U.S. DEPARTMENT OF ENERGY

SOLAR DECATHLON 2009

Solar Energy for the Homeowner

Glen Salas

U.S. DEPARTMENT OF ENERGY

NREL National Renewable Energy Laboratory

APPLIED MATERIALS

bp

pepco Your life. Plugged in.™

Schneider Electric

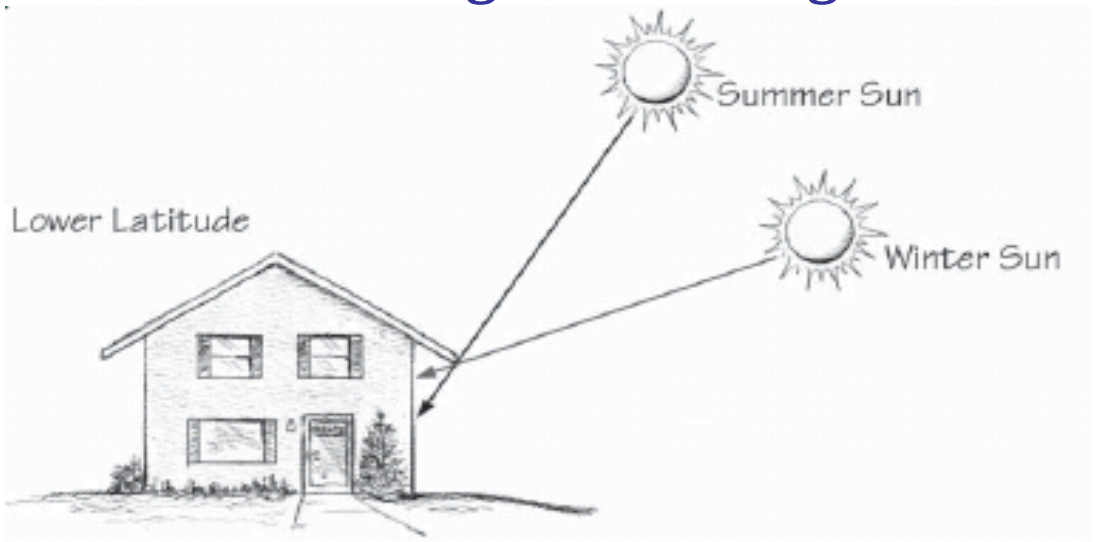
Topics

- Solar Basics and Energy Efficiency
- U.S. Solar Resources
- Solar Water and Home Heating
- Solar Electric Power (Photovoltaic)
- Incentives and Electric Metering
- Financial Considerations
- Planning Your System
- Installation Considerations

Solar Basics and Energy Efficiency

Powering Your Home with Solar

- **First** - make efficiency improvements!
  - Seal & insulate, insulate, insulate
  - Best heating/cooling
  - Best appliances and lighting
  - Best windows & doors
  - Best siting
  - Best shading & overhangs



