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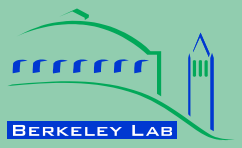

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Evaluating State Markets for Residential Wind Systems: Results from an Economic and Policy Analysis Tool

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National Renewable Energy Laboratory

December 2004

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Evaluating State Markets for Residential Wind Systems: Results from an Economic and Policy Analysis Tool

Prepared for the
Wind & Hydropower Technologies Program
Assistant Secretary for Energy Efficiency and Renewable Energy
U.S. Department of Energy

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Acronyms and Abbreviations

AEO	Annual Energy Outlook
AWEA	American Wind Energy Association
Berkeley Lab	Lawrence Berkeley National Laboratory
BTC	break-even turnkey cost
IRR	internal rate of return
ITC	income tax credit
LCOE	levelized cost of energy
NREL	National Renewable Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
O&M	operation and maintenance
PG&E	Pacific Gas and Electric Corporation
SP	simple payback
SWAT	Small Wind Analysis Tool
TVA	Tennessee Valley Authority
USDA	United States Department of Agriculture

Executive Summary

The market for small wind systems in the United States, often defined as systems less than or equal to 100 kW that produce power on the customer side of the meter, is small but growing steadily. The installed capacity of domestic small wind systems in 2002 was reportedly 15-18 MW, though the market is estimated to be growing by as much as 40 percent annually (AWEA, 2002). This growth is driven in part by recent technology advancements and cost improvements and, perhaps more importantly, by favorable policy incentives targeted at small wind systems that are offered in several states.

Currently, over half of all states have incentive policies for which residential small wind installations are eligible. These incentives range from low-interest loan programs and various forms of tax advantages to cash rebates that cover as much as 60 percent of the total system cost for turbines 10 kW or smaller installed in residential applications. Most of these incentives were developed to support a range of emerging renewable technologies (most notably photovoltaic systems), and were therefore not specifically designed with small wind systems in mind. As such, the question remains as to which incentive types provide the greatest benefit to small wind systems, and how states might appropriately set the level and type of incentives in the future. Furthermore, given differences in incentive types and levels across states, as well as variations in retail electricity rates and other relevant factors, it is not immediately obvious which states offer the most promising markets for small wind turbine manufacturers and installers, as well as potential residential system owners.

This paper presents results from a Berkeley Lab analysis of the impact of existing and proposed state and federal incentives on the economics of *grid-connected, residential* small wind systems. Berkeley Lab has designed the Small Wind Analysis Tool (SWAT) to compare system economics under current incentive structures across all 50 states. SWAT reports three metrics to characterize residential wind economics in each state and wind resource class:

- Break-Even Turnkey Cost (BTC): The BTC is defined as the aggregate installed system cost that would balance total customer payments and revenue over the life of the system, allowing the customer to "break-even" while earning a specified rate of return on the small wind "investment."
- Simple Payback (SP): The SP is the number of years it takes a customer to recoup a cash payment for a wind system and all associated costs, assuming zero discount on future revenue and payments (i.e., ignoring the time value of money).
- Levelized Cost of Energy (LCOE): The LCOE is the levelized cost of generating a kWh of electricity over the lifetime of the system, and is calculated assuming a cash purchase for the small wind system and a 5.5 percent real discount rate.

This paper presents SWAT results for a 10 kW wind turbine and turbine power production is based on a Bergey Excel system. These results are not directly applicable to turbines with different power curves and rated outputs, especially given the fact that many state incentives are set as a fixed dollar amount, and the dollar per Watt amount will vary based on the total rated turbine capacity.

This analysis covers state incentives that directly affect the cash flow of residential customers that purchase and install a small wind system. Table ES-1 below summarizes the state incentives covered in this analysis. The SWAT analysis includes all state incentives that were in place in January of 2004. However, limited funds mean that incentives will not be continuously available to all customers.[1]

Table ES-1. State Small Wind Financial Incentives Included in this Analysis

Incentive Type	Number of Programs	States with Programs
Cash Incentives[2]	10	CA, DE, IL[a], MT, NJ, NY, RI, TN, VT, WI
Income Tax Credits or Deductions	11	AZ, CA, HI, ID, MA, MT, NC, ND, OR, RI, UT
Property Tax Exemptions	11	IN, KS, MN, MT, NV, NY, ND, OR, SD, TX, WI
Sales Tax Exemptions	9	AZ, IA, MA, MN, NV, NJ, RI, VT, WA
Low-Interest Loan Programs	10	CT, ID, IA, MN, MT, NE, NY, OH, OR, WI

[a] At the time of this analysis Illinois was rewriting a state grant program that had historically included 10 kW wind systems, but it has since been determined that wind systems will not be eligible for this program. This program is included in the SWAT analysis presented in this paper, but these results will present a more attractive environment for small wind in Illinois than is currently the case without the grant program.

In addition to the state incentives listed in Table ES-1, there are other financial mechanisms available to residential customers that could improve the economics of a small wind investment. Most notably, tradable renewable certificates are expanding as a market-based mechanism that places added value on the clean energy generated from a wind system. Tradable renewable certificates are not included in this analysis, which instead focuses on more direct state-based incentives.

The major findings and conclusions from the Berkeley Lab SWAT analysis are outlined below.

Small Wind Economics Are Highly Variable Across States

Figure ES-1 below shows results for the BTC of this 10 kW small wind system in the 25 states with the most favorable economics, for wind Classes 2 through 4. Results show that the economics of small wind systems are highly variable across states. Today's typical installed costs of $4.00 - $5.00/Watt for a 10 kW turbine are not generally economically competitive, and only a handful of states could support aggregate system installed costs of over $2.50/Watt. The most economically attractive states, such as New York, California, and New Jersey, are states

[1] For example, Vermont had subscribed all of its funds for the state cash incentive program by August of 2004.
[2] Cash incentives include capital rebates provided upon system installation and production-based incentives that are paid based on a system's kilowatt-hour production over time.

with favorable cash incentive programs in place. New York, the most attractive small wind market in terms of system BTC, could economically support 10 kW residential wind systems that cost over $5.00/Watt in Class 3 wind resource areas.

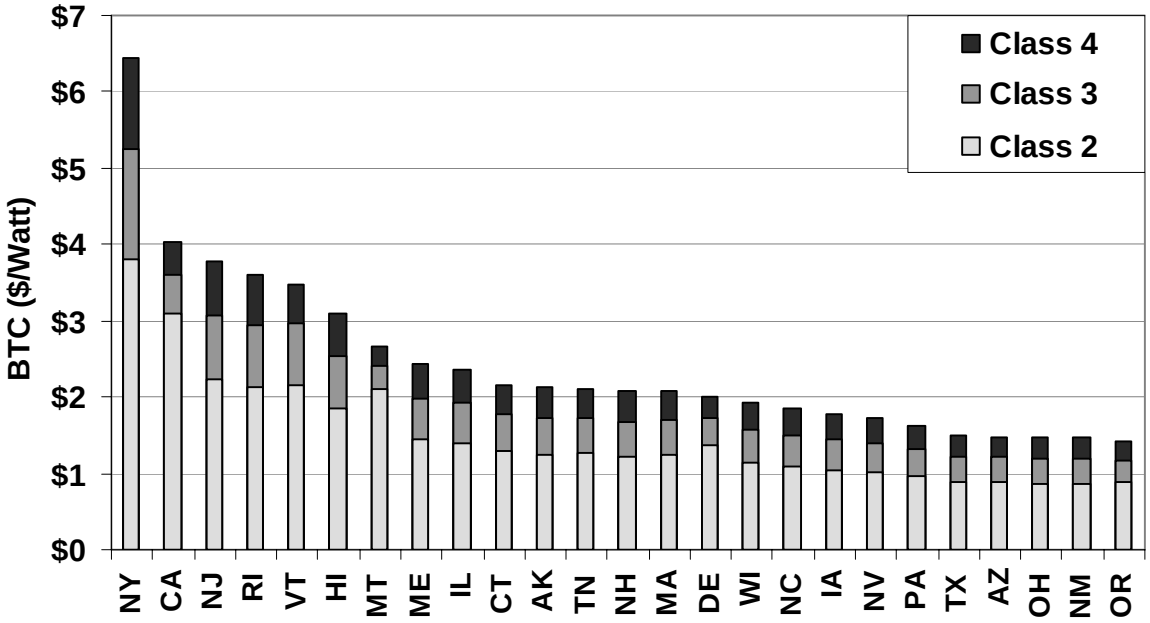

Figure ES-1. BTC Results for SWAT Base-Case Scenario

State Financial Incentives Help Drive the Small Wind Market

The variation of small wind economics across states is due in large part to the availability and structure of state financial incentives. Figure ES-2 shows the resulting state BTC without any state incentives in place, for the 28 states that currently offer some form of financial incentive for residential wind systems. Results show that the BTC of a small wind system is significantly reduced when no financial incentives are available. The states where financial incentives make the largest difference (as a percentage increase over a case with no incentives) tend to be states where multiple incentives are available.[3] Without state financial incentives, a high retail electricity rate is the primary driver of high system BTC, such as in Hawaii, California, and several states in the Northeastern U.S. Note, however, that high retail rates alone, without additional state incentives, are unlikely to support 10 kW wind systems that cost more than $2.00/Watt, as shown in Figure ES-2.

[3] For example, New York and Montana offer a cash rebate, a property tax exemption, and a low-interest loan program, and Montana additionally offers an income tax credit.

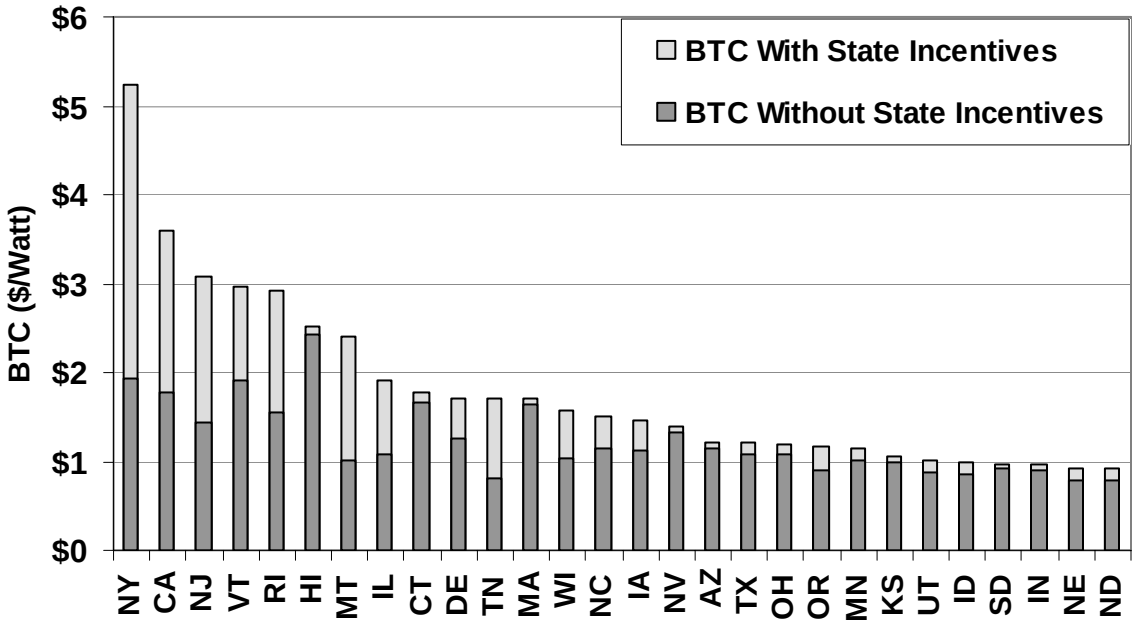

Figure ES-2. BTC With and Without State Financial Incentives (Class 3 Resource)

States with cash incentives (either up-front capital rebates or production-based incentives) provide the most economically attractive environment to small wind system owners. Figure ES-3 shows that in those states with aggressive cash incentive programs, state cash incentives can contribute over half of the system BTC. Figure ES-3 shows the BTC with and without cash incentive programs, for the 10 states with cash incentive programs in place (including Illinois, which historically had a grant program available for 10 kW wind systems).

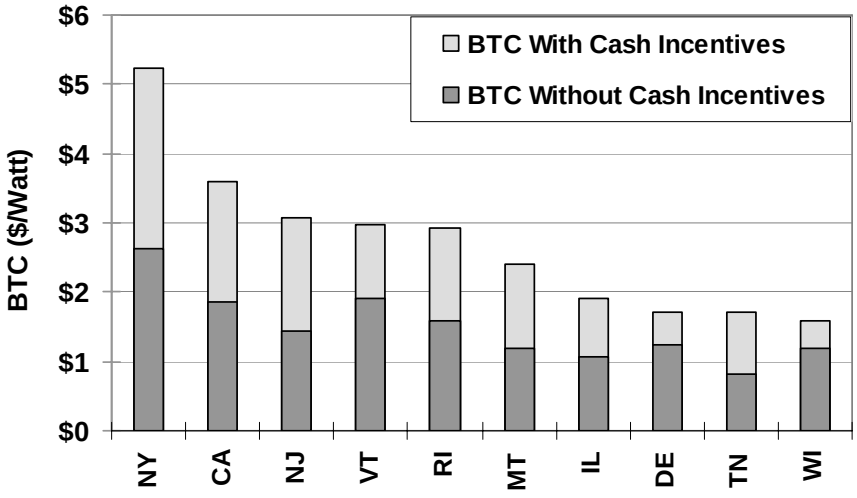

Figure ES-3. BTC With and Without Cash Incentives (Class 3 Resource)

State property tax exemptions, income tax credits (ITCs), and low-interest loan programs are also important contributors – though less so than cash incentives – to an increased BTC in many states. Property tax payments on residential wind systems, when required, can reduce the BTC of 10 kW small wind systems by $0.75 to $1.00/Watt over the system lifetime, though property tax rates are highly variable and total payments are lower in most states. In this analysis, existing state ITCs are generally shown to be too low to have much of an impact on customer BTC, often because the dollar caps on state ITC programs are limiting for this 10 kW system. Dollar caps would be less limiting (on a $/Watt basis) for smaller systems. North Carolina offers the most favorable ITC program at 35 percent of the system cost and a high maximum cap of $10,500. This credit, however, increases the customer BTC by less than $0.40/Watt in a Class 3 site in our analysis. The terms of existing low-interest loan programs vary significantly across states, but the loan interest rate is only one factor in overall system economics. The most favorable programs (those that offer a zero percent interest rate, such as Iowa) are offered in states where the baseline BTC is low for this 10 kW system. The Iowa low-interest loan program, which covers 50 percent of the system cost, increases the customer BTC by $0.34/Watt in a Class 3 resource. The low-interest loan program in New York, which offers a 4 percent interest rate reduction from standard loan terms, can increase customer BTC by almost $1.00/Watt over an alternative cash purchase in which an 8 percent return on investment is required, because of the favorable baseline economics in New York.

