SOLAR POWER HOUR

Solar Power Hour

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

The 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

mrea
midwest renewable energy association

Grow Solar

SunShot
U.S. Department of Energy

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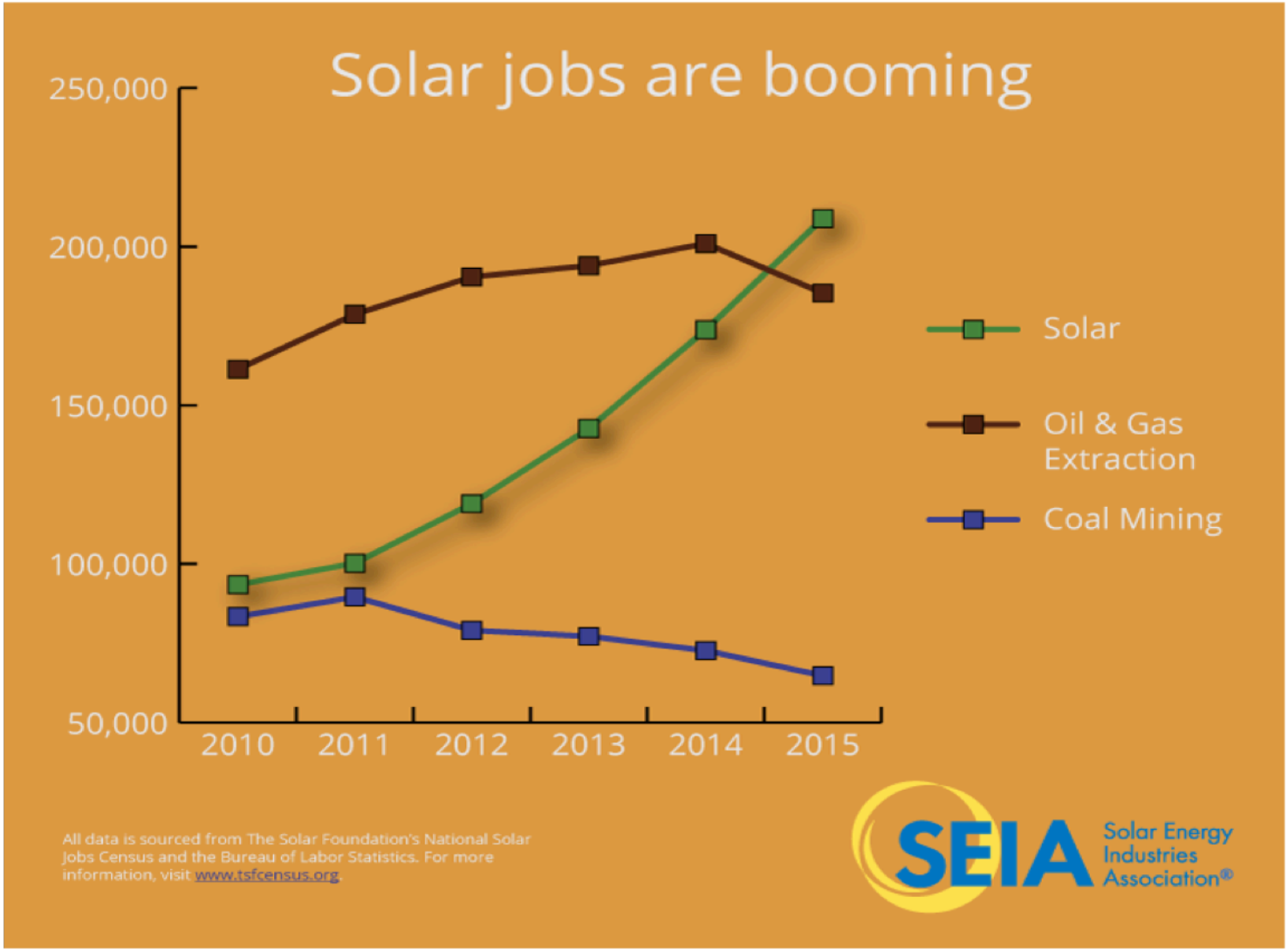
Solar PV Installations To Date

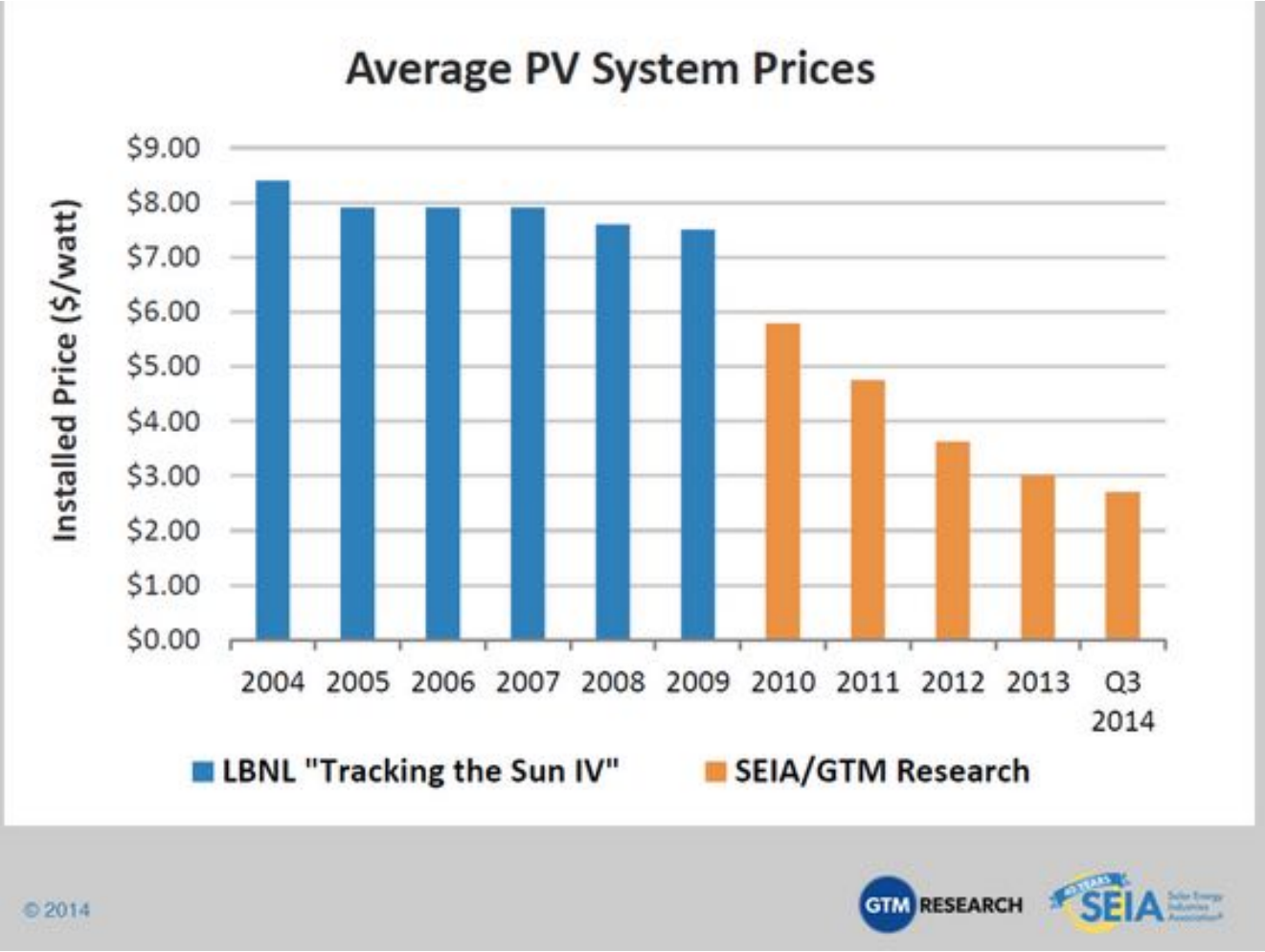
- Now over 28 GW of solar PV installed in US
- Enough to power over 5.5 million homes
- Solar represented 30% of all new electric generating capacity brought on-line in the U.S. in 2015, more than natural gas!
- 2015 was the best year for solar growth ever