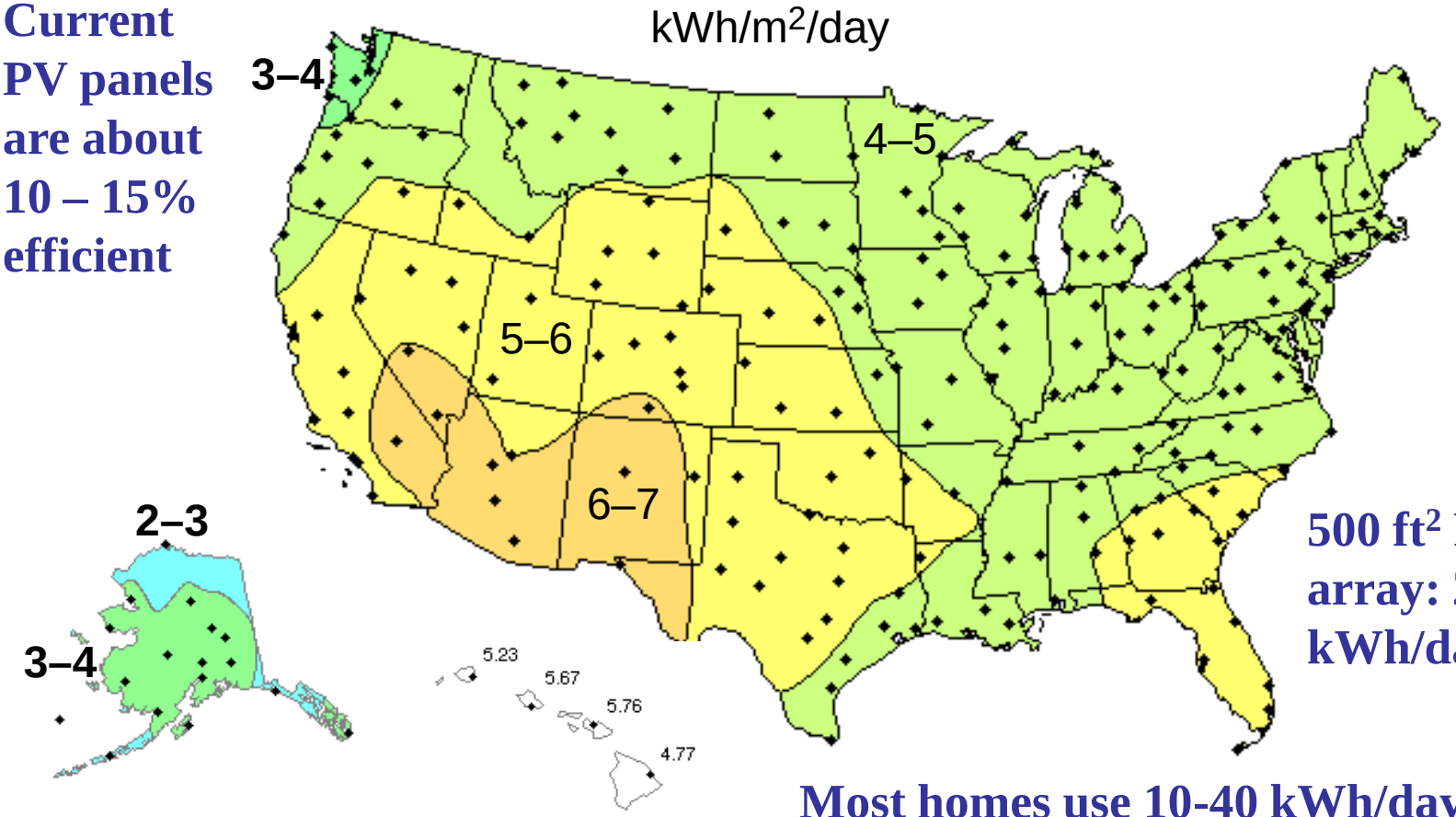
Solar Basics and Energy Efficiency

Powering Your Home with Solar

- **First - make efficiency improvements!**
- **Installation sites should have unshaded access to the southern sky during most of day (9 AM-3 PM) throughout the year.**
- **Building codes and covenants can restrict placement on particular roof surfaces (usually front of house)**
- **Solar electric and water heating need back-up energy**
- **Payback time depends on first cost and cost of energy saved**
- **Can go on new or existing homes, or be ground-mounted**
- **Kind and size of system needed depends on type of home, number in family, home orientation and other factors**
- **Remote or inaccessible sites? Cost-effective solar alternatives might be better than running electric lines.**

U.S. Solar Resources

Current PV panels are about 10 – 15% efficient



500 ft² PV array: 25 kWh/day

Most homes use 10-40 kWh/day

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Translation: Multiply these #s by 1/10 to get kilowatt-hours/m²/day.

Solar Water and Home Heating

- Solar water heating systems are commercially available for both freezing and non-freezing climates – and for swimming pools.
- Collectors can be laid flat on the roof to look like skylights
- Solar space heating (radiant floor) and are also available.
- Two collector system can generally provide most (about 70%) of a family's annual hot water needs

- Usually have thermal storage tank and back-up tank
- Collectors and systems certified by the Solar Rating and Certification Corporation (SRCC)
- ENERGY STAR quailfies complete systems (including back-up heating) for performance, safety, and reliability
- Installers should be NABCEP certified (North American Board of Certified Energy Practitioners)

Solar Electric Power
(Photovoltaics or PV)

- Roof-mounted arrays range in size, type and percent solar contribution depending on available roof space, system cost, aesthetics, net metering with utility and other factors.