Net metering is not strictly a financial incentive program, but can offer an important economic benefit to small wind customers. The SWAT base-case scenario assumes that all turbine electricity output is valued at the retail rate, meaning that customers either have a retail-rate net metering program in place or that the wind system is sized to meet the minimal customer load. Customers in states without net metering programs do not receive retail rate credit for excess generation, and in these cases there can be a sizeable economic loss if a wind system is sized above the minimal customer load. Currently, most states with favorable baseline economics for small wind have net metering programs. SWAT results show that among the states without net metering programs, the BTC can be reduced by as much as $0.44/Watt if 30 percent of the turbine production is excess generation that can not be concurrently used to offset customer load.[4]

New Jersey, New York, Rhode Island, and California Currently Offer the Best Incentive Packages

The LCOE is calculated from turbine investment and operation costs only, and is a useful metric to compare small wind economics across states absent the effect of highly-variable retail electricity rates. The change in the LCOE of a small wind system with and without state incentives gives a rating of the incremental value of those incentives across a more level playing field, i.e. when retail electricity rates are not considered. Figure ES-4 shows results of the incremental increase in LCOE when no state incentives are available, assuming an installed cost of $4.00/Watt. New Jersey, New York, Rhode Island, and California have the most financially attractive incentive programs. The financial incentives available in New Jersey will lower the customer LCOE by $0.14/kWh.

[4] This result assumes that customers receive an avoided cost compensation of $0.03/kWh for excess generation.

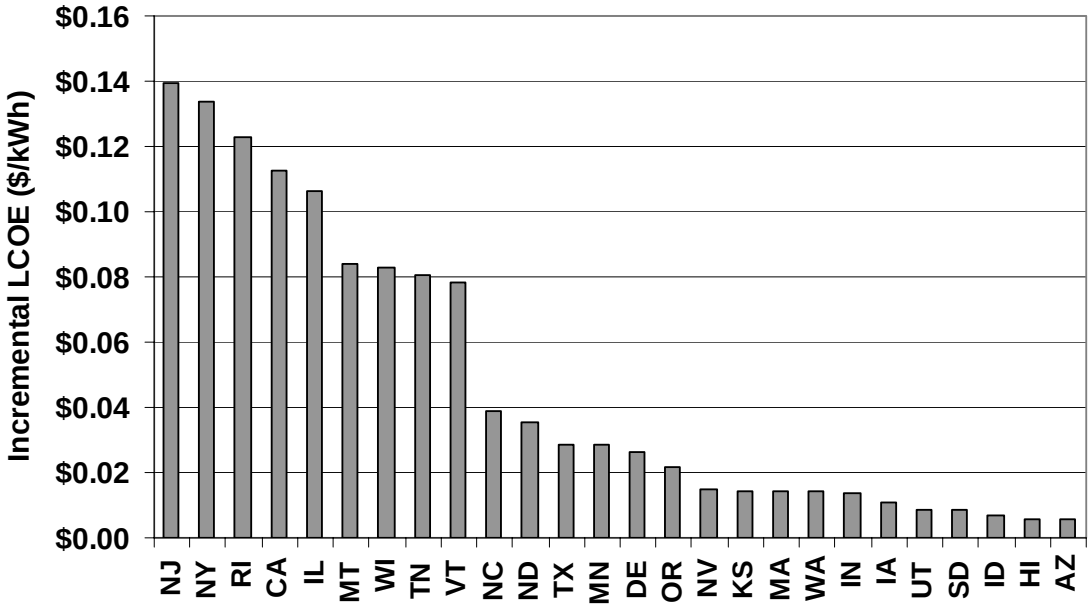

Figure ES-4. Incremental LCOE Without State Incentives ($4.00/Watt Installed Cost, Class 3 Resource)

All States Require an Incremental Rebate to Achieve a SP of 10 years

Figure ES-5 shows the incremental rebate required for this 10 kW wind system to achieve a SP of 10 years in the 25 most favorable states, assuming an installed cost of $4.00/Watt. At an installed cost of $4.00/Watt, all states require some incremental rebate to achieve a SP of 10 years. The lowest *incremental* rebate requirement is $0.41/Watt in New York, which – in combination with New York's existing 50 percent rebate – would bring the *total* rebate requirement in New York to $2.41 in order to achieve a SP of 10 years. Hawaii has the lowest total rebate requirement at $2.13/Watt, $0.28 lower than New York's total required rebate.

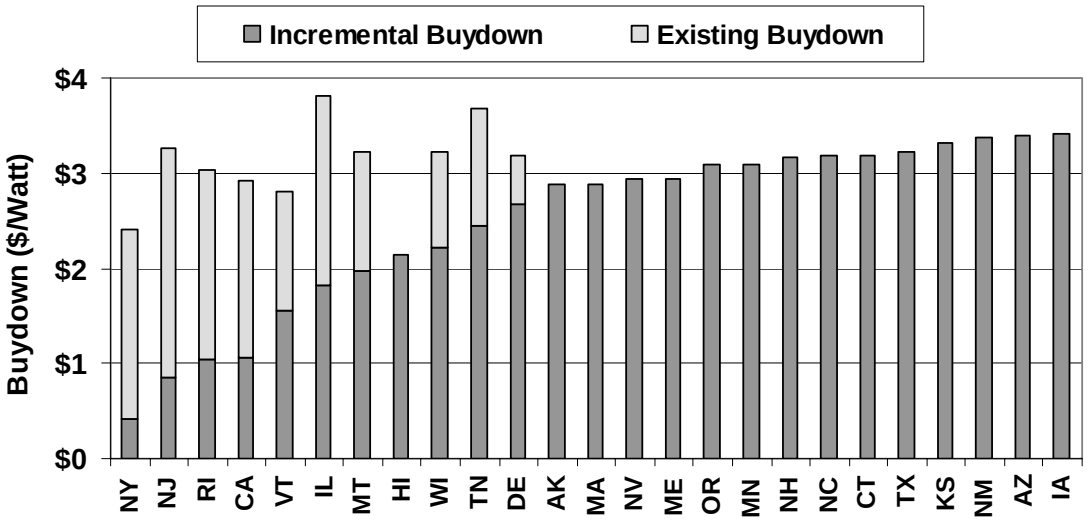

Figure ES-5. Incremental Rebate Required to Achieve a SP of 10 Years ($4.00/Watt Installed Cost, Class 3 Resource)

Absent Additional Incentives, Installed Cost Reductions are Necessary

Figures ES-6 and ES-7 below show the SP period for this 10 kW small wind system, for installed costs of $4.00/Watt and $2.50/Watt. At $4.00/Watt only 9 states offer system paybacks less than 25 years at a Class 3 site, and that number increases to 29 when the installed cost is lowered to $2.50/Watt. If continued technological progress and improved scale economies of manufacturing can drive installed costs to $2.50/Watt, the market for small wind systems in the U.S. will broaden considerably.[5]

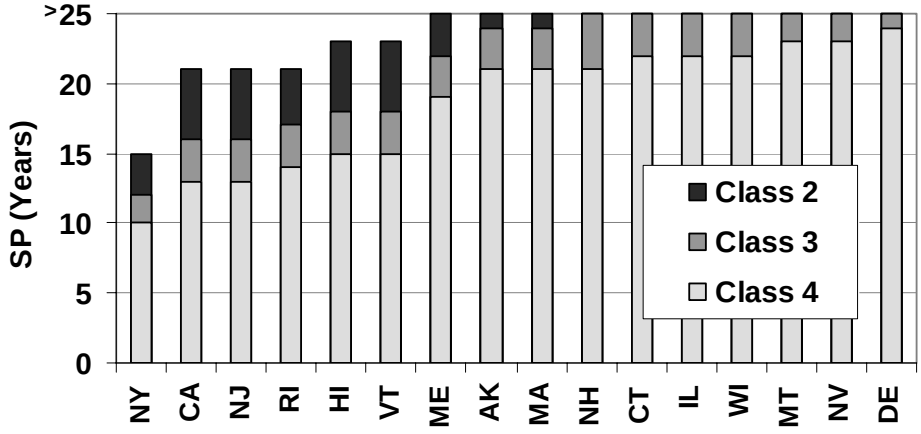

Figure ES-6. SP Results for SWAT Base-Case Scenario ($4.00/Watt Installed Cost)

[5] This calculation assumes 2004 incentive levels, and incentives in some states will likely be significantly lower by the time an installed cost of $2.50/Watt is reached.

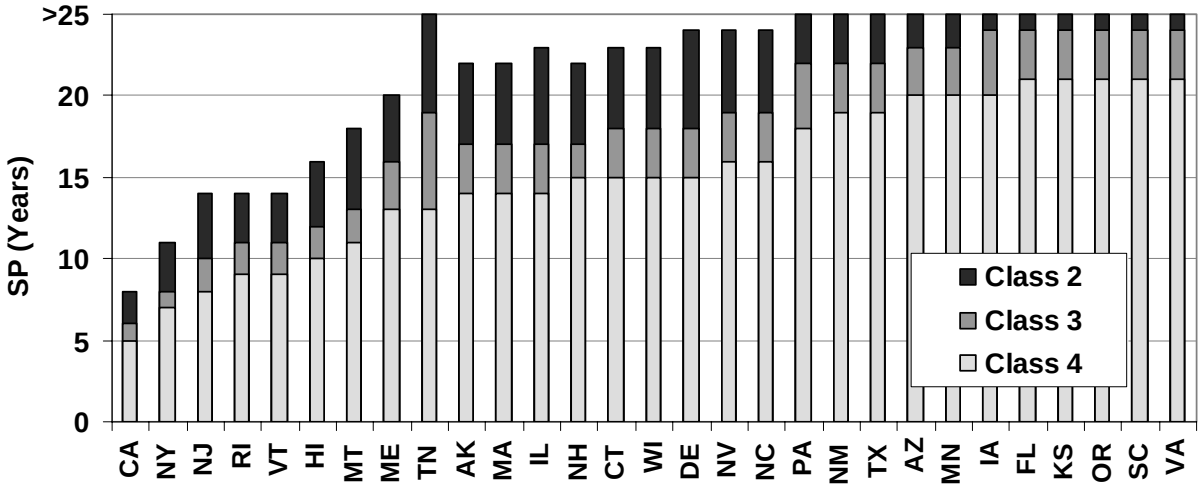

Figure ES-7. SP Results for SWAT Base-Case Scenario ($2.50/Watt Installed Cost)

The Impact of Federal Financial Incentives Will Depend on State Baseline Conditions

There are few *federal* incentives available for small, grid-connected residential wind systems. One available incentive is the United States Department of Agriculture's (USDA) Farm Bill Section 9006 grants, which offer up-front incentives of up to 25 percent of the cost of certain eligible wind systems in rural installations. The target residential customers for the USDA grants are farmers and ranchers who have demonstrated financial need.[6] The 25 percent USDA grant can decrease a system SP by as much as 7 years or increase the BTC by $1.75/Watt, but the effects of the USDA grant are highly variable across states and will depend on a state's baseline economics and on the interaction of available state rebate programs with the USDA grant. In addition, the USDA grant program is competitively awarded and has a moderate effect on most of the states with a high proportion of the program's target customers, which in general do not have favorable baseline economics for small wind systems.

In addition to the USDA grants, proposed federal energy legislation has recently included a personal ITC for the purchase of a residential wind system. The incentive amount proposed as part of the 2004 Energy Policy Act is a 30 percent tax credit with a maximum amount of $2,000. Figure ES-8 shows the effect of the proposed federal ITC on SP, assuming an installed cost of $4.00/Watt. This analysis shows that federal incentives can significantly increase the affordability of small wind systems, but the effect is much greater in states with favorable baseline economic conditions. This analysis also finds that, while a 30 percent federal ITC can decrease customer SP period by 4.5 years on average, the proposed $2,000 cap limits this reduction to 1-2 years for a 10 kW system.[7]

[6] For more information on the USDA Section 9006 grants go to http://www.rurdev.usda.gov/rbs/farmbill/index.html.
[7] Smaller systems with a lower total installed cost would be less constrained by the proposed $2,000 cap.

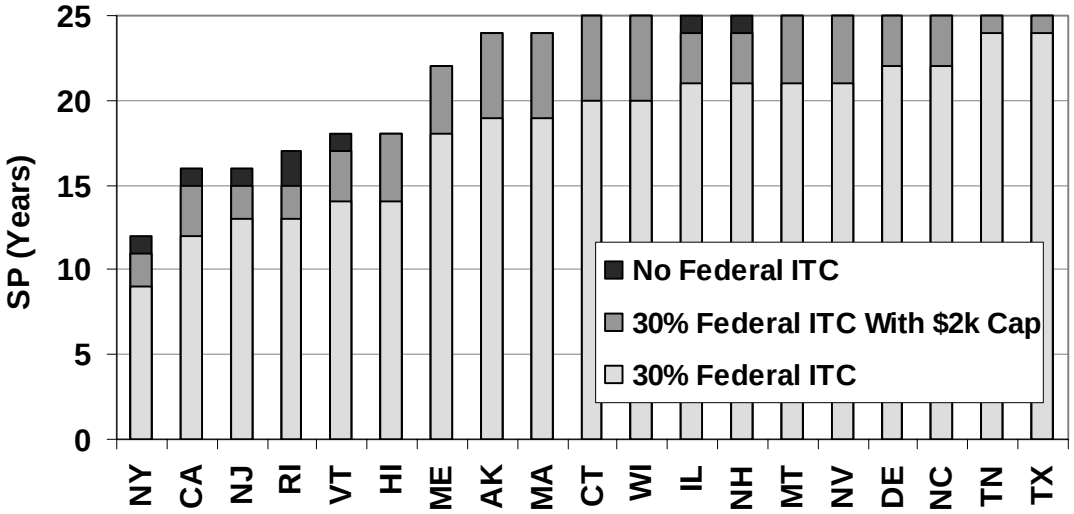

Figure ES-8. SP With and Without the Proposed Federal ITC ($4.00/Watt Installed Cost, Class 3 Resource)

Customer Investment Requirements Have a Larger Effect than Other Financial and Performance Parameters

In addition to financial incentives for small wind, several system economic and performance parameters are important considerations in the evaluation of customer economics. These include operation and maintenance (O&M) costs, the customer required rate of return on the wind investment, high retail electricity costs from tiered residential rate structures, system lifetime, system tower height, and turbine electricity output. Figure ES-9 and Figure ES-10 show the results from SWAT sensitivity analyses on these parameters, for a California Class 3 example case. The California base-case BTC is $3.60/Watt in a Class 3 resource.

