.94	
Number of Years to Equipment Cost Recovery		5.0	Years (This is the MACR
	Simple Payback	12.3	Years
Net Present Value (NPV) of PV System		\$79,678.55	
	Internal Rate of Return	15.96%	
	Profitability Index	2.14	
	Cumulative Cash Flow	\$207,514.97	

30% Tax Credit & MACRS Depreciation



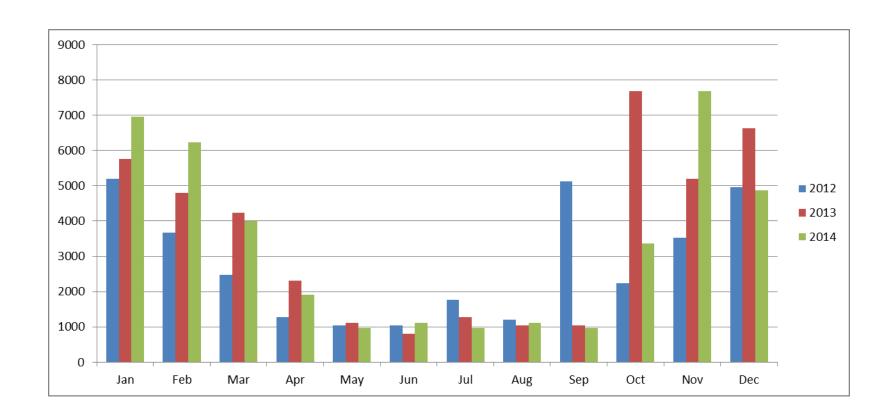
30% Tax Credit Alone



Sizing Up Solar



- Starts with a load analysis
- How much energy use? What's the goal? Budget?



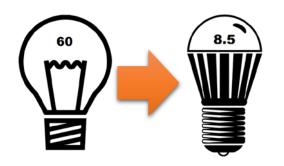


Efficiency first!



Benefits:

- Always the lowest cost option
- Every \$1 invested saves \$3-5
 in a renewable energy project
- Reduce peak loads
- Easier to finance





Opportunities:

- Mostly heavily-used lighting
- Basic fan and motor maintenance
- Occupancy sensors and timers
- Efficient Ventilation/ECM motors
- Behavior change

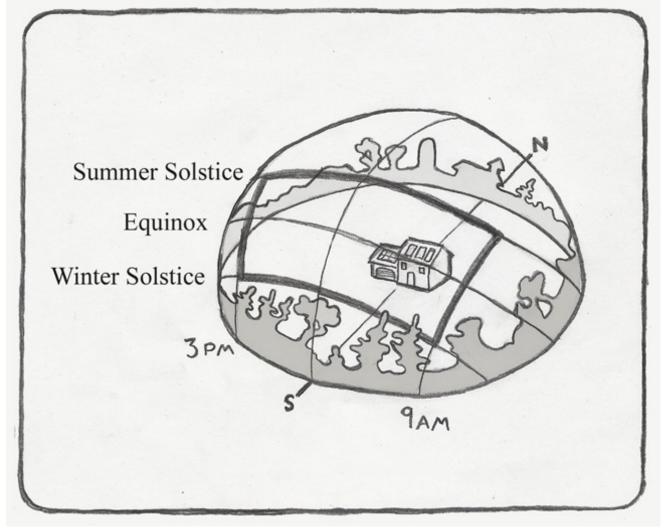






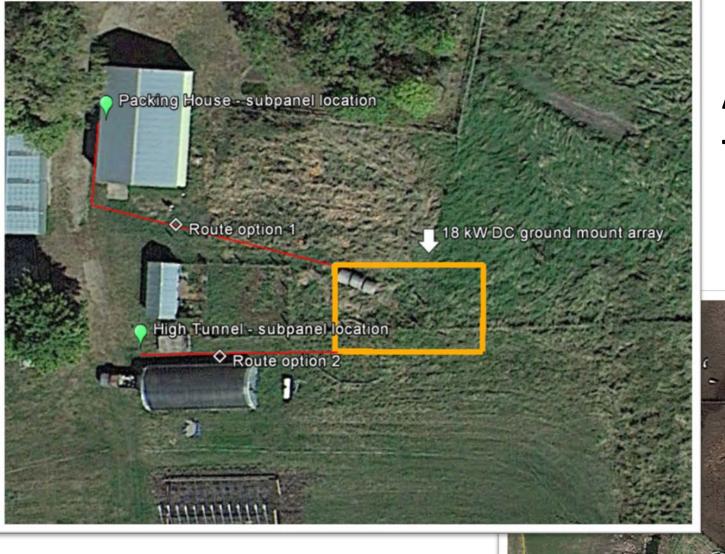
Solar Window





Source: Ramlow, B and Nusz, B. 2010. *Solar Water Heating: A Comprehensive Guide to Solar Water and Space Heating Systems*.