Solar Electric Power

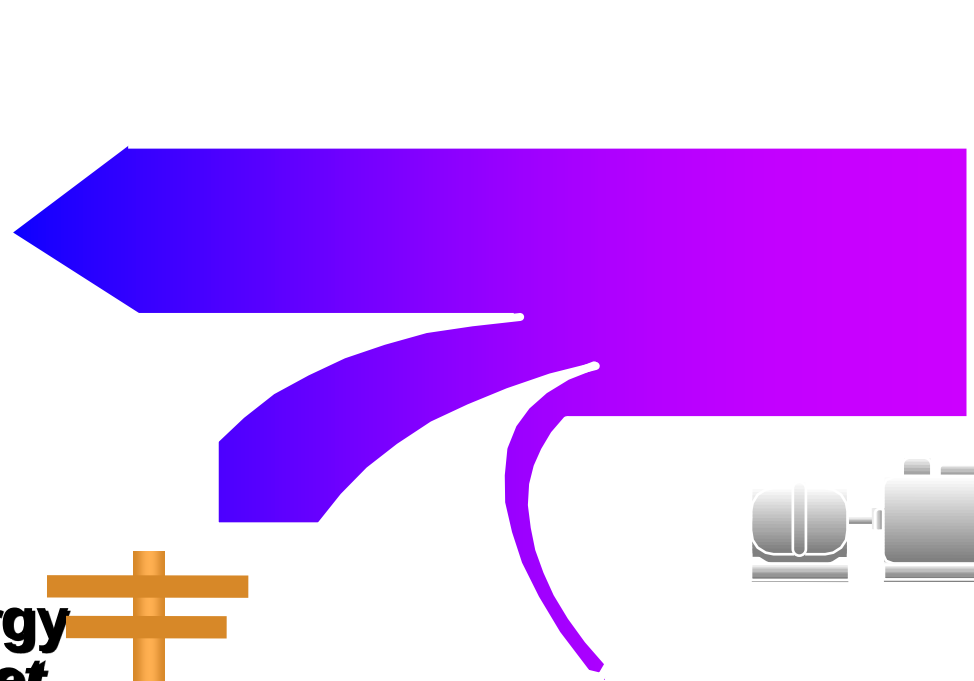
(Photovoltaics or PV)

- PV electricity is Direct Current (DC).
  - Systems need an Inverter to convert to Alternating Current (AC) and be compatible with grid.
  - Most PV homes in U.S are grid-connected without batteries
- DC systems with batteries used for remote or off-grid homes.
- Residential PV systems make best economic sense in areas with net metering because of the export to the grid.
- Time-of-Use rates can be even more attractive depending on efficiency of home and times people are there.
- Current trend: “Building-Integrated PV” (BIPV) where system is built into structure and replaces other building components.

Incentives & Electric Metering

- Check Database of State Incentives for Renewable Energy (www.dsireusa.org) for your state's incentives
- Incentives are in the form of:
  - Buydowns (of hardware cost)
  - Production Incentives (payment for kWh of solar generated energy
  - Other Incentives (Loans, Net Metering, sales & other tax exemptions)

Net Metering



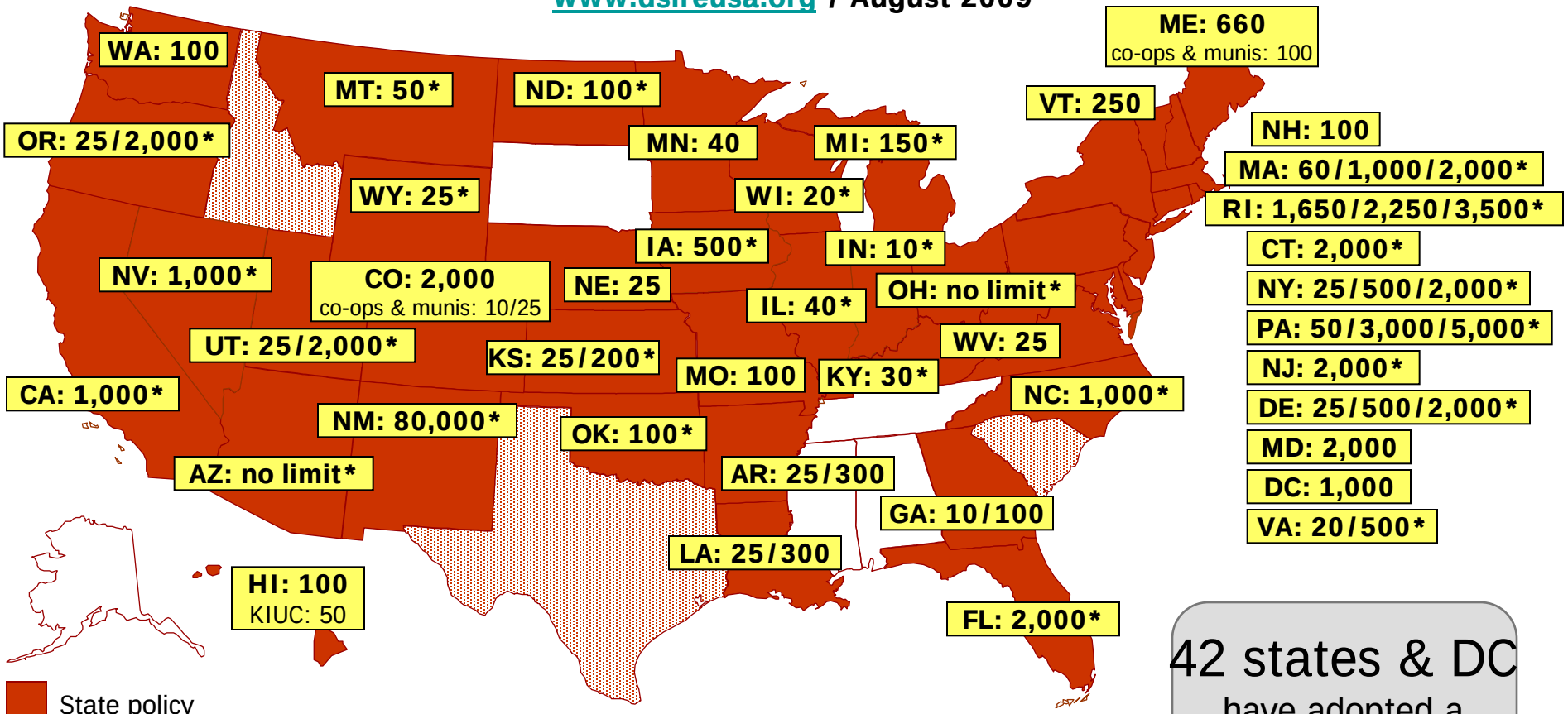
Energy consumed immediately: retail rate

