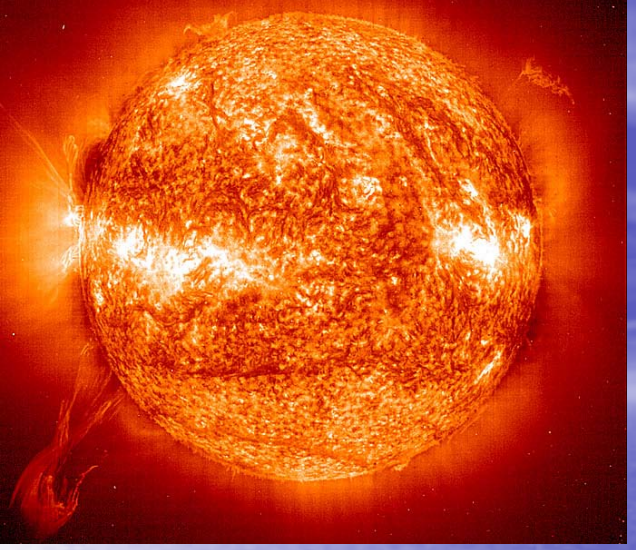
Northeastern Solar Cities Conference

Pittsburgh Oct. 15th and 16th 2009

SOLAR AMERICA CITIES

A Partnership Program with the U.S. Department of Energy

Fusion energy today!
93 million miles away
More solar energy in one
hour than we use
in one year



IRRADIANCE

INSOLATION
SOLAR RESOUCE
SUN SHINE
PEAK SUN HOURS

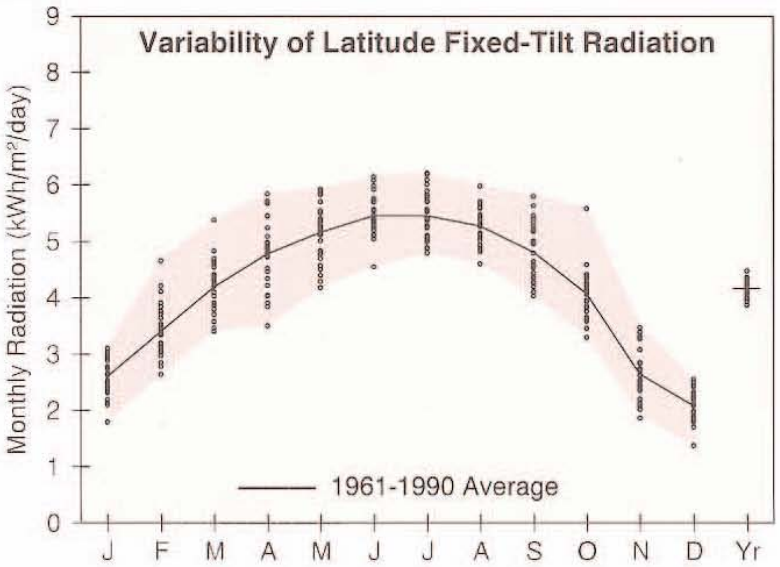
SOLAR RESOURCE

Pittsburgh, PA

WBAN NO. 94823

LATITUDE: 40.50° N
LONGITUDE: 80.22° W
ELEVATION: 373 meters
MEAN PRESSURE: 973 millibars

STATION TYPE: Primary



Solar Radiation for Flat-Plate Collectors Facing South at a Fixed Tilt (kWh/m²/day), Uncertainty ±9%

Tilt (°)		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
0	Average	1.7	2.5	3.5	4.6	5.5	6.1	5.9	5.2	4.2	3.0	1.8	1.4	3.8
	Min/Max	1.4/2.0	2.2/3.1	3.0/4.2	3.5/5.4	4.5/6.2	5.1/6.8	5.2/6.7	4.7/5.8	3.7/4.9	2.5/3.8	1.5/2.1	1.2/1.6	3.6/4.0
Latitude -15	Average	2.4	3.2	4.1	4.9	5.5	5.9	5.9	5.5	4.8	3.8	2.4	1.9	4.2
	Min/Max	1.7/2.8	2.5/4.2	3.4/5.2	3.7/5.9	4.5/6.3	4.9/6.7	5.2/6.7	4.8/6.2	4.1/5.7	3.1/5.2	1.8/3.1	1.3/2.3	3.9/4.5
Latitude	Average	2.6	3.4	4.2	4.8	5.2	5.4	5.5	5.3	4.8	4.1	2.6	2.1	4.2
	Min/Max	1.8/3.1	2.6/4.7	3.4/5.4	3.5/5.8	4.2/5.9	4.6/6.1	4.8/6.2	4.6/6.0	4.0/5.8	3.3/5.6	1.9/3.5	1.4/2.5	3.9/4.5
Latitude +15	Average	2.7	3.5	4.1	4.4	4.6	4.7	4.8	4.8	4.6	4.1	2.7	2.2	3.9
	Min/Max	1.8/3.3	2.6/4.9	3.3/5.3	3.2/5.4	3.7/5.3	4.0/5.3	4.2/5.4	4.2/5.4	3.8/5.6	3.3/5.7	1.9/3.6	1.4/2.7	3.6/4.2
90	Average	2.5	3.0	3.1	2.9	2.6	2.5	2.6	2.9	3.2	3.3	2.3	2.0	2.7
	Min/Max	1.7/3.2	2.2/4.5	2.5/4.0	2.1/3.5	2.2/3.0	2.2/2.8	2.4/2.9	2.6/3.3	2.7/3.9	2.7/4.6	1.5/3.2	1.1/2.5	2.5/2.9

CITY	PEAK SUN HRS	HDD
PITTSBURGH	4.2	3316
PHILADELPHIA	4.6	2752
NEW YORK	4.6	2669
MADISON	4.5	4263
SEATTLE	3.7	2727
PORTLAND	3.9	2512
SAN DIEGO	5.7	688

IRRADIANCE
IS NOT A LARGE BARRIER to SOLAR INSTALLATIONS IN THE NORTHEAST

SAN DIEGO	SEATTLE	PITTSBURGH
5.7 Peak SH	3.9 Peak SH	4.2 Peak SH

IRRADIANCE IS NOT A LARGE BARRIER to SOLAR

SAN DIEGO	SEATTLE	PITTSBURGH
$ 30,000 PV	$ 42,000 PV	$ 38,000 PV
$ 8,000 SHW	$ 11,000 SHW	$ 10,000 SHW

Solar Success in the Northeast in Home Power Magazine # 121

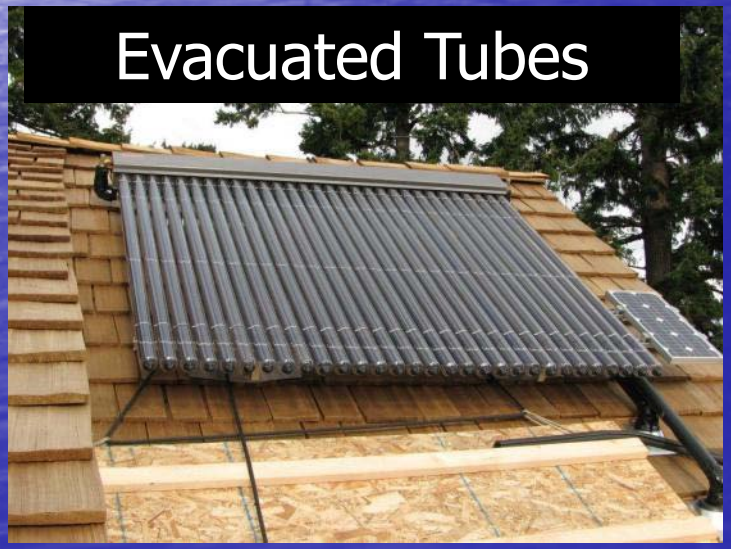
PV System Comparison: New York vs. California

Area	PV System Size (KWp)	AC Output (KWH Per Year)	Average Utility Rate ($ Per KWH)	Electricity Value ($ Per Year)
Capitol region of New York	5.0	5,839	$0.159	$930
Southern California	3.9	5,839	$0.140	$817
Ratio of CA : NY	78.0%	100.0%	87.9%	87.8%

The system size advantage goes to the smaller system in California, but the energy value in dollars is greater in New York, making the point that solar electricity is not only effective in the sunniest parts of the United States, but also in the Northeast due to high retail electricity rates.