SEIA Solar Market Insight Report

Solar Jobs

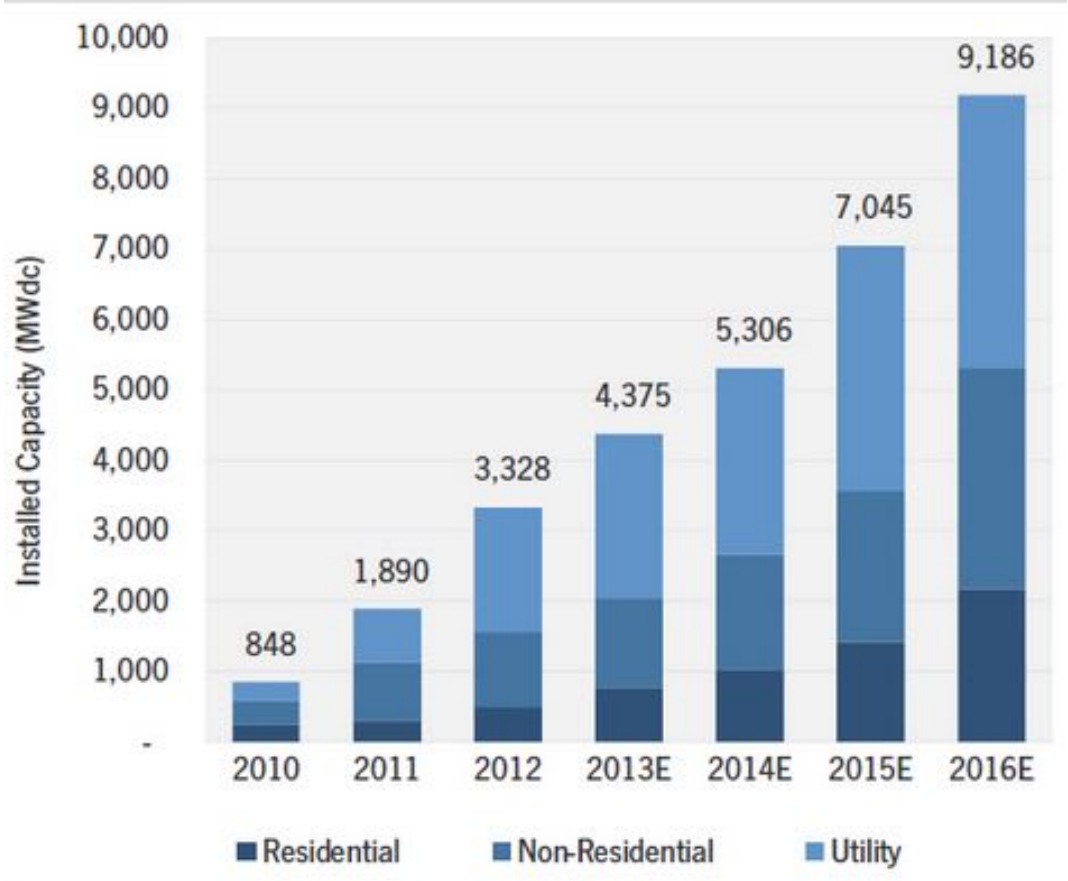

Solar jobs are booming
250,000
200,000
150,000
100,000
50,000
2010
2011
2012
2013
2014
2015
Solar
Oil & Gas Extraction
Coal Mining
All data is sourced from The Solar Foundation's National Solar Jobs Census and the Bureau of Labor Statistics. For more information, visit www.tsfcensus.org
SEIA
Solar Energy Industries Association®