Excess energy used to *offset* consumption at another time: retail rate

Net excess energy (determined monthly or annually): retail rate, avoided cost, or given to the utility

Net Metering

www.dsireusa.org / August 2009



State policy

Voluntary utility program(s) only

* State policy applies to certain utility types only (e.g., investor-owned utilities)

42 states & DC have adopted a net metering policy

Note: Numbers indicate system capacity limit in kW. Some state limits vary by customer type, technology and/or system application. Other limits might also apply.

Time-of-Use Metering

- Often more favorable than Net Metering for PV homeowners with energy-efficient homes and low daytime loads.
- Homeowners may only need to buy grid electricity during off-peak, low-rate times and could sell electricity during system peaks, driven by air conditioning loads.
- Available in limited number of jurisdictions or utility service areas.

System Cost Estimates

2 collector, 80 gal. SWH System; Hawaii

Total System Cost $5,250.00

Local Utility Rebate ***-19%***

Federal Tax Credit ***-30%***

State Tax Credit ***-35%****

NET SYSTEM COST TO CUSTOMER:
$837.50

Customer only pays 16% of the total cost of SWH system!!

*Up to $2,250

2.4 Kw PV Installation; California

Total System Cost $19,200

State Production Based Buydown ***-19%***

Federal Tax Credit ***-30%***

NET SYSTEM COST TO CUSTOMER:
$9,720.00

Customer only pays 51% of the total cost of PV system!!

Planning Your System – First Steps

1. Remember?!! Maximize energy- efficiency opportunities first
   - Estimate electrical and heating loads after efficiency improvements have been made

2. Determine
   - Available roof area and orientation
   - Solar system location.
     - Ground mounting?
     - Check for covenants or other restrictions on placement and visibility from front of house.
3. Make sure the roof surface where solar installation will go is in good condition. Should it be resurfaced first?
4. Estimate system size, performance and cost of system accounting for Federal tax credit, state and local incentives.
5. Find knowledgeable, qualified installer getting at least two, preferable three bids/proposals from local solar contractors or others (electricians or plumbers)

Installation Information

Solar photovoltaic and/or thermal systems:

- **North American Board of Certified Energy Practitioners (NABCEP)**
  - **Tests and certifies PV installers.**
  - **There are a couple hundred NABCEP certified PV installers nationwide and fewer solar water heating installers. www.nabcep.org.**
- **Generally - www.findsolar.com operated and maintained by the Solar Electric Power Association and the American Solar Energy Society.**

Other Information and Considerations

- Department of Energy's website www.eere.energy.gov and through DOE's Efficiency and Renewable Energy Clearing House at 1-800-363-3732 have information.
- Solar Energy Industries Association www.seia.org website has a Guide to Federal Tax Incentives for Solar Energy, a very comprehensive document on the 30% tax credit.
- National Renewable Energy Laboratory at www.nrel.gov
- Sandia National Laboratory at www.sandia.gov.

Thank you!

Glen Salas
D&R Intl.
gsalas@drintl.com
301-588-9387

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Energy Efficiency and Renewable Energy