

Solar Photovoltaic Financing: Deployment on Public Property by State and Local Governments

**Karlynn S. Cory, Jason Coughlin and
Charles Coggeshall**

**Strategic Energy Analysis and Applications Center
National Renewable Energy Laboratory**

Technical Assistance Project for State and Local Officials (TAP)

August 13, 2008

Overview

- The opportunity for state/local public-sector photovoltaics (PV)
- Electricity and renewable energy certificate (REC) revenues
- State and local incentives
- Federal incentives
- Third-Party Ownership
- Insurance

**Focus: deployment
for use by
state/local government**



Source: SunPower -
Alameda County

Why PV in the public sector?

- Reduce current utility electricity bills
- Add predictability to future electricity expenses
- Reduce greenhouse gas emissions
- Meet renewable energy mandates/targets
- As a model for others to deploy solar
- Local workforce development
- Emergency power benefits on critical infrastructure




Source: SunPower –
Thousand Oaks, CA
water treatment plant

State/Local Government: the Solar PV Opportunity

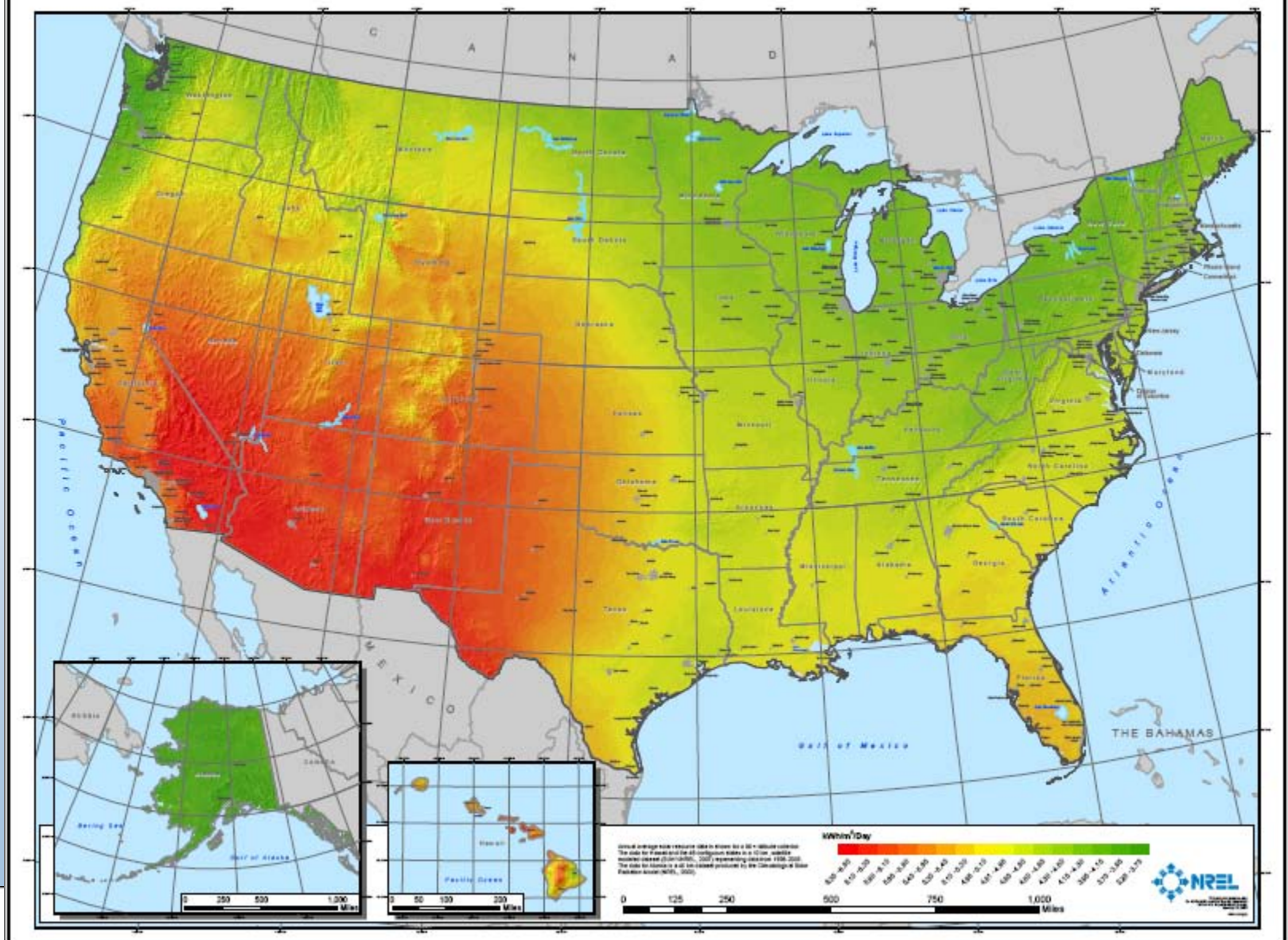
- U.S. state and local government-owned buildings in 2003: **574,000**
 - 12% of all nonresidential buildings
- Electricity consumed in 2003: **178 billion kWh**
- The opportunity
 - If 1% of their total demand was met with on-site solar PV, **1,450 MW** of capacity would be needed.
 - This is approx. **10 times** the annual U.S. grid-tied PV capacity installed in 2007 of 150 MW-dc.

State and local government deployment sites

- 
- Government building roof tops
 - Water treatment plants
 - Airports
 - Ports
 - Conference centers
 - Parking
 - Shading for top level of a garage
 - Shading for flat lots
 - Bus stops
 - Schools/Universities
 - Electricity savings
 - PV as a teaching tool