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

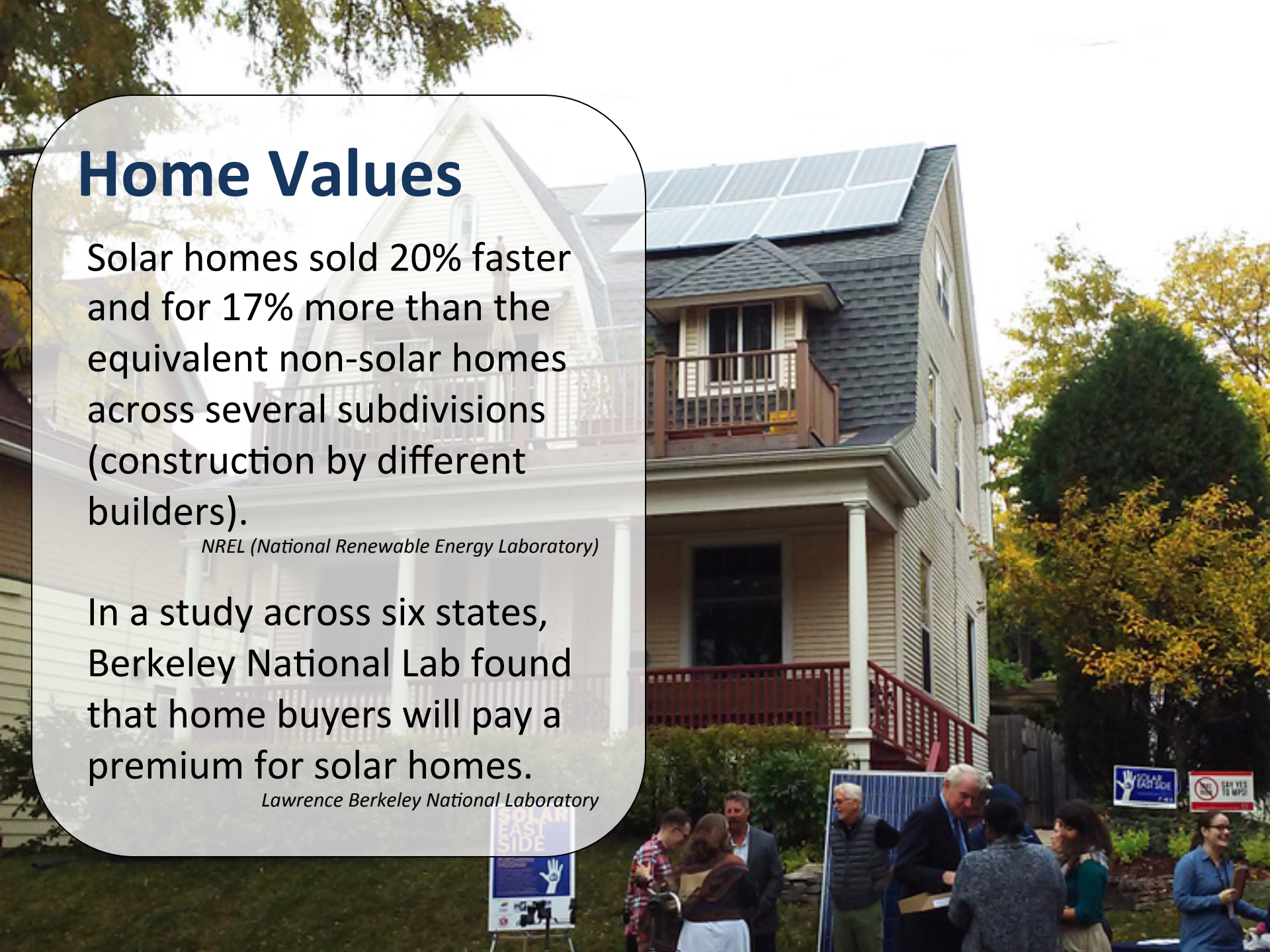
Home Values

Solar homes sold 20% faster and for 17% more than the equivalent non-solar homes across several subdivisions (construction by different builders).

NREL (National Renewable Energy Laboratory)

In a study across six states, Berkeley National Lab found that home buyers will pay a premium for solar homes.

Lawrence Berkeley National Laboratory



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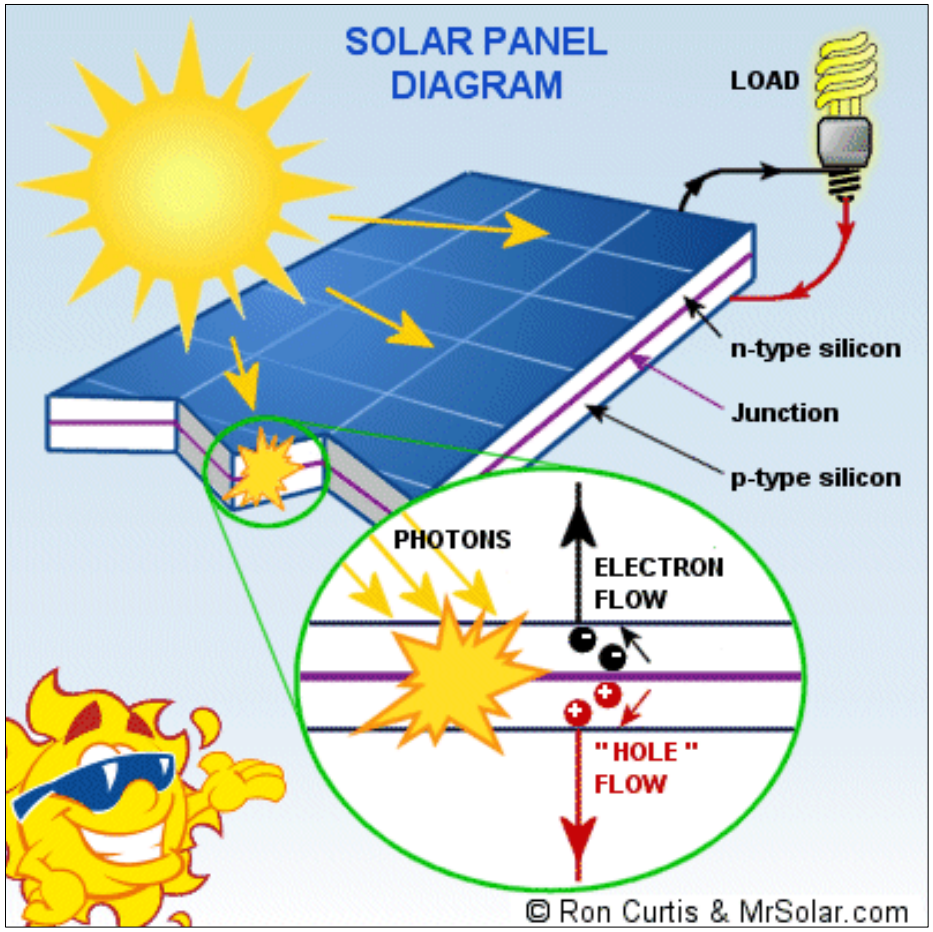
2 Components for a PV System