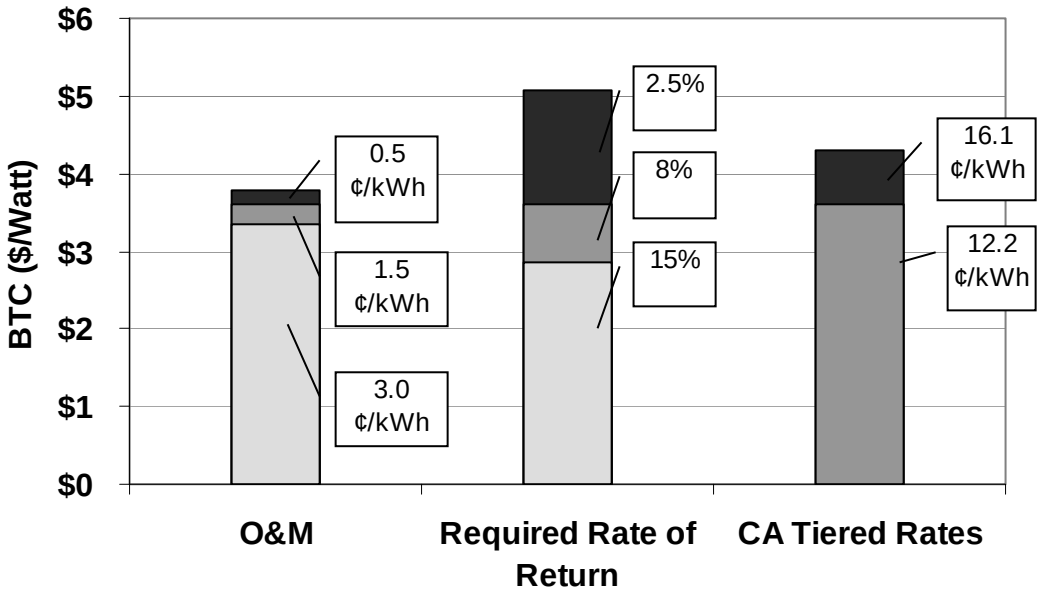

Figure ES-9. Economic Assumption Sensitivity Results (California Class 3 Resource)

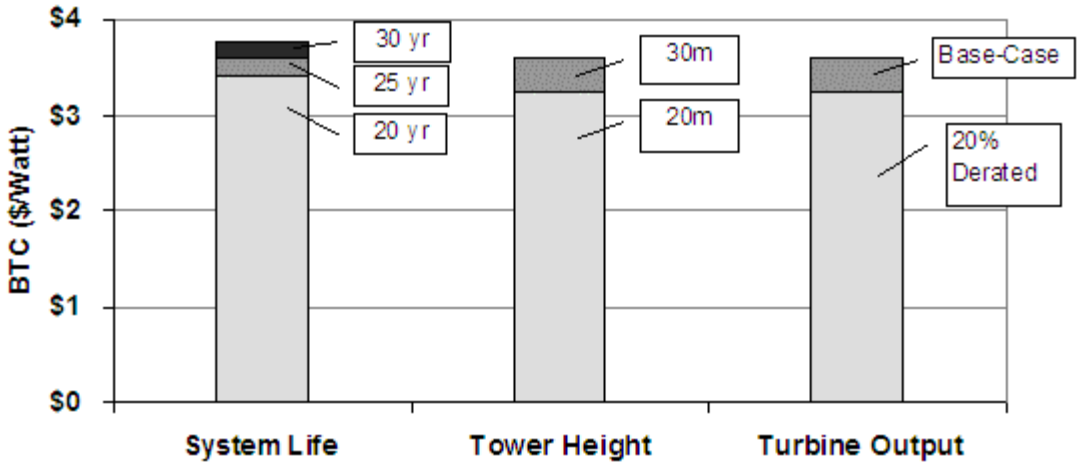

Figure ES-10. Turbine Performance Sensitivity Results (California Class 3 Resource)

The most significant effect comes from the change in the customer required rate of return on the small wind investment. A 15 percent rate of return drives the customer BTC down to $2.85/Watt, while a 2.5 percent rate of return allows for a BTC of over $5.00/Watt in this California Class 3 example.

The customer BTC is also especially sensitive to a change in average electricity rates. In California, and some other states, tiered rates ensure that some customers will see much higher marginal electricity rates than the average. If a small wind system is able to offset an electricity rate that is 30 percent higher than the average statewide residential rate, the BTC increases by $0.70/Watt. Other parameters are shown to impact the BTC more moderately. If O&M costs are reduced from the highest cost case (3.0¢/kWh) to the lowest cost case (0.5¢/kWh) the BTC increases by approximately $0.40/Watt. The range of tower height and turbine energy output values analyzed here change the BTC by approximately $0.35/Watt, while a change in system lifetime of plus or minus 5 years will change the BTC by $0.20/Watt or less.

Conclusion

As shown in this paper, economic analysis using SWAT can help determine which states currently provide the most attractive markets for residential wind systems, or are the best candidates for targeted outreach and consumer education programs. In addition, these results help to quantify the impact of existing and proposed policy incentives on small wind economics in different states. This information may help policymakers and advocates explore the impact of different policy types and levels on customer economics, and thereby make decisions on how best to support the growth of the small wind industry.

1. Introduction

1.1 Overview and Objectives

The market for small wind systems in the United States, often defined as systems less than or equal to 100 kW that produce power on the customer side of the meter, is small but growing steadily. The installed capacity of domestic small wind systems in 2002 was reportedly 15-18 MW, though the market is estimated to be growing by as much as 40 percent annually (AWEA, 2002). This growth is driven in part by recent technology advancements and cost improvements and, perhaps more importantly, by favorable policy incentives targeted at small wind systems that are offered in several states. To date, there have been a limited number of comprehensive studies that address the small wind market potential in the U.S. An early study, conducted in 1981, estimated that there was a market potential for 3.8 million small wind systems in rural residential grid-connected applications (Osborn and Downey, 1981). This study focused only on rural and agricultural applications, and these markets have likely changed due to the shifting demographics and economics of rural communities over the past two decades. The 2002 U.S. Small Wind Industry Roadmap estimates that the number of grid-connected homes in the U.S. with adequate space and wind resource for a small wind system was 7.6 million in 2000 and will rise to 15.1 million in 2020 (AWEA, 2002).

Currently, over half of all states have incentive policies for which residential small wind installations are eligible. These incentives range from low-interest loan programs and various forms of tax advantages to cash rebates that cover as much as 60 percent of the total system cost for turbines 10 kW or smaller installed in residential applications. A comprehensive review of the current status of state programs for small wind systems is available from the Clean Energy States Alliance (Cooperman, 2004). Most state incentive programs were developed to support a range of emerging renewable technologies (most notably photovoltaics), and were therefore not specifically designed with small wind systems in mind. As such, the question remains as to which incentive types provide the greatest benefit to small wind systems, and how states might appropriately set the level and type of incentives in the future. Furthermore, given differences in incentive types and levels across states, as well as variations in retail electricity rates and other relevant factors, it is not immediately obvious which states offer the most promising markets for small wind turbine manufacturers and installers, as well as the best assistance to potential residential system owners.

This paper begins to address these critical needs. Specifically, the paper presents results from a Berkeley Lab analysis of the impact of existing and proposed state and federal incentives on the economics of *grid-connected, residential* small wind systems. The Berkeley Lab Small Wind Analysis Tool (SWAT) calculates the customer break-even turnkey cost (BTC), simple payback (SP), and the levelized cost of energy (LCOE) of residential wind systems in order to compare system economics across all 50 states. The results presented in this report are based on the power production of a 10 kW Bergey Excel wind turbine. Related methodological work in this area has been conducted for customer-sited and commercial photovoltaic (PV) systems (Herig et al., 2002, 2003), and there is ongoing work to document the customer economics of small wind systems within individual states (Jimenez et al, 2002; Forsyth et al, 2000; Clean Power Research, 2003; Rhoads-Weaver and Grove, 2004).

Building on this existing work, we developed SWAT as a simple policy analysis tool capable of incorporating various policy incentive types and structures. Importantly, SWAT is not meant as an alternative to the type of more detailed characterization available from more site-specific analyses (see, e.g., the Clean Power Estimator at www.windpoweringamerica.gov). Instead, our emphasis is on developing a simple tool to compare the average customer economics of small wind across states given different existing and possible future policy incentive types and levels, for an audience largely consisting of state and federal policymakers and related stakeholders. In addition, this tool will allow stakeholders in the small wind industry to identify states suited for targeted outreach programs, due to their favorable combination of incentives and other factors. Over the longer-term, the state-by-state analysis of customer economics presented here, combined with information on the location of potential residential adopters, may assist policymakers and market analysts in more accurately quantifying the number of homes for which a small wind system would be economically attractive at different installed cost targets and incentive levels.

1.2 State Incentives for Small Wind

Historically, state incentives for small wind have been modest, and have included various forms of tax incentives, such as sales and property tax exemptions or income tax credits (ITCs), and low-interest loan programs. More recently, however, 15 states have created renewable energy funds, most often funded through a small "surcharge" on electricity rates. These states are expected to collect more than $300 million per year over the next decade, to be used to support renewable energy development (Wiser et al, 2002). A small fraction of these funds will be used to provide critical incentive support to the small wind market.

This analysis covers state incentives that directly affect the cash flow of residential customers that purchase and install a small wind system. The important but indirect benefits of other state policies, such as streamlined siting and permitting regulations, are not accounted for, though the existence of such policies may be critical to the growth of the small wind market.[8] There are also important financial incentives for small wind that are not state-based, but which should arguably be accounted for when the economics of small wind is assessed. Most importantly, tradable renewable certificates have been growing as a revenue source for small wind systems and have been shown to offer significant benefits for certain installations (Rhoads-Weaver and Grove, 2004).

Table 1 below summarizes the range of existing state policies covered in this analysis. State incentives were taken at their January 2004 values, but funding resources are sometimes minimal or subject to high demand, and are not available for all customers throughout the year. A comprehensive list of the individual state incentives used in this analysis is included in Appendix A.

[8] Permitting fees and costs range from less than $100 to several thousand dollars, and can be a significant barrier to small wind development. AWEA recommends that local jurisdictions review their zoning ordinances and ensure that their fee structures do not discourage potential small wind turbine buyers, with total permitting costs ideally not exceeding two percent of turbine capital costs (Asmus et al, 2003).

Table 1. State Small Wind Financial Incentives Included in this Analysis

Incentive Type	Number of Programs	States with Programs
Cash Incentives	10	CA, DE, IL[a], MT, NJ, NY, RI, TN, VT, WI
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Sales Tax Exemptions	9	AZ, IA, MA, MN, NV, NJ, RI, VT, WA
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[a] At the time of this analysis Illinois was rewriting a state grant program that had historically included 10 kW wind systems, but it has since been determined that wind systems will not be eligible for this program. This program is included in the SWAT analysis presented in this paper, but these results will present a more attractive environment for small wind in Illinois than is currently the case without the grant program.

Cash incentives include capital rebates provided upon system installation and production-based incentives that are paid based on a system's kilowatt-hour production over time. Rebate programs offer customers either a refund of a percentage of the total system cost (generally capped at a maximum dollar amount) or a flat dollar refund, in the form of a total dollar amount or a dollar value per kilowatt of rated capacity (often capped at a maximum percentage of total system cost). Production-based cash incentives reward system owners based on measured production (e.g., Tennessee) or expected production (e.g., Wisconsin).[9]

As we will show, existing cash incentives of these types offer the largest economic benefit to customers.[10] These incentives are typically offered as a way to encourage early adoption and "jump-start" the market for an emerging technology, and for that reason the incentive amount in some programs is structured to decline over time or after a certain number of systems have been installed. Cash incentive programs have been highly influential in the small wind market in recent years, covering as much as 40 percent to 60 percent of the installed system cost. Over 200 grid-connected small wind systems have been installed under the California small wind rebate program in the past 5 years, though growth in the California small wind market may decrease as the incentive levels follow their scheduled decline.

ITCs may also be an effective way to provide a partial refund on investment in a small wind system, and are currently available in 10 states (in addition, Idaho offers an income tax deduction). The ITC amounts range from 5 to 35 percent of the system cost, though many states have absolute dollar caps on the amount a customer can claim, and these can limit the economic attractiveness of an ITC program.

[9] The Wisconsin incentive is provided as an up-front rebate that is linked to expected production based on the installed turbine model and a customer's wind resource regime.

[10] Of these 10 states, Vermont is the only state to offer cash incentives for off-grid systems. The programs in the other states are primarily funded through a surcharge on electric rates, explaining why only grid-connected systems are eligible for the incentives.

Sales and property tax payments on a small wind system can be significant, although the dollar value of these payments is highly variable by state and local jurisdiction. Most states that offer property tax exemptions do so in one of three forms: (1) a universal exemption that applies to all customers in a state, (2) a regulation that gives local authorities the option to exempt a system, or (3) an abatement that assesses the value of the renewable energy system at an amount equivalent to a less expensive conventional (non-renewable) system. In this analysis, only universal property tax exemptions – currently available in 11 states – are considered. Sales tax exemptions are currently available in 9 states, and all but two of these states (Arizona and Nevada) waive the sales tax payments for 100 percent of the system cost.

Ten states currently offer low-interest loan programs that can be used to help finance residential wind systems. These programs offer loans ranging from $10,000 up to the full system cost, and loan rates vary from 0 to 6 percent depending on the program. Some loan programs have income or family size eligibility requirements and are therefore not available to all consumers.[11]

This paper also examines the effect of net metering programs on small wind economics. Net metering allows a customer to receive utility credit for turbine electricity generation in excess of concurrent demand within the billing period, so that an equal amount of electricity can be used during times when customer demand exceeds turbine supply. Though net metering is not strictly a financial incentive, it can directly affect the economic viability of small wind systems. In addition, net metering can provide a streamlined interconnection agreement with the utility, which can result in decreased interconnection costs. Currently, 33 states offer net metering programs either statewide or for customers of the largest utilities in the state.[12] Four additional states have residential wind net metering programs available in small portions of the state. The available programs vary in their treatment of net excess generation, which is the amount of generation that remains in excess of demand at the end of the net metering accounting period. Net excess generation is generally accounted for on a monthly or yearly basis and either credited to the utility for free, or alternatively, purchased from the customer for an amount typically ranging from the utility's avoided costs to as much as the retail rate of electricity.