Solar Resources

United States Photovoltaic Solar Resource : Flat Plate Tilted at Latitude

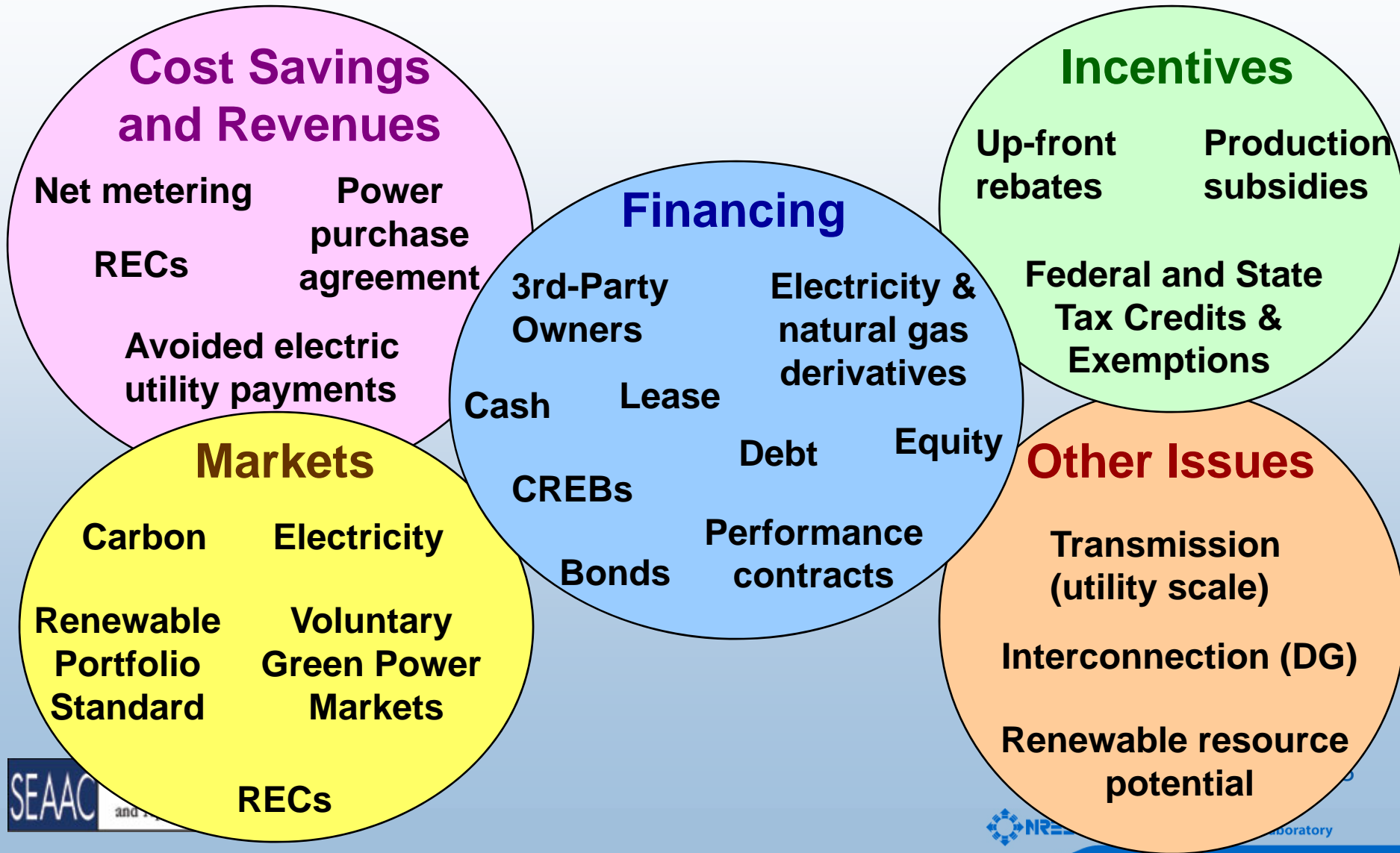


Leading states for solar (MW per year)

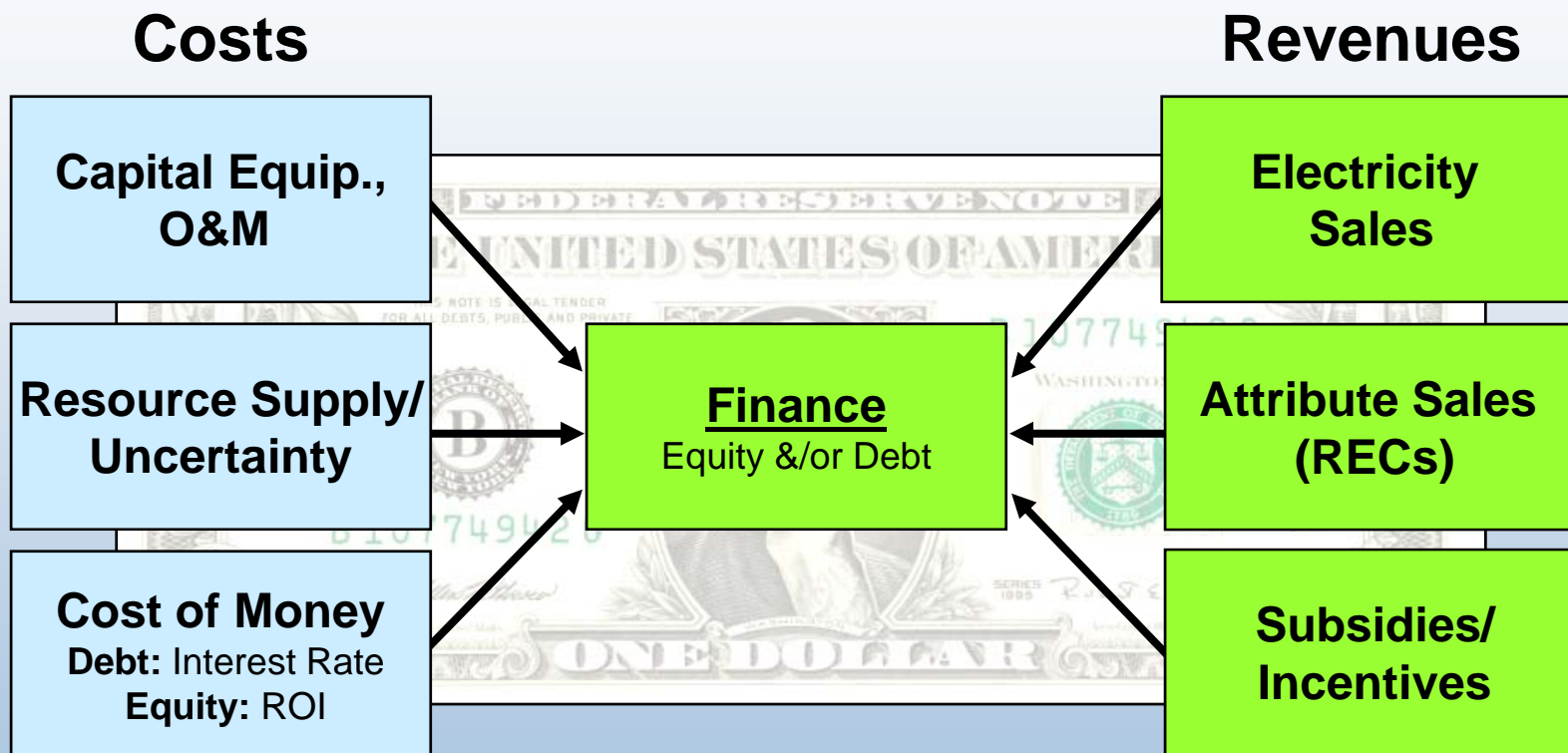
<u>State</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>06-07</u>
California	52	71	87	23%
New Jersey	5.5	18	17	-6%
Nevada	0.5	2.6	15	477%
Colorado	0.2	0.9	12	1233%
New York	1.4	2.7	4.4	63%
Hawaii	n/a	n/a	2.4	n/a
Arizona	1.5	2.1	2.1	0%
Connecticut	0.2	0.5	1.8	260%
Massachusetts	0.6	1.5	1.4	-7%
Oregon	0.4	0.5	1.1	120%
Others	0.7	1.5	4.4	193%
Total	64	102	150	47%

Sources: Prometheus Institute, July 2007 as presented by Mark Sinclair of the Clean Energy States Alliance at the NARUC workshop on Nov. 14, 2007. http://www.narucmeetings.org/Presentations/Sinclair_2.pdf
 Solar Energy Industry Association & Prometheus Institute
http://www.seia.org/Year_in_Review_2007_Ir.pdf