INNOVATION AKA TECHNOLOGY IS NOT A BARRIER FOR THE NE STATES

GATHERING THE SUNLIGHT



The technologies are available and have been for decades

INFRASTRUCTURE

MANUFACTURING
DISTRIBUTION
INSTALLERS
CODES AND STANDARDS
INSPECTION

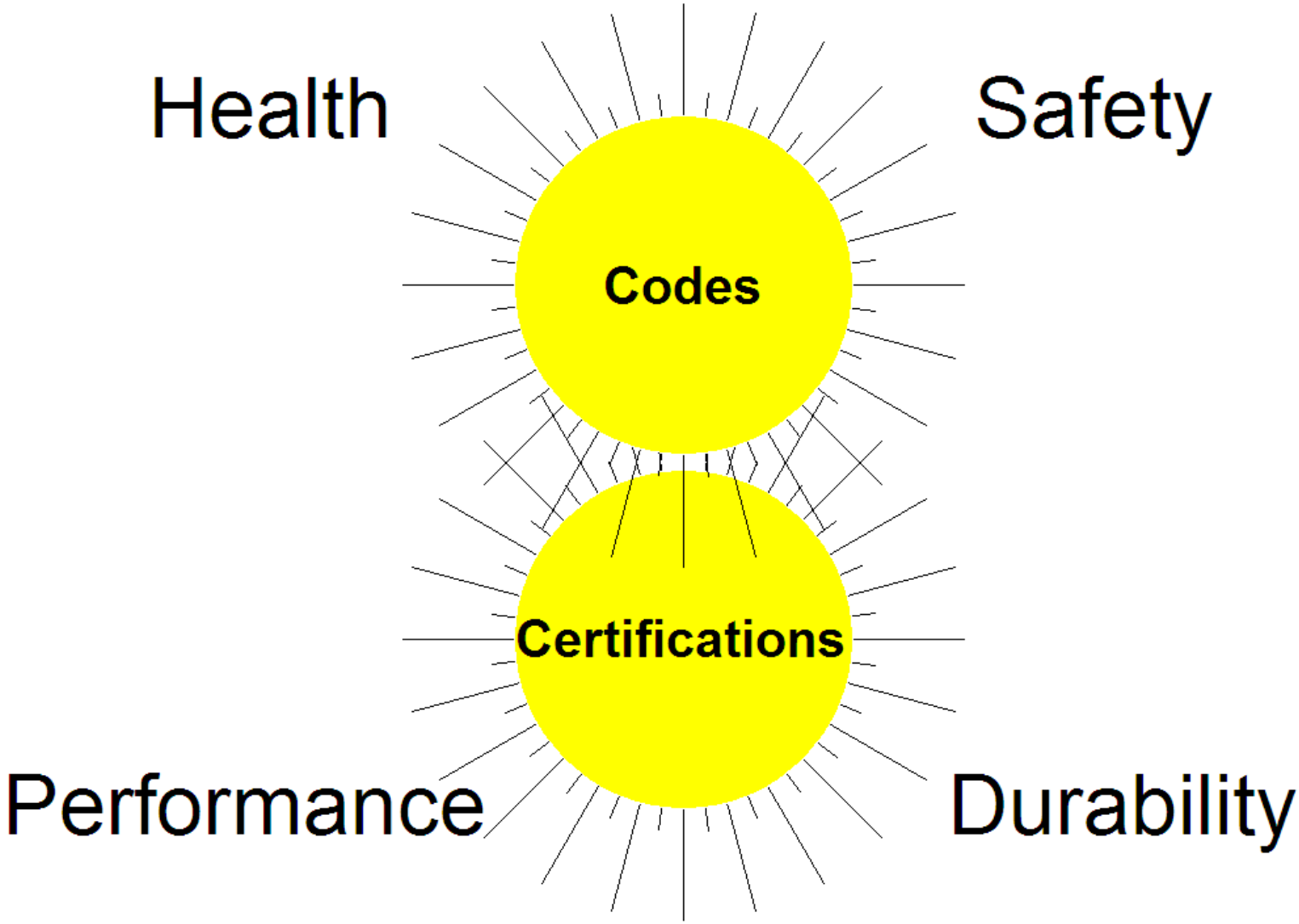
Distribution Chain

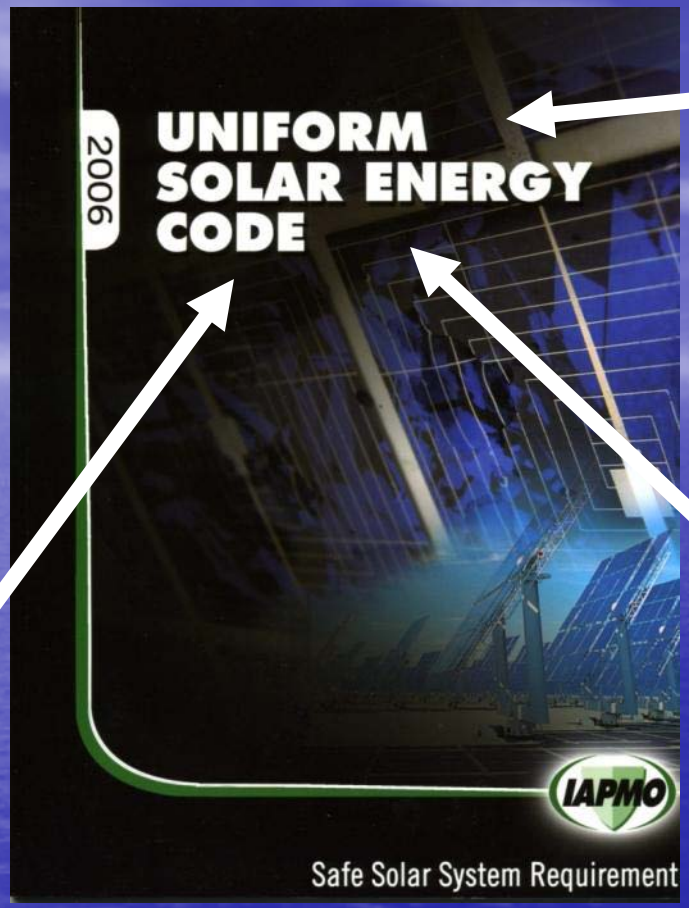
- Manufacturer
- Manufacturers Rep
- Distributor
- Dealer/Installer

