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STATE POLICY EXPERIMENTATION WITH FINANCIAL INCENTIVES FOR SOLAR ENERGY

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INTRODUCTION

States have engaged in extensive policy experimentation to support solar technology. Solar technology has great potential to serve diverse energy needs with minimal environmental impact. Yet, solar technology provides less than 1% of the energy used in the U.S. One major barrier to deployment of solar technology is its high upfront cost compared to more conventional energy sources (Alleng, Byrne, & Zhou, 2001; Roberti, 1981). Financial incentives are only one policy tool to address the cost barrier, but scholars and industry advocates frequently acknowledge their importance in encouraging deployment of clean energy technology (Clean Energy Group & Peregrine Energy Group, 2008; Ross & Hendricks, 2008; Sherwood, 2008; Solar Energy Industries Association & Prometheus Institute, 2008; Wiser, Barbose, & Peterman, 2009).

Even so, little empirical evidence exists regarding the effectiveness of different financial incentive designs, or regarding how or why those incentives have been implemented. One evaluation of early solar legislation in California, New Mexico, and Oregon remarked that state legislation "was drafted and passed in a hasty manner," resulting in administrative difficulties (Warren, 1979, p. 1). Some policy design recommendations have emerged over the years, although empirical evidence linking these practices to effectiveness appears thin (for example, see Ross & Hendricks, 2008). Where effectiveness studies exist, they tend to focus on the availability of income tax credits for investment in solar technology (Bezdek, Hirshberg, & Babcock, 1979; Durham, Colby, & Longstreth, 1988; Fry, 1986; Hassett & Metcalf, 1995). Few researchers compare the effectiveness of investment tax credits to effectiveness of other possible financial incentives, or consider the wide variety of tax incentive designs to isolate those that appear most successful at encouraging solar technology adoption. The best empirical evidence to date on incentive effectiveness has been collected through surveying relevant stakeholders, although there remains considerable room for further empirical assessment (Clean Energy Group & Peregrine Energy Group, 2008; Gouchoe, Everette, & Haynes, 2002; Stern, et al., 1986).

To set the stage for learning from state policy experimentation with incentive design, this report identifies major trends in the design and adoption of financial incentives to support solar energy. Appendix A summarizes the first wave of state policy experimentation with financial incentives. Appendix B and C more carefully reviews the universe of current state incentives and the major design features that vary across incentive programs. Future papers will further probe the adoption and implementation of state financial incentives for solar, and identify incentive designs that have had some success at encouraging solar technology deployment.

DATA

Initial data on the design of state-level financial incentives for solar power was compiled from the *Database of State Incentives for Renewables and Efficiency* (DSIRE). DSIRE tracks ten types of incentives for renewable energy and efficiency: four types of tax incentives (personal income tax, corporate income tax, sales tax, and property tax); rebates; production incentives; grants; loans; bonds; and industry support. DSIRE breaks out many of the characteristics that vary across programs, including eligible technology (photovoltaics (PV), solar water or space heat, other solar electric), applicable sectors (residential, commercial, industrial, agricultural, utility, government and schools), the value of the incentive, and how the incentive is calculated (percentage of cost, absolute dollar value, whether there is a maximum allowable amount).

Further data manipulation and collection was required beyond what is provided in the DSIRE database. The first step involved weeding out the financial incentives that applied to solar technology, rather than to other renewable technologies (especially wind or geothermal) or efficiency programs. A second step involved verifying the data from DSIRE and supplementing it with information from state laws, program documents or other data sources for incomplete or unclear records. Additional information on state property tax incentives was compiled from another George Washington Institute of Public Policy research project, "Significant Features of the Property Tax," supported by the Lincoln Institute of Land Policy.[1] Information on recent state-level activity was compiled from the "Energy and Environment Legislation Tracking Database" of the National Conference of State Legislatures (NCSL).[2]

Dozens of incentive programs were found in DSIRE that are offered by private firms, non-profits, utilities, or local governments. For purposes of this project, the inventory of incentives was limited to those that are directly financed by the states or their dependent agencies (i.e., the program budgets should show up as direct state expenditures or are administered through the state's tax code). Incentives adopted by publicly owned utilities and local governments were not considered state incentives here, even though these entities may receive intergovernmental transfers from states. A few incentives were retained in the inventory as "state" incentives because they are directly administered by the states, even though they may be financed through other means, such as public benefits funds. (Most public benefits funds are financed through surcharges on electricity customers' bills or through contributions from utilities, and do not show up on state budgets.[3])

Initial data processing revealed that some states offer multiple variations of incentives housed within the same incentive program (and associated budget line). For instance, states may offer separate incentives for solar electric technology and solar heating technology, due to inherent differences in how energy is produced through these types of solar technologies. Such incentives are listed separately in

[1] http://www.lincolninst.edu/subcenters/significant-features-property-tax/Report_Encourage_Specific.aspx
[2] NCSL website: http://www.ncsl.org/programs/energy/stnetenergy.cfm
[3] http://www.pewclimate.org/what_s_being_done/in_the_states/public_benefit_funds.cfm

Appendix B and C when the incentive design varies meaningfully by technology (e.g., different technologies have different incentive amounts, maximums, or eligible sectors).

The reader should note that this paper does not track the full history of all state solar financial incentives, but instead focuses on incentives that are currently in place. As of fall 2008, states appeared to be on a second wave of adopting solar financial incentives. The first wave appears from the mid-1970s through the early-1980s (see Appendix A). Some state incentives have remained in place since this first-wave, but many incentives currently offered by states have been adopted or substantially revised since the early 2000s. For this reason, this analysis reports the years that incentives became "effective" for the most recent iteration of the financial incentives, with adoption dates (if different) reported in parentheses. Future analysis will more carefully track the adoption of state solar incentives and motivations for adoption.

Finally, the focus here is on the design and implementation of solar financial incentives offered by particular states. For this reason, the unit of analysis in this paper is the state. The District of Columbia, Puerto Rico, and the Virgin Islands are also treated as states for this analysis, bringing the total number of U.S. states to 53.

FINDINGS

States have experimented widely with the design and adoption of solar financial incentives. Initial analysis of the inventory of state financial incentives for solar energy reveals the following trends:

1. Multiple design features distinguish state financial incentives for solar technology.

Few states offer the same financial incentive designs, which we would expect if they were copying policies from each other. Instead, incentives vary widely by function, type, by the method used to calculate the incentive value, by any maximum incentive value, by the eligible technology, or by the sector(s) that can claim the incentive. Some comments about design features are in order:

- Function- States appear to offer financial incentives to achieve two primary functions: (1) to encourage purchase and use of solar technology; and (2) to encourage R&D or equipment manufacturing and supply. Appendix A summarizes currently offered purchase and use incentives, and Appendix B summarizes currently offered R&D, manufacturing, or sales incentives.

- Type- States have the option to adopt many different types of financial incentives. For our purposes, incentives are classified as follows: (1) income tax incentives (personal and/or corporate; credits or deductions); (2) cash incentives (e.g., grants, rebates); (3) sales tax incentives; (4) property tax incentives; or (5) financing incentives (e.g., favorable loan terms).

- Method of Calculating Incentive Value - The amount of income tax and cash incentives can be calculated in multiple ways, including: (1) as a fixed dollar value; (2) as a share of installed cost (cost-based); (3) based on the installed capacity of the solar technology (capacity-based); or (4) based on the energy output of the solar technology (performance-based), also known as production incentives. Maximum value can be calculated in similar ways.

- Eligible Technology- Various solar technologies are eligible for incentives. This analysis distinguishes three major types of solar technologies: (1) solar electric; (2) solar heating; and (3) solar lighting. Solar electric technologies include photovoltaics (PV) and solar thermal electric systems, which produce electricity that can be used on-site or produced off-site and transmitted to the end-users. Solar technology can also be used directly to provide heating or cooling of water or building space and for simplicity is here referenced as solar heating. Some incentives expressly include solar pool water heating, while others include solar water heating but not solar pool water heating, and are mentioned accordingly. (Readers interested in more information on incentives for particular technologies are directed to the DSIRE database.)

- Eligible Sector- Often, incentives can be claimed by recipients from multiple sectors, including residential, commercial, industrial, agricultural, government, schools, and nonprofits. Residential incentives can apply to single-family homes or multi-unit residential structures, and in some cases apply only to affordable housing developers. Some incentives apply specifically to

commercial and industrial sources that produce solar-powered electricity for off-site use, classified here as "power producers."

2. Most solar financial incentives encourage purchase and use of customer-sited technology.

Most state financial incentives for solar technology are designed to encourage the initial purchase and use of solar technology, and of these, most apply to customer-sited solar technology. Customer-sited solar technology is a form of distributed energy generation that produces energy for on-site use and provides for all or part of a customer's energy needs. For instance, a solar hot water heater on a single-family residence may provide all of the hot water a household needs each day. Similarly, solar electric panels on rooftops can produce electricity for whatever purpose and provide all or part of a household's total electricity needs. Distributed generation has the potential to reduce the overall demand for centralized electricity and associated transmission.

Customers in some states can connect their solar electric technology to the electricity grid, usually to sell excess power back to the utility for use elsewhere. These customers are known as customer-generators with grid-connected solar technology. Selling excess power back to the utility is known as net metering (Stoutenborough & Beverlin, 2008). Most states allow or require net metering, although only a few states offer additional financial incentives to encourage net metering (see discussion of performance-based incentives in Appendix B and C).

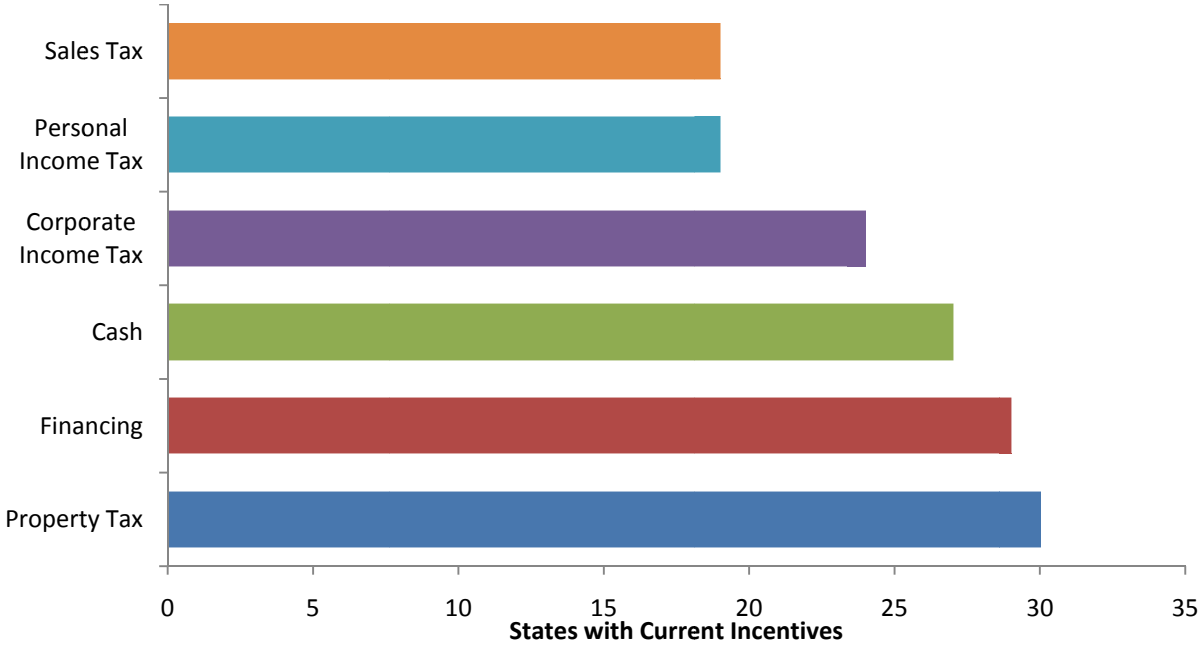
The choice of incentive design and its effectiveness at encouraging purchase and use of customer-sited technology likely depends in part, on whether a state already has other supportive policies in place. For instance, customer-sited technology generally only works when the technology can access direct sunlight. For this reason, most states have adopted laws or standards protecting certain building's access to sunlight in built-up areas, known as solar access laws. In addition, net metering policies likely work best when a state also has standards governing the process of connecting customer-sited technology to the electricity grid, known as interconnection. Several states authorize net metering but do not have statewide interconnection standards, including Maine, North Dakota, Oklahoma, Rhode Island, West Virginia, and the Virgin Islands.