- Solar Panels/Modules

- Inverter

Panels/Modules

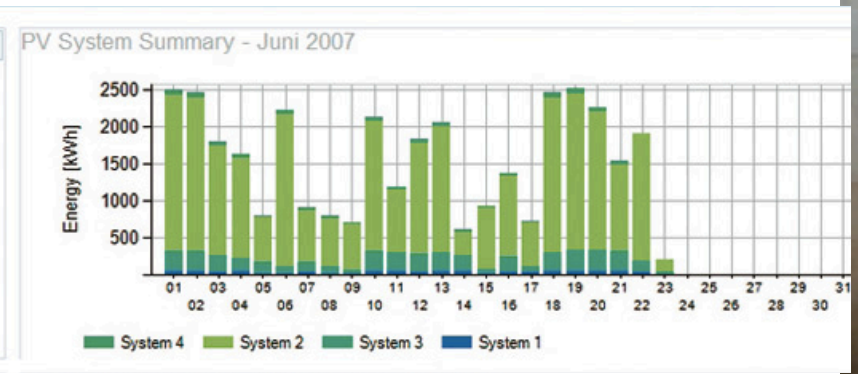


- Panels/Modules usually warrantied for 25 to 30 years
- No moving parts
- Degrade over time
- Can be operational at >75% after 40 years
- Can withstand golf size ball hail at 60mph
- Snow melts off quickly due to dark surface and pitch

SOLAR POWER HOUSE
Solar Shorewood

Inverters - DC to AC Electricity

- The heart of the solar array: an electronic device that converts DC electricity from a PV array to AC electricity



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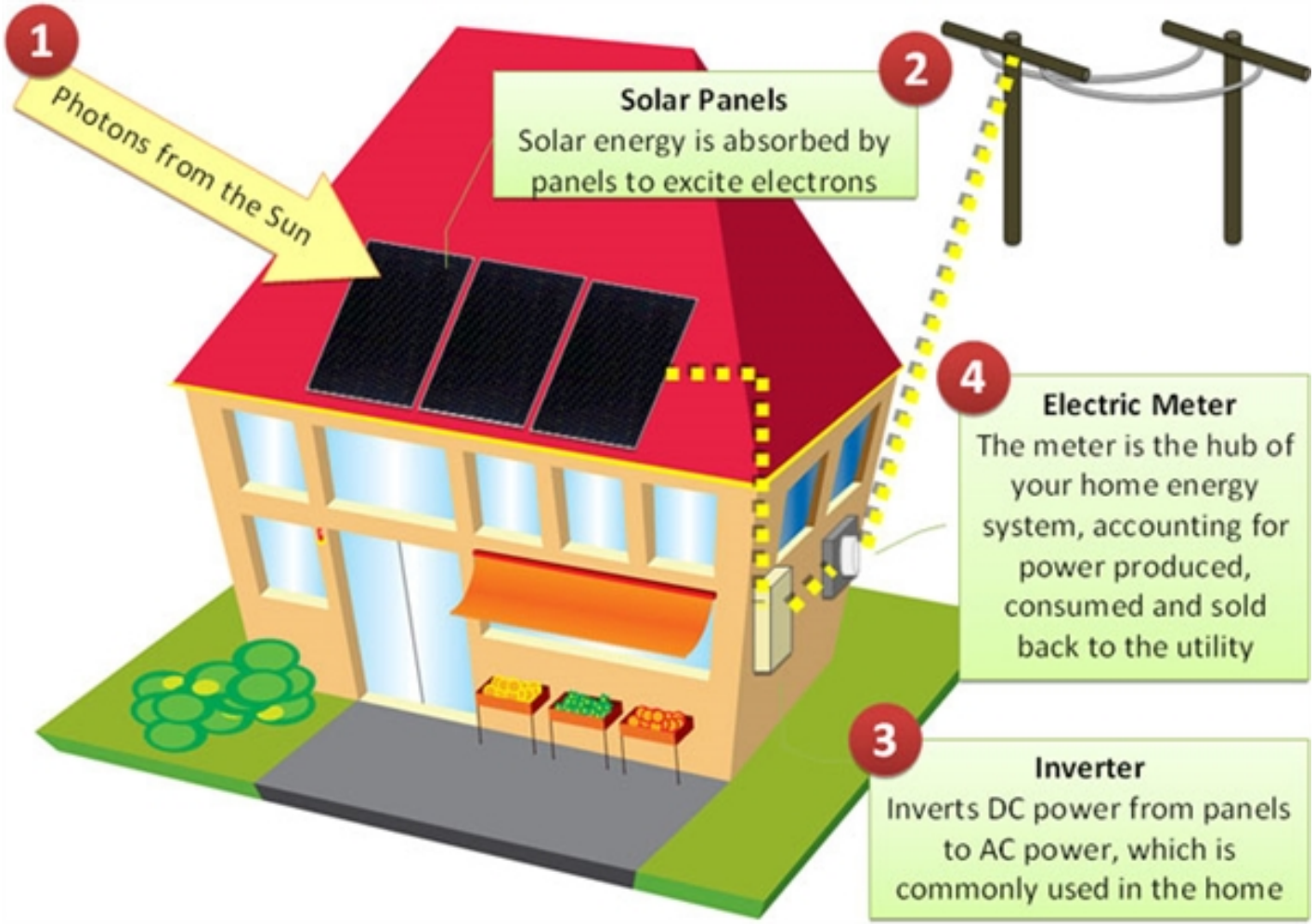
How It Works