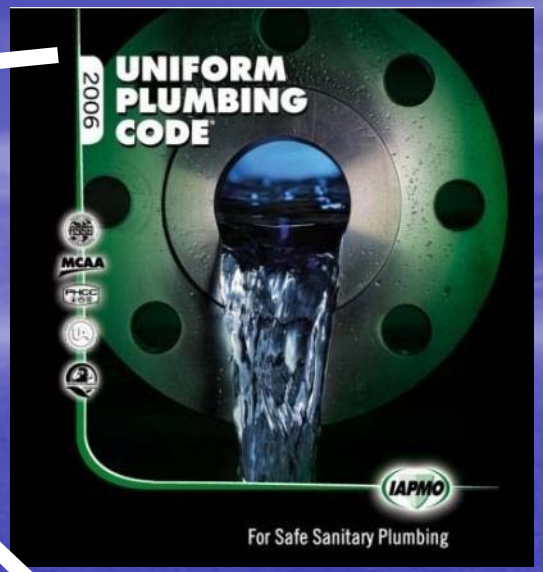
LOCAL MANUFACTURING

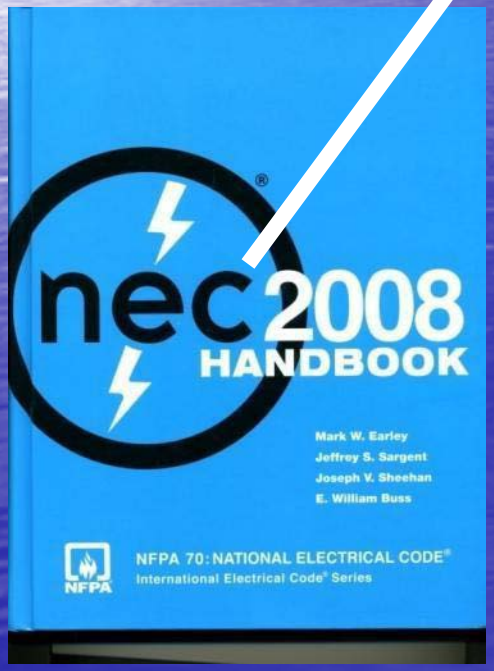
STOCKING DISTRIBUTORS

INSTALLATIONS

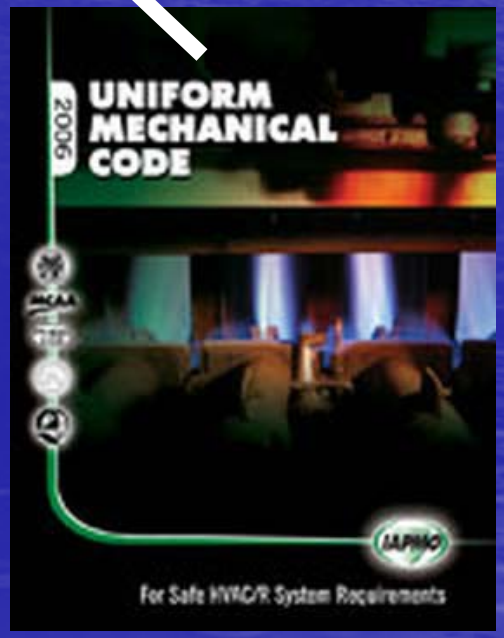

Health
Safety
Codes
Certifications
Performance
Durability







Uniform Solar Code based on 2005 NEC and 2003 Plumbing and Mechanical Code Books



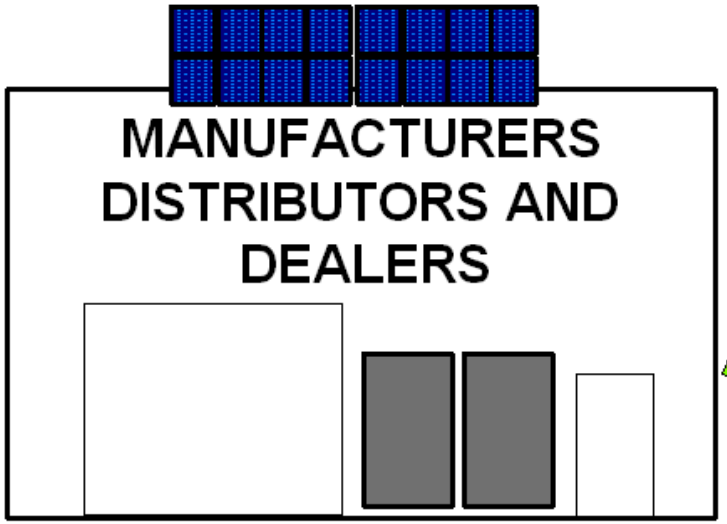
National Electrical Code

NABCEP Certification

Certification for solar installers

PV installers
Entry level program
Thermal installers
Test
Certification is voluntary but that's changing in some locations

