
Power Pack
Building a sustainable solar market

Solar Power Hour

- **Introduction**
- Trends in Solar PV
- Solar Basics
- Energy Efficiency
- Site Assessment
- Affordability of Solar PV
- Financing Options
- Conclusion

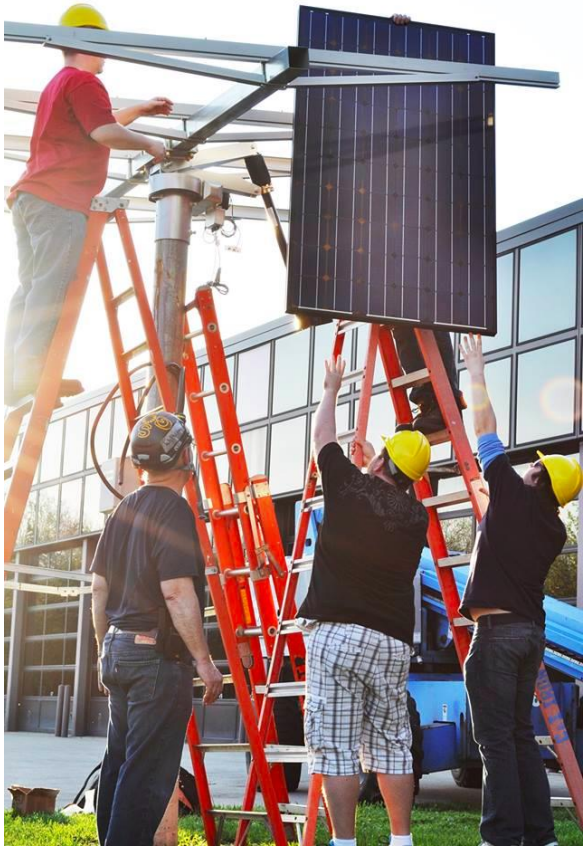
MREA

Midwest Renewable Energy Association

- Founded in 1990 with the first Energy Fair
- Promote renewable energy through educational courses in solar PV, solar thermal and small wind
- Partner with colleges and professionals
- Minnesota Partnerships:
  - Minnesota Clean Energy Resource Teams
  - Great Plains Institute
  - Neighborhood Energy Connection
  - Center for Energy and Environment
  - U.S. Department of Energy

Power Pack

- Educating communities on the benefits of solar energy
- Promoting approved, local installers that offer discounts to potential customers
- Supporting the finest solar components from around the world
- Integrating solar businesses, home efficiency organizations, and financial institution sponsors



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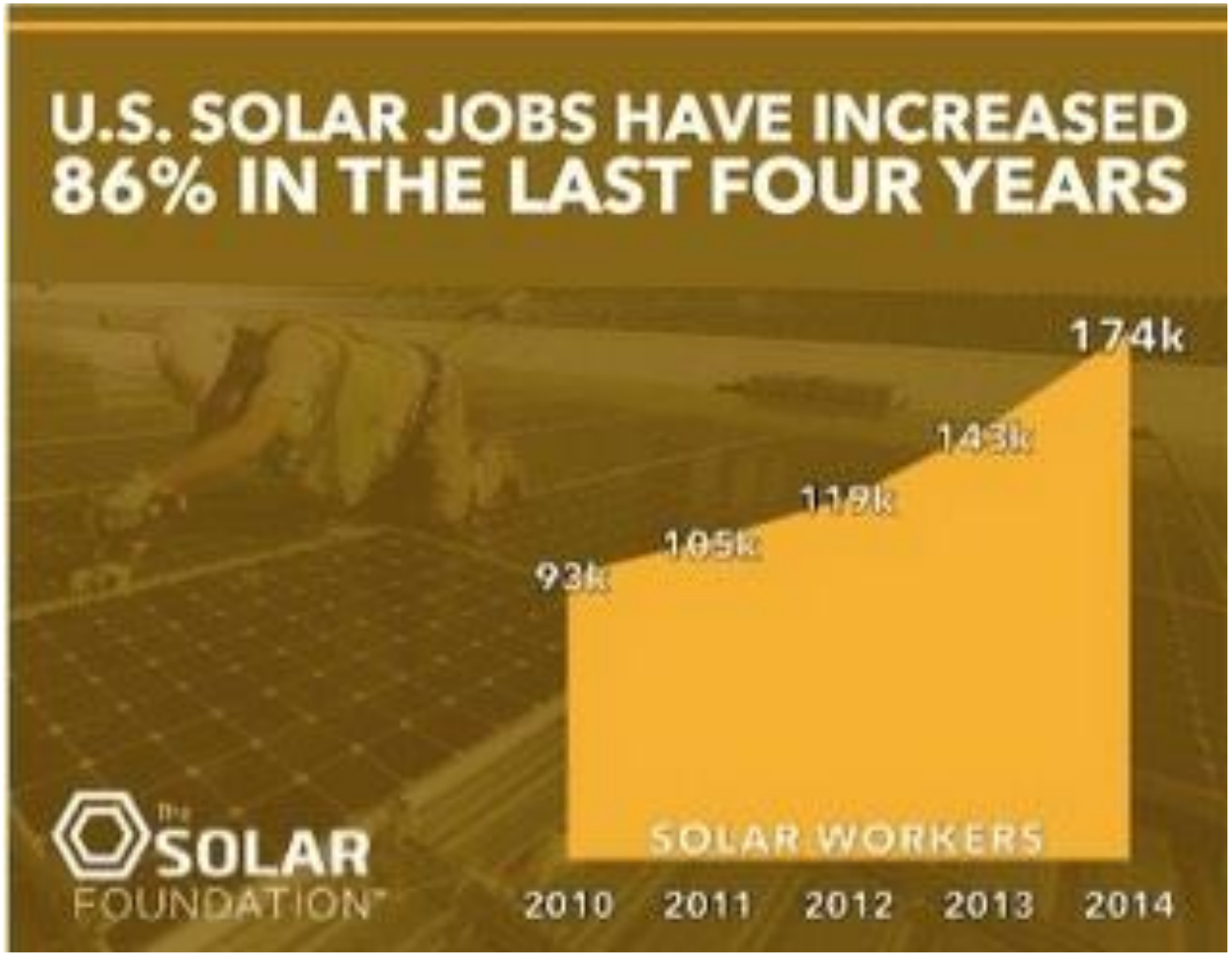
Solar PV Installations To Date

- Now over 25 GW of solar PV installed in US
- Enough to power over 5 million homes
- In 2014, solar accounted for 32 percent of new generating capacity in the U.S., second only to natural gas.
- 2015 was the best year for solar growth ever

SEIA Solar Market Insight Report

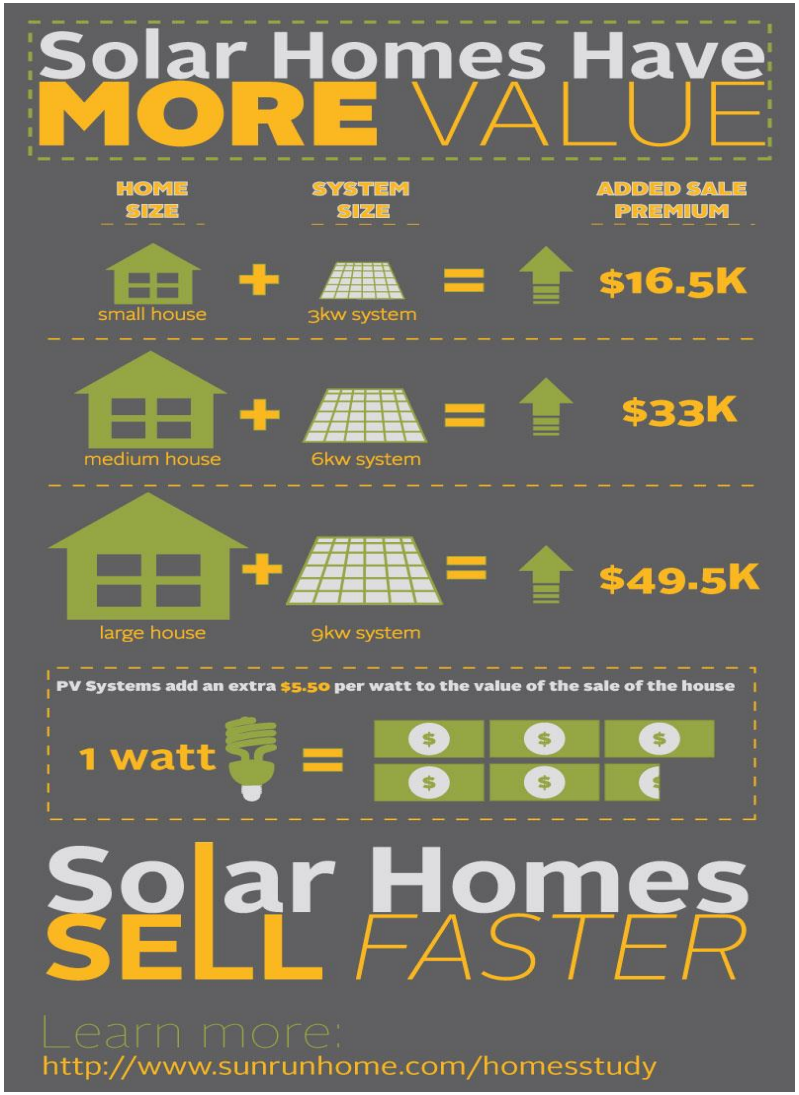
Solar Jobs


U.S. SOLAR JOBS HAVE INCREASED
86% IN THE LAST FOUR YEARS
93k
105k
119k
143k
174k
SOLAR WORKERS
2010
2011
2012
2013
2014
The SOLAR FOUNDATION