There are few *federal* incentives available for small, grid-connected residential wind systems. One available incentive is the United States Department of Agriculture's (USDA) Farm Bill Section 9006 grants, which offer rebates of up to 25 percent of the cost of certain eligible wind systems in rural installations. The target residential customers for the USDA grants are farmers and ranchers who have demonstrated financial need.[13] Due in part to application preparation requirements and outreach and communication hurdles, very few eligible small wind customers in the U.S. were able to take advantage of the grants during their first two years of availability (2003 and 2004). In 2004, 12 projects for small wind were funded, totaling $585,000, or 2.6

[11] For example, small wind turbines are eligible for energy conservation loans offered through the Connecticut Housing Investment Fund, with interest rates that vary between 1 and 6 percent based on family size, income, and location.

[12] See Table A-1. Effective October 1, 2004, Maryland is the most recent state to include small wind as part of a statewide net metering program. Maryland's net metering program is not included in this analysis, which is based on January 2004 incentive levels.

[13] USDA grants also target non-residential customers such as small rural businesses. For more information on the USDA Section 9006 grants go to http://www.rurdev.usda.gov/rbs/farmbill/index.html.

percent of the total awards.[14] In addition to the USDA grants, recently proposed federal energy legislation includes a personal ITC for the purchase of a residential wind system. The incentive amount proposed as part of the 2004 Energy Policy Act is a 30 percent tax credit with a maximum amount of $2,000.

1.3 Report Outline

The SWAT methodology, analysis, and results are presented within the following sections:

- Section 2 describes the methodology of this analysis including the structure of the SWAT, the assumptions behind the model, and the inputs to the base-case analysis.
- Section 3 contains results from the base-case analysis for the three economic metrics of BTC, SP, and LCOE.
- Section 4 presents analysis and results for policy incentive cases including the individual effect of different state incentives and the effects of existing and proposed federal incentives.
- Section 5 presents additional sensitivity cases on model inputs, including economic, wind turbine performance, and financing assumptions.
- Section 6 concludes the analysis.
- Appendix A contains detailed information on existing state financial incentives for residential wind systems.
- Appendix B lists additional input assumptions to the SWAT that vary by state, such as the average state retail electricity rates, state sales and property tax rates, and state income tax rates.
- Appendix C describes the inputs and method used to calculate the wind turbine performance assumptions.
- Appendix D contains detailed tables of results for the base-case, policy cases, and sensitivity cases presented in Sections 3 through 5 of the main report.

[14] 2004 grant awards were announced in a September 15, 2004 news release from the USDA and can be found at http://www.rurdev.usda.gov/rd/newsroom.news.htm. Information on the small wind projects that were awarded is available from the Windustry website at http://www.windustry.org/farmbill/default.htm.

2. Methodology

The Berkeley Lab SWAT is a spreadsheet-based cash-flow model that calculates the customer economics of residential, grid-connected wind systems in each U.S. state for different wind resource regimes. The primary purpose of the model is to analyze the effects of existing state incentives (such as those discussed in the previous section) on the economics of small wind systems. In addition, SWAT can incorporate potential future federal income tax incentives and federal grant or rebate programs, as well as possible new state-level incentives. The tool is specifically designed to help policymakers choose combinations of incentives that will effectively spur the market for residential, grid-connected wind systems.

2.1 SWAT Model Structure and Outputs

SWAT calculates the BTC, the SP period, or the LCOE of small, residential wind systems. These outputs are generated for a given state, wind resource class, and installed system cost (the latter being applicable only to SP and LCOE). Wind turbine annual energy production values for the different wind classes are calculated exogenously, and are included as part of the model. This analysis uses annual energy production values based on a 10 kW Bergey Excel system (see Appendix C). By default SWAT includes all state incentives at January 2004 levels (see Section 1), but this information can be easily updated to include new incentives or to run sensitivity cases on existing incentives. The SWAT also allows the input of user-defined financial incentives, e.g. a federal ITC, in order to analyze the economic impact of hypothetical policy combinations. The overall structure of the SWAT inputs and outputs is shown in Figure 1.

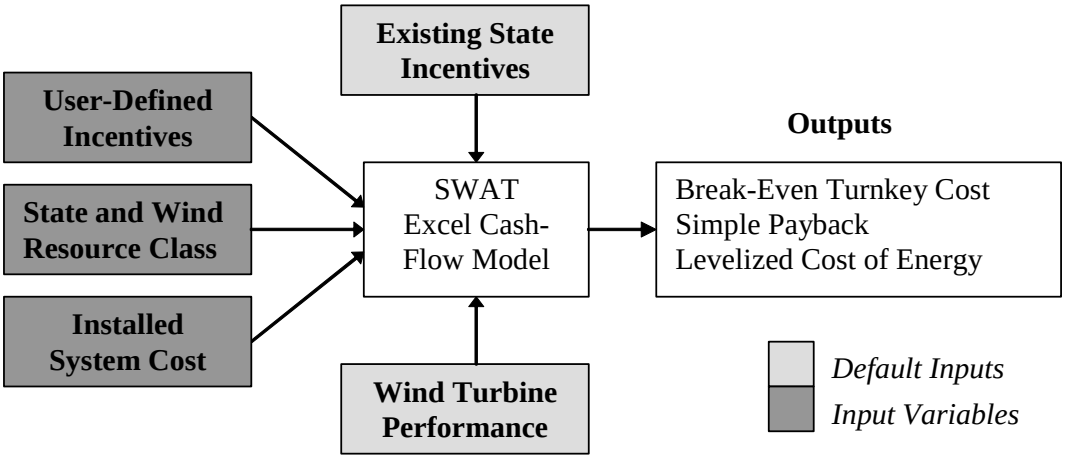

Figure 1. Flowchart of SWAT Inputs and Outputs

The metrics of BTC, SP, and LCOE provide different approaches to quantifying the economics of customer-owned small wind systems:

- The BTC is defined as the aggregate installed system cost that would balance total customer payments and revenue over the life of the system, allowing the customer to "break-even" while earning a specified rate of return on their small wind "investment." The BTC can be thought of as the market hurdle value that corresponds to a specified rate of return on a small

wind investment, and a system installed cost that is lower than the BTC will increase a customer's rate of return. The total customer costs are incurred through system capital payments under different financing structures (cash payment, personal or low-interest loan, or a home mortgage option), operation and maintenance (O&M) costs, and property tax payments if applicable. Customer revenue is derived from available financial incentives and the avoided retail cost of electricity.[15] BTC is an informative metric because it defines the *maximum* installed system cost that would allow a customer to earn a specified rate of return. Unlike SP and LCOE (defined below), the BTC metric does not require a system cost assumption, since installed system cost is the variable when this metric is used. BTC helps to illuminate the large variability in residential wind economics across states; however, this large variation means that sensitivity results are often exaggerated in states with high baseline BTCs and compressed in states with low baseline BTCs. In addition, BTC is defined as the aggregate installed system cost, and does not break this down among turbine capital costs, installation and permitting costs, or sales tax payments. The BTC therefore includes any sales tax that a customer has to pay and can not be used to specifically analyze sales tax incentives.

- The SP is calculated assuming a cash payment for the wind system and all associated costs, and the payback period is calculated assuming zero discount on future revenue and payments (i.e., ignoring the time value of money). While simple payback period is a common tool used for customer evaluation of the economic benefit of an investment, at today's typical installed costs of $4.00-$5.00/Watt for 10 kW wind systems, and statewide average residential electricity rates below $0.10/kWh in most states, customers in many states can not assume they will recoup their investment in a small wind turbine without additional incentives within the expected 25-year system life. Certain states therefore do not result in a viable baseline payback period for comparison with the effect of economic sensitivity cases. In addition, the SP periods are reported as integer values, and minor changes to system economics may not result in a payback change of a year or more. It is also important to note that the calculation of SP does not easily allow for financing options, and therefore state low-interest loan programs cannot be assessed with this method.

- The LCOE is calculated assuming a cash purchase for the small wind system, and is based on a given required rate of return on the customer investment. As with the SP calculation, LCOE does not account for financing options, and does not include the impact of state low-interest loan programs. The LCOE is calculated from customer payments and incentives, and does not incorporate the retail rate of offset electricity in the calculation. Therefore, while LCOE will provide a basis for economic comparison across states without the effect of highly-variable retail electricity rates, it does not serve as the best metric for evaluating the aggregate economic attractiveness of a small wind installation to the customer. LCOE results are not included in many of the results below, though this capability does exist in the SWAT.

[15] Since our base-case assumption is that there is no net excess generation, there are no power sales to the utility to provide a third source of revenue.

2.2 Model Assumptions and Base-Case Inputs

The results presented in this report are based on a 10 kW turbine size, and results for alternative system sizes would be expected to vary somewhat. The assumed turbine's annual energy production under different wind resource classes is based on a grid-connected Bergey 10 kW Excel power curve. SWAT results are generally presented for a Class 3 wind resource throughout this report and for Classes 2 through 4 in Appendix D. For each wind class, the median wind speed at a 30-meter height was used and annual energy production was calculated assuming a Rayleigh wind distribution, using the WindCad Turbine Performance Model prepared by Bergey Windpower Co. The turbine power output generated by the WindCad model is de-rated by the average state elevation above sea level and a 15 percent turbulence factor.[16] Values for median wind speed and annual energy production by wind resource class are shown in Table 2. In the base-case scenario, all energy produced by the turbine is assumed to offset the average state retail electricity rate, meaning that either a net metering program is in place or the system is sized such that its output will not exceed the minimum customer load.

Table 2. Median Wind Speed and Annual Energy Production by Wind Class

Wind Class	Median Wind Speed (m/s)	Total Annual Energy Production for 10 kW Bergey Excel (kWh/yr)
2	5.5	10,319
3	6.2	14,232
4	6.75	17,523
5	7.2	20,262
6	7.8	23,843
7	9.65	32,984

It is important to note that the annual energy production of a wind turbine does not scale with rated system size. Power output can vary widely between turbines, due to both the influence of site-specific factors and variation in turbine power curves, even among turbines of a comparably rated size. The BTC results from this analysis are therefore applicable to the Bergey Excel 10 kW system described above, and can not be directly applied to different turbines without consideration of the variation in power production.

Additional key assumptions of the SWAT are listed below:

- Average statewide residential electricity rates were taken from the Energy Information Administration (EIA) publication "Current and Historical Monthly Retail Sales, Revenue, and Average Revenue per Kilowatt-Hour by State and by Sector." Values from May 2002 through April 2003 (the most recent at the time of this analysis) were averaged to produce annual average electricity rates. Electricity price escalation rates over a 25-year time horizon for the residential sector vary by census division according to the 2003 Annual Energy Outlook. Although this study focuses on grid-connected systems, it should be noted that off-

[16] The 15 percent turbulence factor was used to better represent turbine performance seen in the field (personal communication with Mike Bergey 6/24/03). For more information on the turbine performance assumptions used in this analysis, see Appendix C.

grid households might value electricity at prices significantly higher than those paid by grid-connected retail electricity customers.

- Federal and state income tax rates correspond to an annual household taxable income of $100,000 (which results in a 25 percent federal rate).[17] State ITCs or deductions will de facto result in higher federal tax payments, because state income tax payments are deductible from federal taxable income (i.e. a decrease in state tax payments will result in an increase in federal taxable income).
- The total amount of a tax credit is always less than a customer's total tax liability, thereby allowing the customer to fully utilize available tax incentives.
- Cash incentives are not considered taxable income.[18]
- State incentives are taken at January 2004 values and only residential incentives are considered. [19] Rebates and policies that apply only to customers of small utilities within a state (such as municipal utilities that cover a small percentage of the population) are not included. A complete list of state incentives used in this analysis is included in Appendix A.
- State low-interest loan programs, which are included only in the BTC analysis, apply only if the system economics with the loan program are more favorable than for a system that is financed privately (i.e. the BTC is higher under the state loan program). For state loan programs that set interest rates in relation to "market rates," the market rate is assumed to be 8 percent, equivalent to the rate assumed here for a personal loan.
- Property tax rates are input by state, and were calculated from a sample of property tax rates in 800 U.S. cities.[20] The annual taxable value of the wind system is determined by a straight-line depreciation method with a salvage value of one-tenth the original system cost at the end of the system's assumed lifetime. Property tax payments are tax deductible.
- Inflation rates for O&M payments and offset electricity costs are taken from the 2003 Annual Energy Outlook (AEO) GDP Chain-Type Price Index. These rates average 2.5 percent annually over the 25-year AEO forecast period.[21]
- The LCOE over the life of the wind system is calculated using a 5.5 percent real discount rate.

Base-case values for additional key SWAT input variables are presented in Table 3 below. These assumptions are reasonably aggressive, with a lengthy system lifetime, a high tower height, moderate O&M costs, and a nominal assumed rate of return of 8 percent. A sensitivity analysis was performed for each of these parameters and results are presented in Section 5. A complete set of non-policy input assumptions that vary by state (e.g., electricity prices, tax rates, etc.) are included in Appendix B.

[17] This annual income rate is higher than the national median household income (approximately $43,000 in 2003 according to the US Census Bureau), but it is assumed that higher-income households will be likely adopters of residential wind systems.

[18] Utility rebates for renewable energy systems are currently exempt from federal income taxes, as part of the federal Energy Policy Act of 1992. In this analysis we assume that all rebates are tax-exempt, and that production-based cash incentives are administered such that they do not increase a customer's tax liability. TVA's production incentive is currently administered as a credit on a customer's utility bill.

[19] The one exception is the Illinois state grant program. The Illinois grant program had historically included 10 kW small wind systems as eligible technologies, but was being re-written at the time of this analysis. The grant program was therefore included, but it has since been determined that small wind systems were not eligible in January 2004.

[20] http://verticals.yahoo.com/cities/categories/proptaxrate.html

[21] http://www.eia.doe.gov/oiaf/archive/aeo03/aeotab_20.htm

Table 3. Input Assumptions for SWAT Base-Case Scenario

System Assumptions	
System Lifetime	25 years
Tower Height	30 meters
O&M Costs	1.5 ¢/kWh[22]
Installed Cost (SP and LCOE only)	$4.00/Watt[23]
Financial Assumptions	
Financing Option	Cash Purchase[24]
Required Rate of Return (BTC only)	8 %

[22] A literature review of small wind O&M costs produced several metrics for reporting these costs, including production-based ($/kWh) values (Gipe, 1993; Bergey Windpower Co.), a percent of installed cost (Forsyth et al, 2000), and a total annual cost (National Renewable Energy Laboratory, 2001, Jimenez et al, 2002). This analysis uses production-based values in order to keep O&M payments comparable across states (in a BTC analysis the installed cost is a variable and can vary significantly across states). A base-case O&M value of 1.5¢/kWh is a conservative estimate based on the reviewed literature. A sensitivity analysis on O&M costs is presented in Section 5.