Second Edition. New Society Publishers: B.C., Canada.



Access to a subpanel or the service drop

180° south or close

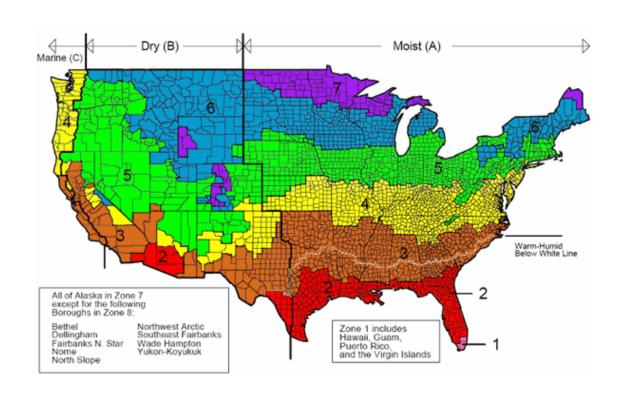


Structural Considerations



Snow load





Do not install solar on shingles that are 10+ years old!

Where to put it?



Ground: Unlimited square feet, less labor. Less heat, easier maintenance



Photo Credit: Green Energy Products



Photo Credit: Farm Market News

Farm Electrical Infrastructure



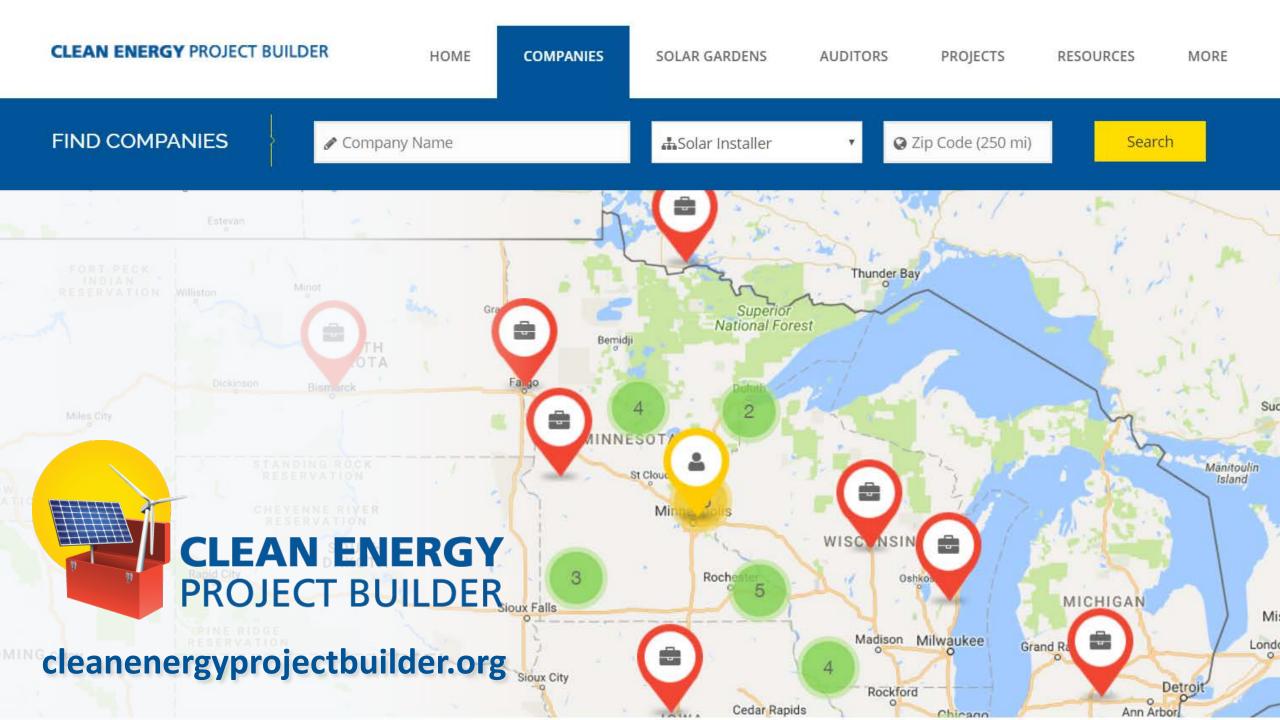
Bus bar spaces for hosting capacity

• NO fuses





Source: Campus, "Fuse box." www.camelblog.com.; The Fuse pany. "Fuses." www.thefusecomet.



Net Metering



Communicate early and often with your electric utility

- Minn. Stat. § 216B.164 and Rule 7385 govern compensation
- Must meet Interconnection Standards



39.9 kW DC = Tennis Court



Grid Access Fee



Usually:

- First 3.5 kW exempt
- \$2.50-\$3.50 per kW monthly
- Added to basic service fee

Example: $10 \text{ kW} - 3.5 \text{ kW} = 6.5 \text{ kW} \times \$3.28 = \$21.32$ plus \$30 basic service fee = \$51.32/mo

(\$35 cap in Agralite Elec. Coop)



Grant or Loan: USDA REAP



Grant Program:

- 25% of eligible project costs
- Labor, equipment, fees, permits
- October & March deadlines
- Competitive: 1 in 4 odds

Loan Program:

- Up to 75% backing of private bank loan