Some states also offer financial incentives targeted at bringing down the costs of large-scale solar power generation. Large-scale generation or central generation is technology that produces power primarily for off-site use, usually for retail sale. Large-scale installations are typically larger than one megawatt in capacity, although some states extend eligibility to smaller installations. Most states in the Western U.S. offer large-scale incentives (e.g., Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico), although some non-Western states also provide large-scale incentives (e.g., Maine, Kentucky, Oklahoma).

3. States tend to offer property tax, financing, or cash incentives for purchase and use of solar technology.

Property tax incentives are the most prevalent financial incentive type currently offered by states for purchase and use of solar technology (see Figure 1). Majorities of states also offer financing and cash incentives for purchase and use. (States themselves may offer different combinations of incentives but overall there are majorities for each of these categories.) Income and sales tax incentives for purchase and use are less common but still widespread.

Figure 1. States Currently Offering Financial Incentives for Purchase and Use



The types of purchase and use incentives offered by states have shifted since the early 1980s, when states with financial incentives tended to offer property tax or income tax incentives (see Appendix A). Today, states continue to offer both types, but also tend to offer financing and cash incentives.

4. Some purchase and use incentives apply only to buildings that meet certain building standards.

Seven states currently offer incentives that are tied to buildings meeting certain standards (Connecticut, Illinois, Maryland, Nevada, New Mexico, New York, and Pennsylvania). Applicable building standards vary, although several incentives apply to buildings achieving a certain rating according to the Leadership in Energy and Environmental Design (LEED) rating system developed by the U.S. Green Building Council (USGBC).[4] Buildings achieve LEED ratings (e.g., Silver, Gold, and Platinum) depending on the number of points collected for various design features, which include use of renewable energy

[4] See USGBC website at www.usgbc.org

technology. Combining a solar incentive with a green building standard requirement suggests a state's commitment to environmental sustainability.

5. Most states offer multiple financial incentives for purchase and use of solar technology.

Four states have adopted all major types of financial incentives for purchase and use of solar technology, including both corporate and personal tax incentives: Maryland, Massachusetts, New York, and Rhode Island (see Table 1). Vermont also offers all five major types for purchase and use, but does not offer personal income tax incentives. At the other end of the spectrum are two states (Arkansas and West Virginia) that do not currently offer any type of state-financed incentive for purchase and use of solar technology.[5] The rest of the states fall somewhere in between, with the majority offering two different types of incentives.

Table 1. States Grouped by Number of Incentive Types Offered for Purchase and Use

No Incentives	One Type of Incentive	Two Types of Incentives	Three Types of Incentives	Four Types of Incentives	Five or Six Types of Incentives
Arkansas West Virginia	Alabama Delaware# District of Columbia Georgia Michigan Mississippi Missouri Nebraska South Dakota# Virgin Islands Virginia	Alaska# Illinois Indiana Kansas Kentucky Maine Nevada# New Mexico North Dakota Oklahoma* Pennsylvania Tennessee# Utah Washington# Wisconsin Wyoming#	Arizona California Colorado Hawaii Idaho* Louisiana Montana New Jersey North Carolina Oregon# Puerto Rico South Carolina Texas#	Connecticut Florida# Iowa Minnesota New Hampshire# Ohio*	Maryland Massachusetts New York Rhode Island Vermont*

* State offers either personal or corporate tax incentives but not both.
\# State does not levy certain taxes.

Not every state is eligible to offer every incentive type, as some states do not levy certain types of taxes. For instance, Alaska does not levy personal income taxes or sales taxes and so cannot offer these types of incentives.

[5] The West Virginia legislature recently adopted a bill establishing residential solar tax credit equal to 30% of the installation cost, up to $2,000, for solar electric and heating technology, to go into effect July 1, 2009. The bill was sent to the governor in April 2009 and is awaiting signature (see NCSL website).

6. Despite widespread variation, states tend to offer certain incentive types together.

Comparison of states with different types of purchase and use incentives reveals several basic conclusions (see Table 2):

- States with personal tax incentives strongly tend to have corporate tax incentives, and states without personal tax incentives tend not to have corporate tax incentives. Only seven states offer one but not both, and three of these states do not levy both income taxes (Florida, Texas, and Washington).

- States with income tax incentives tend not to have cash incentives, and states with cash incentives tend not to have income tax incentives. This tendency applies to personal and corporate tax incentives individually and when considering personal and corporate tax incentives together. Only eight states offer cash incentives and a form of income tax incentive.

- States with income tax incentives tend to offer sales tax incentives, and states without income tax incentives tend not to have sales tax incentives. Sixteen states offer either income tax incentives or sales tax incentives but not both.

- Finally, there is a general tendency for states with sales tax incentives to offer property tax incentives. States without sales tax incentives also tend not to have property tax incentives.

Table 2. Tendency for States to Offer Combinations of Incentives for Purchase and Use

Type of Incentive	Income Tax	Cash	Sales Tax	Property Tax	Financing
Income Tax	Personal vs. Corporate **X^2=29.23** (p=0.000)				
Cash	**X^2=6.80** (p=0.009)				
Sales Tax	**X^2=8.36** (p=0.004)	X^2=1.77 (p=0.184)			
Property Tax	X^2=2.50 (p=0.114)	X^2=0.91 (p=0.341)	**X^2=3.52** (p=0.061)		
Financing	X^2=1.05 (p=0.305)	X^2=0.25 (p=0.875)	X^2=0.19 (p=0.663)	X^2=0.32 (p=0.569)	

Notes: N=53. Chi-square values with probabilities less than 0.01 are bolded.

7. States show their commitment to solar energy by adopting multiple incentives and by designing incentives for multiple technologies and sectors.

States offering multiple types of financial incentives for solar technology display a stronger commitment to environmental protection. Yet, each incentive type may be limited or broad in its reach, as it may apply to one or many technologies or to one or many sectors. Two index variables were developed to characterize the reach of a state's financial incentives for purchase and use of solar technology across the different types of incentives, eligible technologies, and eligible sectors.

First, a dichotomous variable was created to represent whether a state currently offers a particular type of incentive (coded 1=yes, 0=no; matches Table 6). A second dichotomous variable was created to represent whether the state's incentive(s) within that type covered at least two of the three major kinds of solar technologies (electric, heating/cooling, or lighting) (coded 1=yes, 0=no). A third dichotomous variable was created to represent whether the state's incentive(s) within that type covered at least two categories of eligible sectors (coded 1=yes, 0=no). The available sectors were reduced to four categories: residential; non-residential private (commercial, industrial, agricultural); public or nonprofit (includes government buildings and schools); and a separate category for retail power producers. The three dichotomous variables were then added together to represent the reach of the incentive type. Each reach variable ranges from 0 to 3, with 0 representing no incentive of that type, and 3 indicating that the state's incentives cover multiple technologies and sectors. Of the six types of incentives, property tax incentives generally had the widest reach, while financing and corporate income tax incentives had the most limited reach.

The first index variable was constructed to represent the overall reach of a state's financial incentives, by adding together the reach variables for all six types of incentives. The minimum value on this index is 0, which represents a state not currently offering any type of financial incentive (e.g., Arkansas, West Virginia). The maximum possible value for this index is 18. Higher values represent a more extensive offering of incentives.

According to this measure, New York offers the widest reaching set of incentives across all major types (see Table 3). Rhode Island, Maryland, Vermont, and Iowa also offer a set of wide reaching financial incentives for purchase and use of solar technology (with index values all above the 90th percentile). At the other end of the spectrum are the two states that do not offer any incentives (Arkansas and West Virginia) and the five states that offer few incentives with limited reach, including Alabama, Missouri, Mississippi, Wyoming, and the District of Columbia (with index values below the 10th percentile).

Table 3. The Reach of Offered Financial Incentives for Purchase and Use

State	Types of Incentives Offered	Overall Reach of Incentives*	Average Reach of Incentives
NY	6	17	2.83
RI	6	16	2.67
MD	6	15	2.50
IA	5	13	2.60
VT	5	13	2.60
AZ	4	12	3.00
MA	6	12	2.00
PR	4	12	3.00
NC	4	11	2.75
OR	4	11	2.75
CT	4	10	2.50
FL	4	10	2.50
HI	4	10	2.50
MN	4	10	2.50
MT	4	10	2.50

State	Types of Incentives Offered	Overall Reach of Incentives*	Average Reach of Incentives
SC	4	10	2.50
OH	4	9	2.25
CA	3	8	2.67
CO	4	8	2.00
LA	4	8	2.00
NJ	3	8	2.67
NM	3	8	2.67
ID	3	7	2.33
ND	3	7	2.33
TX	3	7	2.33
UT	3	7	2.33
IL	2	6	3.00
KY	3	6	2.00
WI	2	6	3.00
AK	2	5	2.50
GA	2	5	2.50
IN	2	5	2.50
NH	3	5	1.67
NV	2	5	2.50
WA	2	5	2.50
KS	2	4	2.00
ME	2	4	2.00
OK	2	4	2.00
PA	2	4	2.00
TN	2	4	2.00
DE	1	3	3.00
MI	1	3	3.00
NE	1	3	3.00
SD	1	3	3.00
VA	1	3	3.00
VI	1	3	3.00
AL	1	2	2.00
DC	1	2	2.00
MO	1	2	2.00
MS	1	2	2.00
WY	2	2	1.00
AR	0	0	0.00
WV	0	0	0.00

* Table is sorted by overall reach and state.

Some states may not be eligible to offer all types of incentives or may choose not to offer particular types for one reason or another. These states would be unable to score highly on the overall reach index. Still, these states may offer wide reaching incentives within the types they do offer, exhibiting a commitment to solar technology.

A second index variable was constructed to represent the average reach of those incentives that are offered by a state. The second index was calculated by dividing the first index (overall reach) by the number of types of incentives offered. The second index ranges from 0 to 3, as with the individual reach

variables, with 0 representing no incentive offered and 3 representing a state with wide ranging incentives.

Analysis of the second index variable uncovers a different pattern than the first index variable (see Table 3). Eight states and two U.S. territories offer wide reaching incentives within the types offered, including Arizona, Delaware, Illinois, Michigan, Nebraska, South Dakota, Virginia, Wisconsin, Puerto Rico, and the Virgin Islands. These same states have overall reach scores ranging from 3 (for states offering only one incentive type) to 12 (for Arizona and Puerto Rico, offering 4 incentive types). At the other end of the spectrum are two states without incentives and two states with limited reach incentives (Wyoming and New Hampshire). Twelve states plus DC also offer incentives with a relatively moderate reach (scores of 2; below the 10^{th} percentile).