INFRASTRUCTURE



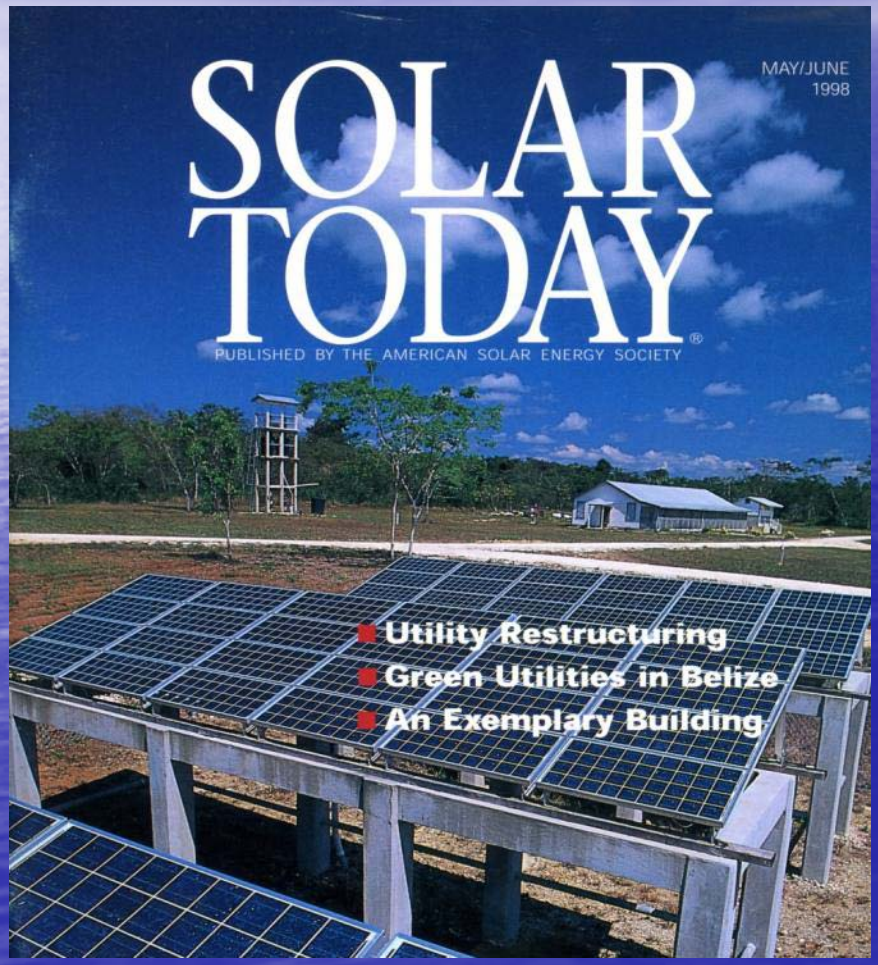
KNOWLEDGEABLE
INSTALLERS

QUALITY INSTALLATIONS

INFORMED PUBLIC

MEDIA ORGANIZATIONS

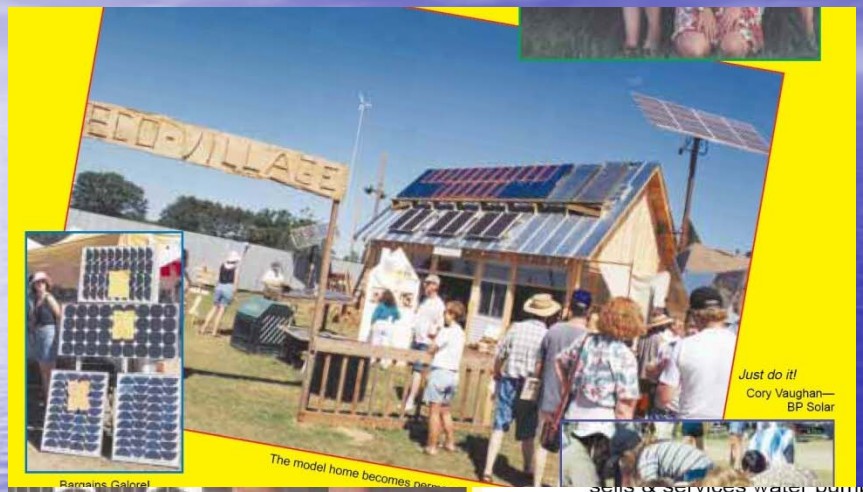
Publications and Schools

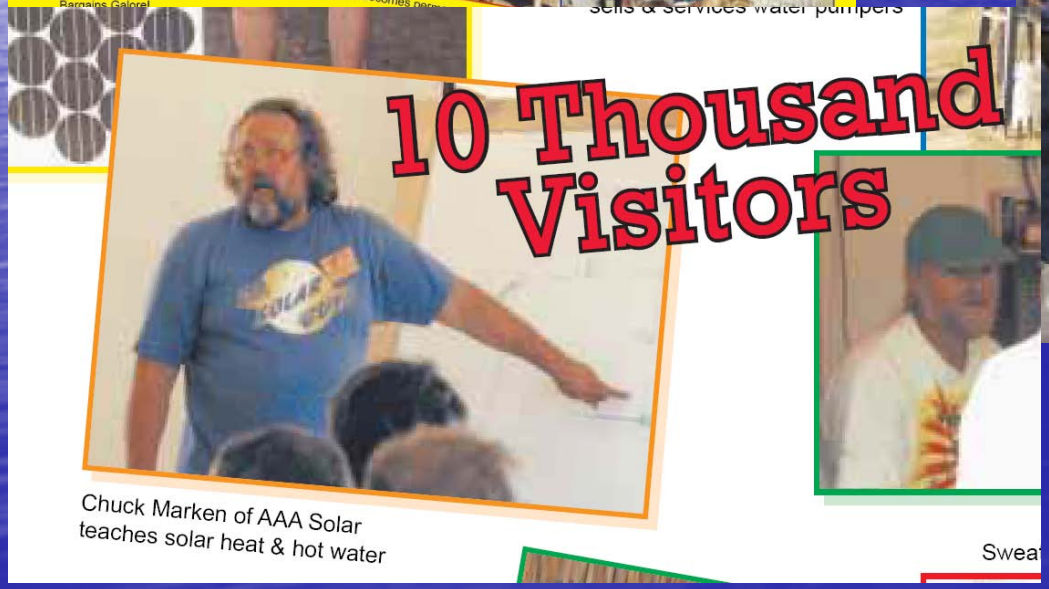


American Solar Energy Society

ases.org

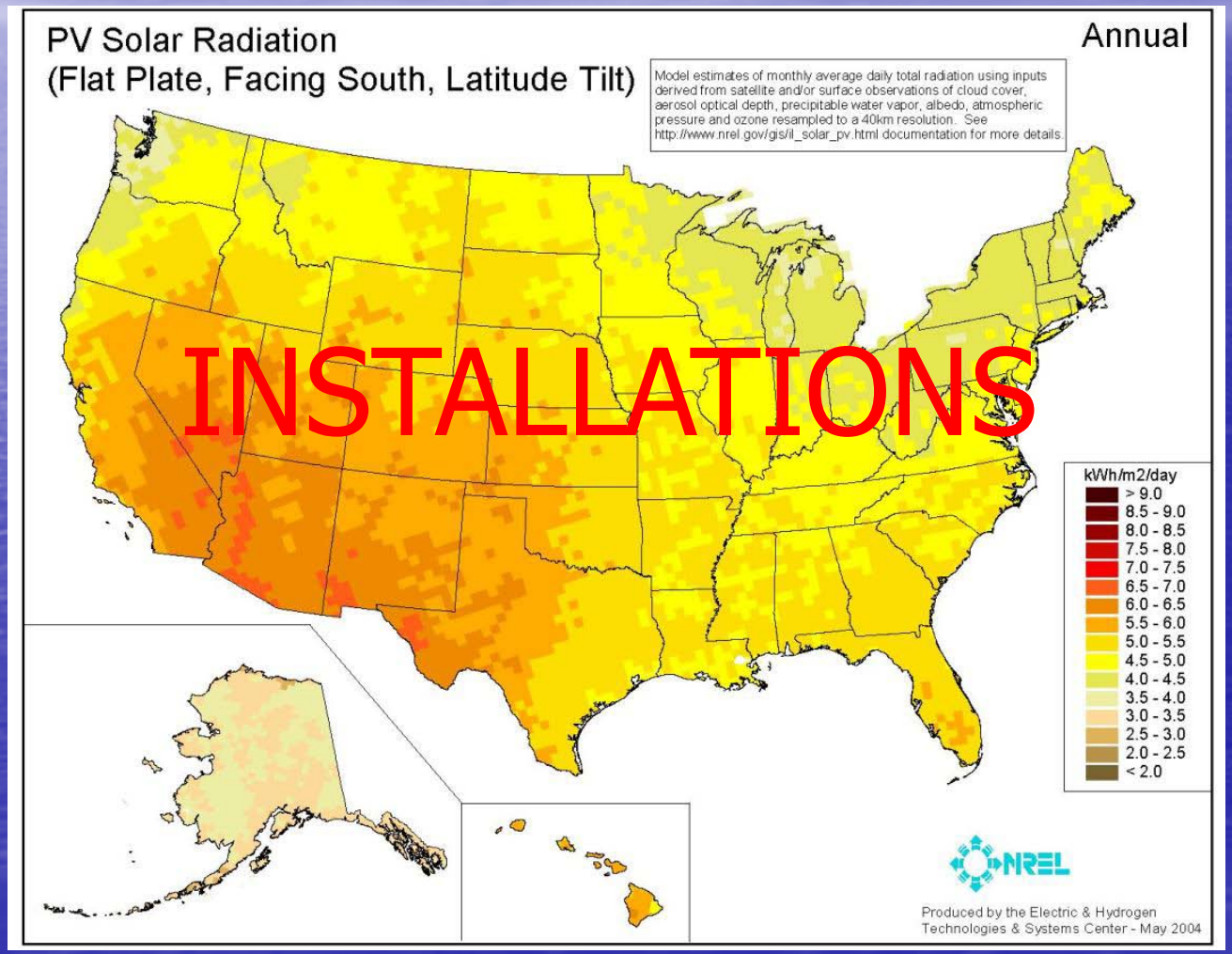
Shows, fairs and conferences



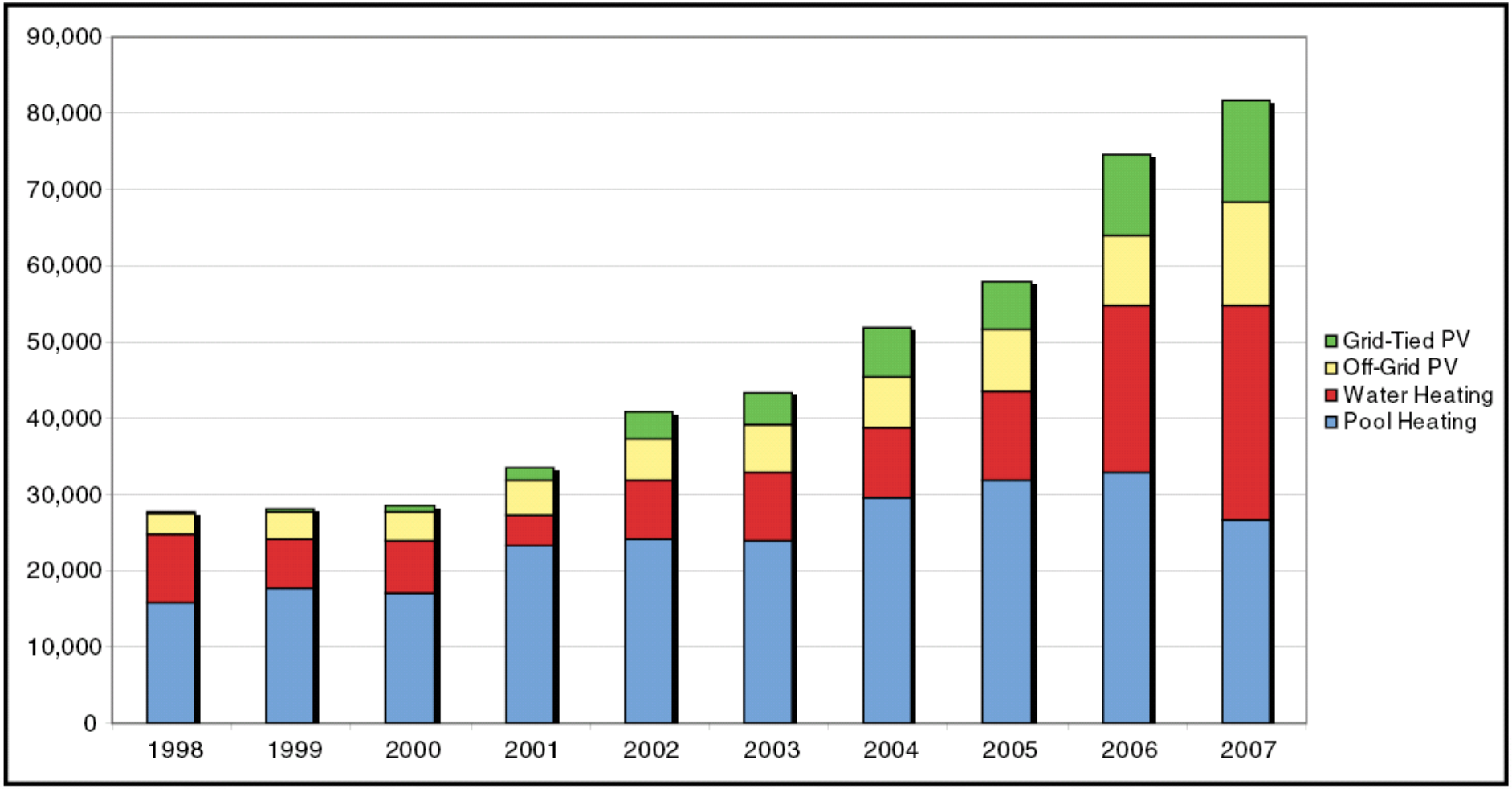


Workshops and Classes

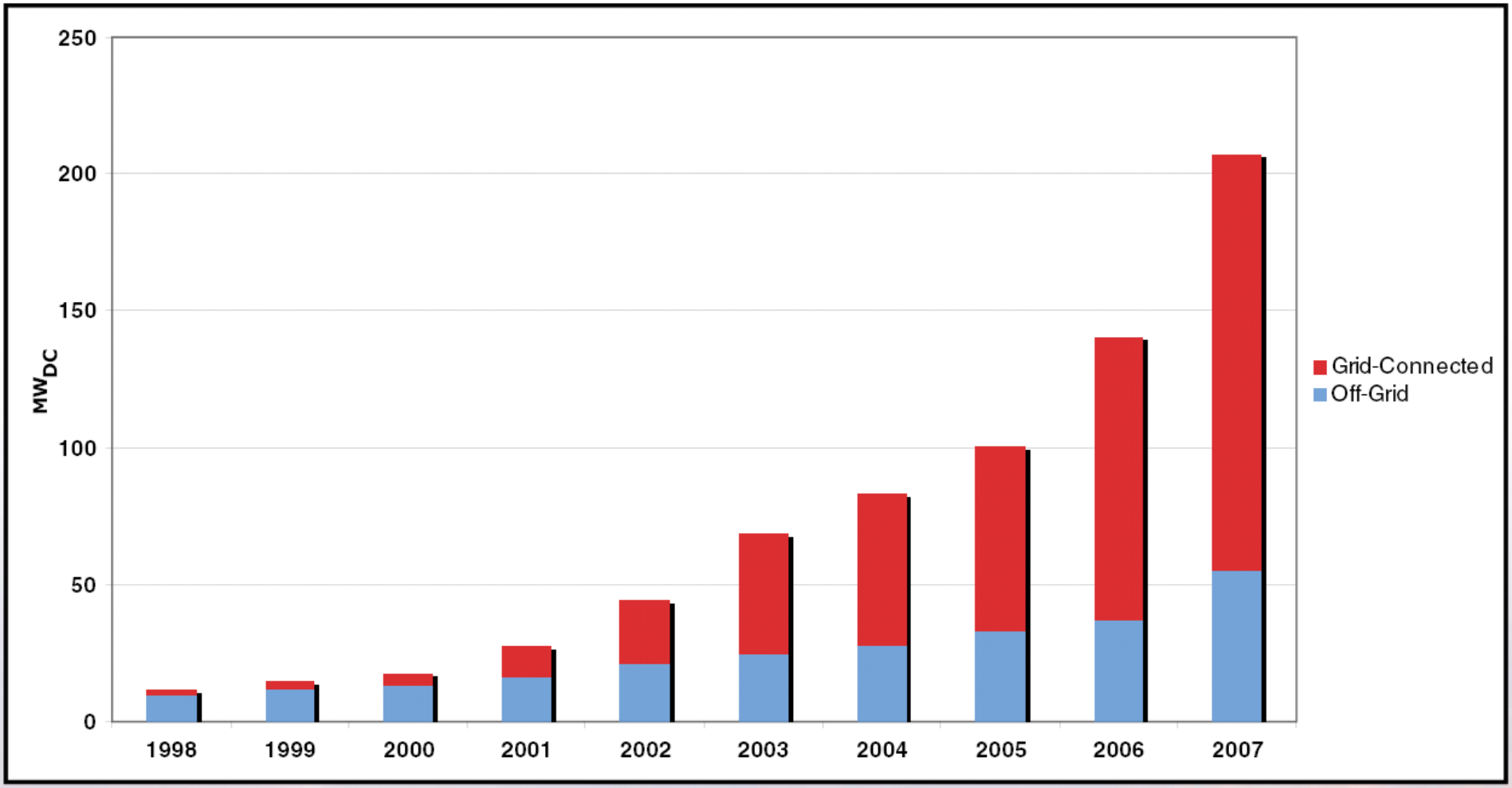
INCENTIVES


PV Solar Radiation
(Flat Plate, Facing South, Latitude Tilt)
Annual
Model estimates of monthly average daily total radiation using inputs derived from satellite and/or surface observations of cloud cover, aerosol optical depth, precipitable water vapor, albedo, atmospheric pressure and ozone resampled to a 40km resolution. See http://www.nrel.gov/gis/il_solar_pv.html documentation for more details.
INSTALLATIONS
kWh/m2/day
> 9.0
8.5 - 9.0
8.0 - 8.5
7.5 - 8.0
7.0 - 7.5
6.5 - 7.0
6.0 - 6.5
5.5 - 6.0
5.0 - 5.5
4.5 - 5.0
4.0 - 4.5
3.5 - 4.0
3.0 - 3.5
2.5 - 3.0
2.0 - 2.5
< 2.0
NREL
Produced by the Electric & Hydrogen Technologies & Systems Center - May 2004