Home Values

On average solar homes in the United States sold 25% faster and for 20% more that the equivalent non-solar homes

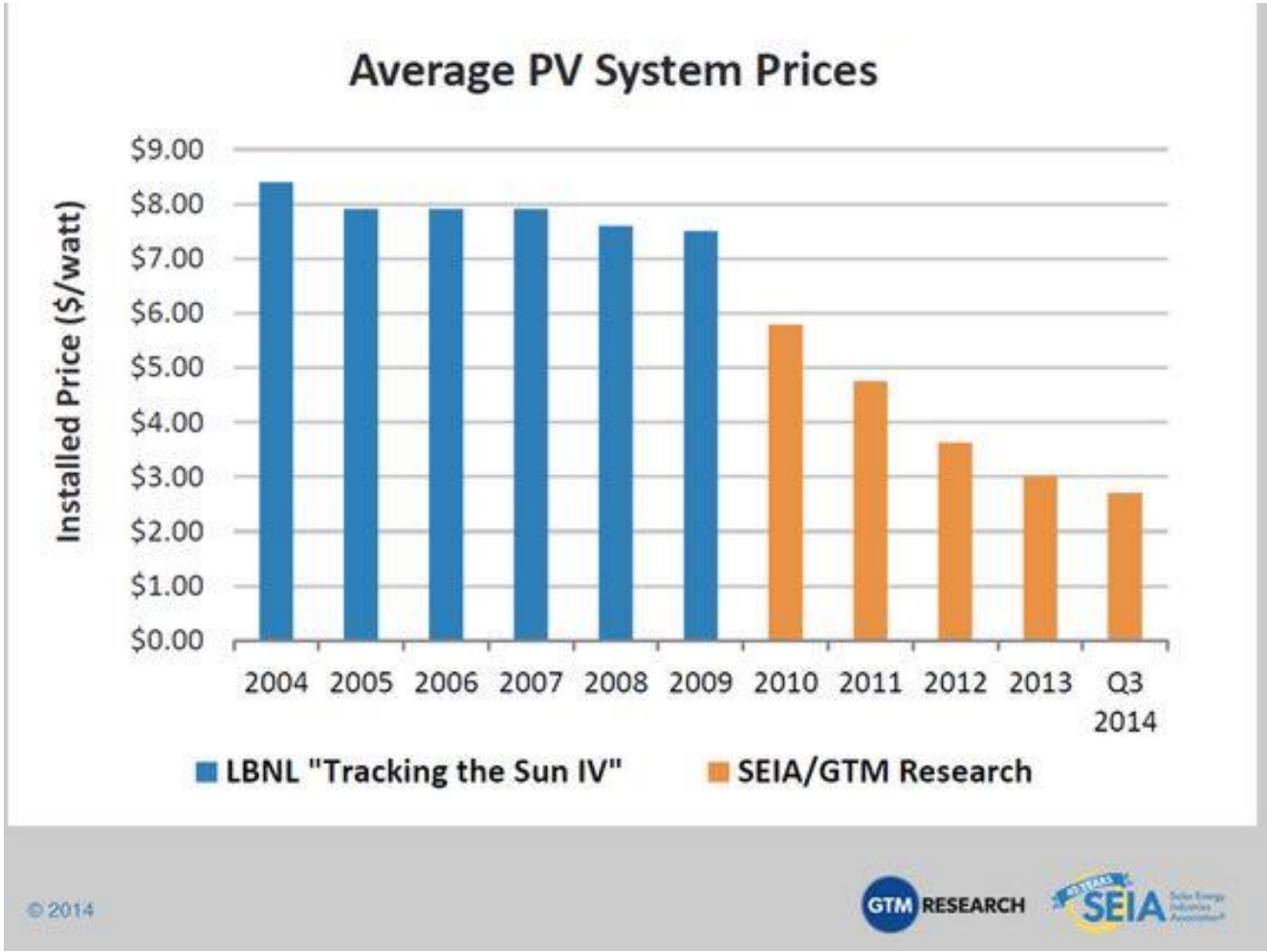
NREL (National Renewable Energy Laboratory)



Commercial Growth

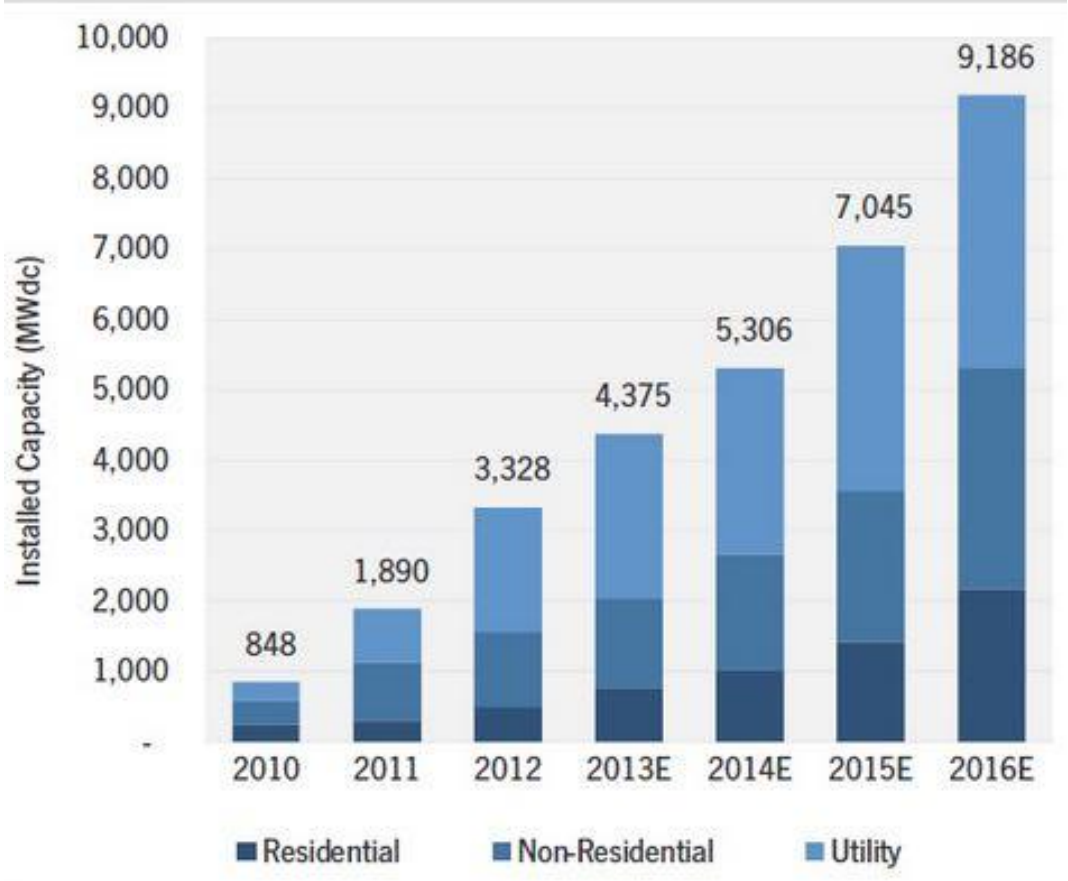
For the fifth straight year, U.S. businesses, non-profits and government organizations added more than 1,000 MW of new PV solar installations.