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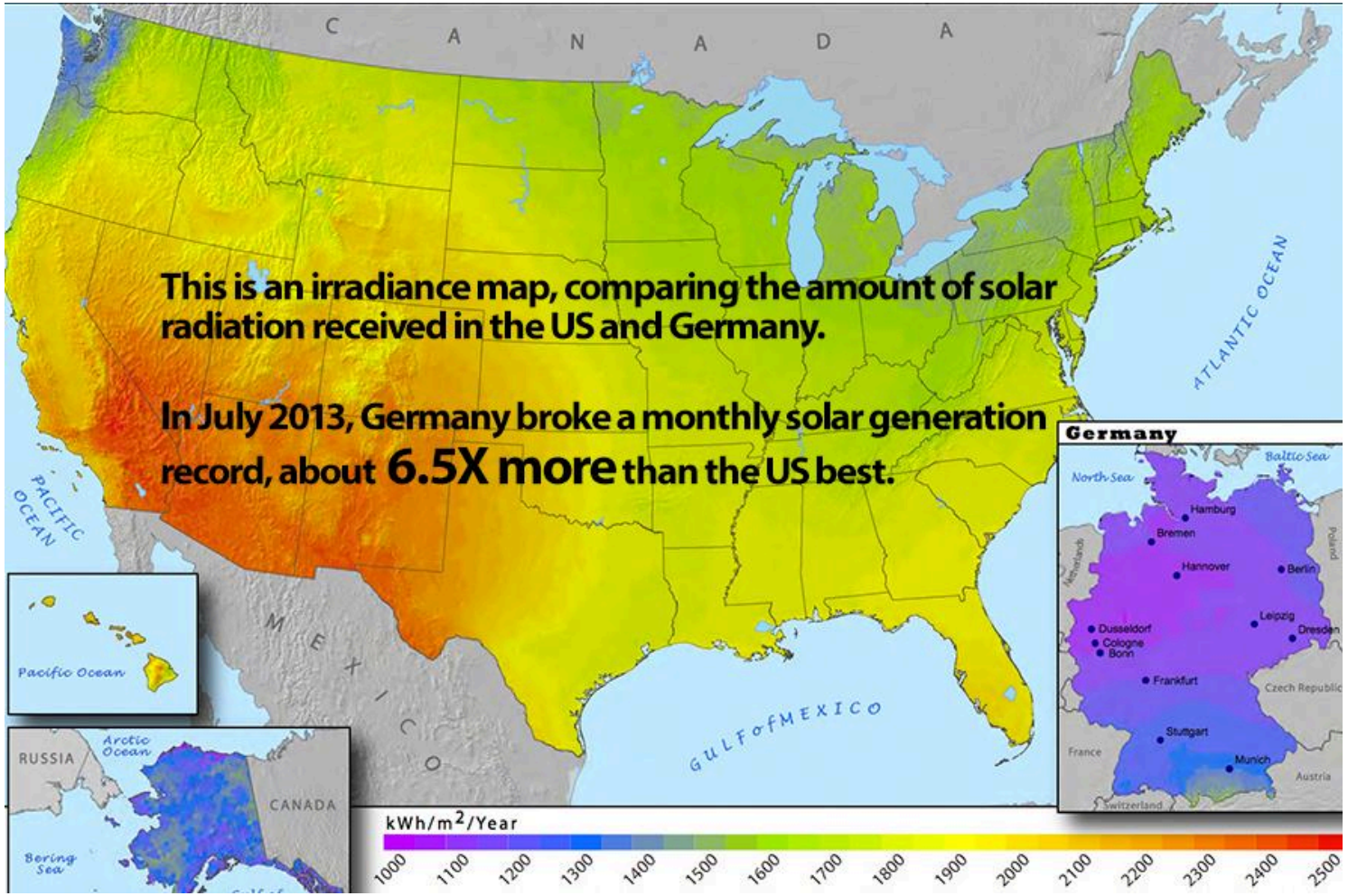
Is there Enough Sunlight?



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Mounting Types

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

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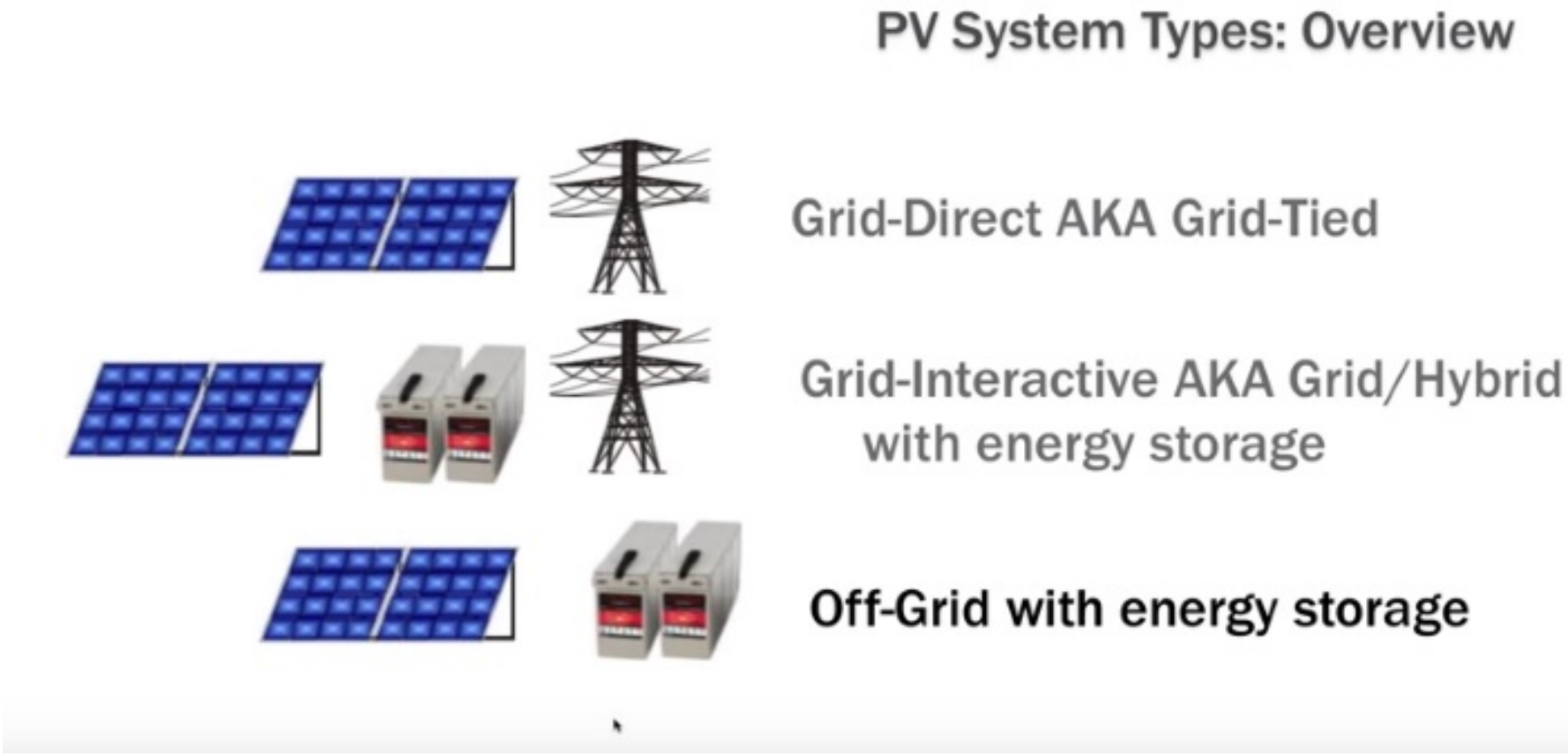
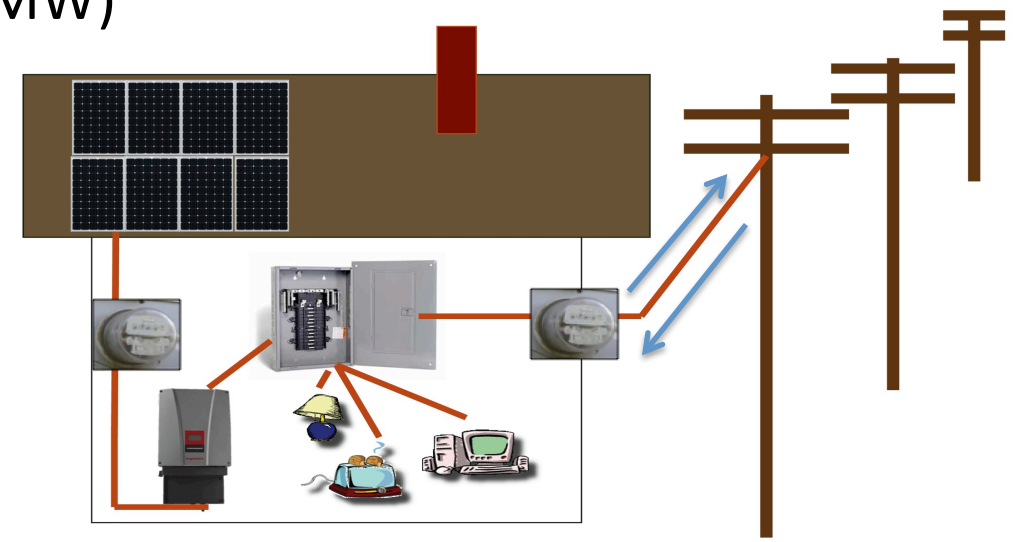
System Types