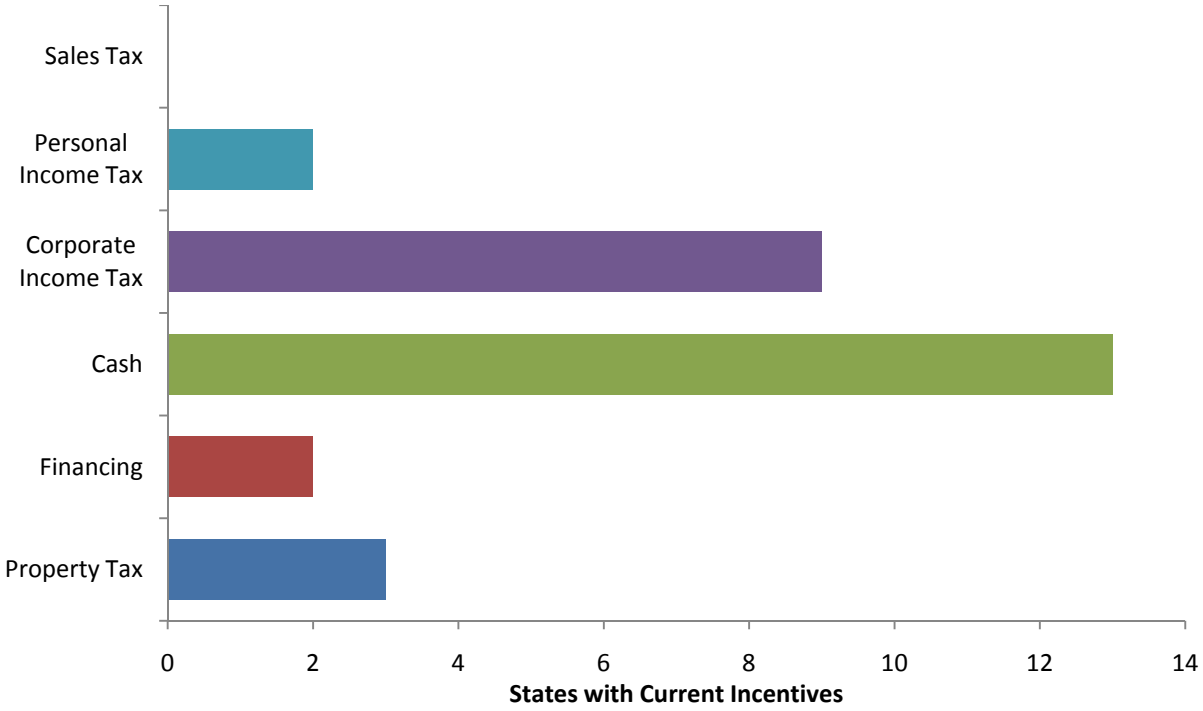
Generally, states with a higher overall reach also tend to have a larger average reach.[6] Yet, this relationship is not strong or linear. The most obvious examples of states not following the trend are states offering only one type of incentive but extending that incentive to multiple technologies and sectors, including Delaware, Michigan, Nebraska, South Dakota, Virginia, and the Virgin Islands. By contrast, Massachusetts follows a different approach by offering all six types of incentives but designing each with a more limited reach.

8. States tend to employ cash incentives or corporate income tax incentives to encourage R&D, manufacturing, or sales.

Incentives for R&D, manufacturing, or sales tend to be cash incentives or corporate income tax incentives (see Figure 2). A few states also offer property tax incentives, personal income tax incentives, or financing incentives. Note that several states offer sales tax incentives for purchase and use, which can indirectly influence sales and installations within the state.

[6] The Pearson correlation coefficient is 0.43 and the Spearman correlation coefficient is 0.32, both indicating a moderate positive relationship.

Figure 2. States Currently Offering Financial Incentives for R&D, Manufacturing, or Sales



All of the states offering at least one type of incentive for R&D, manufacturing, or sales also offer at least some form of incentive for purchase and use. States that offer income tax incentives for R&D, manufacturing, or sales tend to offer income tax incentives for purchase and use. Similarly, states that offer cash incentives for R&D, manufacturing, or sales tend to offer cash incentives for purchase and use.

9. Few states offer multiple financial incentives for R&D, manufacturing, or sales.

Four states (Massachusetts, Michigan, Montana, and Wisconsin) plus Puerto Rico offer two different types of incentives for R&D, manufacturing, or sales (see Table 4). Seventeen more states throughout the country offer one type of incentive for R&D, manufacturing, or sales. The remaining states do not currently offer any financial incentives for R&D, manufacturing, or sales.

Table 4. States Grouped by Number of Incentive Types Offered for R&D, Manufacturing, or Sales

No Incentives	One Type of Incentive	Two Types of Incentives
Alabama	Colorado	Massachusetts
Alaska#	Connecticut	Michigan*
Arizona	Delaware#	Montana#
Arkansas	Florida#	Puerto Rico
California	Hawaii	Wisconsin
District of Columbia	Illinois	
Georgia	Iowa	
Idaho*	New Mexico	
Indiana	New York	
Kansas	North Carolina	
Kentucky	Oregon#	
Louisiana	Pennsylvania	
Maine	South Carolina	
Maryland	Texas#	
Minnesota	Vermont*	
Missouri	Virginia	
Mississippi	Washington#	
Nebraska		
Nevada#		
New Hampshire#		
New Jersey		
North Dakota		
Ohio*		
Oklahoma*		
Rhode Island		
South Dakota#		
Tennessee#		
Utah		
Virgin Islands		
West Virginia		
Wyoming#		

Massachusetts is the only state that offers the maximum different types of incentives for both major functions: purchase and use of solar technology and R&D, manufacturing, or sales. The other states reveal little consistency in the types of incentives offered for purchase and use as opposed to R&D, manufacturing, or sales. The lack of consistency is one reason that the incentives are reported separately by function in Appendix B and C. States may have different motivations for adopting incentives. States with incentives for purchase and use of solar technology are likely to value environmental protection highly. States with R&D, manufacturing, or sales incentives, however, may be driven by a desire to promote economic development within the state. Motivations will be probed further in future research.

CONCLUDING THOUGHTS

States have shown widespread experimentation in the design and adoption of financial incentives for solar technology. These incentives have been applied for multiple purposes, through different policy mechanisms, and made available to different technologies and sectors. The precise incentive design may also vary in amount, how that amount is calculated, and in the maximum amount that can be claimed.

Each design feature offers its own benefits as far as when and how the incentive might be claimed, who is eligible, and the administrative effort required to implement the incentive. Each feature may also have drawbacks depending on how the overall incentive is designed. For instance, one major drawback of fixing a dollar value (through either the incentive value or maximum) is the need to adjust the value as the price of solar technology falls. Indeed, the rapidly changing solar technology market combined with changes in the overall policy framework for clean energy may be influencing the effectiveness of different incentive designs. The need exists to evaluate recent experiences in light of the changing environment to identify incentive features and characteristics that have the strongest impacts on adoption of solar technology.

Evidence of program effectiveness is particularly needed today given the precarious budget situation for many state governments. Policymakers may be looking to trim non-essential programs and state-financed solar incentive programs may seem ripe for budget raiding. In fact, several cash incentive programs have already been phased out in the first quarter of 2009. Rebates, grants, and loan programs may be more susceptible to raiding than tax incentives, as they require annual appropriations and are relatively transparent—two characteristics typically seen as positive in encouraging good public management. The maximum incentive values on incentives may also be adjusted downward or eligible sectors may be reduced as budgets tighten, although the administrative hassle of making these changes may point to canceling the incentive programs entirely.

On the other hand, today's tight fiscal environment makes the availability of state financial incentives all the more important to potential consumers and producers of solar technology. Investors may face difficulty securing private financing and may look to states to fill in the gaps through whatever mechanisms they have available, whether financing, tax, or cash incentives.

Regardless of budget status, sound policy and administrative practice requires program managers to routinely evaluate a policy's effectiveness and consider if modifications could be made to improve a program's design or implementation in light of experiences in other jurisdictions. Such an approach would make best use of the extensive policy experimentation across states. A forthcoming report will shed light on how much states are spending on these incentive programs and what they are getting for their money, topics that have only been weakly explored in the past with respect to state solar financial incentives.

APPENDIX A: FIRST-WAVE OF STATE SOLAR INCENTIVES

States first became active in adopting solar financial incentives in the mid-1970s. At least two forces converged to encourage this behavior. First, the oil price shocks of the early 1970s focused much policy attention on domestic energy security. Second, environmental awareness was rapidly spreading in the 1960s and 1970s, encouraging unprecedented attention to environmental impacts of policy decisions. Together, these forces encouraged state policymakers to look to environmentally friendly energy technologies, such as solar.

Arizona and Indiana paved the way by adopting the first state financial incentives for solar—offered through the property tax—in 1974 (*State solar legislation*, 1977). Twenty-six more states adopted incentives in 1975 and 1976. By 1981, 44 states had adopted some form of solar tax incentive for residential systems (see Table 5). Twenty-eight states had adopted personal income tax incentives for residential solar by 1981, with most being tax credits and a few tax deductions. Thirty-four states had adopted property tax incentives for residential solar by 1981 (6 with "local option" incentives). Eight states had adopted sales tax exemptions and three more adopted sales tax refunds for residential solar. Only one state as of 1981 (Wisconsin) offered a cash rebate for residential solar that was not tied to taxes.

Table 5. State Tax Incentives for Residential Solar Technology as of 1981

State	Income Tax Incentive	Rebate	Sales Tax Incentive	Property Tax Incentive
AK	Up to $200 credit			
AL	Up to $1,000 credit			
AR	100% deduction			
AZ	Up to $1,000 credit		Exemption	Exemption
CA	Up to $3,000 credit per application			
CO	Up to $3,000 credit			Exemption
CT			Exemption	Local option
DE	$200 credit for hot water systems			
FL			Exemption	Exemption
GA			Refund	Local option
HI	10% credit			Exemption
IA				Exemption
ID	100% deduction			
IL				Exemption
IN	Up to $3,000 credit			Exemption
KS	Up to $1,500 credit			Exemption; refund based on efficiency of system
LA				Exemption
MA	Up to $1,000 credit		Exemption	Exemption

State	Income Tax Incentive	Rebate	Sales Tax Incentive	Property Tax Incentive
MD				Exemption statewide plus credit at local option
ME	Up to $100 credit		Refund	Exemption
MI	Up to $1,700 credit		Exemption	Exemption
MN	Up to $2,000 credit			Exemption
MT	Up to $125 credit			Exemption
NC	Up to $1,000 credit			Exemption
ND	5% credit for 2 years			Exemption
NE	Yes			Exemption
NH				Local option
NJ			Exemption	Exemption
NM	Up to $4,000 credit			
NV				Limited exemption
NY	Up to $2,750 credit			Exemption
OH	Up to $1,000 credit		Exemption	Exemption
OK	Up to $2,800 credit			
OR	Up to $1,000 credit			Exemption
RI	Up to $1,000 credit		Refund	Exemption
SC	Up to $1,000 deduction			
SD				Exemption
TN				Exemption
TX			Exemption	Exemption
UT	Up to $1,000 credit			
VA				Local option
VT	Up to $1,000 credit			Local option
WA				Exemption
WI		Yes		Exemption

Source: Adapted from Hinds (1981).

The initial wave of state policy adoption for solar coincided with federal income tax credits, financing through the Solar Energy Development Bank, and solar technology research and development support through the Department of Energy and federally-supported regional solar energy research labs. Federal financial support for solar technology fell off precipitously in the early part of the first Reagan administration, as did support for energy research generally (Moore, 1982). State support also waned during the 1980s and 1990s in some places, but showed renewed interest after 2000.

APPENDIX B: SUMMARY OF INCENTIVES FOR PURCHASE & USE

State purchase and use incentives include income tax incentives, cash incentives, sales tax incentives, property tax incentives, and financing (see Table 6). Early state financial incentives for solar were applied through the tax code, in property taxes, income taxes, and sales taxes (see Appendix A). Over time, states also adopted financing incentives and more transparent cash incentives.

Table 6. States Currently Offering Financial Incentives for Purchase and Use of Solar Technology

State	Personal Income Tax	Corporate Income Tax	Cash	Sales Tax	Property Tax	Financing
AK	N/A		Y	N/A		Y
AL						Y
AR						
AZ	Y	Y		Y	Y	
CA			Y		Y	Y
CO			Y	Y	Y	
CT			Y	Y	Y	Y
DC			Y			
DE			Y	N/A		
FL	N/A	Y	Y	Y	Y	
GA	Y	Y				
HI	Y	Y			Y	Y
IA	Y	Y		Y	Y	Y
ID	Y			Y		Y
IL			Y		Y	
IN			Y		Y	
KS					Y	Y
KY	Y	Y		Y		
LA	Y	Y			Y	Y
MA	Y	Y	Y	Y	Y	Y
MD	Y	Y	Y	Y	Y	Y
ME			Y			Y
MI			Y			
MN			Y	Y	Y	Y
MO						Y
MS						Y
MT	Y	Y		N/A	Y	Y
NC	Y	Y			Y	Y
ND	Y	Y			Y	
NE						Y
NH	N/A*		Y	N/A	Y	Y
NJ			Y	Y	Y	
NM	Y	Y				Y
NV	N/A	N/A	Y		Y	
NY	Y	Y	Y	Y	Y	Y
OH		Y	Y	Y	Y	
OK		Y				Y
OR	Y	Y		N/A	Y	Y
PA			Y			Y

State	Personal Income Tax	Corporate Income Tax	Cash	Sales Tax	Property Tax	Financing
PR	Y	Y		Y	Y	
RI	Y	Y	Y	Y	Y	Y
SC	Y	Y	Y			Y
SD	N/A	N/A			Y	
TN	N/A*		Y			Y
TX	N/A	Y			Y	Y
UT	Y	Y		Y		
VA					Y	
VI			Y			
VT		Y	Y	Y	Y	Y
WA	N/A	Y		Y		
WI			Y		Y	
WV						
WY	N/A	N/A	Y	Y		

Y = yes; N/A = not applicable.