The Solar PV Future



The Solar PV Future

Figure 2.8 U.S. PV Installation Forecast, 2010-2016E



Complete forecast through 2017 by state and market segment available in Full Report

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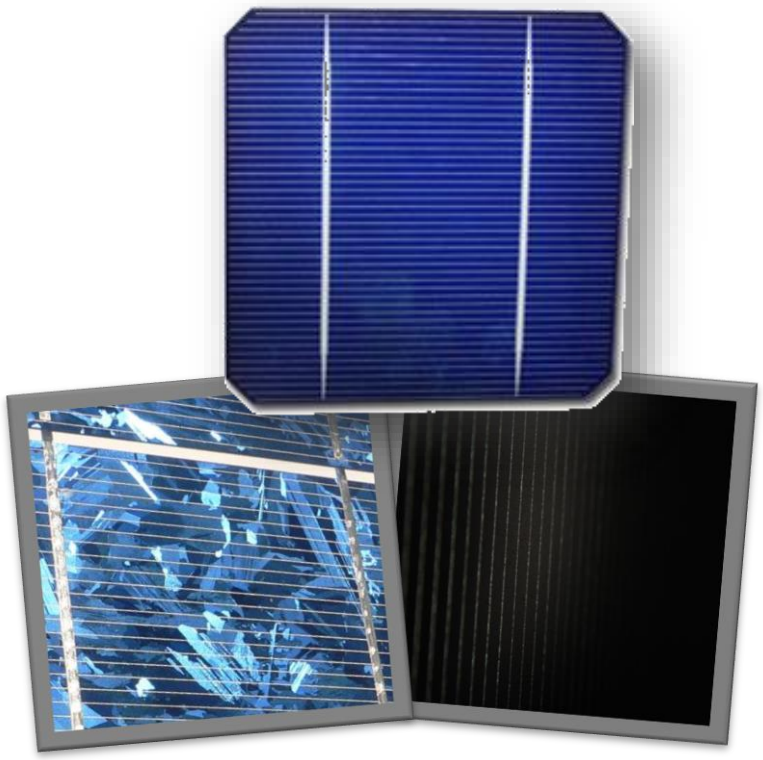
Module

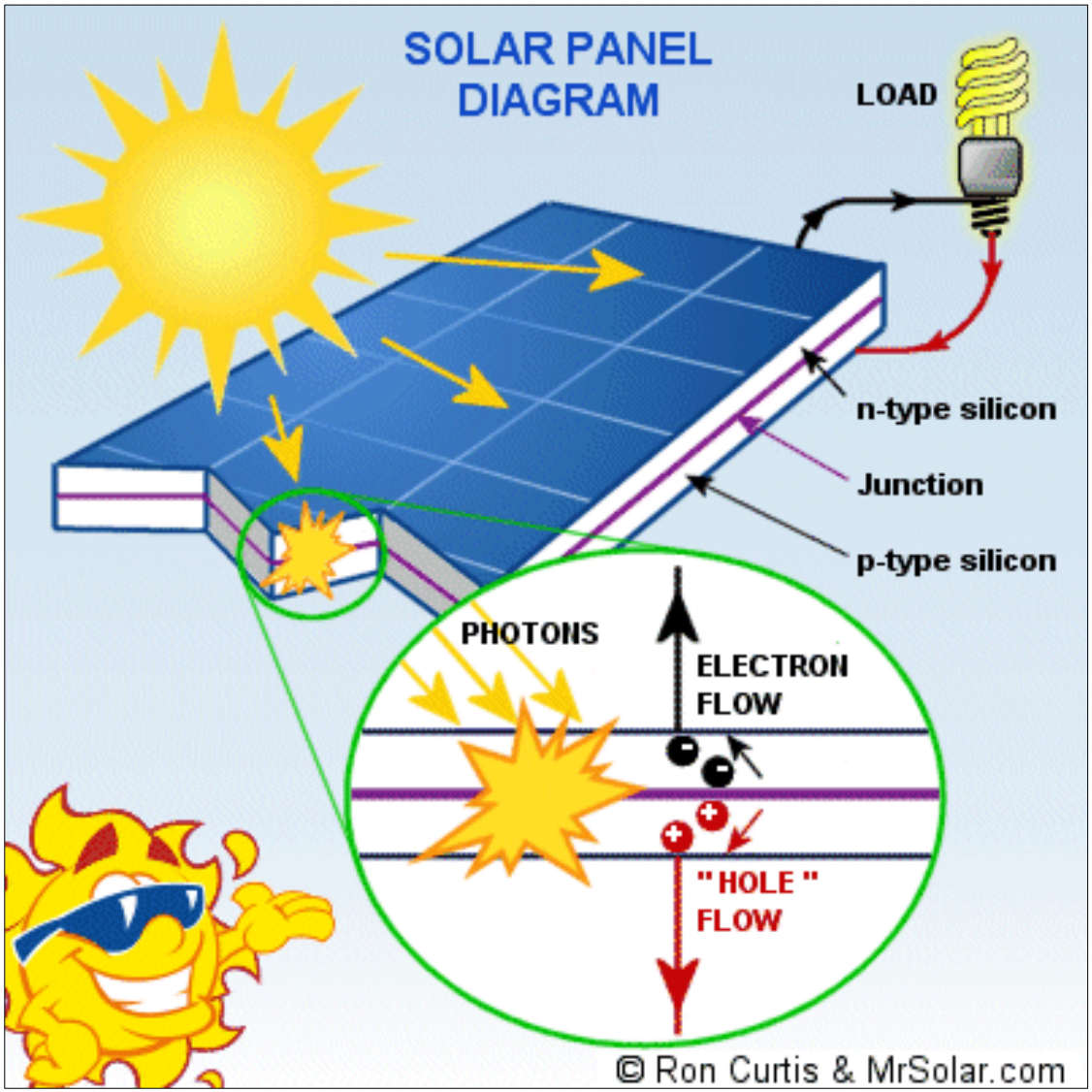
Collection of solar cells

Types of modules:

- Mono-Crystalline
- Multi-Crystalline
- Amorphous



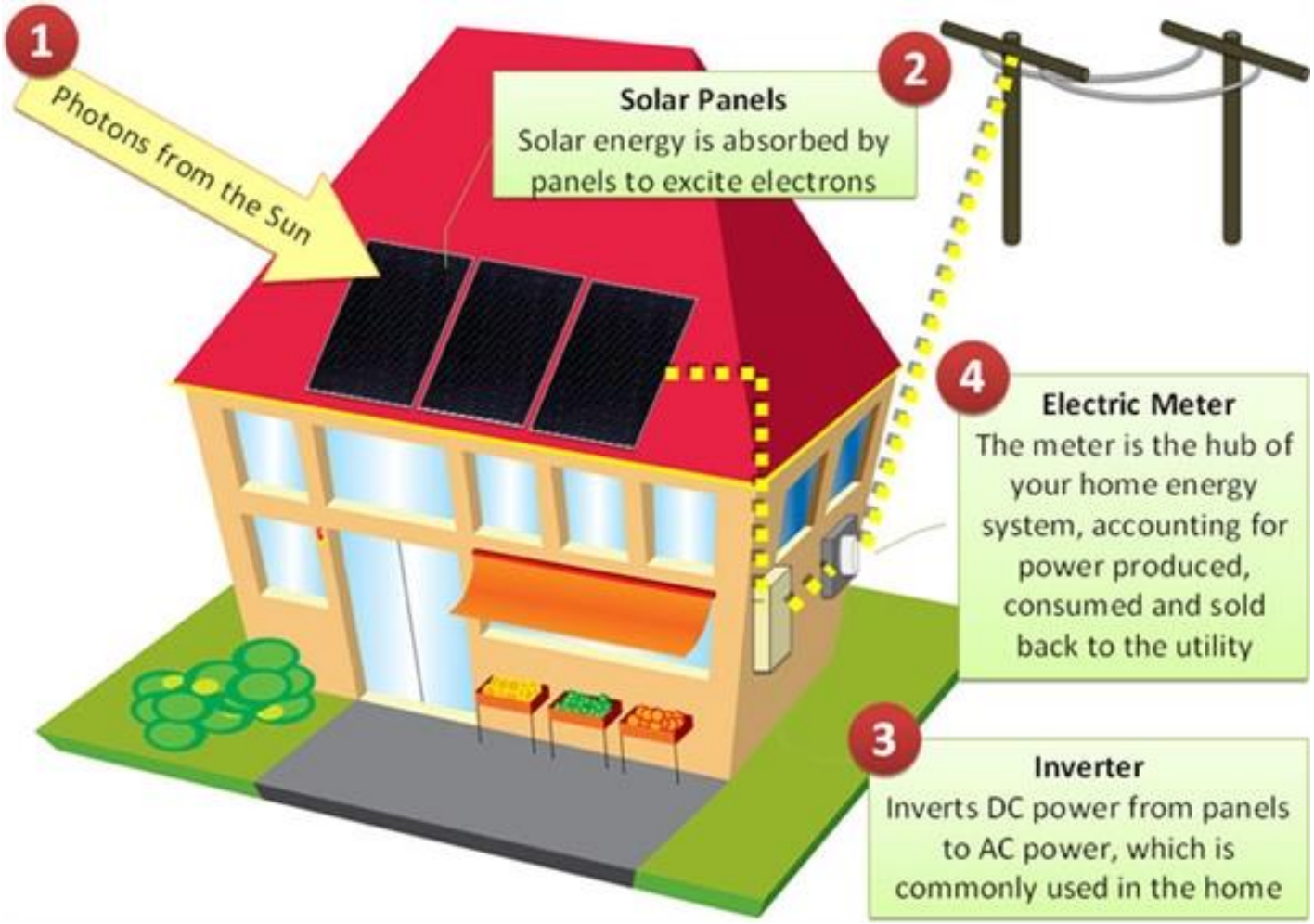
Photovoltaic (PV) Basics



Inverters - DC to AC Electricity

- An electronic device that converts DC electricity from a PV array to AC electricity
- 25 year Warranty
- Central Inverters – optimize output for the entire array
- Micro Inverters – on the back of each solar module. Optimize output for each module.