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)



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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

Net metering varies from state to state, and from utility to utility. Your installer can give you more information on your specific net metering rules

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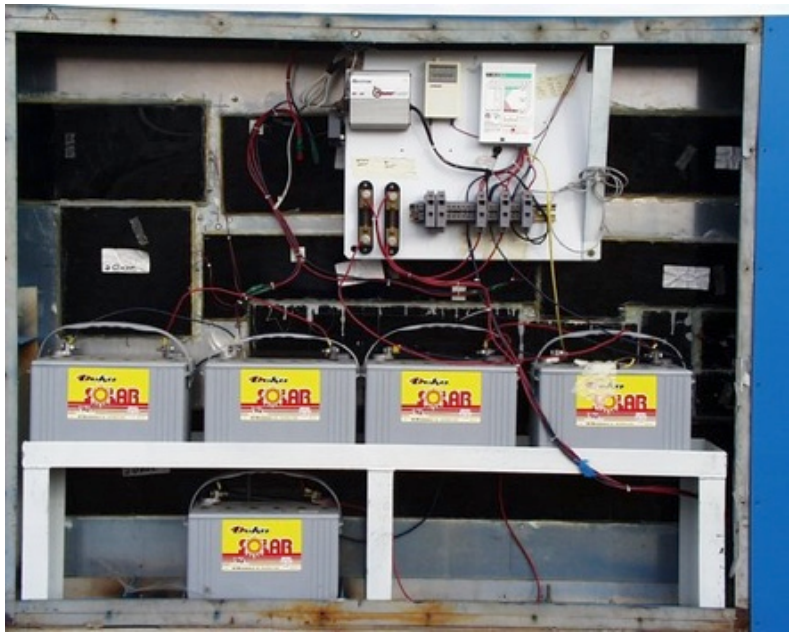
System Designs
Battery Backup & Off Grid

- **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



Monitoring

- **Monitor through online portal or though apps on your phone**
  - Allows for enhanced maintenance
  - See how much energy you are creating and your energy production trends
  - Fault detection
  - Automatic alerts

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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

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Efficiency First!

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

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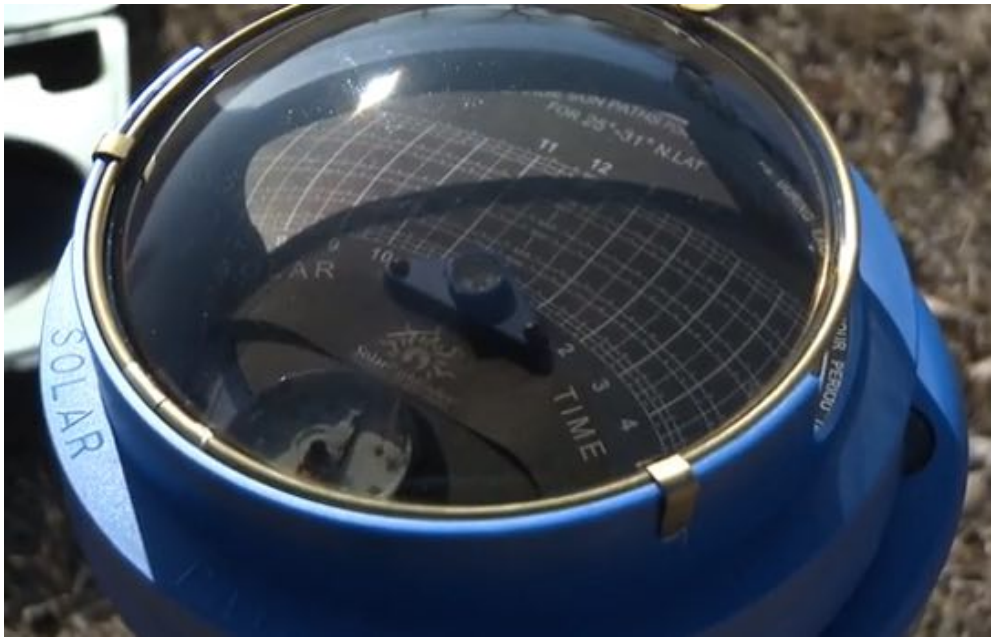
Solar Site Assessment