Solar Energy Systems installed by year

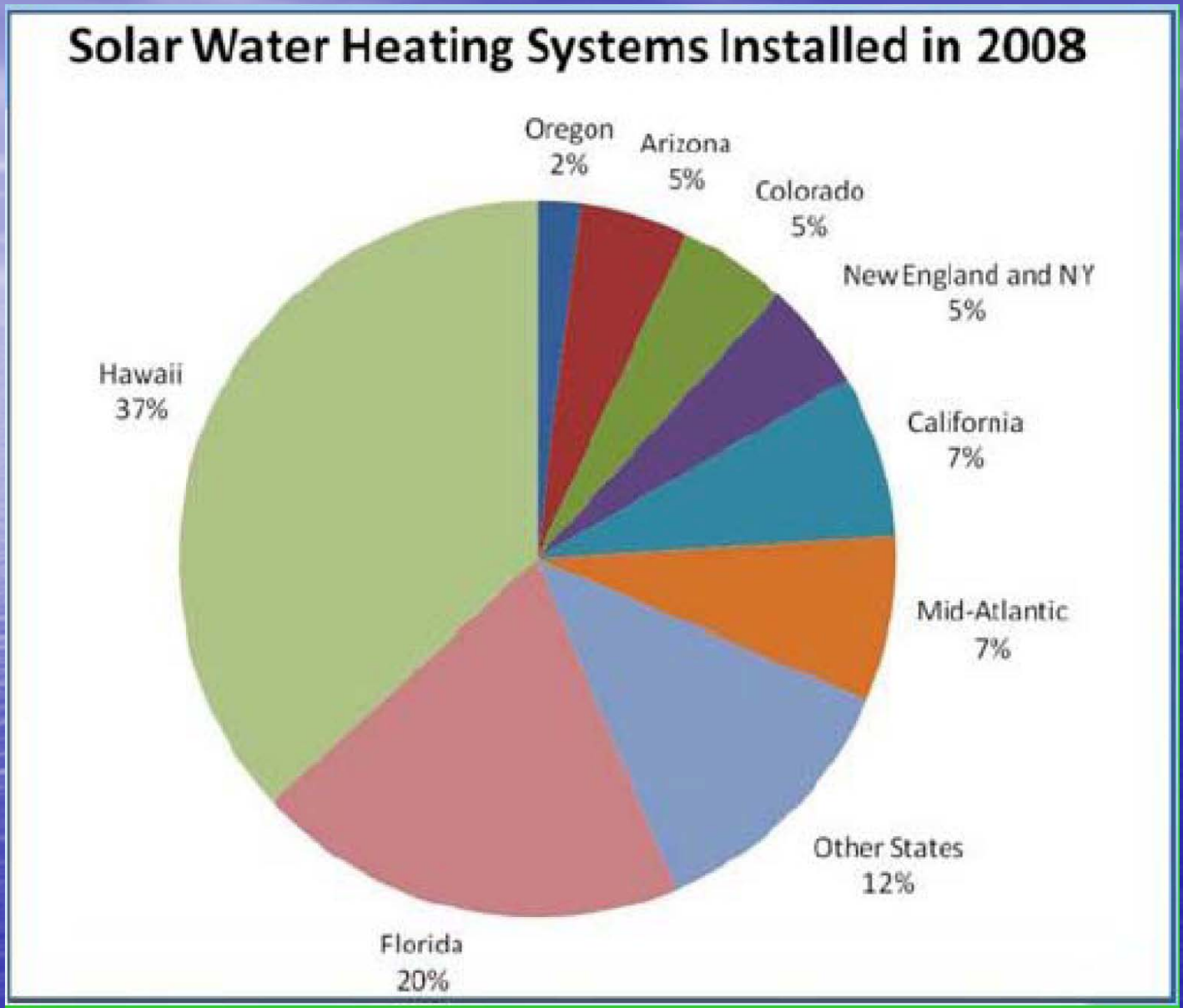


Grid and Off Grid PV Installations by year



Grid Connected PV Systems installed - 2007

State	2006 (MW_{DC})	2007 (MW_{DC})	06 - 07 % change	2007 Market Share	2006 Rank
1. California	69.5	88.8	28%	58%	1
2. New Jersey	17.9	16.4	-8%	11%	2
3. Nevada	3.2	14.7	365%	10%	3
4. Colorado	1.0	12.5	1178%	8%	7
5. New York	3.0	4.3	45%	3%	4
6. Arizona	2.1	2.8	30%	2%	5
7. Hawaii	0.7	2.4	236%	2%	9
8. Connecticut	0.7	1.8	174%	1%	10
9. Massachusetts	1.5	1.4	-5%	<1%	6
10. Oregon	0.5	1.1	112%	<1%	11
All Other States	3.2	5.6	75%	4%	
Total	**103.2**	**151.9**	**45%**		



Source: SEIA: US Solar Industry in Review – 2008
Les Nelson (Western Renewables Group)