- Not competitive
- \$5,000 minimum loan amount
- Rolling applications accepted

Eligibility:

- Farms
- Rural Small Businesses
- Rural Electric Cooperatives



rd.usda.gov/reap

PACE FOR FINANCING

Property-Assessed Clean Energy (PACE)

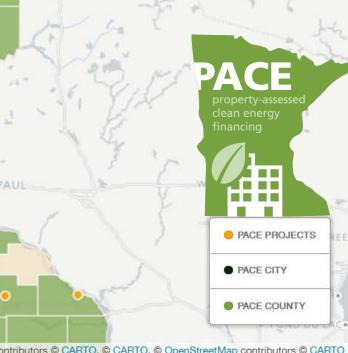
THUNDERGE TER

Finance energy efficiency and renewable energy upgrades for commercial or agricultural property owners

 Project cost is repaid as a separate item on property taxes

Eliminates the burden of upfront costs

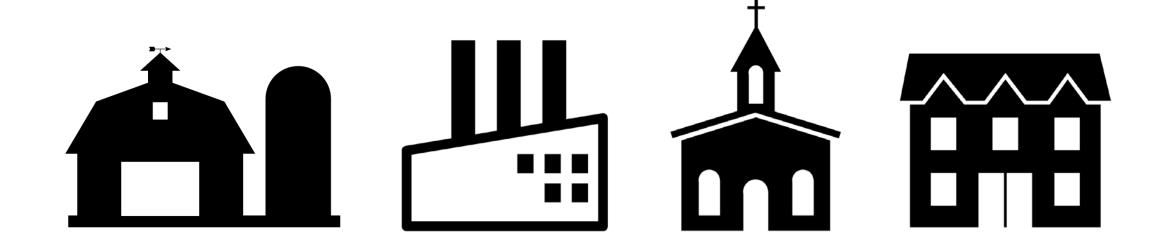
mncerts.org/pace



How does PACE work?

- 1. Landowner scope a project that reduces energy costs (site assessment or energy audit)
- 2. Following loan application approval (due diligence) St. Paul Port Authority provides financing to the landowner
- 3. County adds the property tax assessment to tax rolls
- 4. Landowner pays the assessment for up to 20 years

Qualifying Entities - PACE



Hurdles & Benefits

Hurdles

- Financing limited to 20% of current assessed property value
- Must be current on mortgage and property tax payments
- Davis-Bacon Act may apply

Benefits

- Low origination fee
- Cash flow positive
- Job creator and maintainer
- 5% rate for 10 Year Term or Less



Want to Follow Up?



Fritz Ebinger
Program Manager – Rural Energy
Ebing007@umn.edu
612-626-1028