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
- Get multiple site assessments if possible



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

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Importance of Site Assessment

- Economic Analysis will address
  - Costs
  - ROI
  - Incentives
  - Rebates
  - Energy Savings
  - Financing Payments

Rated System Output (kWp)	2.4
Over-all AC to DC derating factor	0.77
Array Tracking?	fixed tilt
PV array tilt (degrees from horizontal)	33
Annual Output (kWh-AC / year)	2773

	No Incentives	With Fed Tax Credit	With CE FIT & Tax Credit
Initial Purchase Price (incl taxes)	$18,900	$13,230.0	$13,230.0
Utility Price ($/kWh, including sales tax)	$0.111	$0.111	0.65
Value of annual output	$308.93	$308.93	$1,724.45
Simple payback period (years)	61	43	8
Alternative investment yield (30-year treasury)	4.41%		
Marginal income tax rate	39.35%		
Discount rate (after-tax investment yield)	2.67%		
System Lifetime (years)	30	30	12
Present value of savings in utility bills	$6,318	$6,318	$17,503
Net Present Value (NPV)	($12,582)	($6,912)	$4,273
Internal Rate of Return (IRR)	-4%	-2%	8%
Cost of Energy ($/kWh)	$0.33	$0.23	$0.47

Figure 13: NPV for PV in Central Michigan
(Source: Author, 2009)

Is My Home Good For Solar?

- Do I have a south facing roof or 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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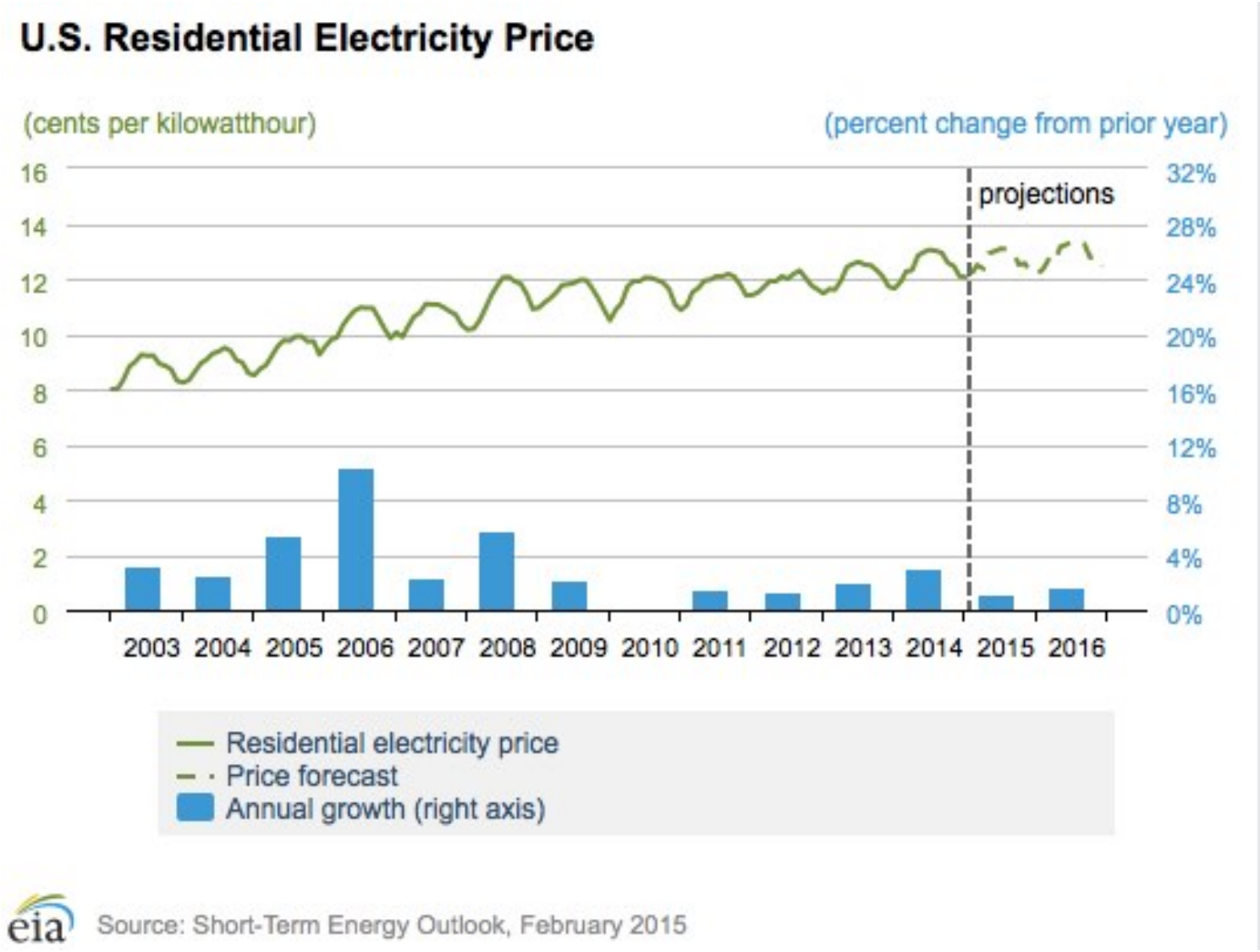
Rising Costs of Fossil Fuels