N/A* = tax covers only dividends and interest.

Note: table does not include incentives offered by utilities, nonprofits, local governments, or other entities.

INCOME TAX INCENTIVES

Income tax incentives are one of the oldest state financial incentives to offset the high costs of purchasing solar technology. Income tax incentives can be structured as a share of installed cost (cost-based), be based on the installed capacity of the technology (capacity-based), or be based on the energy output of the solar technology (performance-based).

Twenty-four states plus Puerto Rico currently have some form of income tax incentive for purchase and use of solar technology. Note that seven states do not tax personal income (Alaska, Florida, Nevada, South Dakota, Texas, Washington, Wyoming) and two states tax only interest and dividends (New Hampshire and Tennessee).[7] Five states do not tax corporate income (Nevada, South Dakota, Texas, Washington, and Wyoming), although Texas and Washington tax gross receipts.[8]

COST-BASED INCOME TAX INCENTIVES

Twenty states plus Puerto Rico currently offer cost-based income tax credits or deductions for purchase of solar technology (see Table 7).[9] Many of these states offer both corporate and personal tax credits and most apply to the common solar technologies (e.g., PV, solar water heating, solar space heating). The tax incentive amounts vary from 10% to 100% of the installed cost. Most of the tax incentives pose some maximum dollar limit, such as $1,000 for personal tax credits for residential installations in Arizona and Massachusetts. Maximum credits for non-residential installations can range substantially higher, such as $2.5 million in North Carolina and $20 million in Oregon (taken over 5 years).

Table 7. Cost-Based Income Tax Incentives for Purchase and Use

State	Type	Amount (of cost)	Maximum	Technology	Eligible Sectors	Effective[10]
AZ	Personal	25% credit	$1,000	Solar electric and heating	Residential	1995

[7] The Tax Foundation, "State Individual Income Tax Rates, 2000-2009." Last Updated January 6, 2009. Available at http://www.taxfoundation.org/taxdata/show/228.html.

[8] The Tax Foundation, "State Corporate Income Tax Rates, 2000-2009." Last Updated January 12, 2009. Available at http://www.taxfoundation.org/taxdata/show/230.html.

[9] The West Virginia legislature recently passed a solar tax credit and had forwarded it to the governor for signature as of April 2009 (see NCSL website).

[10] All tables in Appendix B and C have an effective year column, representing the latest year that an incentive became effective after it was adopted or substantially revised. In some cases a year follows in parentheses, representing the initial year the incentive was adopted, if different from the year it became effective.

State	Type	Amount (of cost)	Maximum	Technology	Eligible Sectors	Effective[10]
AZ	Personal and corporate	10% credit	$25,000 per building; $50,000 max	All	Commercial, industrial, agricultural, nonprofit, government, schools	2006-2012
GA	Corporate	35% credit	$500,000 for solar electric; $100,000 for solar water heat & lighting	All	Multi-unit residential, commercial, industrial, agricultural	2008-2012
GA	Personal	35% credit	$10,500 for PV and space heating; $2,500 for water heating	Solar electric and heating	Residential	2008-2012
HI	Personal and corporate	35% credit	$5,000 for single-unit res PV; $350/unit for multi-unit res PV; $500,000 for commercial PV; $2,500 for single-unit res heating; $350/unit for multi-unit res heating	Solar electric and heating	Residential and commercial	2003 (1976)
ID	Personal	100% deduction	40% or $5,000 in year 1, 20% in years 2-4 (max $20,000)	Solar electric and heating	Residential	1976 (1976)
KY	Corporate	Up to 100% credit	(minimum 50 kW capacity and $1 million invested)	Solar electric	Power providers	2008 (2007)
KY	Personal and corporate	30% credit	$500 for personal; $1,000 for corporate	Solar heating	Residential, commercial, industrial	2009-2015 (2008)
LA	Personal and corporate	50% credit	$12,500	Solar electric and heating	Residential	2008 (2007)
MA	Excise (i.e., corporate)	100% deduction		Solar heating	Commercial, industrial	1976 (1976)
MA	Personal	15% credit	$1,000	Solar electric and heating	Residential	1979
MD	Personal and corporate	20-25% credit (if meet certain building standards)	20,000 square feet buildings	PV	Multi-unit residential, commercial, industrial	2001-2011
MT	Personal	100%	$500	Solar heating and electric	Residential	2002
MT	Personal and corporate	35% credit	(min $5,000)	Solar electric	Commercial and industrial	2002 (2001)

State	Type	Amount (of cost)	Maximum	Technology	Eligible Sectors	Effective[10]
NC	Corporate	35% credit	$2.5 million per institution	All	Commercial and industrial	1977-2010
NC	Personal	35% credit	$1,400-$10,500	Solar electric and heating	Residential, commercial	1977-2010
ND	Personal	15% credit	3% per year for 5 years	Solar electric and heating	Residential	2001-2011
ND	Corporate	15% credit	3% per year for 5 years	Solar electric and heating	Commercial and industrial	2001-2011
NM	Corporate	Credit for 6% of gross receipts, compensating, or withholding taxes	$60 million	Thermal electric	Power providers	2007
NM	Personal	30% credit	$9,000 (less federal tax credit)	Solar electric and heating	Residential, commercial, agricultural	2006-2015 (1975)
NM	Personal and corporate	Varies (if LEED Silver or greater certification)		All	Residential and commercial	2007
NY	Personal	25% credit	$5,000	Solar electric and heating	Residential	1998 (1997)
NY	Personal and corporate	Varies (if meet certain building standards)		All	Residential and commercial	2001 (2000)
OH	Corporate	100% exemption		Solar electric and heating	Commercial and industrial	1978-2010
OR	Corporate	50% credit	$20 million; taken 10% per year for 5 years	Solar electric and heating	Multi-unit residential, commercial, industrial	2007 (1979)
PR	Personal and corporate	25-75% credit		Solar electric	Residential, commercial, industrial	2008
PR	Personal and corporate	30% deduction	$500	Solar electric and heating	Residential	1994
RI	Personal and corporate	25% credit	$15,000 for PV (min 24 sq ft); $7,000 for water heating (min 60 sq ft); $15,000 for active solar heating (min 125 sq ft)	Solar electric and heating	Residential	?
SC	Personal and corporate	25% credit	$3,500 or 50% tax liability	Solar electric and heating	Residential and commercial	2006

State	Type	Amount (of cost)	Maximum	Technology	Eligible Sectors	Effective[10]
TX	Excise (i.e., corporate)	Deduct 10% amortized cost from margin		Solar heating and electric	Commercial, industrial	2007 (1981)
UT	Personal and corporate	10% credit	$50,000	Solar electric and heating	Commercial	2008-2012 (2001)
UT	Personal and corporate	25% credit	$2,000	Solar electric and heating	Residential	2008-2012 (2001)
VT	Corporate	30% credit		Solar electric and heating	Commercial and industrial	2008-2016

The first of the current cost-based income tax credits for solar were adopted by Idaho in 1976, North Carolina in 1977, and Massachusetts and Oregon in 1979.[11] Cost-based tax credits were next adopted in Texas in 1981 and in Hawaii in 1990. Arizona and Wyoming passed their cost-based income tax incentives in 1995 and 1998. The remaining cost-based income tax incentives have been adopted since 2000, with Georgia, Kentucky, Louisiana, Utah, Vermont, and Puerto Rico all adopting (or revising) their tax cost-based incentives in 2008.

Federal tax credits for solar technology

The state cost-based tax credits parallel two cost-based income tax credits offered by the federal government. The federal residential tax credit was first adopted in 1978, equal to 30% of the purchase price of new solar technology, up to $2,000. The residential tax credit expired in 1985 and was reinstated in 2005 at 30% of the purchase price, up to $2,000. The Energy Improvement and Extension Act of 2008 removed the maximum limit and extended the residential tax credit to 2016.

The federal government also adopted a business investment tax credit (ITC) in 1978. The ITC initially allowed businesses to claim a tax credit of 10% of the purchase price for new solar technology. The ITC has been in continuous operation since 1978, and has been increased to 15%, reduced to 10%, and increased again to 30% in 2005. The Energy Improvement and Extension Act of 2008 secured the 30% ITC through 2016.

[11] New Mexico first adopted an income tax credit in 1975, valued at 25% of cost for residential systems, up to $1,000. Hawaii originally adopted an income tax credit up to 10% cost in 1976. The following states also adopted early cost-based tax incentives, which are no longer in effect: (1) in 1976, Arizona adopted a full income tax deduction (over 36 months) for technology installed on all types of buildings; (2) in 1976, California adopted an income tax credit of 10% up to $1,000; (3) in 1976, Kansas adopted a tax deduction of 25% up to $1,000 for individuals and $3,000 for businesses; (4) in 1977, Arkansas adopted an income tax deduction for 100% of the installed cost for homeowners for the year of installation (*State solar legislation*, 1977).

Both federal tax credits apply to most all solar energy technologies, including PV, solar space heating, and solar water heating (except pool heating). All states except New Mexico allow eligible recipients to claim the full amount of both the federal and state tax incentives.

Until passage of the Energy Improvement and Extension Act of 2008, entities affected by the alternative minimum tax or entities with no tax basis (such as public utilities) were unable to take advantage of the federal tax credits. Advocates are now calling on the U.S. federal government to make the solar tax credits "refundable," so that all entities investing in solar technology could receive a grant from the federal government equal to the credit, regardless of their tax basis (St. John, 2009). Such a change would make the federal tax credits more accessible and likely more effective over its traditional design.

CAPACITY-BASED INCOME TAX INCENTIVES

Capacity-based incentives are calculated based on the installed capacity of the solar technology. Solar heating capacity is usually measured by the size of the solar collector needed to heat a given amount of space or water (in square feet) or by the calculated energy output from a solar collector (in Btu per day). Most all other solar capacity is measured in watts (W), kilowatts (kW; 1,000 W), or megawatts (MW; 1,000,000 W).

Only three states have adopted capacity-based income tax incentives (see Table 8). Kentucky and Oregon offer capacity-based income tax credits of $3 per W for PV, with limits of up to $1,000 in Kentucky and $6,000 in Oregon. Georgia offers a $0.60 per square foot corporate tax credit for solar daylighting retrofits, up to $100,000. Oregon adopted its solar tax incentives in 2005 and Kentucky and Georgia adopted their incentives in 2008.

Table 8. Capacity-Based Income Tax Incentives for Purchase and Use

State	Type	Amount	Maximum	Technology	Eligible Sectors	Effective
GA	Corporate	$0.60 per square foot	$100,000	Solar daylighting retrofits	Multi-unit residential, commercial, industrial, agricultural	2008-2012
KY	Personal and corporate	$3.00 per W	$500 for single-unit residential; $1,000 multi-unit residential and commercial	PV	Residential and commercial	2009-2015 (2008)
OR	Personal	$3.00 per W	$6,000	PV	Residential	2005-2015 (1977)

PERFORMANCE-BASED INCOME TAX INCENTIVES

Performance-based incentives (PBIs) are calculated based on the actual energy produced by the solar technology, usually measured in kilowatt-hours (kWh). One kWh is the amount of energy needed

to power a piece of technology with 1 kW capacity for 1 hour. The PBI rates are set higher than retail electricity rates to account for the higher upfront costs of purchasing solar technology and its longer "payback" period. For small customer-generators, the PBI rates are typically an extra payment on top of the retail electricity rate that is paid by the utility through net metering. For larger-scale generators, the PBI rates are typically set as an extra payment beyond the rate the generators negotiate with their utility under a long-term power purchase agreement (PPA). In general, PBI rates decline as the cost to produce electricity with solar technology falls towards market rates. PBIs have all been adopted recently, and most apply only for a limited number of years.