How It Works


1
Photons from the Sun
2
Solar Panels
Solar energy is absorbed by panels to excite electrons
4
Electric Meter
The meter is the hub of your home energy system, accounting for power produced, consumed and sold back to the utility
3
Inverter
Inverts DC power from panels to AC power, which is commonly used in the home

Roof Mount

- Most common
- Need good solar window
- Concerns
  - Snow
  - Wind Loading
  - Roof Condition

Pole Mount

- Good for larger arrays
- Take advantage of best solar window
- With a tracker can follow the sun
- Concerns
  - More expensive
  - Trackers have moving parts

Ground Mount

- Good for larger arrays
- Require large un-shaded area
- Take advantage of best solar window
- Anchor to ground mounts
- Easy to remove snow, dust

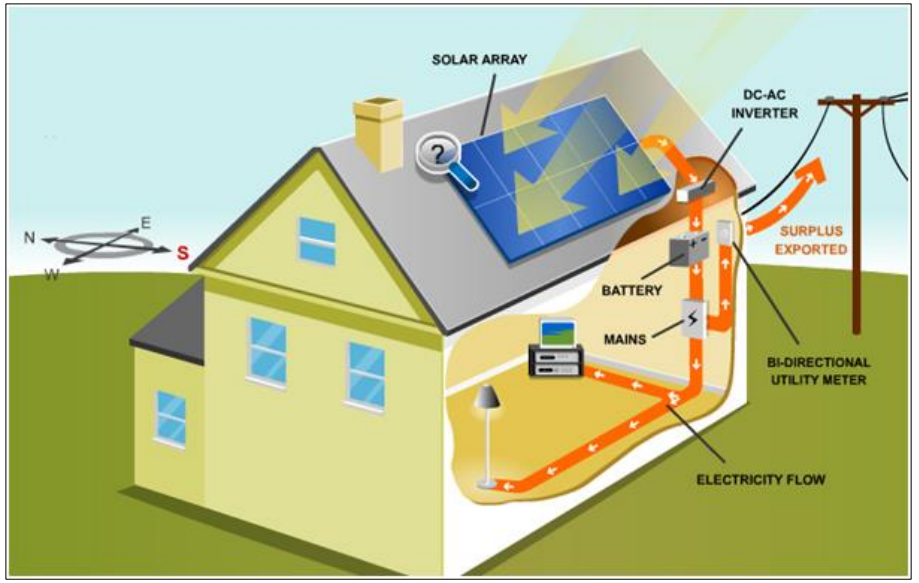
Other Mounting Types

Awning Mount

Canopy Mount

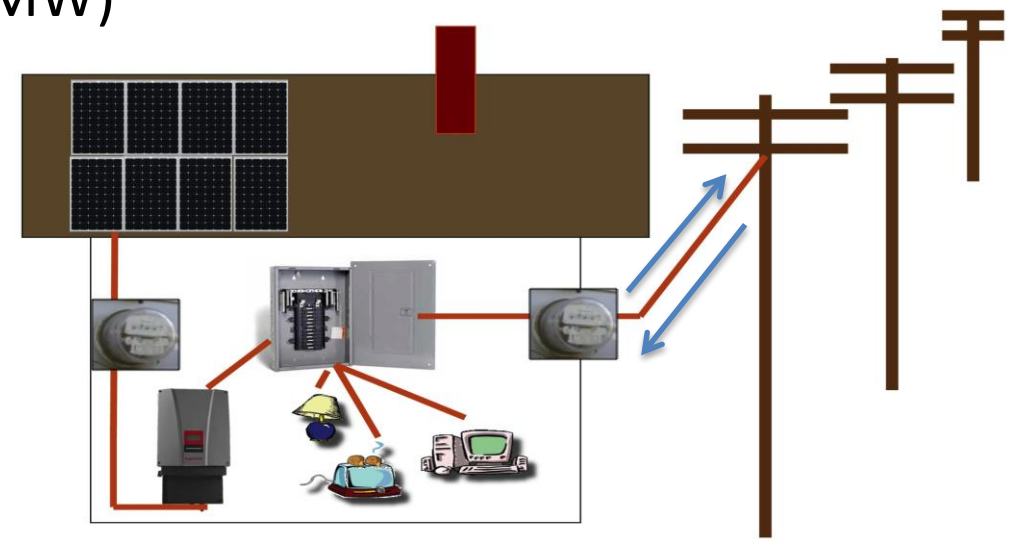
Location, Siting, and Regulations

- Good southern exposure
- Angle of roof or mounting system
- Shading: trees, buildings, poles



System Designs
Utility Interactive (Grid Tied)

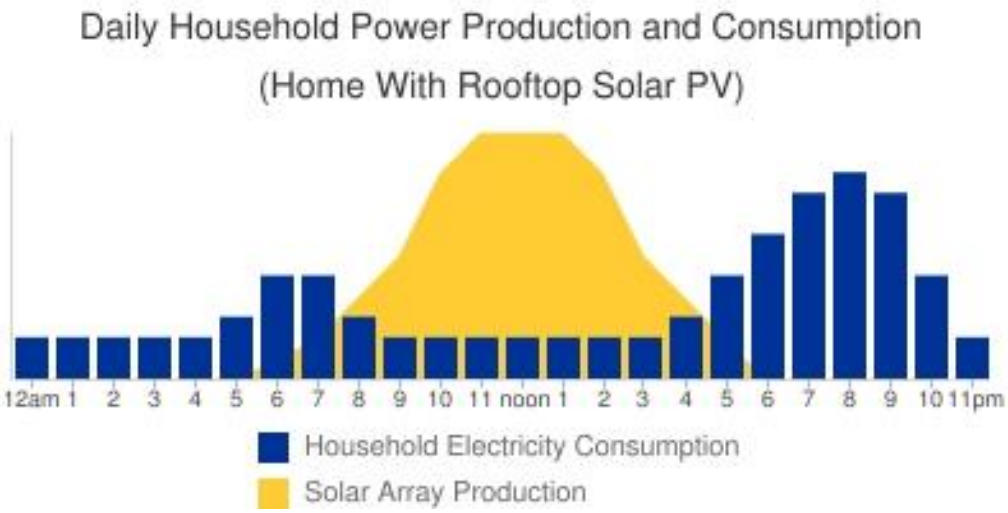
- PV system connected to the utility grid
- Grid goes down, PV system goes down
- Utility supplies electricity above the system output
- Least expensive type of system
- Net metered (under 1MW)



System Designs
Utility Interactive (Grid Tied)

Net Metering

- Similar to rollover minutes with your cell phone
- Generally, calculated on a monthly basis



System Designs
Utility Interactive (Grid Tied)

Net Metering - Example

NET USER	NET PRODUCER
Uses from grid 1000 kWh	Uses from grid 200 kWh
Puts on grid 100 kWh	Puts on grid 300 kWh
Billed for 900 kWh	Billed for 0 kWh
Credited for = 0 kWh	Credited for= 100 kWh

System Designs
Battery Backup & Off Grid

- **Utility Inter-Tied With Batteries**
  - PV system connected to the utility grid
  - Battery storage supplies power during utility outages
- **Off Grid or Standalone System**
  - System not connected to utility grid
  - All energy produced must be used or stored - batteries
  - Most expensive type of system

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Efficiency First

- CFL, LED lighting
- Energy Star appliances
- Power strips
- Weatherization
- Electricity usage habits
- And more….

What can the NEC do for you?

The Neighborhood Energy Connection improves people's lives by making energy conservation easy.

Help customers with:

- Earning rebates
- Scheduling energy audits
- Understanding their report
- Having a Home Energy Squad visit
- Completing energy projects
- Financing for the work

Neighborhood Energy Connection
tools for energy-efficient living

Energy efficiency: the smart step toward solar

The cheapest energy is the energy that you do no use.

Be smart and economical:
Reduce the amount of energy you consume before shifting to a renewable energy source.