[23] In addition, results are presented for an installed cost of $2.50/Watt in the base-case analysis, and all results for an installed cost of $2.50/Watt are included in Appendix D. An installed cost assumption is not required for a BTC analysis, since installed cost is the output variable.

[24] A cash purchase is always assumed for a SP or LCOE analysis, and is assumed for a BTC analysis unless turbine economics are more favorable under a state low-interest loan program.

3. Base-Case Results

This section presents results from the SWAT base-case scenario for system BTC, SP, and LCOE. These results apply to the specific Bergey Excel 10 kW system described in Section 2.2 above, and should not be interpolated to systems of different makes or sizes without consideration of the variation in turbine power curves. Tables of these results are included for reference in Appendix D.

3.1 Break-Even Turnkey Cost Results

Figure 2 on the next page presents BTC results for the base-case scenario for wind Classes 2 through 4. The BTC represents the market hurdle value in a given state, and installed costs below the BTC would result in the benefit of a higher rate of return on the customer investment. Results show that the economic attractiveness of small, grid-connected residential wind systems is highly variable by state. Most states would require a turnkey installed cost of less than $2.00/Watt for Class 2 or 3 sites to provide their owners an 8 percent return on investment over the system lifetime. This compares to typical installed costs of 10 kW residential wind systems of $4.00 - $5.00/Watt, and shows that residential, grid-connected small wind installations are not strictly economical in most states, even in some states that provide fairly aggressive policy support.

Of the 10 most attractive states[25], only two (Hawaii and Maine) do not provide cash incentives for the purchase of small wind systems, and the economic attractiveness of these two states is due in large part to high average retail electricity rates (16¢/kWh and 13¢/kWh respectively). New York and California have the highest BTC, driven primarily by favorable rebate programs, and augmented by high retail electricity rates. In a Class 3 wind regime, 10 kW residential wind systems in New York could be installed at a cost of over $5.00/Watt and still provide an 8 percent return to residential system owners over the assumed 25-year system life, given our base-case assumptions. Installed system costs of over $3.00/Watt could be supported at Class 3 wind sites in two additional states: California and New Jersey. With installed costs that generally range from $4.00-$5.00/Watt at present, New York is the only state where typical 10 kW systems can be sold strictly on an economic basis under our base-case assumptions and with existing incentive policies in place.

[25] Illinois is one of the 10 most attractive states with the inclusion of its state renewable energy grant program, but a 10 kW wind system is no longer eligible under this program. All results shown in this analysis include the previously available Illinois renewable energy grant program.

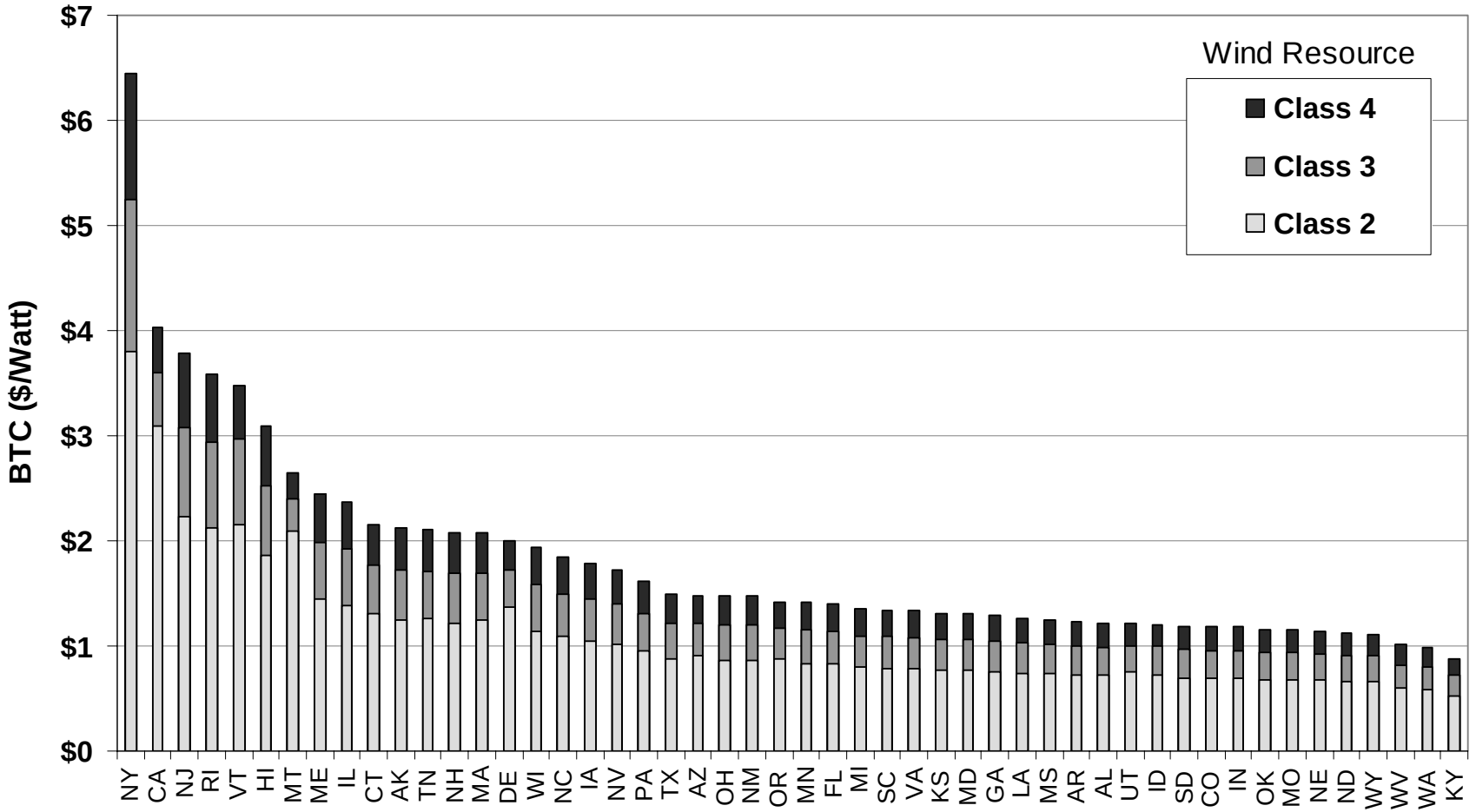

Figure 2. BTC Results for SWAT Base-Case Scenario

3.2 Simple Payback Results

Figure 3 shows base-case results with SP as the figure of merit instead of BTC, for an assumed installed cost of $4.00/Watt in wind Classes 2 through 4. Sixteen states are included in the figure, meaning that they offer a SP period less than the system life of 25 years in at least one of the wind regimes analyzed here. As shown, at an installed cost of $4.00/Watt, there are 6 states that provide a customer payback of less than 25 years in Class 2 wind resource areas, and 9 states where the customer payback is less than 25 years in Class 3 wind resource areas. No states have a simple payback of less than 10 years, even in a Class 4 resource. New York, California, and New Jersey remain the most attractive state markets for wind based on this metric.

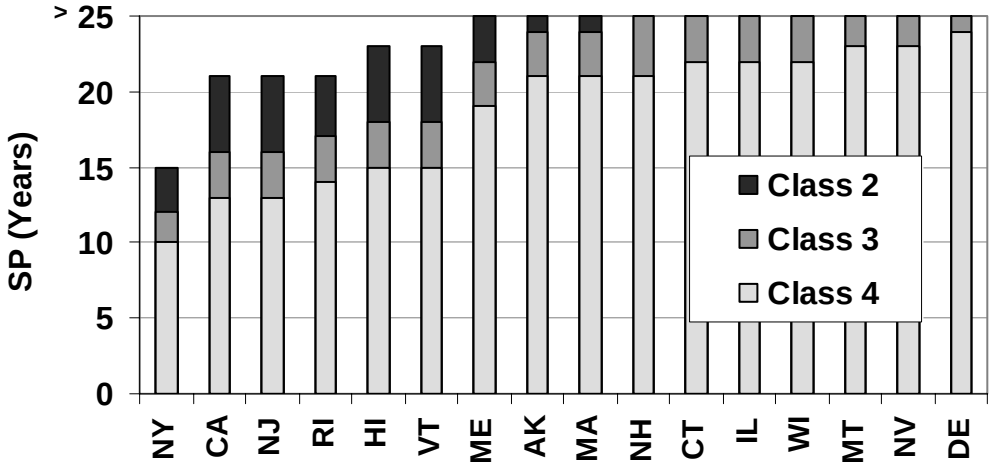

Figure 3. SP Results for SWAT Base-Case Scenario (Installed Cost of $4.00/Watt)

Figure 4 shows base-case SP results if the installed turbine cost was to hit an aggressive target of $2.50/Watt. If continued technological progress and improved scale economies of manufacturing can drive installed costs to $2.50/Watt, the market for small wind systems will broaden considerably. In a modest Class 2 resource, 17 states achieve simple paybacks of fewer than 25 years with existing incentives in place, and markets improve considerably in higher wind resource classes.[26] In California, the payback period is reduced by more than half when the installed cost target drops to $2.50/Watt (assuming 2004 incentive levels), to as low as 5 years in a Class 4 resource. The effect of a lowered installed cost is the most pronounced in California because California's $/Watt rebate structure becomes an increasing share of the total system cost, as opposed to rebate programs structured as a percentage of total system cost. However, these results assume 2004 incentive levels, and the current amount of California's rebate is set to decline over time. Barring a change in the design of the California rebate program, current incentive levels will not be applicable to future installed costs of $2.50/Watt. These results strongly suggest that a vibrant small wind market in the U.S. will require both continued policy support and technical and infrastructure developments that reduce installed system costs.

[26] Tennessee stands out as a competitive wind market in a Class 4 resource, but the payback period increases more dramatically than other states in wind Classes 2 and 3. This is because the green power purchase incentive provided by TVA expires after 10 years, at which point the payback rate for a TVA customer will slow significantly.

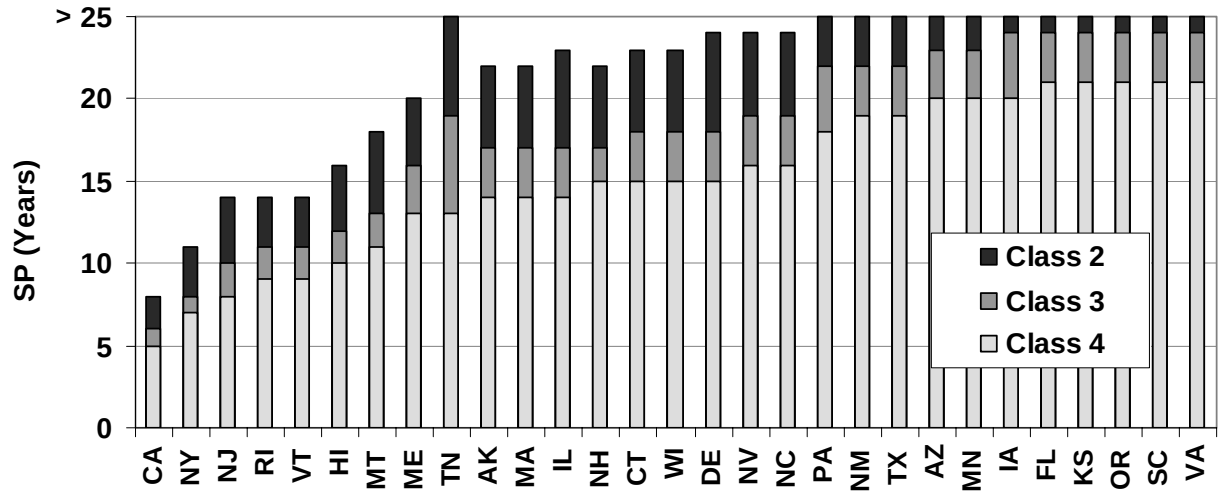

Figure 4. SP Results for SWAT Base-Case Scenario (Installed Cost of $2.50/Watt)

3.3 Levelized Cost of Energy Results

Figure 5 shows base-case results for the customer LCOE for installed costs of $4.00/Watt and $2.50/Watt, in a Class 3 wind resource only. State LCOE values are calculated assuming a real discount rate of 5.5 percent. Results are shown along with the 2003 average retail rate of electricity in each state.[27] At a system installed cost of $4.00/Watt the LCOE ranges from 13¢/kWh in New Jersey up to 29¢/kWh. Only one state, New York, has an average retail rate of electricity that is higher than the system LCOE for an installed cost of $4.00/Watt in a Class 3 resource. At a system cost of $2.50/Watt, California has the lowest LCOE at 7¢/kWh and the LCOE increases to a high of 19¢/kWh in some states. Five states (New York, New Jersey, Rhode Island, California, and Vermont) have current residential retail rates that are higher than system LCOE if installed costs decrease to $2.50/Watt. However, both state incentives and retail electricity rates will likely change by the time installed costs of $2.50/Watt are available.

[27] These results do not account for the importance of hedging against retail electricity price risk provided by investment in a small wind system. While the LCOE results shown in Figure 5 will be constant over the life of the small wind system, there is significant uncertainty in forecasts of retail electricity costs over the next 25 years. For this reason only 2003 values are shown.