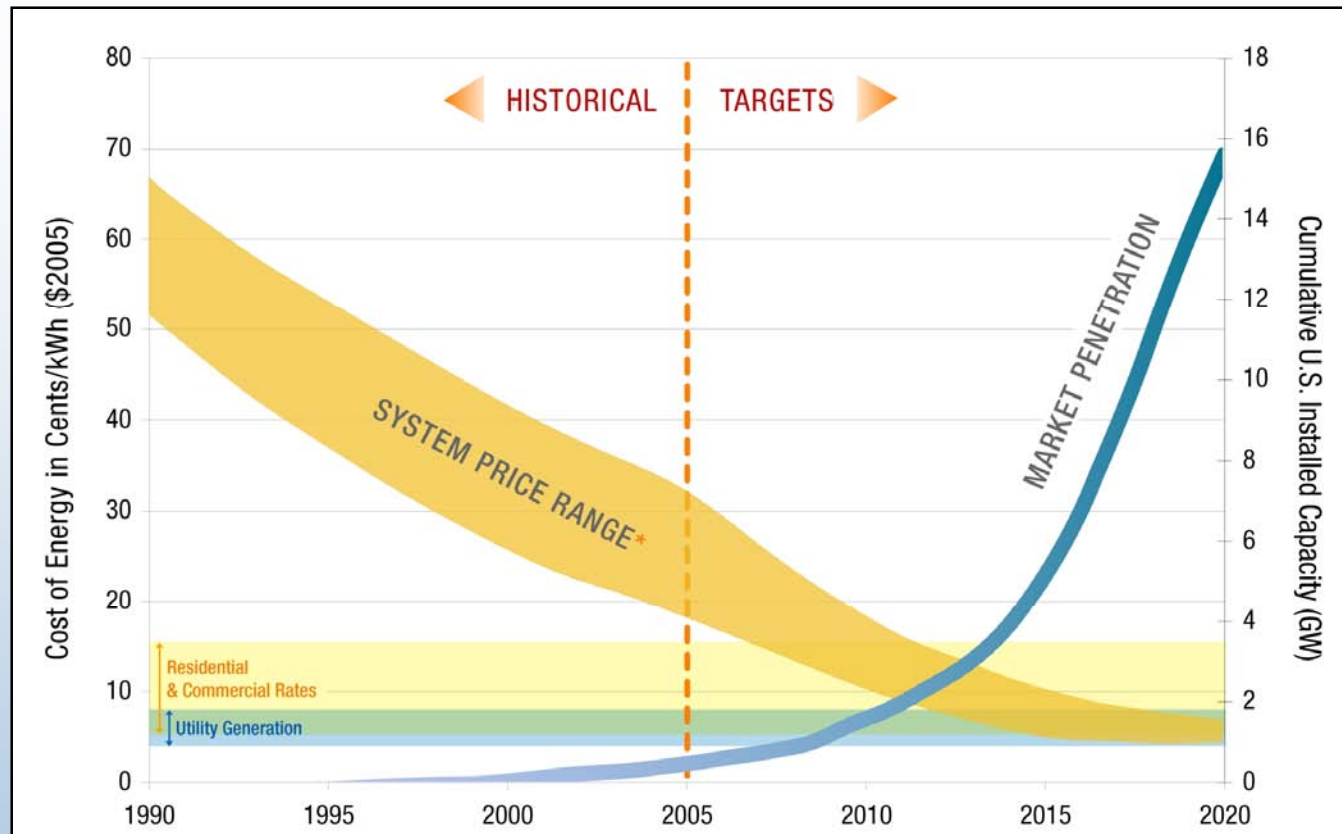
EE and RE Financing is Complex



Balancing Costs and Revenues



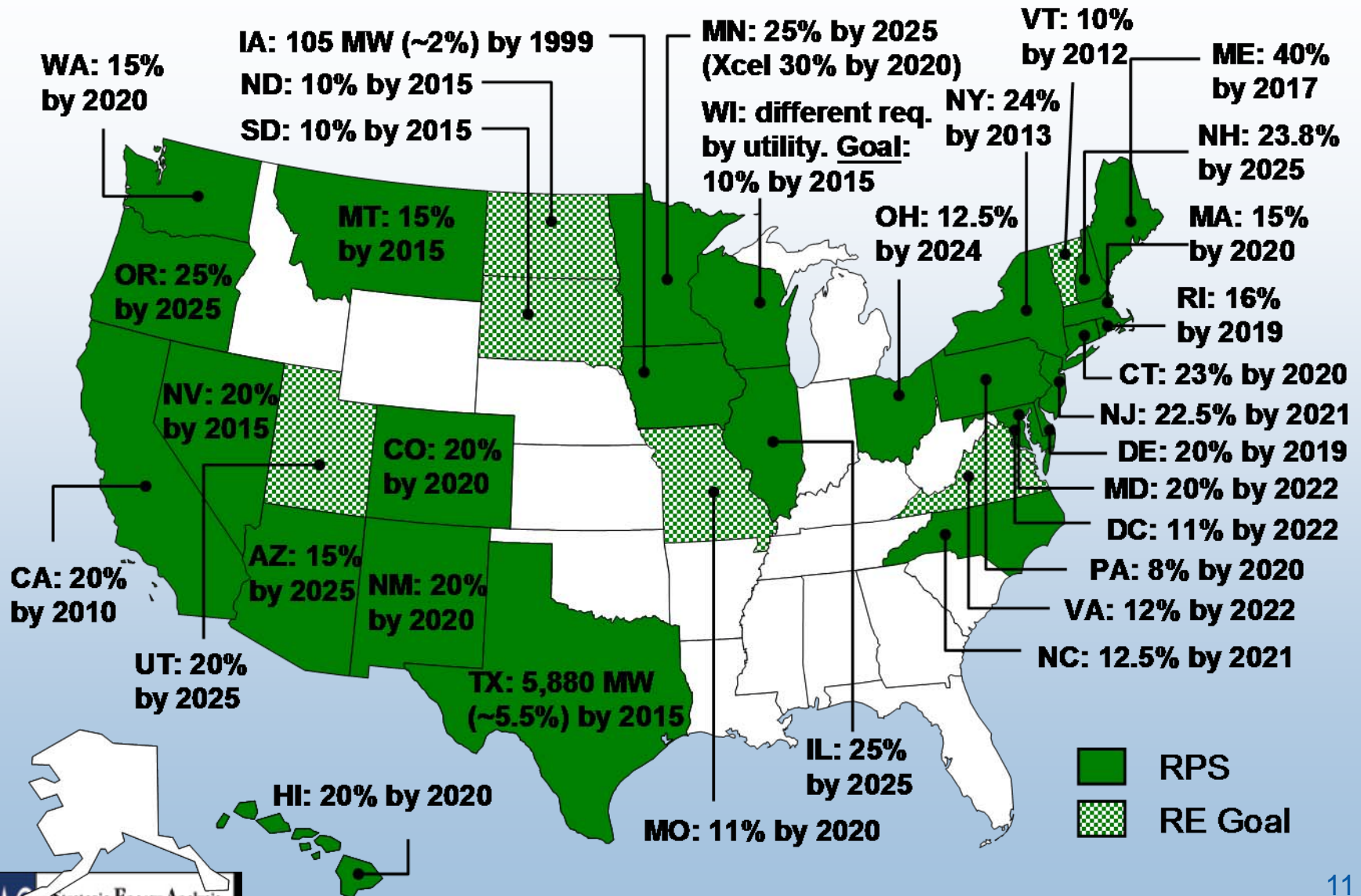
U.S. Grid Parity: 2010 – 2015 expected



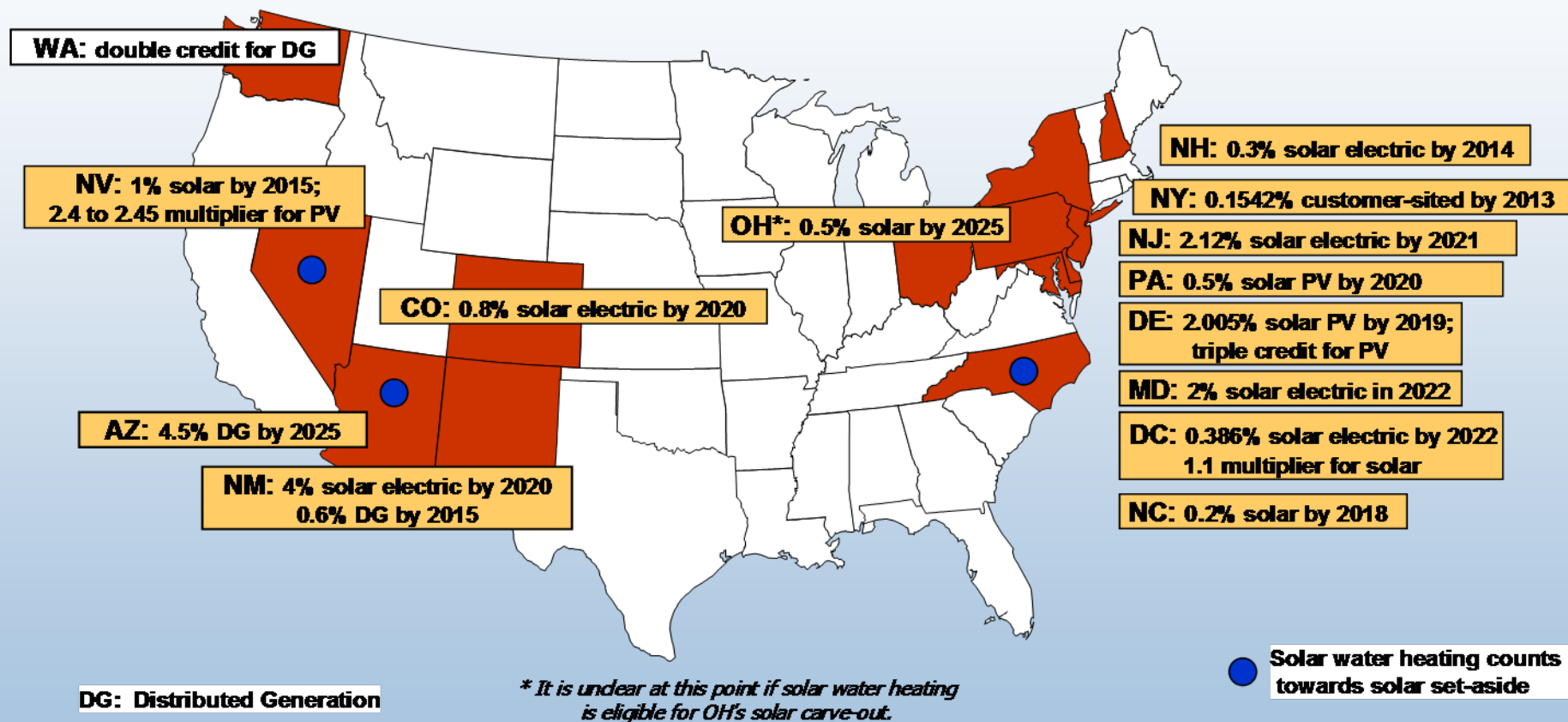
Sources:
Robert Margolis
(NREL) and
DOE Solar
America
Initiative