Five states (Florida, Iowa, Maryland, New Mexico, and Oklahoma) have adopted PBIs that are administered through state income taxes for solar electric technology (see Table 9).[12] These five PBIs range from $0.0025 per kWh (Oklahoma) to $0.027 per kWh (New Mexico). Oklahoma and New Mexico's PBI are specifically designed for large-scale generators (>1 MWh). In addition, Washington state offers a hybrid tax-cash program. In Washington, customer-generators are eligible to receive a payment from their local utility of $0.15-0.54 per kWh of solar electricity produced (net of on-site use), up to $2,000 per year. Utilities then can receive a tax credit from the state equal to the amount of solar power they purchased from customers, up to $25,000 or 0.25% of their taxable electricity sales. Finally, Oregon also offers a personal tax credit of $0.60 per kWh saved from solar space heating ($0.40 for water heating and $0.15 for solar pool heating), for the first year after purchase.

Table 9. Performance-Based Income Tax Incentives for Purchase and Use[13]

State	Type	Amount	Minimum	Maximum	Eligible Technology	Eligible Sectors	Program Maximum	Effective
FL	Corporate tax credit	$0.01 per kWh			Solar electric	Commercial	$5 million available per fiscal year	2007-2010 (2006)
IA	Corporate & personal tax credits	$0.015 per kWh		2.5 MW per owner	Solar electric	Commercial, industrial, agricultural, schools	20 MW CIC	2005-2012
MD	Corporate & personal tax credits	$0.0085 per kWh		$2.5 million over 5 years	Solar electric	Residential, commercial, industrial, agricultural	$25 million available	2007-2010
NM	Corporate & personal tax credit	$0.027 per kWh (average)	1 MW	200,000 MWh per year	Solar electric	Residential commercial, industrial, agricultural	500,000 MWh per year	2002-2018

[12] A bill to establish a renewable energy production tax credit is currently pending in Arizona (see NCSL website).
[13] Local power distributors of electricity produced by the Tennessee Valley Authority (TVA), a federally owned power provider in the Southeastern U.S., also provide PBIs to customer-generators ($0.15 per kWh for residential and small commercial; $0.20 per kWh for large commercial).

State	Type	Amount	Minimum	Maximum	Eligible Technology	Eligible Sectors	Program Maximum	Effective
OK	Corporate tax credit	$0.0025 per kWh	1 MW	10 years	Solar electric	Commercial		2003-2012 (2002)
OR	Personal tax credit	$0.15 per kWh		50% cost; 1st-year only	Pool heating	Residential		2007-2015 (1977)
OR	Personal tax credit	$0.40 per kWh		25% cost; 1st-year only	Water heating	Residential		2007-2015 (1977)
OR	Personal tax credit	$0.60 per kWh		$1,500; 1st-year only	Space heating	Residential		2007-2015 (1977)
WA[14]	Incentive paid by utilities; utilities receive tax credits	$0.15 - $0.54 per kWh		$2,000 per year per customer; $25,000 per utility (or 0.25% taxable sales)	Solar electric	Residential, commercial, government		2005-2014

The state income tax PBIs have all been adopted since 2002. The programs currently have targeted end dates between 2010 (in Florida and Maryland) and 2018 (in New Mexico).

[14] Additional authority under this program is pending in Washington state legislature (see NCSL website).

CASH INCENTIVES

Twenty-five states plus the District of Columbia and the Virgin Islands currently offer some kind of cash incentive that can be claimed at time of purchase or within a short period after purchase. Cash incentives can be structured as fixed value incentives, cost-based incentives, capacity-based incentives, or performance-based incentives, and vary by eligible technology and sector.

In many cases, the cash incentives look very similar in design to the income tax incentives discussed above. The implementation of cash incentives can be more transparent than tax incentives. Cash incentives may also apply to entities that might not otherwise be eligible to claim an income tax incentive (e.g., nonprofits, governments and schools, and entities without a large tax basis).

Cash funds are typically made available on a first-come first-served basis, and may be depleted early in the program year. In this way, cash incentives may not directly substitute for tax incentives. Some states allow recipients to be placed on a waiting list for cash incentives in the following program year, subject to available funds.

FIXED VALUE CASH INCENTIVES

California, Florida, South Carolina, and the Virgin Islands offer fixed value rebates for installation of solar water heating systems (see Table 10). The rebates range from $100 for installation of solar pool heaters in Florida to $1,500 for solar water heating systems in California. South Carolina adopted its fixed value incentive in 2005, with the others to follow in 2006 and 2007. Colorado also offers a rebate program for residential installation of PV that must be matched by local utilities. The Colorado program applies to customers outside the service territory of other utility-financed rebate programs, and was adopted in 2008.

Table 10. Fixed Value Cash Incentives for Purchase and Use

State	Type	Amount	Technology	Eligible Sectors	Effective
CA	Rebate	$1,500	Water heating	Residential and small commercial	2007 (2006)
CO	Rebate	$3,000-$6,000 (matched)	PV	Residential; for certain geographical areas only	2008
FL	Rebate	$100	Water heating—pool	Residential only	2006-2010 (1999)
FL	Rebate	$500	Water heating	Residential only	2006-2010 (1999)
SC	Rebate	$1,000	Water heating	Residential only	2005
VI	Rebate	$500-$1,000	Water heating	Residential and commercial	2008-2009

COST-BASED CASH INCENTIVES

Thirteen states plus the Virgin Islands offer cost-based grants or rebates for purchase of solar technology, ranging from 25% to 90% of installed cost (see Table 11). These incentives have maximum values ranging from $5,000 or under in Maine, Maryland, New York, and Wyoming, to $50,000 in Michigan, Tennessee, Wisconsin, and substantially higher in Illinois, New York, Pennsylvania, and Rhode Island. Some incentives cover labor costs for installation while others do not.

Table 11. Cost-Based Cash Incentives for Purchase and Use

State	Type	Amount (of cost)	Maximum	Technology	Eligible Sectors	Effective
DE	Grant	25%	$200,000	Solar electric and heating	Commercial	2001
DE	Rebate[15]	50%	Varies	Solar electric and heating	Residential, commercial, industrial, agricultural	1999
IL	Grant	30%	$250,000 (min $50,000)	Solar thermal	All	2008
IL	Rebate	30%	$10,000	Solar electric and heating	Residential and non-residential	2008 (2007)
IN	Grant	50%	$25,000	Water heating	Non-residential	?
MD	Rebate	30%	$3,000	Water heating	Residential, commercial, nonprofits	2004
ME	Grant	Varies	100 MW; $50,000	Solar electric	Non-profits, electric cooperatives and municipal corporations	2000
ME	Rebate	30-35%	$2,500-$3,000	Solar heating	Residential	2005-2010
ME	Rebate	30-35%	$10,500	Solar heating	Non-residential	2005-2010
MI	Grant	90%	$50,000	PV and water heating	Commercial, governments, nonprofits, schools	2000
NY	Grant	Varies	Varies	PV and water heating	Non-residential	?
NY	Grant	50%	$5,000	PV and water heating	Low-income residential	?
NY	Rebate	50-75%	$1.65 million for ConEd customers; $850,000 for other customers	Solar heating and daylighting	All but single-unit residential	?-2009

[15] The DE Green Energy Program rebates include three separate rebate programs. One is for the state's only investor-owned utility; one is for the state's municipal-owned utilities; and one is for the DE Electric Cooperative. The DE Green Energy Program is financed by state-mandated customer surcharges on utility bills and is administered by the state Energy Office.

State	Type	Amount (of cost)	Maximum	Technology	Eligible Sectors	Effective
PA	Grant	Varies	$500,000	Solar electric and heating	Governments, nonprofits, schools	2003
PA	Grant	Varies	$25,000 (approximate) (if LEED Silver certified or greater)	All	New schools	2005
RI	Grant	Varies	$500,000	PV and heating	All	2008
TN	Grant	40%	$75,000 (min $5,000)	PV and water heating	Commercial and industrial	2006
VI	Grant	Varies	$20,000	Solar lighting	Nonprofits, schools, governments	?
VT	Grant	Varies	Varies	PV	Commercial	2005
WI	Grant	25%	$50,000 (max 50 kW capacity)	Solar electric and water heating	Residential and non-residential	?-2009
WI	Grant	35%	$50,000 (max 50 kW capacity)	Solar electric and water heating	Nonprofits & governments	?-2009
WI	Rebate	25%	$35,000	PV	Residential, commercial, industrial	?-2009
WI	Rebate	35%	$35,000	PV	Nonprofits & governments	?-2009
WY	Rebate	50%	$3,000	PV	Residential	1996

Most all of the cost-based grants and rebates have been adopted since 2000. The earliest of the current cost-based cash incentive was adopted in 1996 by Wyoming for residential PV installations.[16] The most recent cost-based incentives were adopted in Illinois and Rhode Island in 2008.

CAPACITY-BASED CASH INCENTIVES

Capacity-based incentives are those rebates or grants that are calculated based on the installed capacity of the solar technology. Their design varies primarily by the eligible technology.

CAPACITY-BASED SOLAR HEATING CASH INCENTIVES

California, Florida, Minnesota, and Vermont currently offer capacity-based rebates for solar water heating (see Table 12). Ohio also offers separate residential and non-residential grant programs for solar water heating, which function similarly to rebate programs for eligible grant recipients.

Table 12. Capacity-Based Cash Incentives for Purchase and Use of Solar Water Heating

State	Type	Amount	Maximum	Technology	Eligible Sectors	Effective
CA	Rebate	$15-20 per	$75,000	Water	Large commercial only	2007

[16] Wisconsin had a cash rebate program in place as early as 1981, when all the other states only offered income tax incentives, property tax incentives, or sales tax incentives (see Appendix A).

State	Type	Amount	Maximum	Technology	Eligible Sectors	Effective
		square foot		heating		
FL	Rebate	$15 per kBtu/day	$5,000	Water heating	Multi-unit residential and non-residential	2006-2010 (1999)
MN	Rebate	$30 per square foot	Varies	Water heating	Residential	2008
OH	Grant	$30 per kBtu/day	50% of cost	Water heating	Separate residential and non-residential programs; limited geographic coverage	1999
VT	Rebate	$17.50 per kBtu/day	$8,750	Water heating	Single-unit residential and non-residential	2003
VT	Rebate	$35 per kBtu/day	$35,000 or 50% cost	Water heating	Multi-unit residential, affordable developer	2003

Ohio's current grant program dates back to 1999. The other current capacity-based rebate programs for solar water heating have been adopted since 2003.

CAPACITY-BASED SOLAR ELECTRIC CASH INCENTIVES

Fifteen states plus the District of Columbia and the Virgin Islands now offer some capacity-based grant or rebate incentives for PV (see Table 13). The capacity-based grants and rebates range from $0.45-$6 per watt. Seven programs are limited to small installations (<10 kW), two to larger-scale installations (>200 kW and >500 kW), and two exclude very small installations (>2 kW).