Neighborhood Energy Connection
tools for energy-efficient living

This increases how much of your home is powered by solar energy.

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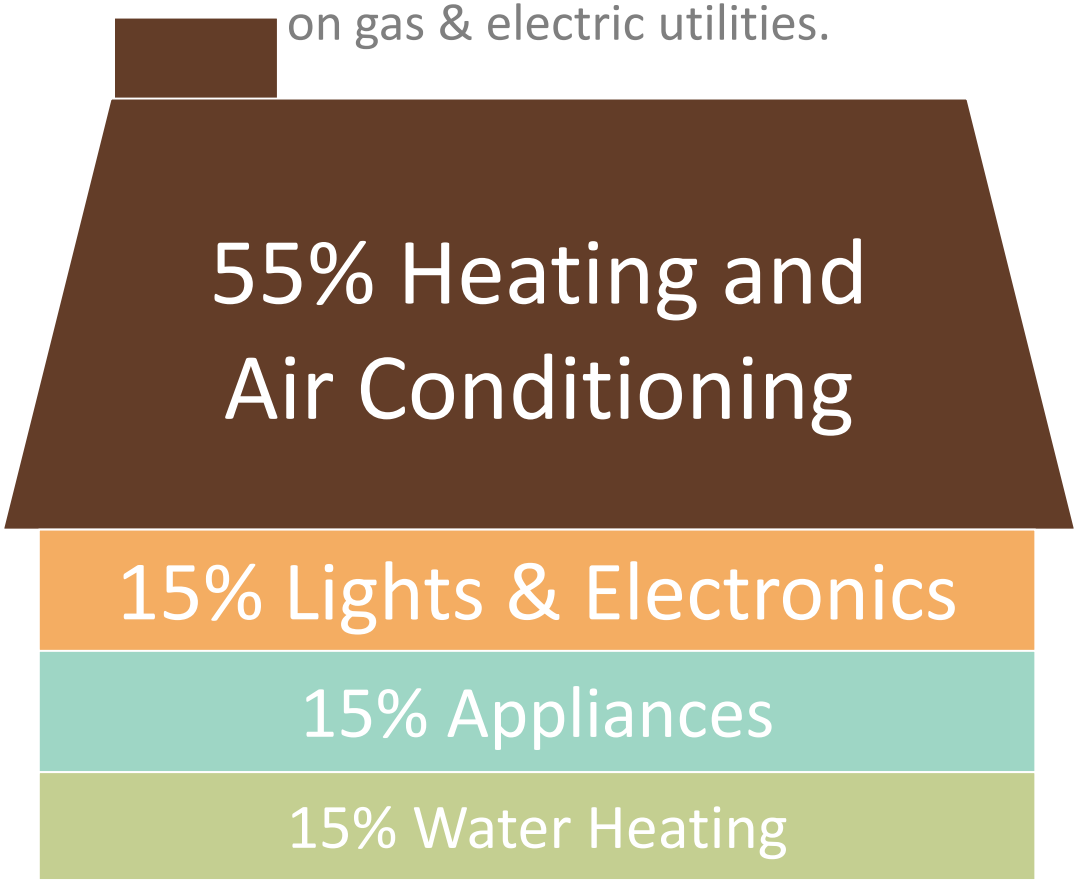
NEC programs help lower utility costs

The average Roseville household spends

$1,852/year

on gas & electric utilities.



MN Department of Commerce- Division of Energy Resources

Energy efficiency means what again?

Using less energy to provide the same service

Energy efficient homes have:

- Fully insulated attic & walls
- Efficient lighting and appliances
- Efficient heating system
- Efficient water heater

The NEC is here to help every step of the way

- SOLAR ENERGY
- WINDOWS
- APPLIANCES
- WATER HEATING
- HEATING & COOLING
- INSULATING & VENTILATION
- AIR SEALING
- LIGHTING
- LOW COST/NO COST
- BEHAVIOR

The NEC has Energy Advisors to help you.

energyadvisor@theNEC.org

In one visit, the NEC will get you on the right path:

Home Energy Audit

Personalized analysis and reporting from our energy experts

Energy Advisor Service

Guidance to help you complete your most important energy projects

Home Energy Squad

Installed energy saving measures that lower your bills immediately

After the presentation, stop by the NEC table

- Ask us questions
- Figure out your best next step
- Learn about potential energy efficiency rebates

Sign up for an Xcel Energy audit:

$100 Infrared Audit or a $60 Blower Door Audit

Combine it with a $20 Home Squad Visit

Xcel Energy℠

Neighborhood Energy Connection

tools for energy-efficient living

HOME ENERGY SQUAD

Xcel Energy® CenterPoint. Energy

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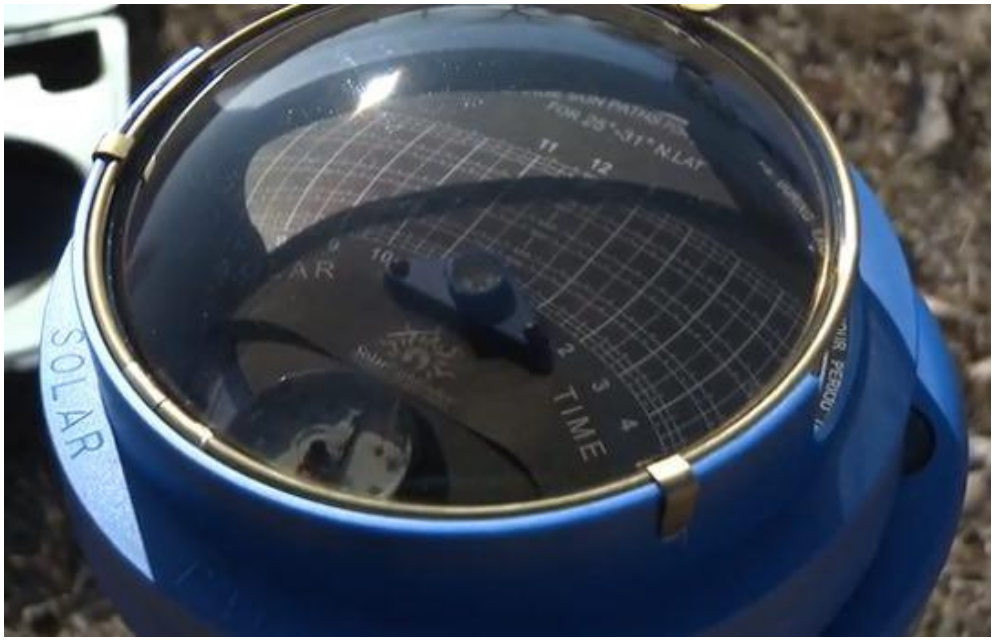
Solar Site Assessment

A good site assessment should:

- Review your renewable energy goals
- Conduct energy analysis
- Recommend efficiency improvements
- Evaluate the solar window
- Recommend system size
- Provide an initial cost estimate and economic analysis
- Next steps toward installation