Market Sector	Current U.S. Market Price Range (¢/kWh)	Cost (¢/kWh) Benchmark 2005	Cost (¢/kWh) Target 2010	Cost (¢/kWh) Target 2015
Residential	5.8-16.7	23-32	13-18	8-10
Commercial	5.4-15.0	16-22	9-12	6-8
Utility	4.0-7.6	13-22	10-15	5-7

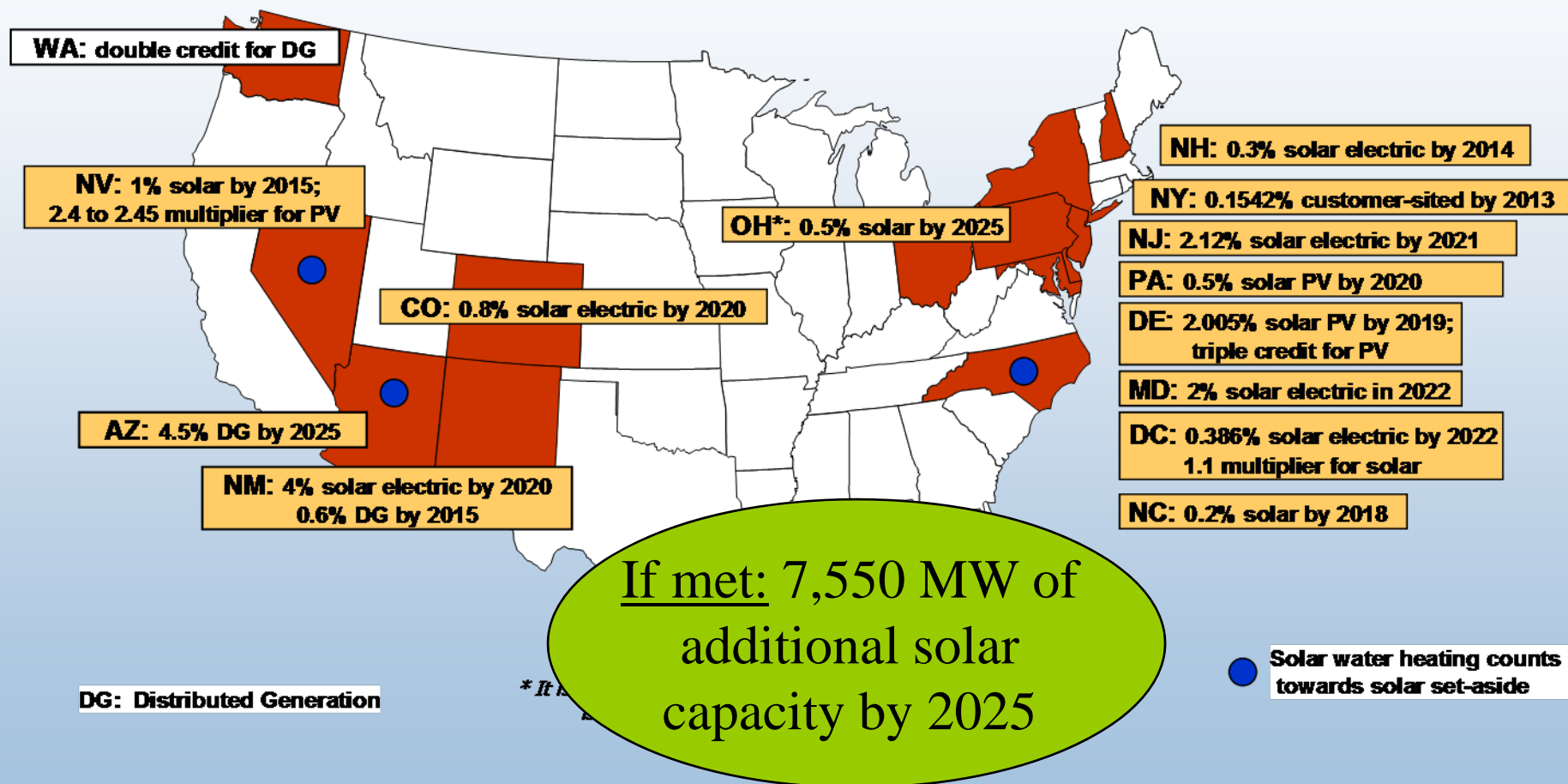
State Renewable Portfolio Standards (RPS)