Table 13. Capacity-Based Cash Incentives for Purchase and Use of Photovoltaics

State	Type	Amount (per W)	Maximum	Eligible Sectors	Effective
CA	Rebate	$2.50-$3.25	50 kW in 2008-09; 30 kW in 2010 and after	Residential, commercial, government, nonprofit	2006
CA	Rebate	$2.50-$3.50		Residential	2007 (2006)
CA	Rebate	$3.30-$4.00		Multi-unit residential	2009-2016
CT	Grant	$0.45	65 MW; for distributed baseload projects only	All	2005-2010
CT	Grant	$3.50-$4.75	200 kW (min 10kW)	Commercial, industrial, government, schools	2005-2010
CT	Rebate	$4.30-$5.00	10 kW; $46,500	Residential	2004
CT	Rebate	$5.00	10 kW; $50,000	Government, nonprofits	2004
CT	Rebate	$6.00	10 kW; $60,000	Single-unit residential, affordable developer	2006-2010
CT	Rebate	$6.00	200 kW; $850,000	Multi-unit residential, affordable developer	2006-2010
DC	Grant	$2.50	8 KW; $20,000	Non-residential	2006
DC	Grant	$3.00	3 kW; $9,000	Residential	2006
DC	Rebate	$1.00-$3.00 ($3.00 for 1st 3 kW; $2.00 for 3-10 kW; $1.00 for 10-20 kW)	$33,000 per site per program year (min 1 kW)	Residential, commercial, nonprofit, schools	2009-2012
FL	Rebate	$4.00	$20,000 (min 2 kW)	Residential	2006-2010 (1999)

State	Type	Amount (per W)	Maximum	Eligible Sectors	Effective
FL	Rebate	$4.00	$100,000 (min 2 kW)	Non-residential	2006-2010 (1999)
IL	Grant	$3.00	$250,000 (min $50,000) (if LEED Silver certified or greater)	All	?-2009
IL	Grant	$3.25	$250,000 (min $50,000) (if innovative PV, meaning building integrated or highly efficient)	All	?-2009
IN	Grant	$5.00	5 kW; $25,000	Non-residential	2008
MA	Rebate	$2.00 - $5.50	5 kW or 100% cost	Residential	2008-2011
MA	Rebate	$2.00 - $5.50	500 kW or 100% cost	Non-residential	2008-2011
MD	Rebate	$2.50	$10,000	Residential, commercial, nonprofit	2005 (2004)
ME	Rebate	$2.00	$2,000	Residential and commercial	2005-2010
MN	Rebate	$2.00-$2.25	10 kW; $20,000-$22,500	Residential, commercial, government, nonprofits, schools	2002
NH	Rebate	$3.00	5 kW; $6,000 or 50% cost	Residential	2008
NJ	Rebate	$1.85 - $4.10	20 kW or $245,000	Residential, commercial, government, nonprofits, schools	2001 (1999)
NV	Rebate	$2.30	$11,500-$230,000; 1 MW	Residential and commercial	2004-2010 (2003)
NV	Rebate	$4.60	$11,500-$230,000; 1 MW	Governments, nonprofits, schools, agricultural	2004-2010 (2003)
NY	Rebate	$3.00-$5.00	10 kW	Residential	?-2009
NY	Rebate	$3.00-$5.00	50 kW; $850,000	Non-residential	?-2009
OH	Grant	$3.50	50% costs; $150,000 for traditional systems (min 10 kW), $200,000 for third-party systems (min 50 kW)	Non-residential	1999
VI	Rebate	$3.50	$3,500	Residential and commercial	?-2009
VT	Rebate	$1.75	$8,750	Residential, commercial, government, schools, agricultural	2003
VT	Rebate	$3.50	$350,000 or 50% cost	Multi-unit residential	2003

Examples[17]

The value of capacity-based incentives depends on the incentive rate, the size of the installation, the eligible sector, and any maximum incentive. Consider the effects of these incentives on three sample PV systems.

First, consider a 2 kW PV system for a single-family home. Possible capacity-based incentives for homeowners on this installation would range from $900 in Connecticut (grant) to $10,000 also in Connecticut (rebate). Affordable housing developers in Connecticut could receive up to $12,000 for the same installation on a single-family home. With average costs for a 2 kW system running about $18,000, the value of this incentive would range from 5% to 56% of the cost for a homeowner in all states offering these incentives, and up to 67% of the cost to the affordable-housing developer in Connecticut.

Next, consider a 50 kW PV installation on a commercial building. Possible capacity-based incentives would range in value from $22,500 in Connecticut (grant) to $200,000 in Florida (rebate). With average costs for a commercial installation of this size around $340,000, the value of this incentive would range from 7% to 59% of its cost.

Finally, consider a 500 kW PV installation on an industrial building. Possible incentives would range in value from $225,000 in Connecticut (grant) to $2.3 million in Florida (rebate). With average costs for an installation this size topping $2.45 million, the value of this incentive would range from 9% to 93% of its cost.

Ohio's grant program was adopted in 1999, with the other grant programs being adopted since 2005. The current capacity-based rebate programs date back to New Jersey's in 2001, followed by Minnesota's in 2002, Vermont's in 2003, Connecticut's government and schools rebate in 2004, and the rest since 2005. Oregon's tax credit was adopted in 2007 and Kentucky's tax credit was adopted in 2008. Several state incentive programs are phasing out in early 2009 or have been discontinued, including in Illinois, Indiana, New Jersey, New York, and the Virgin Islands.

PERFORMANCE-BASED CASH INCENTIVES

California, Connecticut and New Jersey offer cash PBIs, somewhat similar to the tax PBIs offered by Florida, Iowa, Maryland, New Mexico, Oklahoma, Oregon, and Washington (see Table 14).

[17] Average installation size and current costs for example PV systems determined by SolarBuzz LLC and reported at http://www.solarbuzz.com/SolarIndices.htm.

Table 14. Performance-Based Cash Incentives for Purchase and Use

State	Type	Amount	Minimum	Maximum	Eligible Technology	Eligible Sectors	Program Maximum	Effective
CA	Rebate	$0.39 per kWh for taxable entities; $0.50 per kWh for governments and nonprofits		Five years only	Solar electric & space heating	All	$2.2 million over 10 years	2006
CA	Incentive paid by utilities	$0.09 - $0.22 per kWh	50 kW	1.5 MW; 10-20 year agreements	Solar electric	Residential, commercial, industrial	500 MW CIC	2008 (2007)
CT	Incentive paid from public benefits fund	$0.055 per kWh + $50,000	1 MW	Long-term agreements	Solar electric	Commercial		2003-2008
NJ	Incentive paid by utilities	$0.46 per kWh (average)			Solar electric	All		2008-2016 (2004)

Many financial incentives work toward compliance with state renewable portfolio standard (RPS) requirements by creating more renewable energy capacity. Performance-based incentives fall on a continuum of being designed implicitly or explicitly toward RPS compliance.

Programs like the California Solar Initiative rebate and the Connecticut Project 150 incentive implicitly work toward RPS compliance. The California Solar Initiative rebate is calculated according to the amount of energy produced from eligible solar electric and space heating technology, for the first five years of use. Installations smaller than 50 kW have the option of participating in this program or in the capacity based cash rebate program while installations larger than 50 kW only have the option of participating in the production incentive rebate program. The program extends to residential, commercial, industrial, governmental, and non-profit purchasers.[18]

Connecticut's Project 150 program requires its public utilities to enter into long-term PPAs for renewable power in order to obtain at least 150 MW of Class 1 renewable energy (includes solar). Pricing under these contracts includes a premium of up to $0.055/kWh. Contracts for eligible projects must be approved by the state's Department of Public Utility Control. The program is financed through the state's public benefits fund and administered by an entity chartered by the state legislature.

[18] The rebate applies to applicants in investor-owned utility territories for Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric. A separate CA law (SB1, effective 1/1/07) requires municipal-owned utilities in CA to adopt their own rebate programs, to complement the CA Solar Initiative.

The California Feed in Tariff (FIT), like the Connecticut program, is mandated by state law but paid for by the utilities. Customer-generators in California can enter into 10-year to 20-year PPAs with their local utilities and receive a payment from the utility of $0.09-0.22 per kWh produced up to 1.5 MW, depending on market prices for electricity. The renewable energy credits (RECs) associated with this energy are then granted to the utility to help them meet the state's RPS requirements of 20% energy sales from renewable sources (e.g., solar, wind, geothermal) by 2010. Customer-generators participating in the FIT cannot participate in other CA incentive programs (e.g., rebates). The CA FIT will be in place until the state reaches 500 MW of cumulative installed solar capacity.

While the California FIT transfers RECs to the utilities for RPS compliance, it does not explicitly use RECs to distribute PBIs. The New Jersey PBI, on the other hand, is an example of an incentive program that is explicitly designed toward RPS compliance. It is essentially an RPS-derived PBI.

New Jersey's RPS requires each utility in the state to produce at least 22.5% of its electricity from renewable sources by 2021. In addition, New Jersey has a "set-aside" for solar, meaning that by 2021, 2.12% of the electricity sold by each provider must come from solar power. To achieve the solar set-aside RPS goals, New Jersey requires its utilities to obtain solar renewable energy certificates (SRECs). SRECs are created with the generation of solar power. Utilities can obtain SRECs (in bundles of 1 MWh) by operating solar power systems or by purchasing SRECs from other solar power generators on a competitive market. If the utility fails to obtain enough certificates equal to the RPS requirement, it must make an alternative compliance payment to the state for the difference. Thus, the state payment effectively sets a maximum price on the certificates, which is currently around $0.71 per kWh. The current average market price for SRECs used for FY2010 compliance is around $0.48/kWh, creating an effective PBI for any solar power producer. SRECs are paid on top of any benefit achieved through electricity purchases foregone or from selling excess electricity to the utility through net metering.

New Jersey has the most developed market for SRECs among the RPS states with solar or distributed generation set-asides. That being said, many other states have active REC markets. Recent trends appear to be moving toward increased use of RECs for RPS compliance and standardization of REC designs and markets so that RECs can be traded among utilities in different states. RPS's that use RECs for compliance essentially create a "de facto" PBI for all applicable renewable technologies (Wiser & Barbose, 2008). However, in the absence of a solar or distributed generation set aside or multiplier, REC markets will drive investment toward the least cost renewable technology – generally wind power – thereby reducing the amount of incentives available to solar power installations.

Other states have PBIs similar in design or function to one of the above-mentioned PBIs but implemented and financed by utilities or entities other than the states. Utility-run PBIs now operate in Alaska, Arizona, California, Colorado, Florida, Minnesota, New Mexico, Oregon, Vermont, and

Wisconsin.[19] In addition, several non-profit administered programs now operate PBIs. For instance, interested parties in North Carolina created the non-profit NC GreenPower in 2003 to oversee a statewide production incentive program. Participating customer-generators receive a payment from NC GreenPower of $0.15 per kWh and a payment from their local utilities of about $0.04 per kWh for solar generated power. Similar non-profit programs now exist in South Carolina through Palmetto Clean Energy, in Rhode Island through People's Power & Light, in Massachusetts through MassEnergy Consumers Alliance, and in the northwestern U.S. (Idaho, Montana, Oregon, and Washington) through Northwest Solar Cooperative. Several of these programs have funding conditional on utility customers' voluntary purchase of "green" electricity.

OTHER CASH INCENTIVES

Two states also offer cash incentives of undisclosed sizes. For instance, Alaskan power producers or governments desiring to construct renewable energy projects can apply to the state for grants to cover feasibility, planning, design, and/or construction costs. Grants are recommended each year by the Alaska Energy Authority but awarded by the state legislature. The program was adopted in 2008 and will be in place through 2013.

The Massachusetts Technology Collaborative (the state's economic development agency) offers matching grants to communities to fund clean energy projects when its residents purchase power from projects eligible for the state's renewable portfolio standard. The matching grant program was adopted in 2004 and currently disburses $2.5 million per year.

[19] Local power distributors of electricity produced by the Tennessee Valley Authority (TVA), a federally owned power provider in the Southeastern U.S., also provide PBIs to customer-generators ($0.15 per kWh for residential and small commercial; $0.20 per kWh for large commercial).

SALES TAX INCENTIVES

Eighteen states plus Puerto Rico currently have 100% sales tax exemptions or refunds for purchase of customer-sited solar technology (see Table 15).[20] Colorado allows its cities and counties to offer local sales tax exemptions. Five states–Alaska, Delaware, Montana, New Hampshire, and Oregon—also do not levy state sales taxes.

Table 15. Sales Tax Incentives for Purchase and Use

State	Amount	Maximum	Eligible Technology	Eligible Sectors	Effective
AZ	100% exemption	Removed 1996	All	Residential and commercial	1997-2010 (before 1996)
CO	Local option		Solar electric	Residential, commercial, industrial, agricultural	2007
CT	100% exemption		PV and solar heating	Residential and commercial	2007
FL	100% refund		PV and solar heating (including pools)	Residential and commercial	1997
IA	100% exemption		Solar electric and heating	Residential, commercial, agricultural	2006
ID	100% refund if greater than 25 kW		Solar electric	Residential, commercial, industrial	2005-2011
KY	100% exemption	50% cost (minimum 50 kW)	Solar electric	Commercial	2008 (2007)
MA	100% exemption		PV and solar heating	Residential	1977
MD	100% exemption		Solar electric and heating	Residential and commercial	2008
MN	100% exemption		PV and solar heating	Residential and commercial	2005
NJ	100% exemption		All	Residential and commercial	1980
NY	100% exemption		Solar electric and heating	Residential	2005
OH	100% exemption		Solar electric and heating	Commercial and industrial	?
PR	100% exemption		Solar electric and heating	Agricultural	?
PR	100% exemption		Solar electric	Residential and commercial	2008

[20] Eight states offered sales tax exemptions and three states offered sales tax refunds for residential solar purchases in 1981 (see Appendix A).