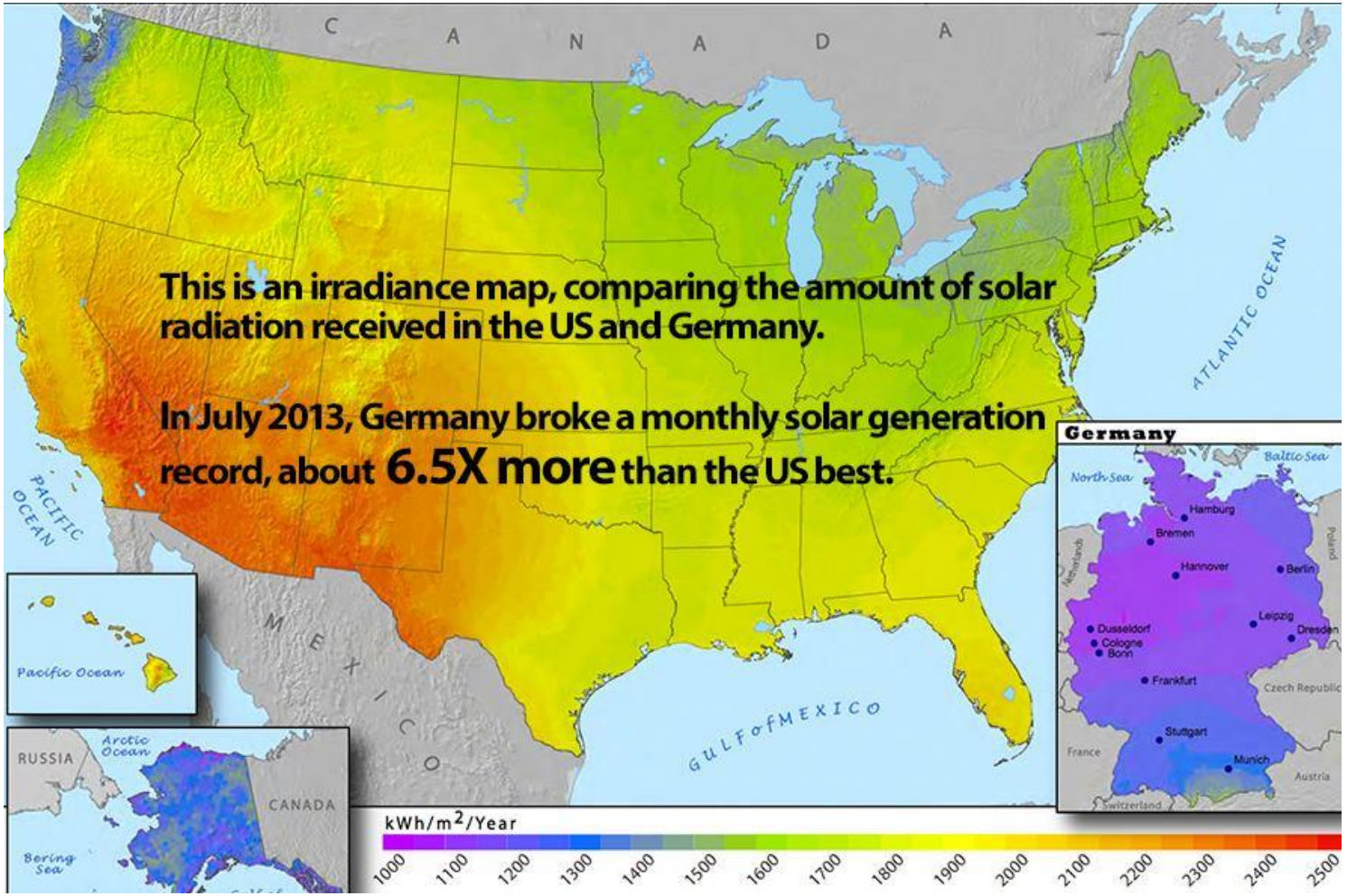
Importance of Site Assessment

Ensures benefits and limitations of a system are outlined before any installation work begins.



A Solar Pathfinder is a tool used to evaluate the solar window

Is there Enough Sunlight?



Is My Home Good For Solar?

- Do I have a south facing roof location?
- Are there shade issues?
- When do I anticipate re-roofing?
- Is my roof structurally sound?
- Am I going to be in the home for a while?
- Is my home energy efficient?
- Talk to a solar installer!

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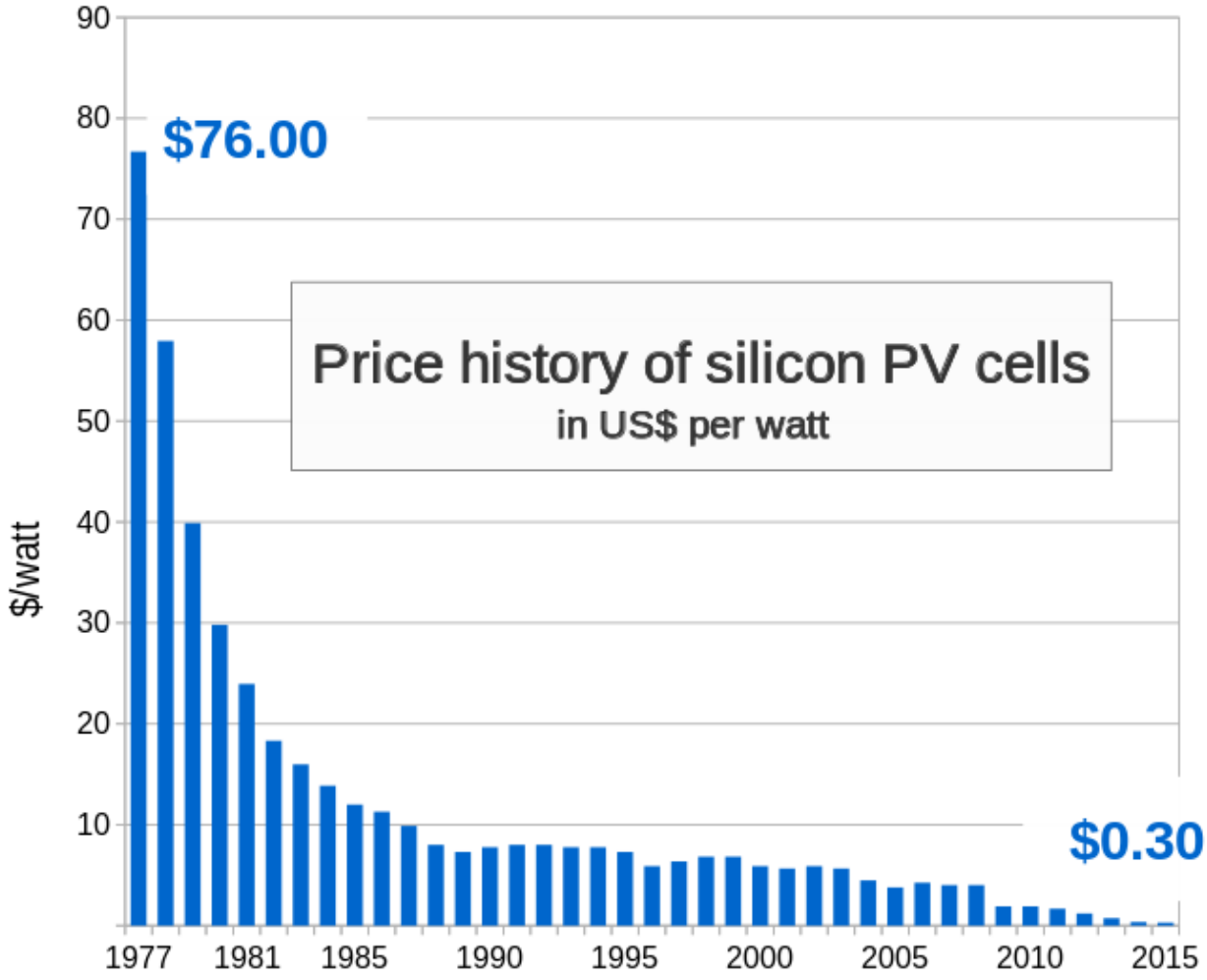
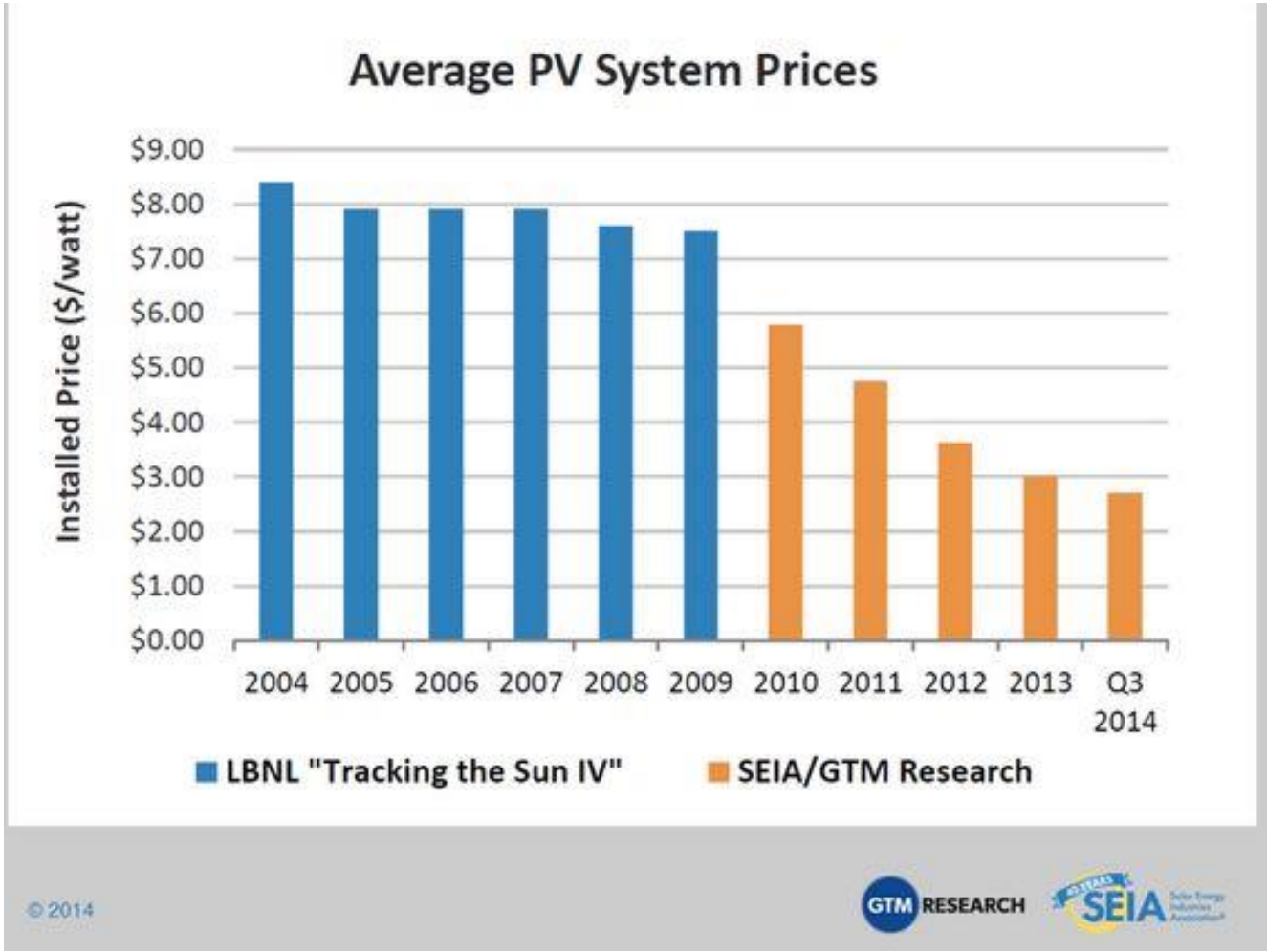
Declining PV Costs