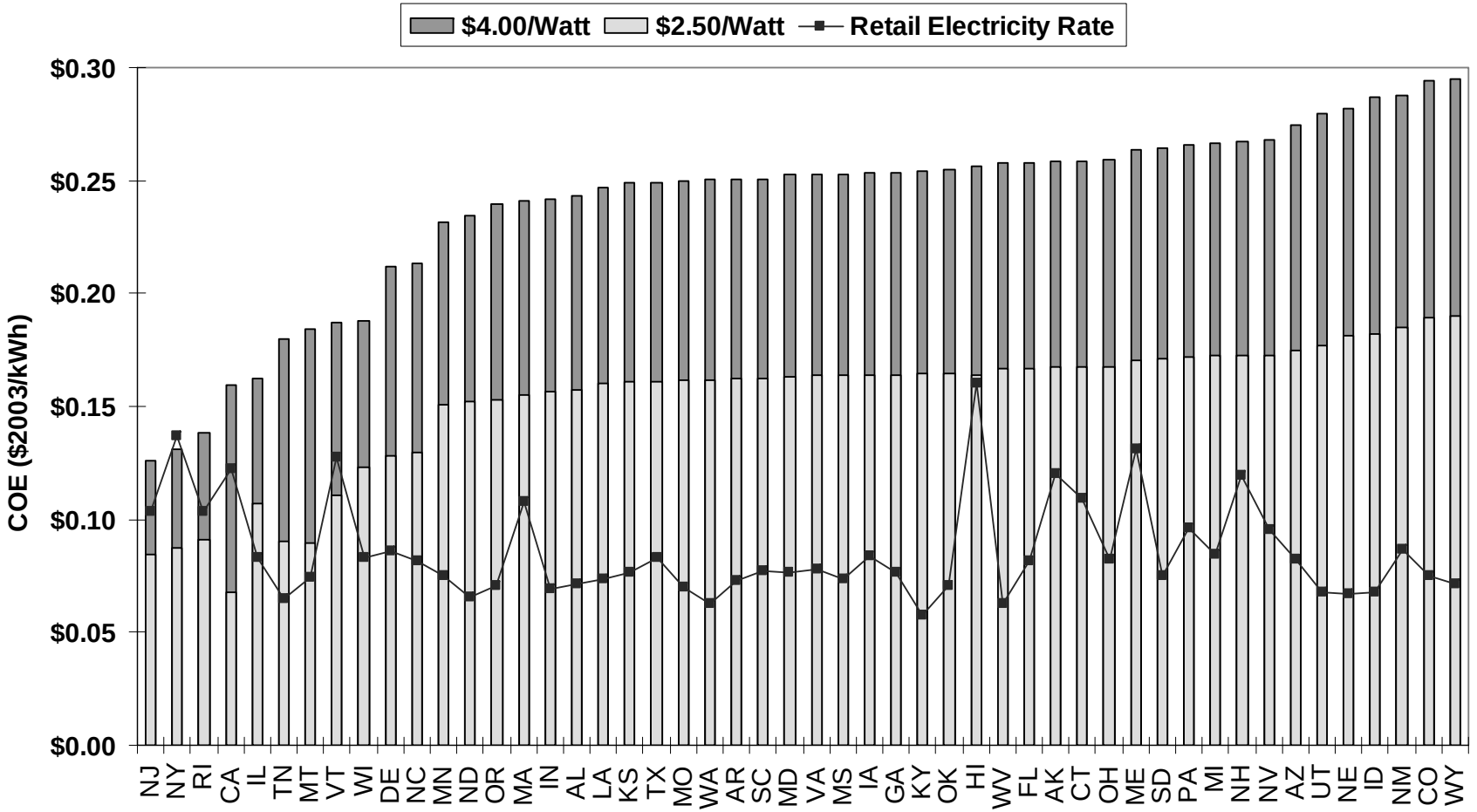

Figure 5. LCOE Results from SWAT Base-Case Scenario (Installed Costs of $4.00/Watt and $2.50/Watt, Class 3 Resource)

3.4 State Wind Resource Availability

An important consideration of the economic potential of small wind is the wind resource availability in each state. The BTC results presented in Section 3.1 above are calculated statewide based on numerous different factors, including the wind class of the installation site. Only certain regions within economically attractive states will provide a high BTC, given the limitation of wind resource geography. Figure 6 shows regions in the U.S. where state economics and site wind resource result in a SWAT base-case BTC greater than $2.00/Watt. Wind resource data were taken from the Wind Energy Resource Atlas of the United States, published in 1987. Results show that regions with a BTC over $2.00/Watt are dominated by California, Montana, and the Northeastern U.S. Parts of Nevada, New Mexico, Tennessee, Alaska, and Hawaii are also included. It is important to note that certain utilities or regions within a state may not be eligible for state-administered financial incentives, and these ineligible regions have not been removed from the states shown on the map below.

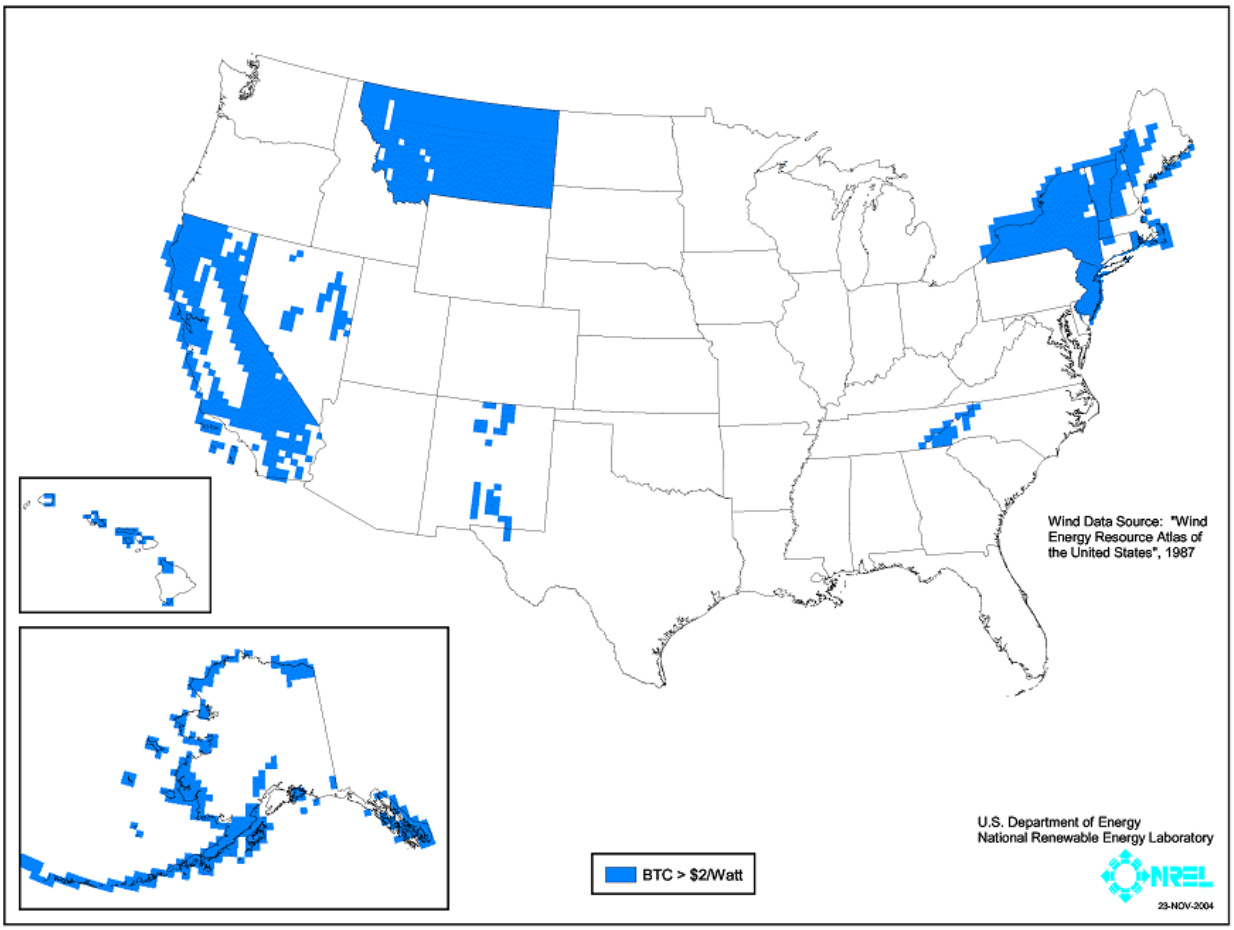

Figure 6. U.S. Regions with a SWAT Base-Case BTC over $2.00/Watt

4. The Impact of Policy Incentives on Small Wind Economics

This section presents BTC, SP, and some LCOE results from sensitivity cases on the impact of individual state financial incentive programs and on two additional incentives potentially available to residential small wind consumers: the proposed federal ITC and the existing USDA Farm Bill grant. For simplicity, results are shown for a Class 3 wind resource only. BTC results are shown for the select states with a given incentive program, unless otherwise noted. SP and LCOE results are shown assuming an installed cost of $4.00/Watt. A complete set of sensitivity results for wind Classes 2-4, for an installed cost of $2.50/Watt, and for all 50 states is included in Appendix D.

4.1 Existing State Incentives

The results in Sections 4.1.1 through 4.1.7 below show the contribution of all existing state incentives and the individual contribution of each incentive type to the BTC and SP of a small wind system.

4.1.1 All State Incentives

The existence of state incentives is one of the most significant factors in determining a state's economic attractiveness for customers of small wind systems. Figure 7 below shows the contribution of all existing state incentives to the BTC of a small wind system. The remainder amount (the BTC without state incentives) shows the variation across states in the maximum amount a customer can pay (the market hurdle value) when only state electricity and tax rates are considered. Results show that the high BTC in the most economically attractive states is driven considerably by state incentives. Without financial incentives, a high retail electricity rate is the primary driver of high system BTC, such as in Hawaii, Alaska, California, and several states in the Northeastern U.S. The incentives are those included in the base-case analysis, namely, cash incentives, property and sales tax exemptions, income tax credits, and low-interest loan programs. There are 28 states with at least one type of financial incentive available to residential customers who install small wind systems.

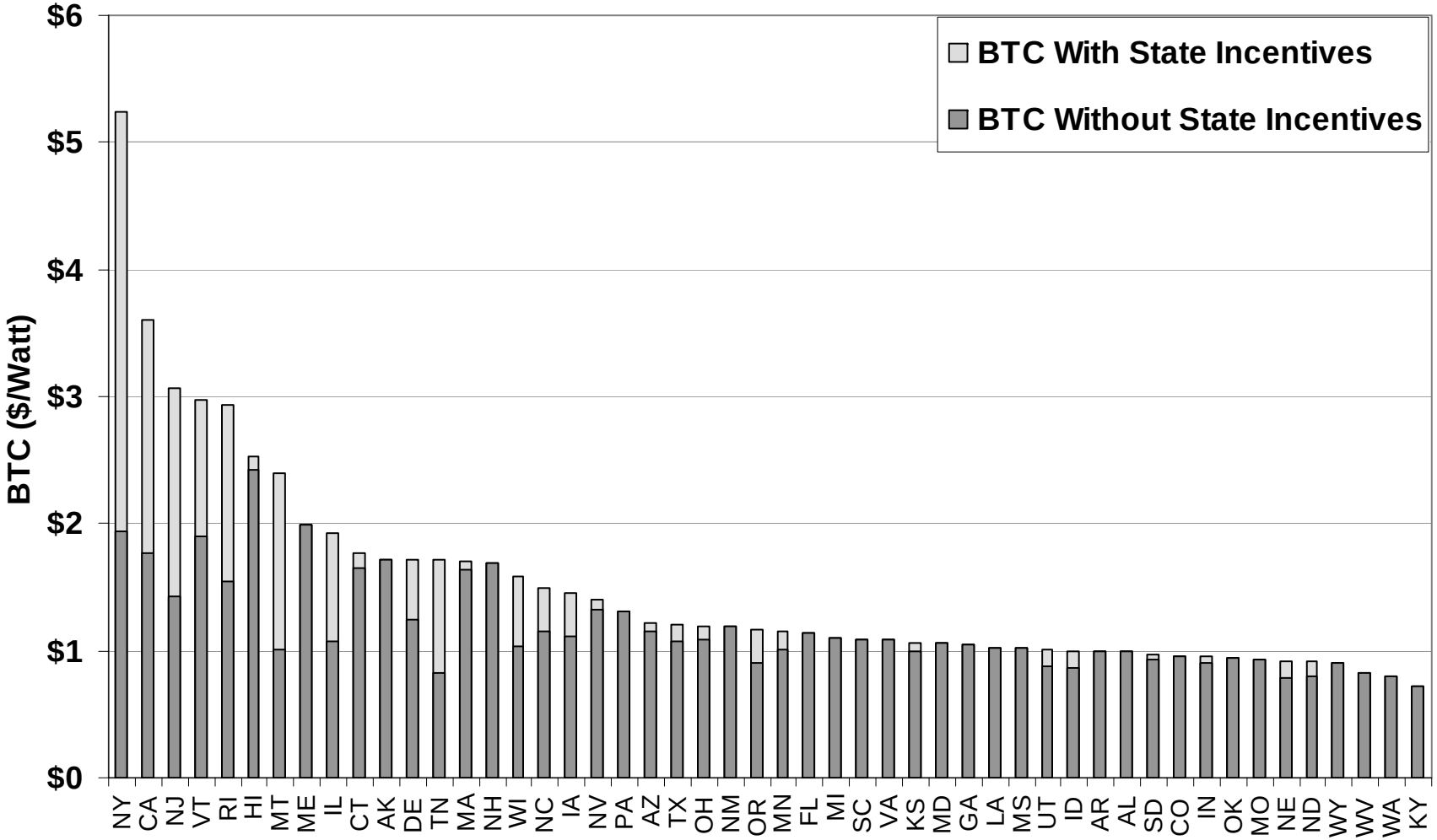

Figure 7. BTC With and Without All State Incentives (Class 3 Resource)

Similarly, Figure 8 shows the SP results when all existing state incentives are removed, for all states with paybacks under 25 years. Without state incentives, a small wind system that costs $4.00/Watt would recover its investment cost within a 25-year lifetime in only 6 states: New York, California, Hawaii, Vermont, Maine, and Alaska.[28]

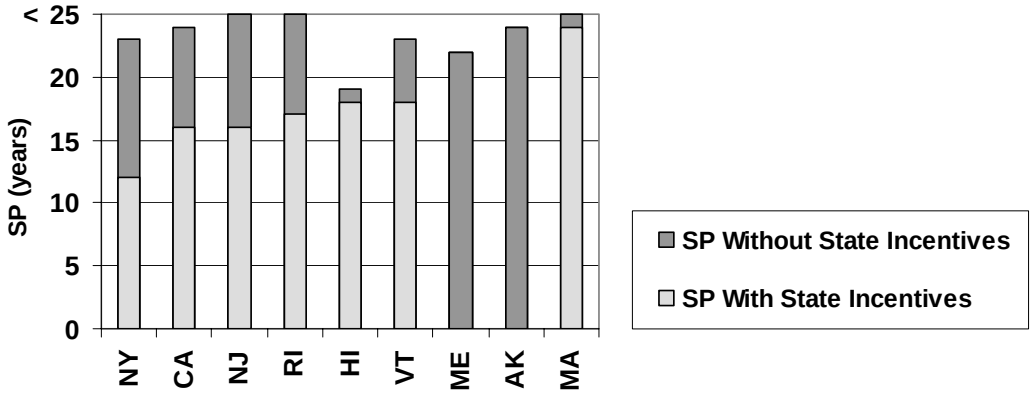

Figure 8. SP With and Without State Incentives (Installed Cost of $4.00/Watt, Class 3 Resource)

As shown in Figure 7 and Figure 8, the economic attractiveness of small wind systems declines significantly without current state incentives in place. The states where financial incentives make the largest difference (as a percentage increase over a case with no incentives) tend to be states where multiple incentives are available.[29] While the largest impact is in states with cash incentive programs (discussed below), there is also a noticeable difference in states without such programs, such as Iowa, Nevada, and North Carolina, which either have a single aggressive financial incentive or a beneficial combination of different incentive types. Without any existing incentive programs, Hawaii has the most favorable small wind economics; Hawaii has a BTC of $2.43/Watt and a SP of 19 years with the base-case assumptions.