Solar Policy

Solar Policy in the US

Solar Energy
Industries
Association
seia.org

INSTALLATIONS

WORD OF MOUTH IS THE BEST WAY FOR MORE

Installation Truck 34 Firehouse

Installation Truck 34 Firehouse

IMPEDIMENTS

INCLEMENT WEATHER
COVENTENTS
REGULATIONS
OLD WAYS OF THINKING
CHEAP FOSSIL FUELS

IRRADIANCE – CAN’T CHANGE IT

INNOVATION – TECHNOLOGY EXISTS

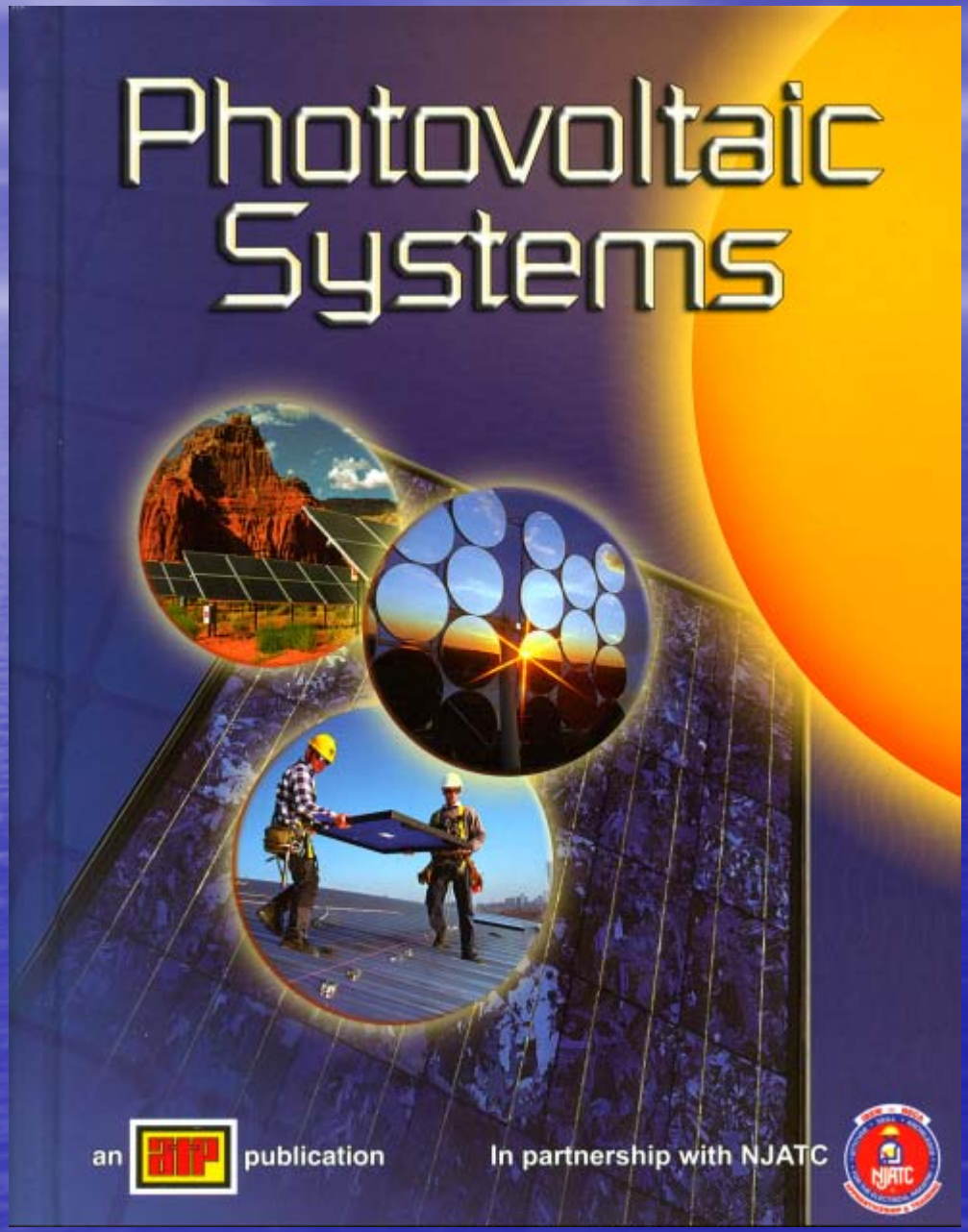
INFRASTRUCTURE – NEEDS WORK

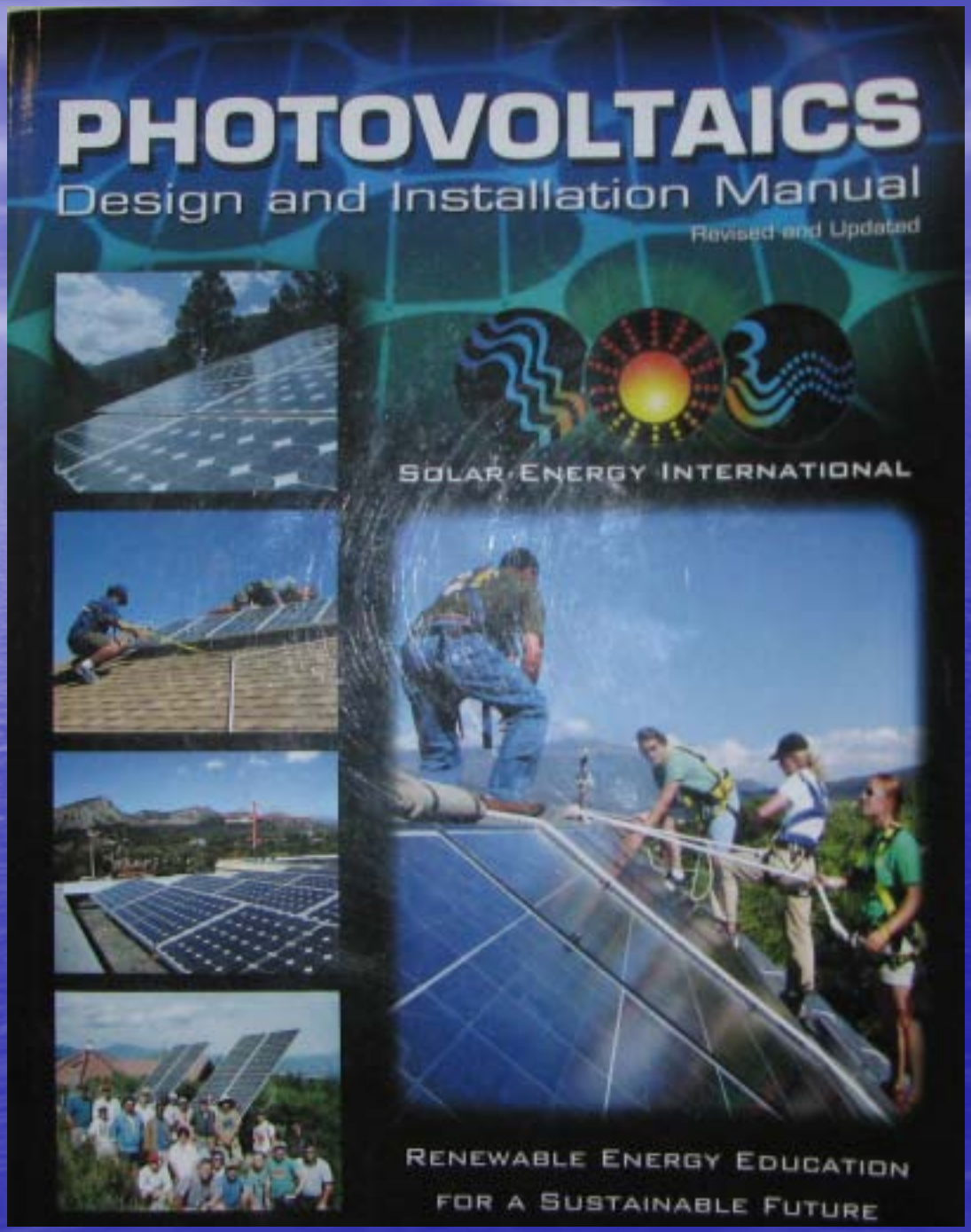
INFORMED PUBLIC – NEEDS WORK

INCENTIVES – GOOD SOME LOCATIONS

INSTALLATIONS – NOT ENOUGH

Additional Resources


Photovoltaic Systems
an publication
In partnership with NJATC
NJATC


PHOTOVOLTAICS
Design and Installation Manual
Revised and Updated
SOLAR ENERGY INTERNATIONAL
RENEWABLE ENERGY EDUCATION
FOR A SUSTAINABLE FUTURE

home power
The Hands-On Journal o ade Power
Go with the
flow
Harness Hydro Power
Buyer's Guide to
High-Efficiency
WINDOWS
Hybrids
vs.
Diesels
Buy the Right Ride
DIY
Solar
HEAT
Project
Invest Smart
Solar-Electric System Payback
Running on Sunshine
Plug-in Solar Car
Feb / Mar 2007, Issue 117
homepower.com

October/November 2008

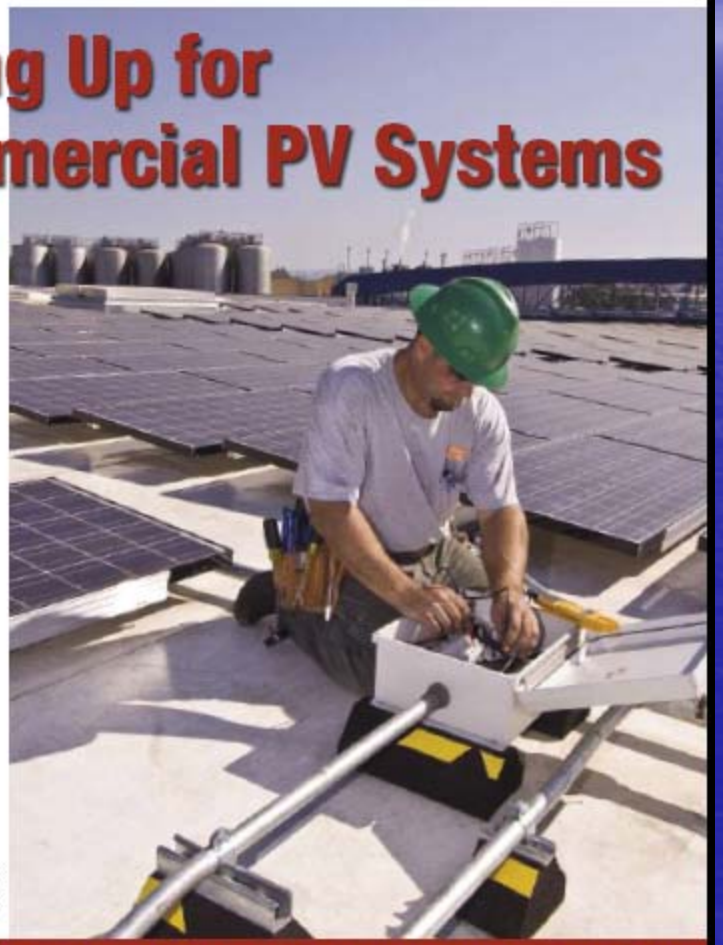
Our 2009 Grid-Direct String Inverter Guide

SOLARPRO

Optimal Design, Installation & Performance

solarprofessional.com

Scaling Up for Commercial PV Systems



Large Thermal Arrays
Design & Engineering Considerations

Pitched Roof Racking
Fasten, Flash & Seal for the Long Haul

Equipment Grounding
What's New in the 2008 *NEC*®?