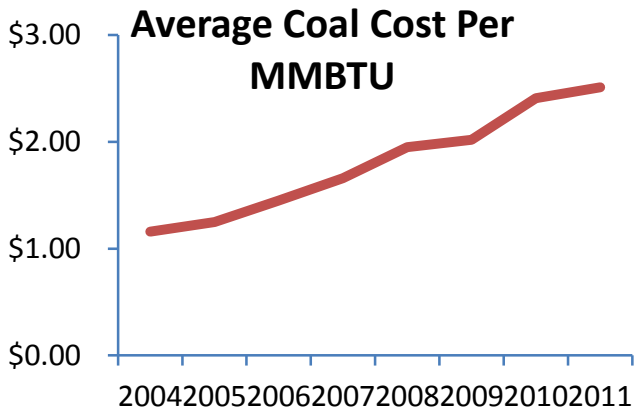


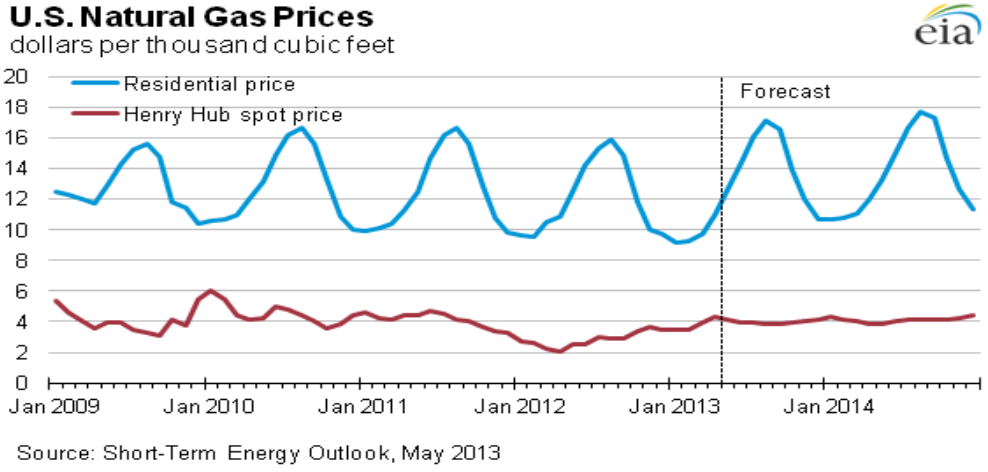
Source: Bloomberg New Energy Finance & pv.energytrend.com