State	Amount	Maximum	Eligible Technology	Eligible Sectors	Effective
RI	100% exemption		Solar electric and heating (including pools)	Residential and commercial	2005
UT	100% exemption (for purchase or lease if 7 years or more)		Solar electric	Commercial and industrial	2004-2019
VT	100% exemption	250 kW for electric	Solar electric and water heating	Residential, commercial, agricultural	1999
WA	100% exemption		PV and water heating	Residential and commercial	?-2009
WY	100% exemption		Solar electric	Commercial and industrial	2003-2012

In most of the states, the sales tax incentives apply to residential and commercial or industrial installations, although some are limited only to commercial (e.g., Kentucky, Utah, Wyoming) and some are limited only to residential (e.g., Massachusetts, New York). Sales tax incentives usually cover PV and other solar electric technology, although solar water heating and especially solar pool heating may be excluded (e.g., Maryland, New York). Idaho's program only applies to purchases of solar technology with more than 25 kW in capacity.

Examples

The value of state sales tax incentives depends on sales tax rates in effect. Current rates range from 4% in New York and Wyoming to 7% in New Jersey and Rhode Island.

For a 2 kW residential PV system valued at $18,000, the sales tax savings would range from $720 to $1,260. For a 50 kW commercial system valued at $339,000, the savings would range from $13,560 to $23,730. In addition, for a 500 kW industrial system valued at $2.45 million, the savings would range from $98,160 to $171,780.

Massachusetts was the first of the states with current sales tax incentives for solar to adopt in 1977.[21] Many of the programs have been adopted since 2003.

[21] Texas adopted a sales tax incentive in 1975, Georgia adopted a local option incentive in 1976, and Michigan adopted two incentives in 1976. These programs are no longer in effect (*State solar legislation*, 1977).

PROPERTY TAX INCENTIVES

Some of the oldest incentives for customer-sited solar technology are administered through the property tax.[22] Twenty-nine states plus Puerto Rico currently offer some form of property tax incentive (see Table 16). These incentives generally vary by type, eligible sectors, and eligible technology. The programs can also vary by other factors (e.g., whether the incentive applies to real or personal property, whether it applies to all or some property taxes).

Table 16. Property Tax Incentives for Purchase and Use

State	Description	State levies own property taxes?	Applies to state or local property taxes?[23]	Eligible Technology	Eligible Sector	Effective
AZ	100% permanent exemption	Yes		All	Residential, commercial, industrial	2006 (1974)
AZ	Assess at 20% appreciated cost	Yes		PV	Power producers	?-2040
CA	100% exemption	Yes		Solar electric and heating	Residential, commercial, industrial	1999-2016
CO	Assess as conventional equipment	No	Local	Solar electric	Utility-scale power producer	2006 (2001)[24]
CO	Local option	No	Local	Solar electric	Residential, commercial, industrial, agricultural	2007
CT	100% permanent exemption	Yes		PV and solar heating	Residential, commercial, industrial, agricultural	2007
CT	Local option- assess as conventional equipment, 15 years	Yes	Local	Solar heating	Residential, commercial, industrial, agricultural	2007 (1976)

[22] By 1981, twenty-eight states offered property tax exemptions for residential solar, one state offered a partial exemption, and six had local-option property tax exemptions (see Appendix A).

[23] Local property taxes of some form are collected in all states. Most states also collect state property taxes, although twelve states plus the District of Columbia do not, according to the Tax Foundation. Seven of the twelve states without state property taxes do offer some form of property tax incentive for solar technology. Twenty-two of the remaining states (plus Puerto Rico) collect state property taxes and have property tax incentives for solar technology. It is not clear whether the property tax incentives in some of these twenty-two states apply to state property taxes only, local property taxes only, or to both state and local property taxes. Where unclear, additional information is being sought from the state tax offices.

[24] In 1975, Colorado adopted a property tax incentive directing solar equipment to be assessed at 5% of its value. This incentive is no longer in effect.

State	Description	State levies own property taxes?	Applies to state or local property taxes?[23]	Eligible Technology	Eligible Sector	Effective
FL	100% permanent exemption	Yes		PV and water heating	Residential, commercial, industrial	2009 (2008)
HI	100% exemption	No	Local	All	All	2004-2014 (1976-1981)
IA	100% exemption for 5 years	No	Local	Solar electric and heating	Residential, commercial, industrial, agricultural	1978
IL	Assess as conventional equipment	Yes		PV and solar heating	Residential, commercial, industrial	1975
IN	100% permanent exemption	Yes		Solar heating	Residential, commercial, industrial	1975 (1974)
KS	100% permanent exemption	Yes		Solar electric	Residential, commercial, industrial	1999
LA	100% permanent exemption	Yes		PV and solar heating (including pools)	Residential	1978
MA	100% exemption for 20 years	Yes		Solar electric and heating	Residential, commercial, industrial, agricultural	1975
MD	100% permanent exemption	Yes	State and local	PV and water heating	Residential, commercial, industrial	2008
MD	Assess as conventional equipment	Yes		Space heating	Residential, commercial, industrial	2008 (1975)
MD	Local option- exemption if LEED Silver or greater	Yes	Local	PV and solar heating	Commercial, industrial	2004
MD	Local option- tax credit	Yes	Local	Solar electric and heating	Residential, commercial, industrial, agricultural	1976 (1975)
MN	100% permanent exemption	Yes	State	PV	Residential and commercial	1992
MT	50% reduction for 5 years; reduced each year until no reduction in 10th year (subject to local approval)	Yes		Solar electric	Power providers (minimum 1 MW)	1989

State	Description	State levies own property taxes?	Applies to state or local property taxes?[23]	Eligible Technology	Eligible Sector	Effective
MT	100% exemption for 5 years	Yes		Solar electric	Power providers (less than 1 MW)	2001
MT	100% exemption for 10 years; up to $20,000; $100,000 if multi-unit residential	Yes		Solar electric and heating	Residential, commercial, industrial, agricultural	2005
NC	80% exemption	No	Local	PV	Residential, commercial, industrial, agricultural	2008
NC	Assess as conventional equipment	No	Local	Solar heating	Residential, commercial, industrial	1977
ND	100% exemption for 5 years	Yes	Local	Solar electric and heating	Residential, commercial, industrial (non-utility)	2007 (1975)
NH	Local option	Yes	Local	PV and solar heating	Residential	1976 (1975)
NJ	100% permanent exemption	Yes	Local	Solar electric and heating	Residential, commercial, industrial	2008
NV	25% abatement for LEED Silver, 30% for LEED Gold, 35% for LEED Platinum	Yes		PV and solar heating	Commercial, industrial	2007
NV	50% abatement for 10 years (min 10 kW)	Yes		Solar electric	Commercial	1997-2009
NV	100% permanent exemption	Yes		PV and solar heating	Residential, commercial, industrial	1983 (1975)
NY	Local option- 100% exemption for 15 years	No	Local	Solar electric, heating , and daylighting	Residential, commercial, industrial, agricultural	1991-2010 (1977)
NY	Varies; up to $62,500 per year or tax owed (for buildings in NY cities with more than 1 million residents)	No	Local	PV	All	2008
OH	100% permanent exemption	Yes		Solar electric and heating	Commercial and industrial	1978
OR	100% permanent exemption	Yes		Solar electric and heating (including pools)	Residential, commercial, industrial (non-utility)	2007-2012 (1975)

State	Description	State levies own property taxes?	Applies to state or local property taxes?[23]	Eligible Technology	Eligible Sector	Effective
PR	100% permanent exemption			PV and heating (including pools)	Residential, commercial, industrial, agricultural	2008
RI	Local option	Yes	Local	PV and solar heating	Residential, commercial, industrial, agricultural	1980
RI	Assess as conventional equipment	Yes	Local (municipal)	PV and solar heating	Residential	?
SD	100% exemption for 3 years, partial for 3 more years	No	Local	Solar electric and heating	Residential	1975
SD	50% exemption for 3 years, partial for 3 more years	No	Local	Solar electric and heating	Commercial (non-utility)	1975
TX	100% permanent exemption	No	Local	Solar electric and heating (including pools)	Residential, commercial, industrial (on-site use only)	1981
VA	Local option	Yes	Local	Solar electric and heating	Residential, commercial, industrial	1977 (1976)
VT	Local option	Yes	Local	Solar electric and heating	Residential, commercial, industrial, agricultural	1976
WI	100% permanent exemption	Yes		Solar electric and heating (including pools)	Residential, commercial, industrial	1981

Sixteen states plus Puerto Rico offer a full and permanent property tax exemption for customer-sited solar technology. A full exemption means that taxpayers do not have to pay property taxes on the assessed value of solar technology. Five more states offer a full exemption for a limited time after installation (ranging from 5 to 20 years). Two states provide less than full exemptions for solar technology. Four states require that solar technology be assessed the same as comparable conventional technology (i.e., a solar hot water heater would be assessed the same as a conventional hot water heater powered by electricity or natural gas).

Eight states allow their municipalities to offer property tax incentives. These "local option" programs are designed and implemented by the municipalities. Thus, these local options act as enabling legislation but do not ensure action on the part of local municipalities (except for New York where cities and counties have to opt-out of providing the incentive). In New Hampshire, 77 cities and towns have

adopted customer-sited property tax incentives (out of 13 cities and 221 towns). Twenty-one cities and counties in Virginia have adopted incentives (out of 39 cities and 95 counties). In Maryland, five counties (out of 24) have so far adopted property tax incentives (Anne Arundel, Harford, Howard, Montgomery, and Prince George's), covering much of Maryland's property within the Washington and Baltimore metropolitan areas.

Many of the customer-sited property tax incentives apply to residential, commercial, and industrial installations. Several programs also apply to agricultural installations (Iowa, Maryland, Massachusetts, Montana, New York, North Carolina, Rhode Island, and Puerto Rico; plus Connecticut's solar heating incentive). Louisiana, New Hampshire, and Rhode Island limit their programs to residential installations, and Ohio limits its program to commercial or industrial installations.

Most of the customer-sited property tax incentives apply both to solar electric and solar heating technology, although there is some variation. Maryland and North Carolina have separate incentive programs for solar electric and solar heating. Indiana's program only applies to solar heating. Programs in Colorado, Kansas, Minnesota, and New York only apply to solar electric technology.

Arizona, Colorado, Montana, and Nevada also offer property tax incentives for large-scale solar generation. Montana's program offers a 100% exemption from property taxes on solar generation systems less than 1 MW in size for 5 years. Montana also offers 50% tax abatement on larger systems for 5 years, with declining abatements in years 6-10, subject to local approval. Nevada offers 50% property tax abatement for 10 years. Taxable property for energy producers in Arizona is assessed at 20% of the depreciated cost of the solar electric system. Finally, Colorado assesses solar generation technology the same as conventional generation systems for local property tax purposes, with current rates of $420-$1,008/kW, depending on size.

Arizona and Indiana first adopted property tax incentives in 1974, followed by ten states in 1975, and six more in 1976 (*State solar legislation*, 1977). Eight more states adopted property tax incentives between 1977 and 1981. Several states adopted new or revised incentives after 1981, with a concentration of activity again in 2007 and 2008.

FINANCING INCENTIVES

Twenty-nine states currently offer financing for the initial purchase of solar technology (see Table 17). State programs vary widely, depending on eligible entities, eligible technologies, and financing terms.