To compare the relative economic impact of incentive programs in different states without the effect of highly-variable retail electricity rates, we calculated the LCOE with and without state incentive programs, assuming an installed cost of $4.00/Watt for our 10 kW unit. Figure 9 below shows the incremental increase in LCOE without state incentives, for those states with some form of incentive in place.[30] These results clearly show that states with cash incentive programs offer the most sizeable incentives for small wind.[31] Ignoring retail electricity rates, the incentives available in New Jersey provide the largest economic benefit to a small wind customer, and lower the LCOE of a small wind system by $0.14/kWh. New York, California, and Rhode Island also provide incentives that will lower the LCOE by more than $0.10/kWh. The LCOE in Illinois

[28] Maine and Alaska do not currently offer incentives for small wind, so there is no difference in payback with or without state incentives.
[29] For example, New York and Montana offer a cash rebate, a property tax exemption, and a low-interest loan program, and Montana additionally offers an income tax credit.
[30] Since LCOE is calculated assuming a cash purchase, these results do not include low-interest loan programs.
[31] The one exception is Delaware, which offers a cash incentive program of 50 percent of the system cost with a maximum cap of $5,000. The LCOE in Delaware is reduced by less than $0.03/kWh in this analysis, because the maximum cap is limiting for a 10 kW system.

would also be lowered by more than $0.10/kWh if, as shown here, the state grant program applied to this 10 kW wind system.

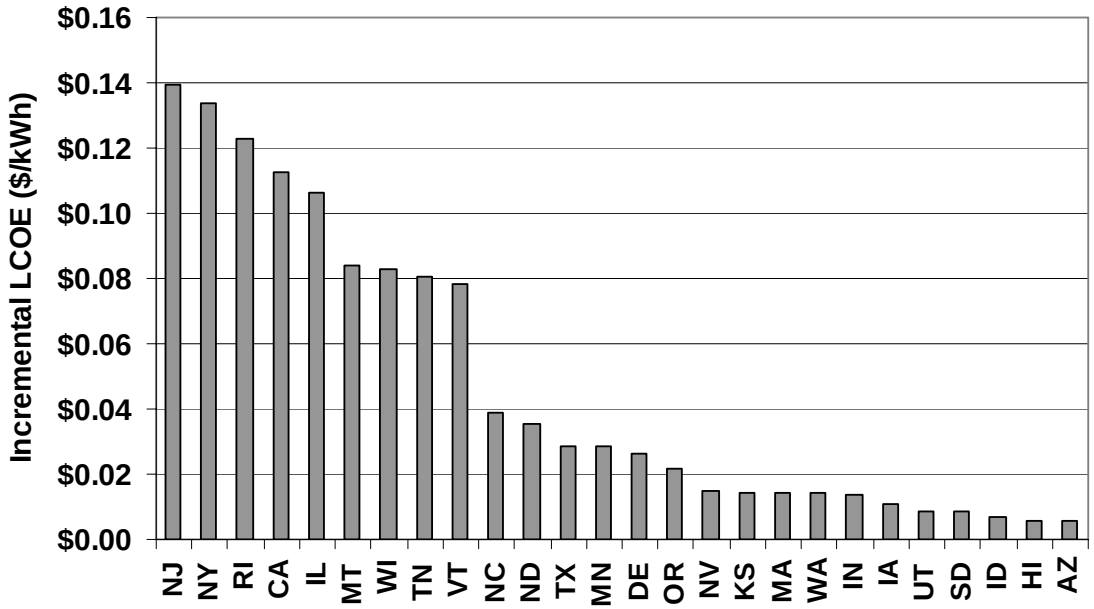

Figure 9. Incremental Levelized Cost of Electricity Without State Incentives (Installed Cost of $4.00/Watt, Class 3 Resource)

4.1.2 State Cash Incentives

State cash incentives – typically structured as rebates on installed system costs – are the most significant individual factor in the economics of residential wind systems. In particular, state cash incentives such as grants, rebates, or production incentives are the biggest drivers for states with high BTCs or low SP periods.

Figure 10 shows the contribution of individual state cash incentive programs to total system BTC. The figure includes all states with a cash incentive program available in January 2004, including Illinois, which was rewriting its state grant program at the time. In New Jersey, Montana, and Tennessee the addition of the state cash incentive program more than doubles the customer BTC at a Class 3 site.[32] In some instances, states with similar rebate programs vary significantly in BTC. For example, the New Jersey and New York state rebate programs are two of the most favorable in the country.[33] The BTC in New York state, however, is much higher than in New Jersey, due primarily to New York's property tax exemptions and higher average

[32] The change in BTC with and without a state rebate is not necessarily correlated on a one-for-one basis with the rebate amount. While a sizable rebate will cause the BTC to increase, a higher BTC will in turn effectively increase the assumed property tax payments (and affect other variables), thereby reducing the BTC somewhat.

[33] NYSERDA's New York Energy $mart^{SM} program refunds 50 percent of the project costs with a maximum rebate value of $100,000 for systems 500 W to 10 kW. The New Jersey Clean Energy Program offers $5.00/Watt or a maximum of 60 percent of the project costs in the most favorable rebate tier for a 10 kW system; for the system cost ranges covered in this analysis, the New Jersey rebate is effectively 60 percent.

state electricity rates, which increase the amount that a customer is able to pay (and still break even) in the absence of any cash incentives.

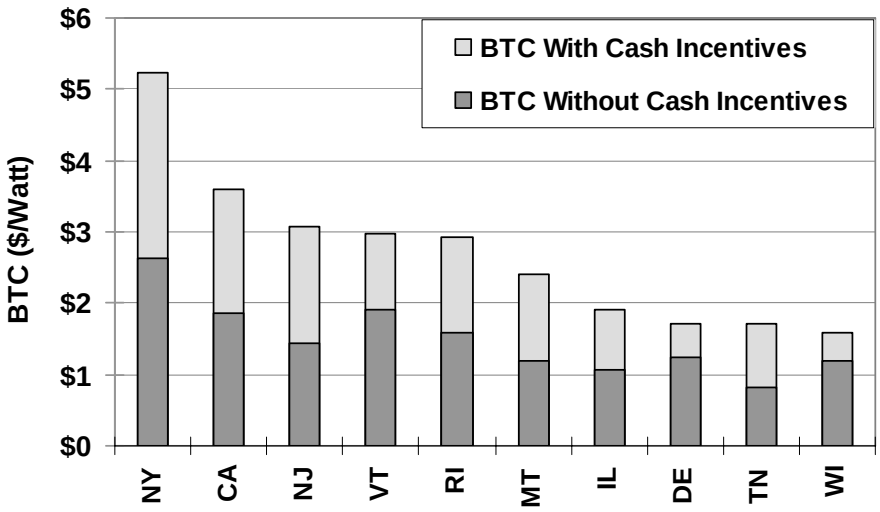

Figure 10. BTC With and Without Cash Incentives (Class 3 Resource)

Figure 11 shows the contribution of state cash incentives to system SP. Absent cash incentives, the SP of a small wind system is increased between 4 to 8 years at an installed cost of $4.00/Watt. Only 5 of the 10 states with cash incentive programs are shown in Figure 11, meaning that the markets in the remaining 5 states (Delaware, Illinois, Montana, Tennessee, and Wisconsin) do not support a payback on a system investment of $4.00/Watt, even with their existing cash incentive programs. In two states, New Jersey and Rhode Island, a system would not achieve SP within 25 years without the existing state cash incentive programs in place.

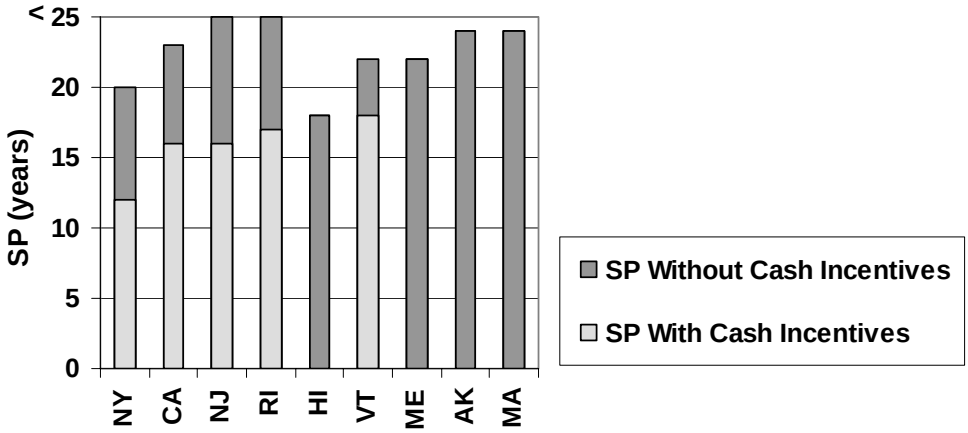

Figure 11. SP With and Without Cash Incentives (Installed Costs of $4.00/Watt, Class 3 Resource)

Additional sensitivity analysis on the impact of state cash incentive programs is presented in Section 4.2 below.

4.1.3 State Income Tax Credits

Figure 12 shows the contribution of existing state ITC policies to the system BTC. In this analysis, existing state ITCs are generally shown to be too low to have much of an impact on customer BTC, often because existing caps on the total dollar amount of the credit are limiting - on a $/Watt basis - for the 10 kW system analyzed here. Of the 11 states that offer ITCs or deductions, 7 have maximum dollar limits that are less than $2,000 (which is equal to $0.20/Watt for a 10 kW system). North Carolina offers the most favorable state income tax credit program at 35 percent of the system cost and a high maximum cap of $10,500. This credit, however, increases the customer BTC by less than $0.40/Watt at a Class 3 site in our analysis, because other economic factors (such as a low average retail electricity rate) keep the BTC low in North Carolina.

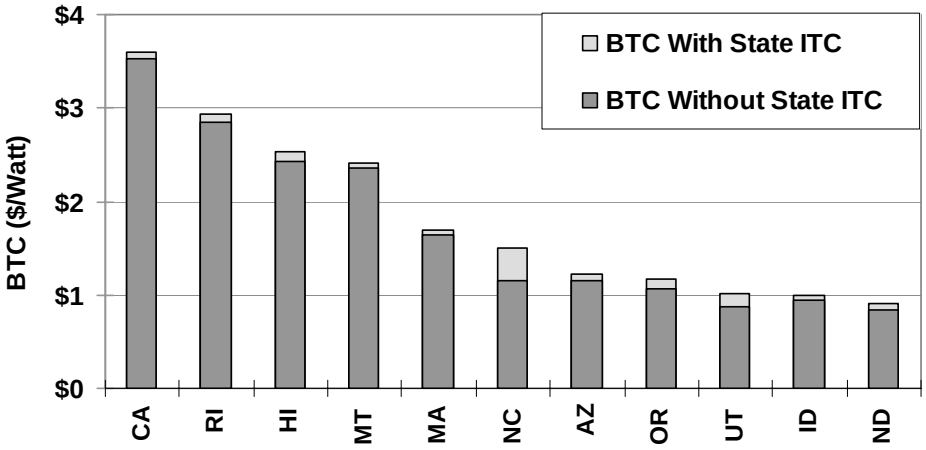

Figure 12. BTC With and Without State ITCs (Class 3 Resource)

Figure 13 shows the effect of state ITC policies on SP results. Of the states with a base-case payback under 25 years, only Hawaii and Massachusetts show an increase in payback without their state ITC policies. California and Rhode Island also have ITC policies, but these programs are not shown because they do not provide a change in payback of 1 year or more for this example case. The change in payback across states does not necessarily reflect the relative magnitude of the state tax credit, since payback is affected by additional factors such as retail electricity rates and property tax payments. [34]

[34] For an installed cost of $4.00/Watt, California customers receive a take-home credit of $1,373 for a 10 kW system, while Massachusetts customers receive $750 for a 10 kW system (after federal taxes).

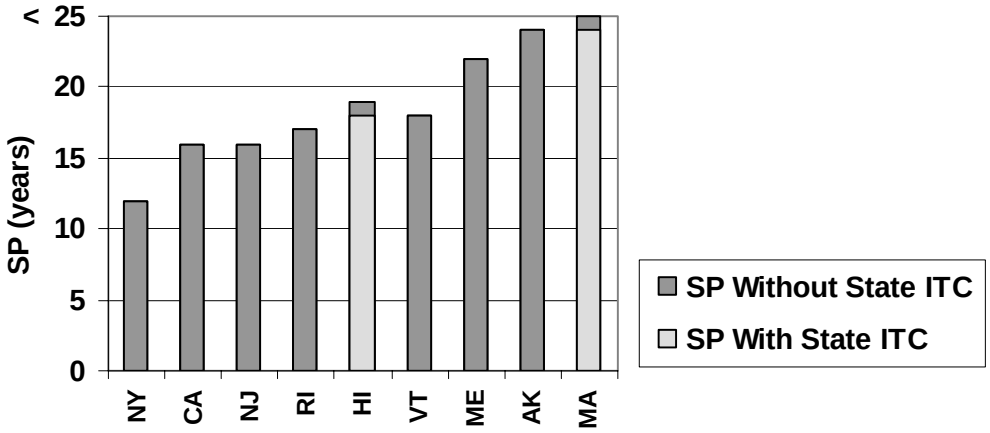

Figure 13. SP With and Without State ITCs (Installed Cost of $4.00/Watt, Class 3 Resource)

4.1.4 State Property Tax Incentives

Eleven states currently offer property tax exemptions for small wind systems on a statewide level (see Table 1). Three states (Montana, North Dakota, and South Dakota) exempt wind systems from property tax payments for a limited number of years, while the remaining states provide the exemption for the entire system lifetime. The average property tax rate in these 11 states ranges from 1.1 – 2.6 percent, and the economic impact of the property tax exemption is directly dependent on that rate and on the increased property value associated with the wind turbine (the turbine cost).[35] In states where property tax payments on residential wind systems are required, the cumulative cost of these payments over the system's lifetime can amount to an equivalent up-front cost of $0.75 to $1.00/Watt for wind systems that initially cost $4.00/Watt, though total payments are lower in most states. Figure 14 shows the contribution of existing property tax exemptions to system BTC.