Declining PV Costs



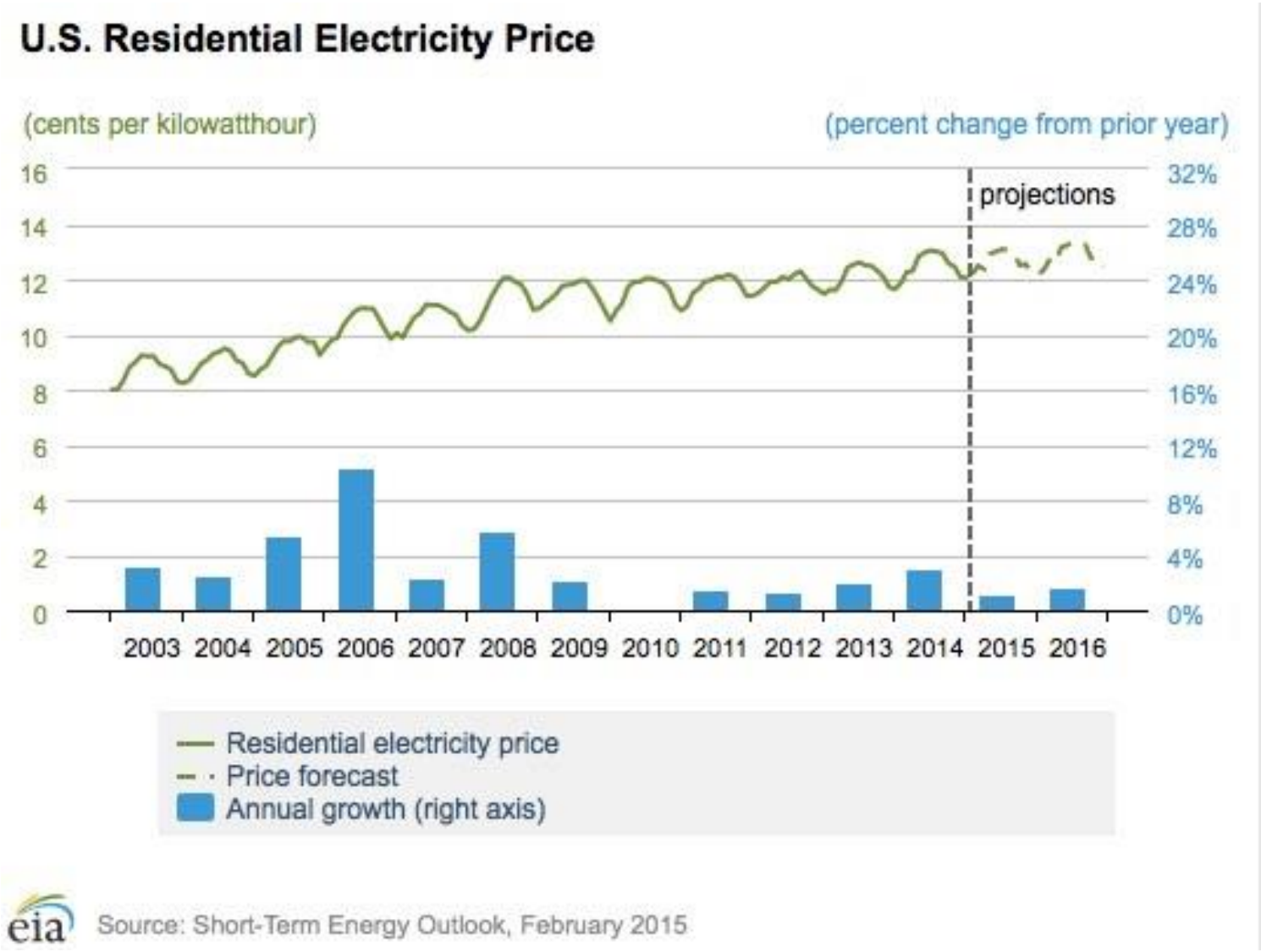
Rising Costs of Fossil Fuels





Source: Short-Term Energy Outlook, May 2013

Rising Costs of Fossil Fuels

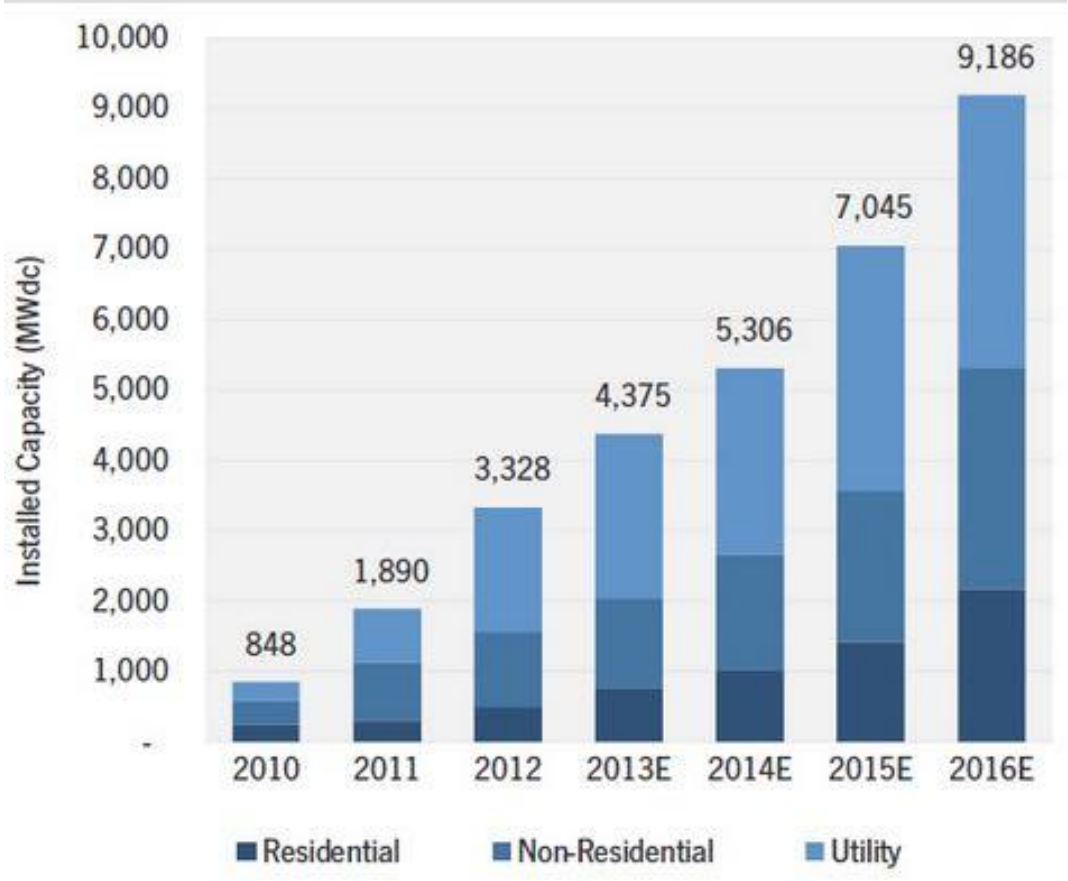


Solar


When there's a huge solar energy spill,
it's just called a "nice day"
www.votesolar.org

The Solar PV Future

Figure 2.8 U.S. PV Installation Forecast, 2010-2016E



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Cost Factors

- System size and design
- Module type
- System siting location
- Efficiency measures taken
- Other factors such as roof condition

How much solar do I need?

- Depends on your energy usage and energy efficiency measures employed
- Each KW of solar will produce roughly 1200 kwh/year.
- If you use 10,000kWh/year and want 100% offset, then you need a roughly 8KW system.
- Solar is modular!

2

Your Home's Month-To-Month Electricity Usage And Electric Charges

	May 2012 - April 2013			May 2013 - April 2014	
Bill Month	Electricity Usage (kWh)	Electric Charges*	Bill Month	Electricity Usage (kWh)	Electric Charges*
May 2012	1,363	$139.97	May 2013	1,156	$118.24
Jun 2012	1,665	$172.50	Jun 2013	1,601	$170.85
Jul 2012	2,513	$272.27	Jul 2013	2,065	$225.36
Aug 2012	2,557	$280.48	Aug 2013	1,265	$131.81
Sep 2012	1,638	$177.57	Sep 2013	2,255	$244.17
Oct 2012	1,378	$145.91	Oct 2013	926	$94.51
Nov 2012	1,390	$144.70	Nov 2013	1,276	$135.80
Dec 2012	1,421	$114.29	Dec 2013	1,573	$173.12
Jan 2013	2,290	$191.10	Jan 2014	1,903	$215.64
Feb 2013	2,297	$183.33	Feb 2014	1,548	$175.81
Mar 2013	1,835	$146.28	Mar 2014	1,451	$166.19
Apr 2013	1,540	$163.84	Apr 2014	1,107	$91.14
Total	21,887	$2,132.24	Total	18,124	$1,942.64

Residential 5 kW System

- Meets approximately 1/2 to 3/4 of annual household usage
- Total installed cost approximately $20,000

Residential 10 kW System

- Meets about 3/4 to ALL of annual household usage
- Costs approximately $40,000

Incentives

- Federal tax credits
- State and local rebates, credits
- Federal, state and local incentives for energy efficiency measures
- Database of Incentives for Renewables & Efficiency (DSIRE) website, dsireusa.org

Residential Renewable Energy Tax Credit (Federal)

- Tax credit of 30% on qualified expenditures
  - Includes labor costs, system installation, interconnection wiring
- No maximum credit
- Recently extended to 2022
- The home must be owned by the taxpayer but does not have to serve as the principal residence
- Incentive details at dsireusa.org and at energystar.gov

Business Energy Investment Tax Credit (ITC) (Federal)

- Commercial, agricultural, and industrial taxpayers.
- Tax credit equal to 30% of expenditures
- No maximum credit
- Eligible solar energy property includes equipment that uses solar energy to generate electricity.
- Also extended to 2022
- Incentive details at dsireusa.org

Made in MN Rebate

- Provides additional an incentive
- Performance based incentive determined by how much electricity your system produces in a year(# of kWh)
- Depending on the type and size of Made in MN solar module installed, the cash rebate varies between .13 to .39 cents per kW hr. It is realized over a 10 year period
- Apply between January 1 and February 29

Sample 5 kW System

5% Power Pack Discount

- Provides additional an incentive
  - 5% off equipment purchased from partnering distributor
  - 5% off design and installation labor from participating installer
- Deadline to participate: May 15th, 2016

SAMPLE INVOICE	
Equipment purchased from [partnering distributor]	10,000
5% [partnering distributor] equipment discount	($500)
Other components	$1,000
Design & Installation Labor	$8,000
5% Design and installation labor discount	($500)
Permit Fee	$200
Interconnection Fee	$200
Total	**$19,400**

simpleray

WERNER ELECTRIC
SOLUTION • SUPPLY • SUPPORT

Power Pack MN Installer Discount

Minnesota Installers

The following solar installers participate in the Minnesota Power Pack Discount program.

- All Energy Solar
- Cedar Creek Energy
- Juhl Energy
- Solar Connection
- Solarized
- Zenergy

Installer Qualifications

- Training Standard
  - North American Board of Certified Energy Practitioner (NABCEP)
  - Underwriter Laboratories (UL) Photovoltaic System Installer Certification
  - U.S. Department of Labor (DOL) Recognized Electrical Apprenticeship Certification or Accredited Solar Design and Installation Certificate/Degree with at least 2 documented installations
- Must have conducted three solar installs
- 5 year labor warranty
- Cost competitive

Other Incentives

- Xcel Solar Rewards
  - Available in Xcel territory
  - $0.08 per kWh produced for 10 years

Xcel Energy®
Solar*Rewards

Sample 5 kW System

- Total cost $20,000
- 5% Power Pack Discount
- Federal tax credit of 30%
- Xcel Solar Rewards
- Cash down payment 10% of system cost

PV System Costs	
Initial cost of PV system	$20,000
5% Power Pack Discount (from previous example)	-$1,000
Federal Tax Credit (30% of $19,000)	-$5,700
Xcel Solar Rewards	-$3,700
Total System Cost	$9,600
Cash down payment (10%)	-$1000
Total Remaining to Finance	$8,600

Sample 5 kW System

Environmental Benefits

- 124 tons of carbon dioxide (CO2) eliminated from your ecological footprint
- Equivalent to:
  - Planting 2,889 trees
  - Driving reduced by 248,000 auto miles, or 12,648 gallons
  - Recycling 392 tons of waste instead of sending it to landfill
  - Displacing CO2 emissions from the annual electric use of 14 homes

Work With Your Installer

- Costs and incentives vary
- Work with a qualified installer
- Ask questions

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Power Pack MN Financing

Center for Energy and Environment

Neighborhood Energy Connection
tools for energy-efficient living

USDA

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Next Steps

1. Connect with Power Pack installers (sign up by May 15th)
2. Get a site assessment
3. Obtain financing from your local or Power Pack lending institution.
4. Install your solar system.
5. Celebrate, share your story, enjoy free clean energy!

Stay informed – Join as an MREA Member

- Choose a Personal or Business Membership
- Receive great benefits including:
  - Free admission to The Energy Fair
  - Free access to online, on-demand courses
  - Newsletter covering policy updates
  - And more!

Many ways to join:

- Sign up online at www.midwestrenew.org/join
- Call MREA's Custer, WI office at 715-592-6595
- Contact Communications Director Gina Miresse at ginam@midwestrenew.org

Member support allows us to continue offering free educational sessions like this one. Let's grow solar!