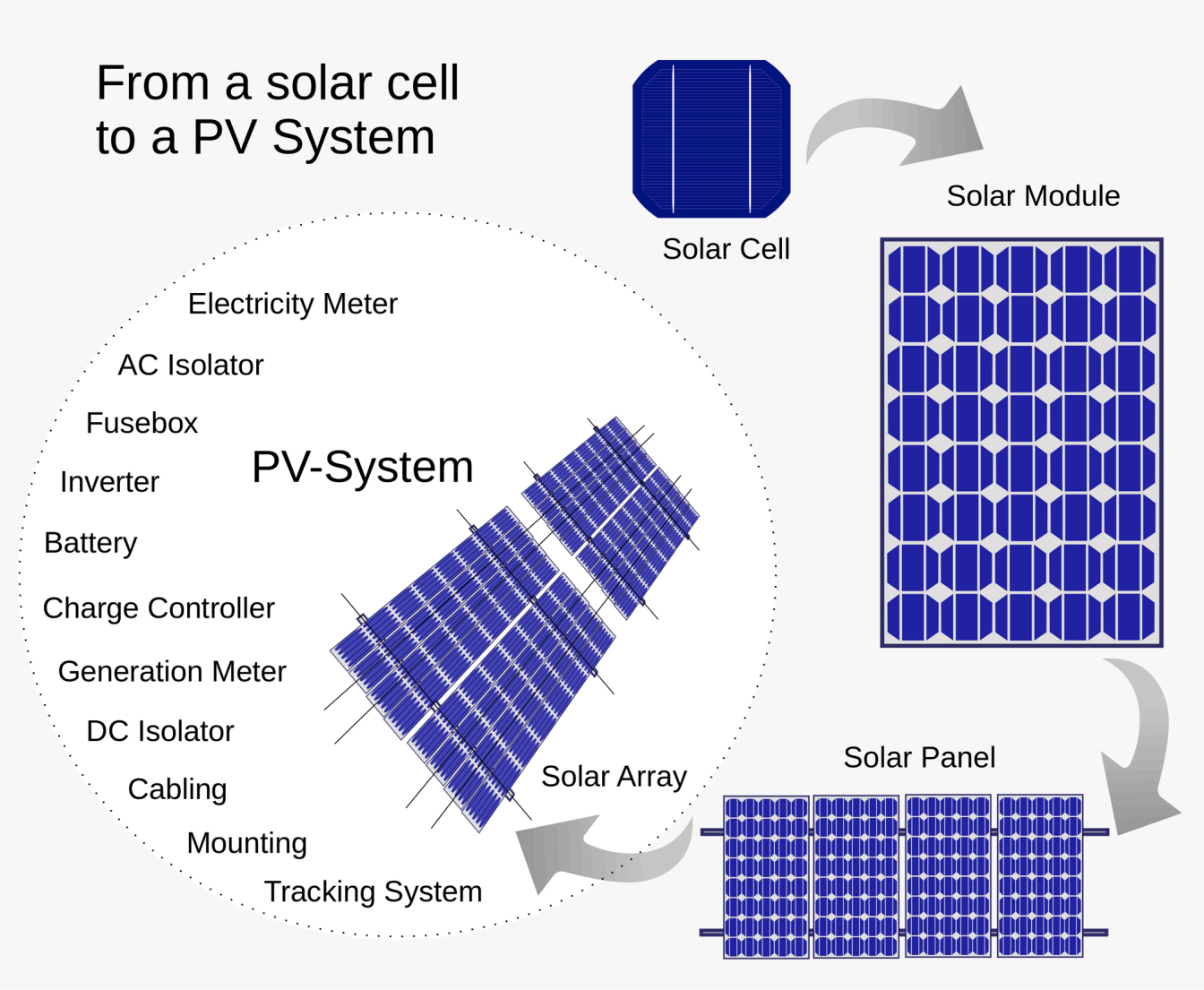
Solar


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

Cost Factors

- System size and design
- Module type
- Inverter type
- Slope, height of roof
- Complexity of electrical interconnection
- Type of roofing material
- Other factors such as roof or site condition

Sample System Sizes



Residential 5 kW System

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

Residential 10 kW System

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

Incentives

- Federal tax credits
- Utility Net Metering Credits
- State and local rebates, credits
- Federal, state and local incentives for energy efficiency measures
- Utility Rebates
- Installer Discounts

Incentives

- Your installer will assist you in applying for the incentives that are available in your area/ utility
- For a complete list of incentives that are available to you visit dsireusa.org
  - The Database of State Incentives for Renewable and Efficiency
  - Lists all incentives at your exact location

Incentive Examples - Federal

- Residential Renewable Energy Tax Credit
- Business Energy Investment Tax Credit
- Property Tax exemption

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
  - 30% until 2019
  - 25% in 2020
  - 20% in 2021
  - 10% thereafter
- 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 with same timeline
- Incentive details at dsireusa.org

Incentive Examples - State

- Made in Minnesota Rebate (MN)
- Focus on Energy Rebate (WI)

Made in MN Rebate (MN)

- 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 .30 cents per kW hr. It is realized over a 10 year period
- For a 5kw system this could be upwards of 10,000 dollars

Focus on Energy Rebate (WI)

- Earn up to **$2,400** in incentives for installing a qualifying solar electric system. To qualify for an incentive you must:
  - Install the solar electric system in an existing residential or non-residential property. New construction projects are not eligible.
  - Must be installed within 45 degrees of due south.
  - Must be installed with a panel tilt between 10-50 degrees.
  - Must have less than 10% obstacle shading based on analysis of an industry-accepted tool.

Incentive Examples - Utility

- Xcel Solar Rewards (Xcel in parts of MN)

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

Sample 5 kW System

- Total cost $20,000
- Federal tax credit of 30%
- State/Utility Rebates
- Cash down payment of $1000

PV System Costs	
Initial Cost of PV system	$20,000
Federal Tax Credit (30% of $20,000)	-$6,000
State/Utility Rebate	-$4,000
Total System Cost	$10,000
Cash down payment	-$1000
Total Remaining to Finance	$9,000

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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Financing Options

cee
Center for Energy and Environment

USDA Rural Development

focus on energy
The power is within you.

PACE
Property Assessed
Clean Energy Program

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SOLAR POWER HOUR

GOING SOLAR IS A GOOD CHOICE!

- Delivers a profitable long term investment!
- Provides predictable home energy prices for 25+ years
- Results in impactful environmental benefits
- Offers clean energy independence
- Creates interest from neighbors – solar is contagious

  Yale/NYU study

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Next Steps

1. Connect with an installer (there are many here)
2. Get multiple site assessments
3. Do efficiency upgrades
4. Find financing
5. Install your solar system
6. Celebrate, share your story, enjoy free clean energy!