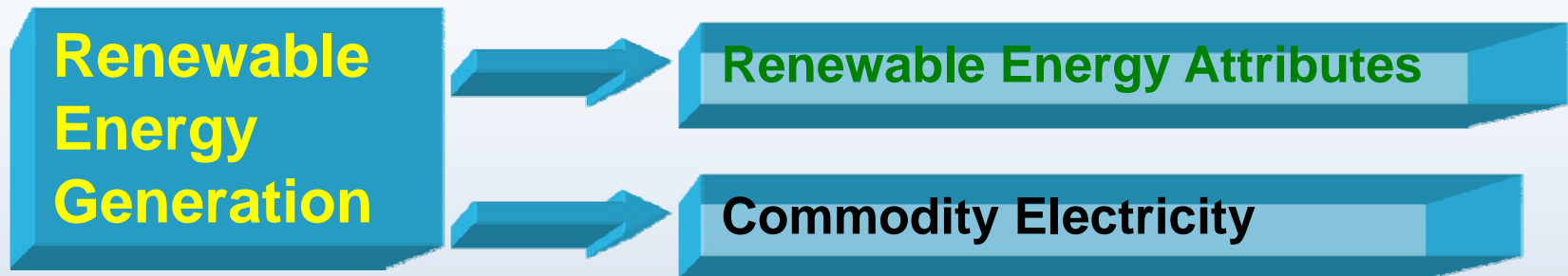
Solar/DG Provisions in State RPS Policies



Solar/DG Provisions in State RPS Policies



Renewable Energy Certificates (RECs)



- Commonly used for mandatory and voluntary markets
 - Not allowed for RPS compliance in AZ, CA, HI and IA
- A REC represents the non-electrical attributes of 1 MWh of renewable energy generation
- Has value separate from commodity electricity
- RECs can be critical to getting projects financed

REC Market Value Factors

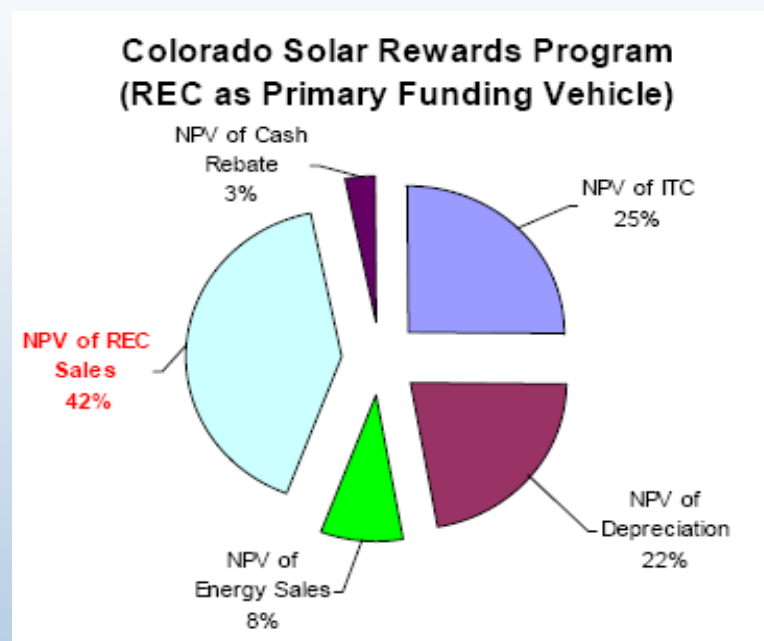
- Compliance vs. voluntary market
- Regional Issues
 - Quality of resource
 - Incremental cost of development above energy market
 - REC supply-demand balance
- Long-term policy stability/uncertainty
- Other market rules/conditions (e.g. technology, price cap)

	RECs	Solar RECs
Voluntary	\$1-7*/MWh	\$18-21/MWh
RPS	\$3-22/MWh	\$205-265/MWh**
RPS (shortage)	\$48-56/MWh	???

**2009 NJ SREC cap:
\$711/MWh**

Solar REC Revenues Can Be Critical

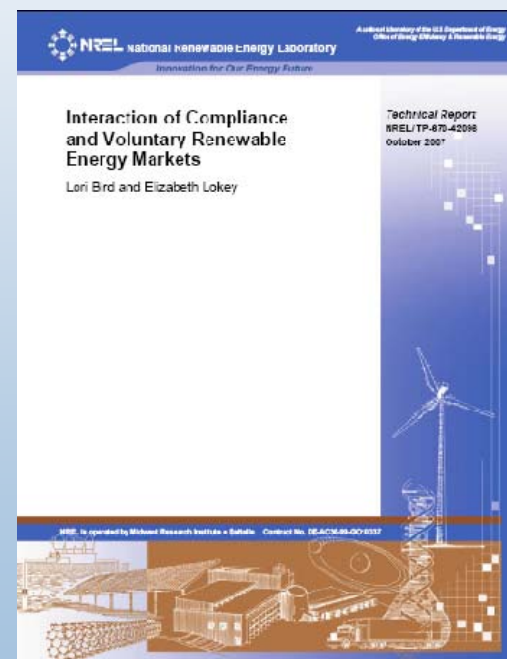
- Solar REC revenues higher in states with RPS solar set-aside
 - CO ~40% of total cash flow
 - NJ ~50% of installation costs
 - RECs can be 40-80% of total project revenue stream
- REC revenues expected to be increasingly important as state incentives ramp down (e.g. CA, NJ)



Source: “Selling Solar with RECS,” Presentation by 3 Phases Energy Services, January 31, 2007, California Solar Forum

To Sell RECs or Not?

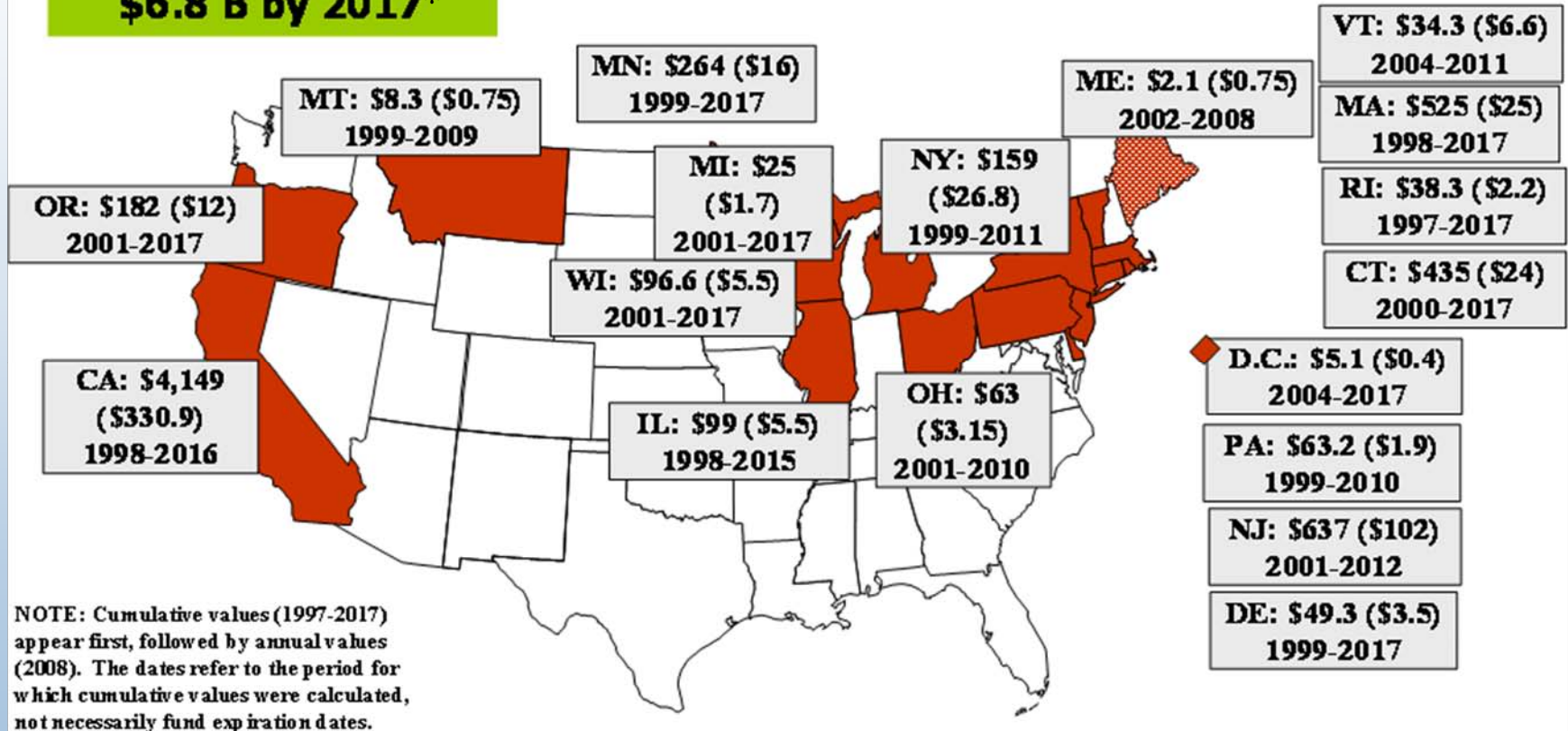
- Selling RECs generated by an on-site facility can help re-coup the project costs
- However, once you sell a REC you sell the right to claim using green power
 - Can still claim the system is hosted on-site
 - Can also purchase (cheaper) replacement RECs
- Most states do not allow double counting
 - NREL recently completed a report that examined interactions between voluntary and compliance markets:
<http://www.nrel.gov/docs/fy08osti/42096.pdf>