Interview: AEE Solar's David Katz
Thirty Years in the Wholesale Supply Chain

Chico Electric
Sierra Nevada Brewing Co.
Chico, CA

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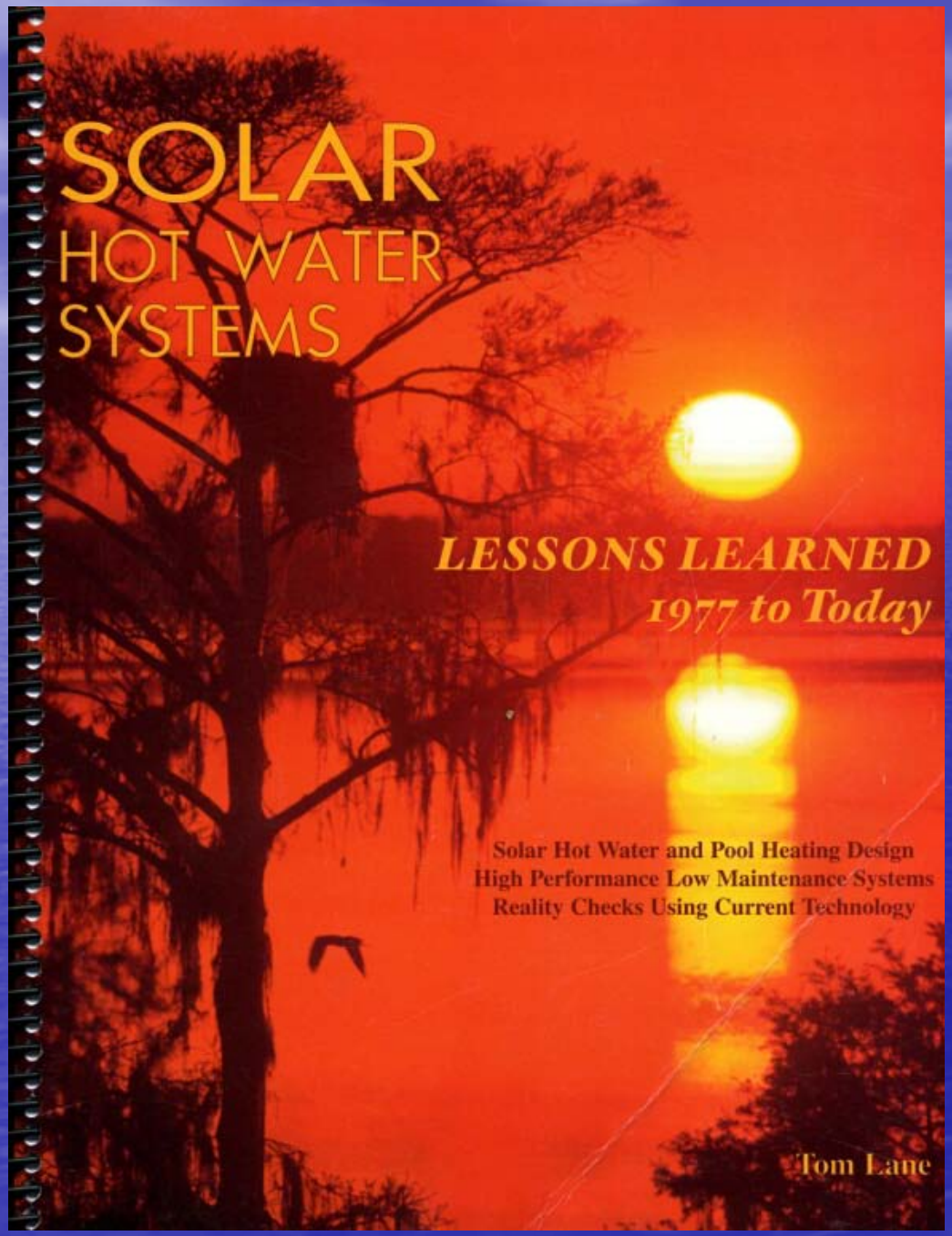
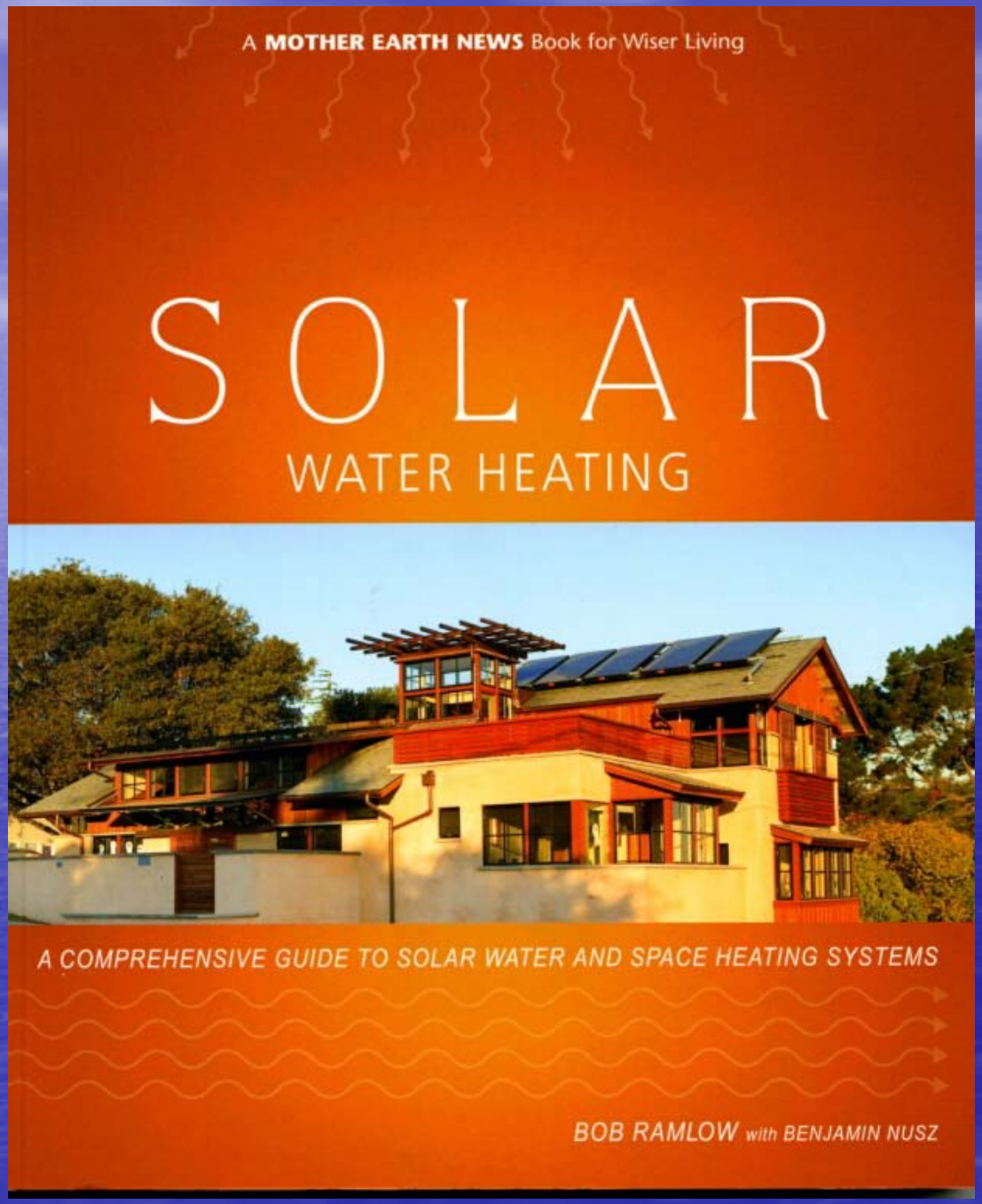

SOLAR
HOT WATER
SYSTEMS
LESSONS LEARNED
1977 to Today
Solar Hot Water and Pool Heating Design
High Performance Low Maintenance Systems
Reality Checks Using Current Technology
Tom Lane


A MOTHER EARTH NEWS Book for Wiser Living
SOLAR
WATER HEATING
A COMPREHENSIVE GUIDE TO SOLAR WATER AND SPACE HEATING SYSTEMS
BOB RAMLOW with BENJAMIN NUSZ

Source: NASA

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the U.S. Department of Energy