Table 17. Financing Incentives for Purchase and Use

State	Type	Amount	Maximum	Program Maximum	Eligible Technology	Eligible Sector	Effective
AK	Loan	Varies (interest rate tied to municipal bonds)			Solar electric and heating	Small scale energy providers (commercial, government, utility)	?
AL	Loan	0% interest, 10-year	$350,000 (municipal and county governments), $500,000 (schools)		PV and solar heating	Government, schools	?
CA	Loan	3.2% interest, 7-year	$500,000	$3 million	Solar electric and water heating	Commercial, agricultural	?
CT	Lease	$120/month average (variable monthly cost depending upon system size)	15 years	$38.6 million	PV	Residential	2008
CT	Loan	1-6% interest, 10-year	$25,000 ($60,000 for multi-unit residential with more than 4 units)		PV and solar heating	Residential	?
CT	Loan	Fixed rate no greater than prime rate, 10-year	65 MW (50 kW minimum)	$150 million	PV	All	2005
CT	Loan	Varies (25% cost share required)	$750,000	$4 million (2008-2010)	Solar electric	Commercial	2005-2010
HI	Loan	1% interest, 40-year	85% of system costs or $1.5 million		PV	Agricultural	2008
IA	Loan	0% interest, 20-year	50% of project costs or $1 million		Solar electric and heating	Residential, commercial, industrial	1996
IA	Loan	Varies			Solar electric and heating	Government, nonprofits	1986

State	Type	Amount	Maximum	Program Maximum	Eligible Technology	Eligible Sector	Effective
ID	Bond	Varies			Solar electric	Non-utility energy providers	2005
ID	Loan	4% interest, 5-year	$100,000		PV and solar heating	Residential, commercial, government, agricultural	?
KS	Loan	0% interest	50% of costs or $10,000	$2 million	PV and solar heating	Residential	?
LA	Loan	2% interest	50% of costs pr $6,000		PV and solar heating	Residential	?
MA	Loan	0% interest, 7-year	$10,000		Water heating	Residential	?[25]
MD	Loan	0% interest			All	State government	1991
ME	Loan	3.95% interest, 15-year	$30,000		Water heating	Residential	2006
MN	Loan	6% interest, 20-year	$35,000		PV and water heating	Residential	?
MO	Loan	0.5% interest, 20-year; bond rate, 15-year	$1 million	$3.8 million	PV and solar heating	Government, schools	1989
MS	Loan	3% below prime rate, 7-year	$300,000	$7 million	Solar electric and heating	Commercial, industrial	1989
MT	Loan	5% interest, 10-year	$40,000		PV and water heating	Residential, commercial, government, nonprofits, schools	2001
NC	Loan	1% interest, 10-year			Solar electric and heating	Commercial, industrial, government, nonprofits, schools	2001
NE	Loan	5% interest, 15-year	$75,000 residential; $175,000 non-residential		PV and solar heating	Residential, commercial, government, nonprofits, agricultural	?
NH	Loan	1% below prime rate, 7-year	($10,000 minimum)		Solar electric and water heating	Commercial	?
NM	Bond	Varies	$20 million		All	Government, schools	2005

[25] Massachusetts first authorized banks and credit unions to offer loans for solar systems in 1977.

State	Type	Amount	Maximum	Program Maximum	Eligible Technology	Eligible Sector	Effective
NY	Loan	4% below prime rate, 10-year			PV and water heating	All	?
NY	Loan	5.99% interest			PV and water heating	Residential (1-2 family, owner-occupied)	?
OK	Loan	3% interest, 6-year	$150,000 government; $200,000 per school district; $300,000 higher education	$1 million	PV and solar heating	Government, schools, higher education	?
OR	Loan	Varies			Solar electric and heating	All	1980
PA	Loan	Varies	Varies	$20 million	PV and water heating	Residential	?
RI	Loan	Varies	$500,000		Solar electric and heating	All	2008
SC	Loan	Varies	$250,000		PV and water heating	All	2007
TN	Loan	0-3% interest, 7-year	$300,000		Solar electric and heating	Commercial, industrial	1987
TX	Loan	3% interest, 10-year	$5 million	$98.6 million	PV and solar heating	Government, schools	?
VT	Loan	2% interest	$1 million		Solar electric	Residential, commercial, government, nonprofits	2005

Three states offer a reduction in market interest rates for new loans (Mississippi, New Hampshire, and New York) of 1% to 4%. Five states offer 0% interest rates (Alabama, Iowa, Kansas, Maryland, and Massachusetts). Sixteen more states offer loan interest rates up to 6% (California, Connecticut, Hawaii, Idaho, Louisiana, Maine, Minnesota, Missouri, Montana, New York, North Carolina, Nebraska, Oklahoma, Tennessee, Texas, Vermont). Connecticut, Iowa, Oregon, Pennsylvania, Rhode Island, and South Carolina have loan programs with varying terms for small-scale projects. Alaska offers loans to small-scale public or private producers, tied to municipal bond rates. Idaho and New Mexico offer bond financing. Idaho's program applies to non-utility providers of energy, and New Mexico's program applies to state government buildings and schools.

Eight states offer loans with maximum borrowing amounts less than $100,000, generally targeted for use in residential properties. The remaining state loan programs have higher limits, although several programs are designed only for government or school buildings (e.g., Alabama, Oklahoma, Missouri, and Texas).

Information is not readily available on effective dates for all financing programs. Of those available, Oregon's loan program began in 1980, followed by programs in Iowa in 1986, Tennessee in 1987, and Missouri and Mississippi in 1989. Recent loan programs have been adopted in South Carolina (2007), Hawaii (2008), and Rhode Island (2008). The two bond programs were adopted in 2005.

APPENDIX C: SUMMARY OF INCENTIVES FOR R&D, MANUFACTURING, OR SALES

Although most financial incentives for solar technology are used to encourage purchase and use, twenty-one states plus Puerto Rico offer some financial incentive for research & development (R&D), manufacturing, or sales of solar technology (see Table 18). These incentives vary widely by design, and include tax credits, property tax incentives, grants, and loans.

Table 18. States Currently Offering Financial Incentives for R&D, Manufacturing, or Sales

State	Personal Income Tax	Corporate Income Tax	Cash	Sales Tax	Property Tax	Financing
CO			Y			
CT			Y			
DE			Y	N/A		
FL	N/A		Y			
HI		Y				
IA			Y			
IL			Y			
MA	Y	Y				Y
MI		Y			Y	
MT	Y	Y		N/A	Y	
NC			Y			
NM		Y				
NY			Y			
OR		Y				
PA			Y	N/A		
PR		Y			Y	
SC			Y			
TX	N/A	Y				
VA			Y			
VT			Y			
WA	N/A	Y				
WI			Y			Y

Y = yes; N/A = not applicable.

Note: table does not include incentives offered by utilities, nonprofits, local governments, or other entities.

INCOME TAX (OR EQUIVALENT) INCENTIVES

Eight states plus Puerto Rico offer some form of income or income-related tax incentive to encourage R&D, manufacturing, or sales of solar equipment (see Table 19). There is little commonality across states in the design of these income tax or equivalent incentives, reflecting unique situations in each state. The earliest of the current tax incentives for R&D, manufacturing, or sales was adopted by Massachusetts in 1979 and Texas in 1982.[26] The others were adopted after 2000.

Table 19. Income Tax Incentives for R&D, Manufacturing, or Sales

State	Type	Description	Amount	Maximum	Effective (First Adopted)
HI	Corporate tax credit	100% tax credit on equity investments in companies that conduct research on renewable energy technologies	Varies	$2 million over 5 years	2001-2010
MA	Personal and corporate excise tax deduction	Deduction of income from sales or lease of patent; or from sales or lease of property or manufactured materials subject to patent	100%	5 years from issuance of patent	1979
MI	Business payroll tax credit	To support R&D	100%		2003 (2002)
MI	Business tax credit	To support R&D and manufacturing	Varies	Varies	2002 (1976)
MT	Personal or corporate tax credit	Reduction of liability for manufacturing plant or for income from energy produced on-site	35%	(min $5,000)	2002 (2001)
NM	Corporate tax credit	For manufacturing	Varies	5% qualified expenditures	2007 (2006)
NM	Corporate tax deduction	Deduction of gross receipts from sale and installation of solar energy systems	100%		2007
OR	Corporate tax credit	For manufacturing	50% (10% per year for 5 years)	$20 million	2008-2015 (1979)
PR	Corporate tax credit	For R&D and manufacturing	4% fixed income tax rate for 15 years; 50% credit for R&D		2008
TX	Franchise tax (i.e., corporate) exemption	For manufacturing, sales, and installation	100% exemption		1982 (1975)

[26] Texas first adopted a business tax exemption for manufacturing, sales, and installation in 1975 and Michigan first adopted an exemption of receipts from sales of solar technology in 1976 (*State solar legislation*, 1977).

State	Type	Description	Amount	Maximum	Effective (First Adopted)
WA	Business and occupation tax abatement	For manufacturing	40% tax abatement		2005-2014

CASH INCENTIVES

Thirteen states currently offer cash incentives for R&D, manufacturing, or sales of solar technology (see Table 20).[27] The cash incentives vary idiosyncratically, with some fixed cost (Connecticut), some cost-based (Delaware and Wisconsin), and some capacity-based (Virginia).

Table 20. Cash Incentives for R&D, Manufacturing, or Sales

State	Type	Description	Amount	Maximum	Program Maximum	Effective
CO	Grant	To attract renewable energy product manufacturers	Varies		$650,000 est. 2008	2007
CT	Grant	For pre-commercial technology development	$10,000		$50,000 per year	?
DE	Grant	For R&D	35% cost	$250,000	10% available funding from PBF	1999
FL	Grant	For demonstration, commercialization, and R&D	Varies		$15M for FY08-09	2006
IA	Grant	For R&D	Varies			1990
IL	Grant	To support business development activities for renewable energy businesses and manufacturers	Varies	$1 million		?-2009
NC	Grant	For R&D and commercialization	Varies	$100,000		2007
NY	Grant	For business development	Varies	$200,000 (with 50% cost-share)	$6.4 million	?-2010
NY	Grant	For manufacturing and pre-production development	Varies	$1.5 million	$10 million	?-2011
PA	Grant	For R&D and manufacturing	Varies	$1 million	$11 million (2008)	1982
SC	Grant	For planning or R&D (matching)	Varies	$10,000 for planning; $200,000 for R&D (up to 50% costs)		2007
VA	Grant	For in-state production of PV panels	Up to $0.75/W	6 MW	$4.5 million per year	1996 (1995)
VT	Grant	For development and deployment	Varies			2005
WI	Grant	For business development and marketing	50%	$10,000 per project ($500,000 per individual or business)		?

[27] A bill is currently pending before the California state legislature that would provide new cash incentives for solar manufacturers (see NCSL website).

State	Type	Description	Amount	Maximum	Program Maximum	Effective
WI	Grant	For R&D	$100,000-$500,000 per project (with 50% cost-share)		$15 million per year for grants and loans	2008-2010

Pennsylvania's grant program for R&D and manufacturing dates back to 1982, Iowa's grant program for R&D dates back to 1990, Virginia's to 1996, and Delaware's to 1999. The remaining state cash incentives for R&D, manufacturing, or sales have been adopted since 2000.

PROPERTY TAX INCENTIVES

Montana, Michigan, and Puerto Rico currently offer property tax incentives for R&D, manufacturing, or sales of solar technology (see Table 21). Montana allows a 50% abatement of property taxes, up to 19 years for manufacturing facilities or $1 million for R&D. Puerto Rico provides an abatement of 90% and Michigan provides an abatement of 100% of property taxes for R&D and manufacturing facilities. All three programs have been adopted since 2000.

Table 21. Property Tax Incentives for R&D, Manufacturing, or Sales

State	Type	Description	Amount	Maximum	Effective
MT	Property tax abatement	For new production and manufacturing facilities and R&D	50%	19 years for facilities; $1 million for R&D	2007
MI	Property tax exemption	For R&D and manufacturing (2 MW maximum)	100%		2003-2012
PR	Property tax exemption	For R&D and manufacturing	90%		2008

FINANCING INCENTIVES

Finally, Massachusetts and Wisconsin offer loan incentives for R&D or manufacturing (see Table 22). The loan programs have also been adopted since 2000.

Table 22. Financing Incentives for R&D, Manufacturing, or Sales

State	Type	Description	Amount	Maximum	Program Maximum	Effective
MA	Loan	For early-stage development	Varies	$500,000		2004
MA	Loan	To support manufacturing	Varies	$500,000- $3 million (up to 50% capital expenses)		2007
WI	Loan	For commercialization and supply-chain development	4% fixed rate loans up to 15 years		$15 million per year for grants and loans	?

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