State – Public Benefit Funds for RE

Cumulative 1997-2017 and Annual (2008) in Million \$

**16 State Funds + DC
\$6.8 B by 2017***



* Not counting Maine

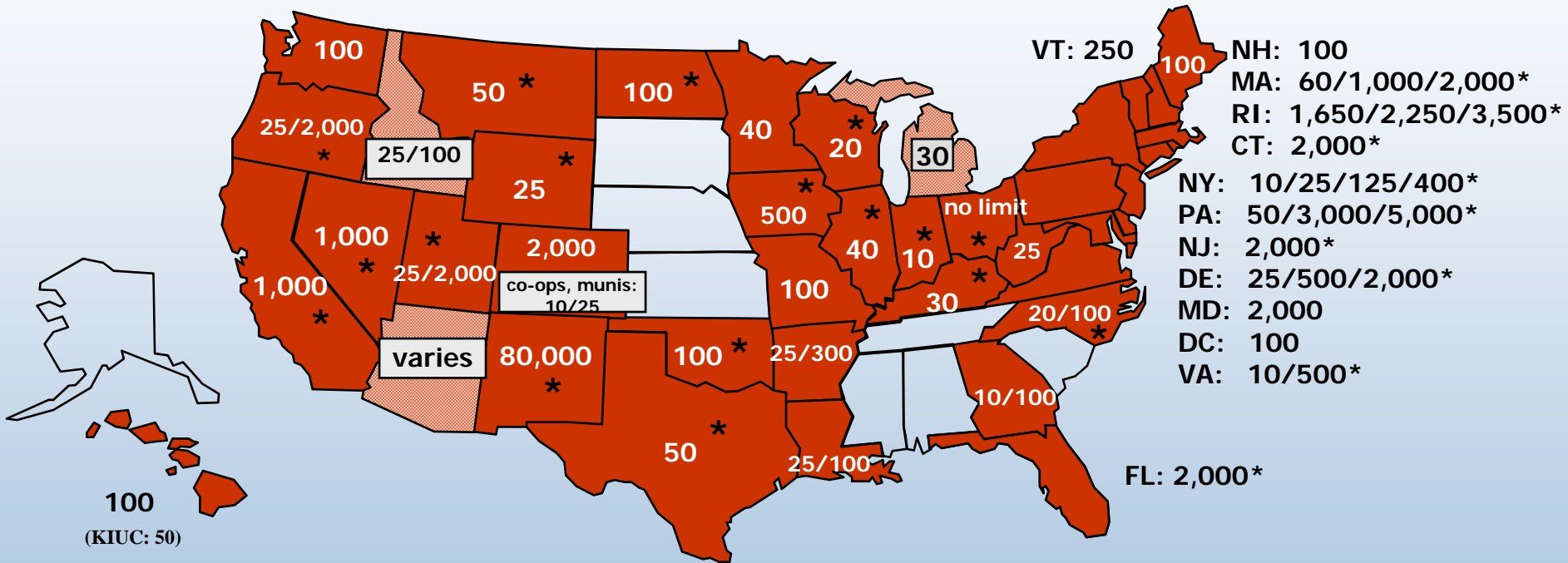
Funded by Voluntary Contributions






State – A Sample of Significant Solar PV Incentives

State	Utility	Incentive	Maximum
CA	California Solar Initiative	\$2.30/W PGE (step 5) \$2.30/W SCE (step 5) \$2.65/W CCSE (step 4)	\$3.2 billion total; incentive ramps down as cumulative state MW targets are met (currently ahead of schedule)
CO	Xcel	\$4.50/W (small) \$2/W + \$115/MWh (med) <u>REC auctions</u> : \$205-265/MWh (est.) +\$200k	0.5 kW – 10 kW PV systems (small) 10 kW – 100 kW PV systems (med.) 100kW – 2 MW/project on customer site; 20 year contract; Round 3 closed: 04/08
CT	a/CL&P, UI b/ RE fund	a/ \$5/W _{DC} b/ 1 kW public PV system	a/ <10 kW, \$50k each (\$11.5 MM total) b/ 20% RE electricity, plus residential & business sign-ups
NJ	PSE&G	\$475/MWh set as REC price floor	15-yr loan repaid with SRECs. Max capacity of 9MW for munis / non-profits
NY	NYSERDA	\$5/W for 1 st 25kW \$4/W for balance	50 kW/site, 100 kW/ municipal government
OH	Energy Fund	Starting at \$3.50/W, decreasing to \$1.50/W	Rebate depends on system size and is capped at 75 kW for nonresidential

State Net Metering

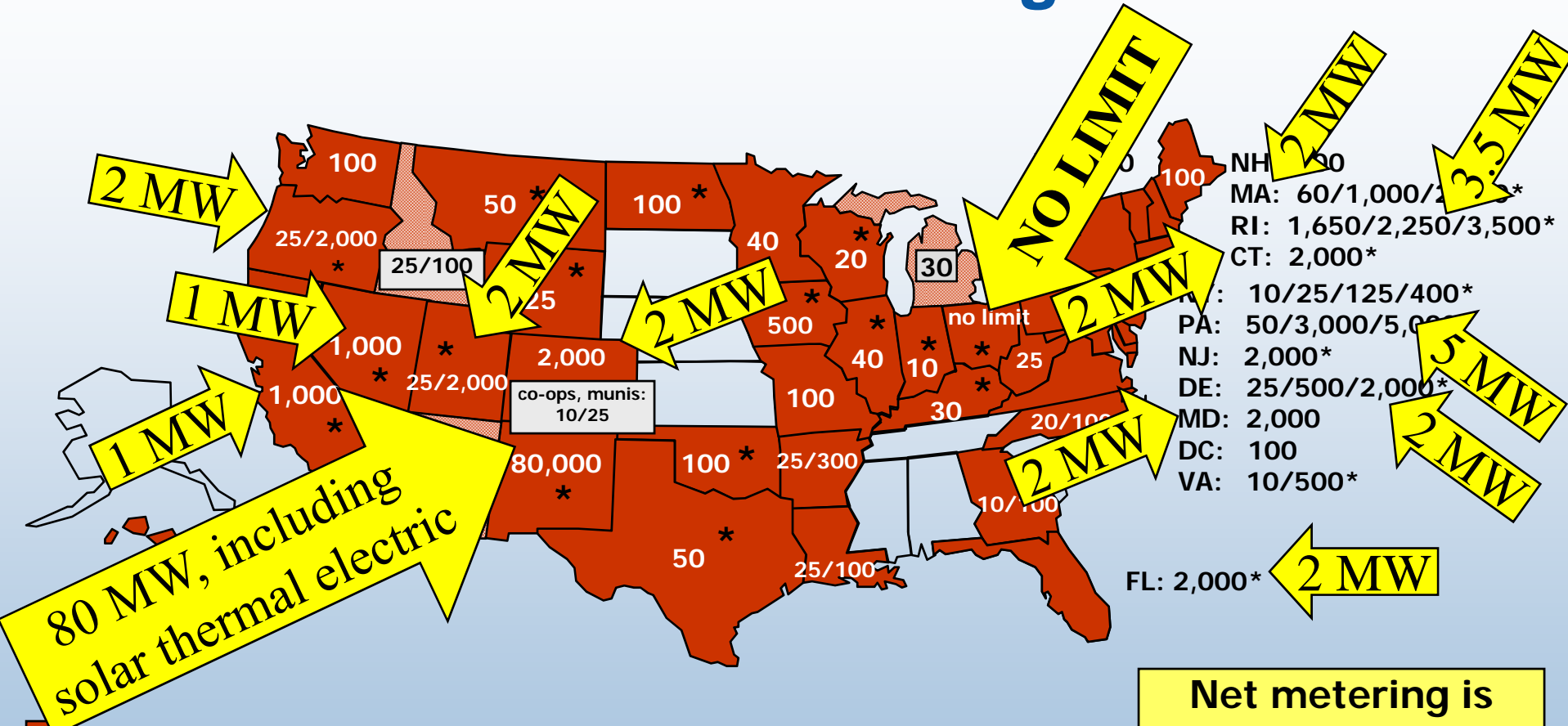


**Net metering is
available in
42 states + D.C.**




-  State-wide net metering for all utility types
-  State-wide net metering for certain utility types only (e.g., investor-owned utilities)
-  Net metering offered voluntarily by one or more individual utilities

(Note: Numbers indicate individual system size limit in kilowatts. Some states' limits vary by customer type and/or technology.)

State Net Metering



**Net metering is
available in
42 states + D.C.**

-  State-wide net metering for all utility types
-  State-wide net metering for certain utility types only (e.g., investor-owned utilities)
-  Net metering offered voluntarily by one or more individual utilities

(Note: Numbers indicate individual system size limit in kilowatts. Some states' limits vary by customer type and/or technology.)

State Tax Incentives

- State incentives
 - Investment tax credits
 - Production tax credits
 - Income tax credits
 - Property and sales tax exemptions
- Example: OR Business Energy Tax Credit
 - State income tax credit up to 50% of installed cost
 - Tax credits can be sold by public entities

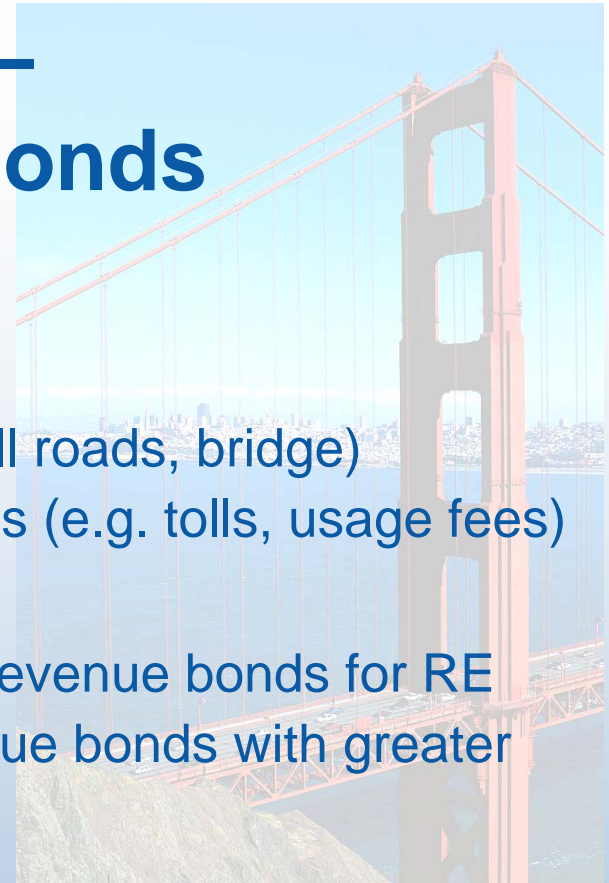


State & Local – General Obligation Bonds

- General Obligation Bond Mechanism
 - Repayment secured by issuer's taxing authority
 - Require voter approval
 - Total debt obligations are limited
- Example: Honolulu
 - Issued \$7.85MM solar general obligation bonds in FY05
 - For: Solar parking lot lights, energy retrofits, and LED streetlamp
- Example: New Mexico Finance Authority (NMFA)
 - Approval to issue \$20MM general obligation bonds (none yet)
 - For: Loans to state agencies, universities, and public schools to implement EE and RE
 - 90% of the energy savings expected to fund debt service



State & Local – Energy Revenue Bonds



- Energy Revenue Bond Mechanism
 - Issued by “special authority”
 - Designated for a specific purpose (e.g. toll roads, bridge)
 - Repayment supported by project revenues (e.g. tolls, usage fees)
- Example: San Francisco
 - Proposition B passed for \$100 million of revenue bonds for RE
 - Proposition H passed for additional revenue bonds with greater flexibility as to the issuer and the amount.
 - Not yet issued
- Example: Delaware’s Sustainable Energy Utility
 - Special purpose, tax-exempt bonds up to \$30 million
 - For energy efficiency, weatherization, and distributed RE
 - Energy savings are expected to generate funds for repayment

Federal Incentives – CREBs, or Clean Renewable Energy Bonds

- CREBs
 - Apply to the IRS for an allocation
 - Federal tax credit to bond owner in lieu of interest payment from bond issuer
 - May be more attractive than tax-exempt municipal bonds
 - Issuer only pays back bond principal (for most part)
- Total allocation of \$1.2 B
 - Up to 62.5% for public sector projects (rest: coops)
 - Round 1: 401 of 610 public sector PV projects
 - Round 2: \$262MM for public-sector PV projects
 - Additional rounds possible



CREBs Challenges



- Not truly equivalent to interest-free bond
 - Assumes bond issuer is equiv. to AA corporate
 - Public entities with weaker credit must either
 - Make supplemental interest payments, or
 - Sell the bond at a discount
- Transaction costs are high
 - Allocations made from smallest to largest projects
 - Solution: MA bundled 12 projects (1MW)
- First principal payment due in December of the year the CREB is issued

Federal Incentives – Renewable Energy Production Incentive (REPI)

- Authorized under EPLAct 1992
 - Amended under EPLAct 2005
- Program funding is uncertain
 - Subject to annual congressional appropriations
 - To date, have been unable to meet the total requests each year.
- Uncertainty means that REPIs are not bankable in project financing



Federal Tax Incentives

- Investment Tax Credit (ITC)
 - Upfront tax credit for solar, fuel cells, geothermal and microturbines
 - 30% credit for solar through 12/31/08
 - Residential: up to \$2,000
 - Commercial: no cap
 - Reverts to 10% for solar if not reauthorized
- Modified Accelerated Cost Recovery System (MACRS)
 - Accelerated depreciation of assets over 5 years
 - In addition to ITC for solar
 - 2008 Bonus depreciation (50% in year 1)

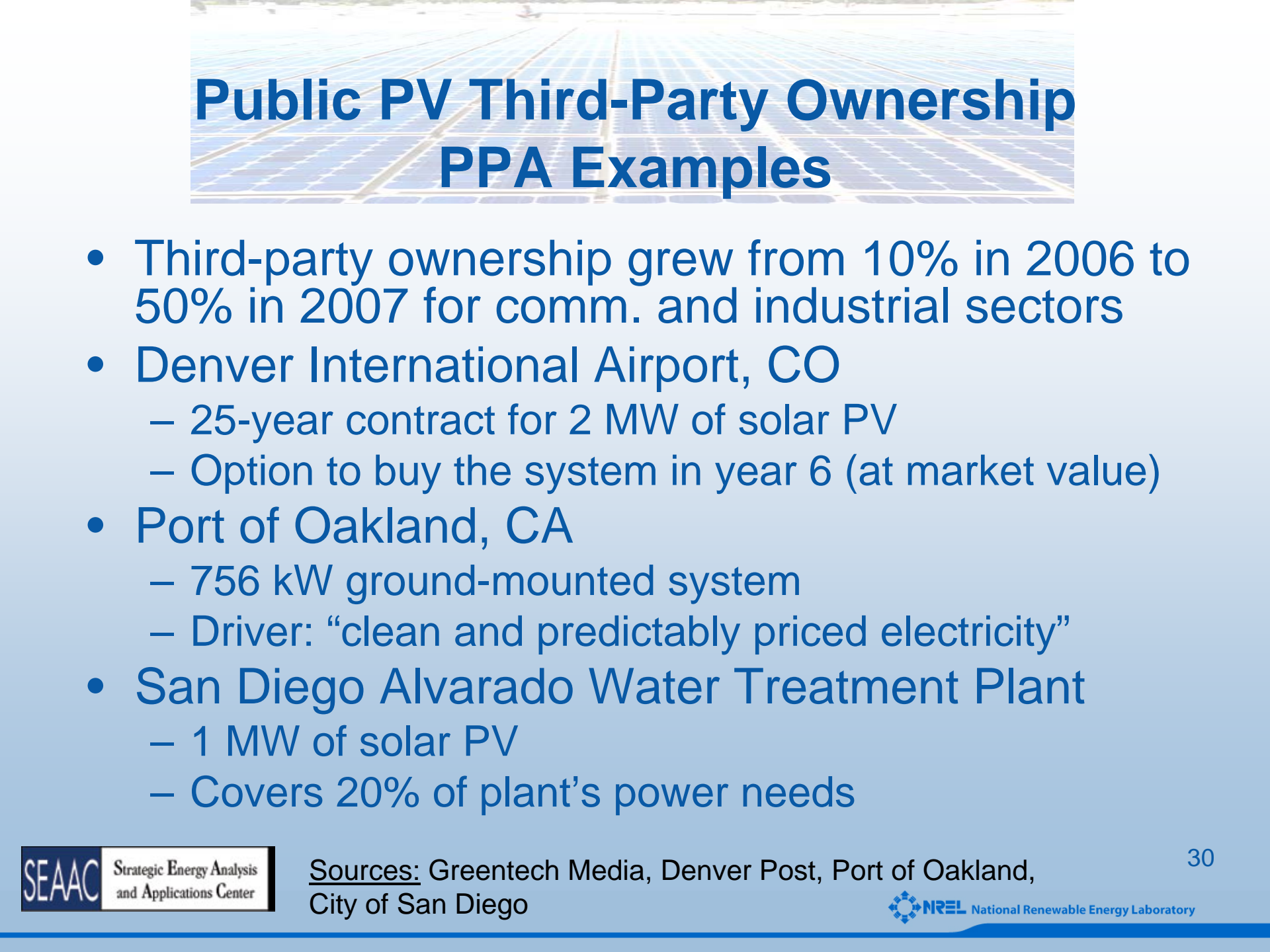


The Third-Party Ownership Model

- Public-sector “hosts”, but does not own PV
- Signs a long-term power purchase agreement (PPA)
- Third-party owns the system and benefits from tax incentives; passes benefit on to public sector host in PPA contract.

Benefits

-Pre-determined electricity price for 20-25 years
 hedge vs. volatility, fossil prices
-No upfront outlay of capital
-No O&M responsibilities
-Path to ownership
 if included as option in PPA



Public PV Third-Party Ownership PPA Examples


- Third-party ownership grew from 10% in 2006 to 50% in 2007 for comm. and industrial sectors
- Denver International Airport, CO
 - 25-year contract for 2 MW of solar PV
 - Option to buy the system in year 6 (at market value)
- Port of Oakland, CA
 - 756 kW ground-mounted system
 - Driver: “clean and predictably priced electricity”
- San Diego Alvarado Water Treatment Plant
 - 1 MW of solar PV
 - Covers 20% of plant’s power needs

Caveats with Third-Party Ownership

- Truth in advertising: green power claims
- Legality concerns – compete with utility monopoly?
- Leased buildings – will landlord allow?
- Delayed ownership
- Legal transaction costs
- Access to site is critical



Solar Financing Challenges-1

- Up-Front System Cost 
- Federal - 30% ITC Expiration on 12/31/08
 - Will it be reauthorized before it expires?
 - Effect: Solar ITC will revert to 10%, putting many PV projects in jeopardy
- State Incentives Changing
 - Challenge: States ramping down up-front rebates in lieu of:
 - Production-based incentives (CA), or
 - To rely on the SREC market (NJ)

Solar Financing Challenges-2

- Net metering and interconnection issues
 - Not consistently applied nationwide
 - Challenge: Critical for solar projects
- On-site REC tracking and verification
 - Separate meter usually required to create RECs
 - Smaller systems may use engineering estimates
- REC Price Uncertainty
 - Cause: RPS policy changes, regional disparities, uncertain eligibility of DG generators, lack of RPS enforcement/penalty
 - Effect: Long-term REC value questioned; little/no REC forward market has developed



Insurance Issues for Public PV

- State and local govts typically self-insure
- Utility interconnection agreements may require additional insurance (varies by state)
 - Potentially significant additional cost to the project
- Solution: State-wide public group policy (Massachusetts)
 - Group public projects together
 - Secure umbrella insurance policy
 - Reduced incremental cost/project



Conclusions

- Solar PV can make sense, even in states without great solar resources
 - Policies and incentives are key
- Renewable energy valuation depends on:
 - Regional electricity revenues
 - Value of federal, state, local and utility incentives
 - Ability to secure REC revenues to cover incremental costs
 - Better if RPS solar set-aside
- Third-party ownership with PPA is emerging as a dominant model for financing
 - Challenges with CREBs implementation
 - Challenges with issuing successful bonds
- Insurance is important issue to consider

Full report:

<http://www.nrel.gov/docs/fy08osti/43115.pdf>

Thank you for your attention!

Karlynn Cory, NREL

(303) 384-7464

Karlynn_Cory@nrel.gov

Jason Coughlin, NREL

(303) 384-7434

Jason_Coughlin@nrel.gov

Two Models for Third-Party Ownership

- **Sale-Leaseback**

- Tax equity investor buys the PV system and leases it to the third-party PPA provider/developer
- In turn, the third-party PPA provider signs the contract with the state or local government agency
- After tax benefits are exhausted, developer provider usually purchases the system; can have PPA option for host to purchase the system

- **Partnership-Flip**

- Developer partners with the tax-equity investor as an LLC or special purpose entity to install and operate the PV system
- This entity then enters into a PPA with the public-sector host,
- After tax benefits are exhausted, ownership transfers to the developer; can have PPA option for host ownership