[35] This means that the economic impact of property tax payments is based on the total installed cost of the wind system, not the amount that a customer pays after any available rebates are received.

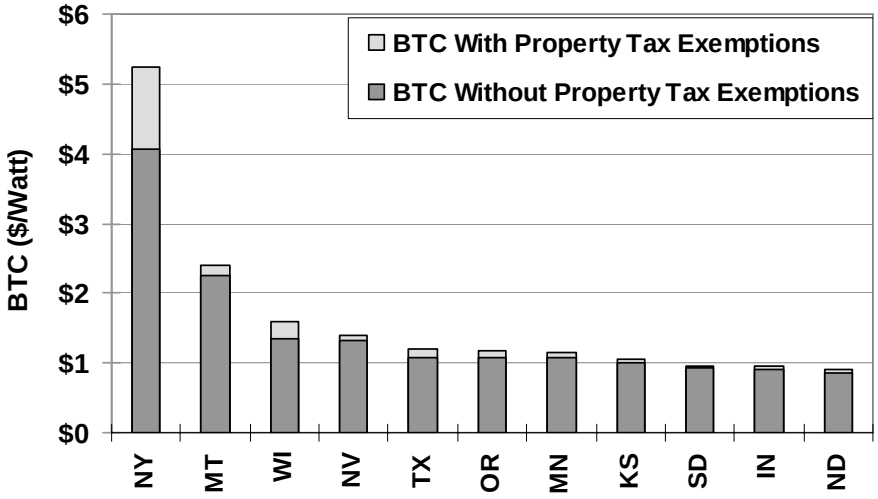

Figure 14. BTC With and Without Property Tax Incentives (Class 3 Resource)

Our analysis shows that, in some cases, property tax exemptions can be an important tool in improving small wind economics, especially when the system is exempt over the full lifetime. While property tax exemptions can increase the customer BTC by as much as $1.00/Watt in New York, the effect is significantly less ($0.25/Watt or lower) in other states. Wisconsin's high average property tax rate of 2.5 percent gives the property tax exemption a larger effect than in most other states.

Of the states with a base-case SP under 25 years for a system cost of $4.00/Watt, only one (New York) has a property tax exemption for residential wind systems. SWAT SP results show that this property tax exemption reduces the payback period in New York by 3 years (from 15 to 12 years) in a Class 3 wind resource.

4.1.5 State Sales Tax Exemptions

Figure 15 shows SP results when sales tax exemptions are removed.[36] Of the 9 states with sales tax exemption programs, only 3 have base-case paybacks less than 25 years at an installed cost of $4.00/Watt. In Rhode Island, the state sales tax exemption reduces the customer SP by one year, and in New Jersey the SP is decreased by two years. In Massachusetts, the sales tax exemption lowers the SP to 24 years, from a SP of greater than 25 years without the exemption. The effect of sales tax exemptions on customer economics is not large, though these programs offer an additional benefit to some customers since they provide an up-front incentive at the time of purchase.

[36] BTC results are not included for this section. The BTC is the *turnkey* cost of the system, and by definition includes all up-front costs a customer must pay, including permitting fees and sales tax (if applicable). While a larger portion of the up-front cost could be spent on the capital cost of the system if no sales tax payment were required, the turnkey cost would remain unchanged.

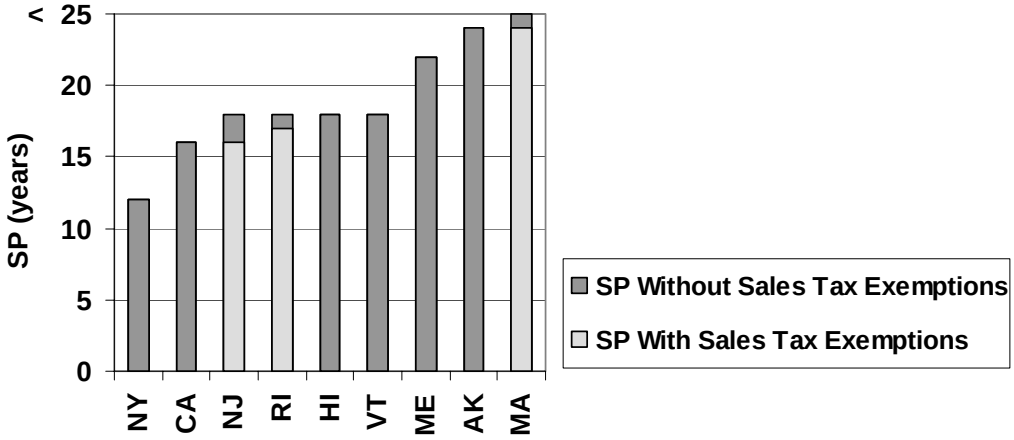

Figure 15. SP With and Without Sales Tax Exemptions (Installed Cost of $4.00/Watt, Class 3 Resource)

4.1.6 State Low-Interest Loan Programs

There are 10 states that currently offer low-interest loan programs for all or part of a small wind purchase (shown in Table 1), with interest rates that vary from 0 to 6 percent. Low-interest loan programs can generally increase the economic attractiveness of a small wind system compared to the other financing options available to a customer, although residential customers in many states must meet income eligibility requirements to qualify. Figure 16 shows results for customer BTC with available low-interest loan programs compared to customer BTC with a cash purchase.[37] In this Class 3 wind resource example, the low-interest loan programs in all states result in a higher BTC than a cash purchase. The terms of existing low-interest loan programs vary significantly across states, but the loan interest rate is only one factor in overall system economics. The most favorable programs (those that offer a zero percent interest rate, such as Iowa) are offered in states where the baseline BTC is low for this 10 kW system. The Iowa low-interest loan program, which covers 50 percent of the system cost, increases the customer BTC by $0.34/Watt over an alternative cash purchase in which an 8 percent return on investment is required. [38] The low-interest loan program in New York, which offers a 4 percent interest rate reduction from standard loan terms, can increase customer BTC by almost $1.00/Watt, because of the favorable baseline economics in New York.

[37] The change in SP period without low-interest loan programs was not calculated, since the SP assumes no system financing and therefore does not account for state low-interest loan programs.

[38] This is because the customer's opportunity cost of capital is presumed to be 8 percent, which is well above zero percent.

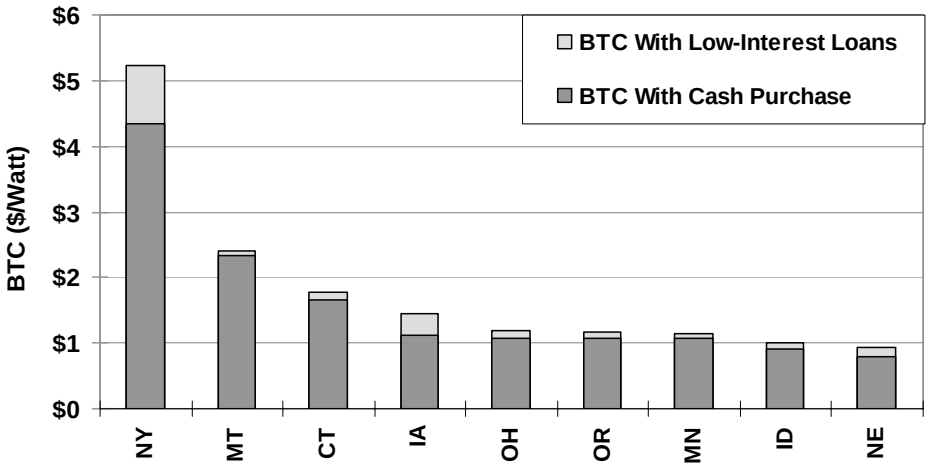

Figure 16. BTC With and Without Low-Interest Loan Programs (Class 3 Resource)

In addition to the states shown in Figure 16, Wisconsin offers a favorable low-interest loan program with a 2 percent interest rate, but customers in Wisconsin are not eligible to claim both the available state cash incentive and the loan. This analysis includes only the cash incentive program because, when analyzed independently, the cash incentive results in a higher customer BTC than the low-interest loan.[39] If the low-interest loan program could be claimed in addition to the cash incentive, the combination would significantly increase the customer BTC in Wisconsin, from $1.58 to $2.11 in a Class 3 resource.

4.1.7 Net Metering

Net metering programs can provide an important economic benefit to grid-connected customers who invest in a variable output wind system but do not have extensive energy storage capabilities. Currently, 33 states offer net metering programs for small wind systems either on a statewide or utility level, where the participating utility (or utilities) is large enough to cover a majority of customers in the state.[40] Small utilities in 4 additional states also offer net metering for wind systems, but for the purposes of this analysis it is assumed that these states do not have net metering programs in place. Tennessee is an exception to this rule; while the state does not offer a net metering program, TVA will purchase 100 percent of the power output of a small wind system at a rate of $0.15/kWh for 10 years, and this effectively credits the total turbine output (over the first 10 years) at an equal rate whether it is used by the customer or not.

The SWAT base-case scenario assumes that all turbine electricity output is valued at the retail rate, meaning that customers have a retail-rate net metering program in place and do not produce net excess generation, or for customers in states without net metering programs, that the wind system is sized to meet the minimum customer load. However, states without net metering

[39] The Wisconsin Focus on Energy cash-back reward program is production-based, so the relative economic benefit of the cash incentive program and the low-interest loan program will depend on estimated turbine output. In a Class 2 environment, the BTC in Wisconsin is the same ($1.14/Watt) with either the cash-back reward program or the low-interest loan program.

[40] See Table A-1 for a list of states.

programs may provide a less favorable environment for small wind than is demonstrated by the base-case results. If customers in states without net metering programs produce excess generation above the instantaneous customer load, there is no retail-rate compensation for that excess power. Figure 17 shows results for the change in BTC when customers in states without net metering programs produce excess generation above the minimum customer load. Only states without net metering programs are shown.[41] Results are shown for two cases, where a customer is assumed to forfeit retail rate compensation for 10 percent and 30 percent of the total electricity generated by the small wind system (a 20 percent excess generation case is additionally included in the detailed results tables in Appendix D). We assume that this excess generation is valued at the utility's avoided cost of electricity, assumed to be $0.03/kWh in all states.[42]

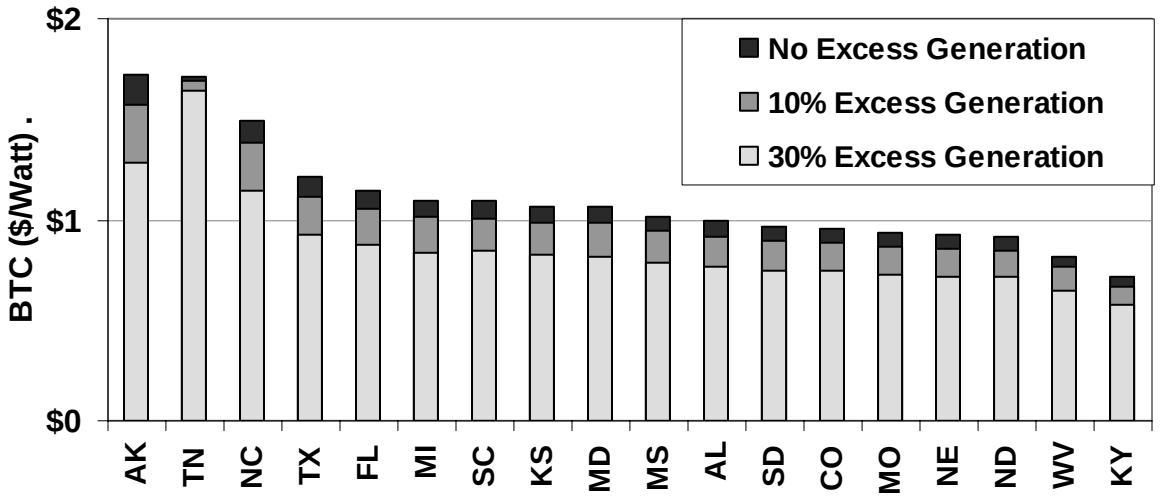

Figure 17. BTC Results for Net Metering Electricity Loss Cases (Class 3 Resource)

Results show that net metering can have a sizable impact on the economic attractiveness of small wind systems, but that most of the states without net metering programs do not have very favorable baseline conditions for grid-connected small wind, with or without net metering programs in place. In other words, net metering programs are already in place in the majority of states with favorable small wind economics. Alaska has the most favorable economics of any state without net metering programs, and is the only state without net metering among the 9 states with a baseline SP of less than 25 years (at an installed cost of $4.00/Watt). BTC results show that net excess generation of 30 percent would reduce the BTC in Alaska from $1.72/Watt to $1.28/Watt. Small wind economics do not change extensively in Tennessee without a net metering program, because the incentives offered through the TVA's green power switch apply to the full amount of electricity generated; a customer will begin to incur a financial loss from the absence of net metering only after 10 years of production.

[41] Effective October 1, 2004, Maryland has included small wind as part of a statewide net metering program. In this analysis, based on January 2004 incentive levels, it is assumed that Maryland does not have a net metering program.
[42] This is an approximate average of the national rate for avoided electricity costs.

4.2 Cash Incentive Sensitivity Cases

Among the state incentive programs included in Section 4.1, cash incentives make the largest contribution to an increased state BTC or a lowered SP, and cash incentives offer the most direct way to lower a customer's initial costs. In the SWAT base-case analysis, New York is the only state that achieves a BTC over $4.00/Watt in a Class 3 resource (i.e. a BTC that is consistent with current installed costs of $4.00 - $5.00/Watt for 10 kW units in the U.S.). All other states require an incremental rebate (above current incentive levels) to achieve a $4.00/Watt BTC. Figure 18 shows this incremental rebate amount for each state, along with the existing rebate contribution in states with cash incentive programs.[43] The 25 most favorable states are shown below and full results are included in Appendix D. As shown, many states would need to implement incremental rebate programs of $2.00 - $3.00/Watt to meet this target.

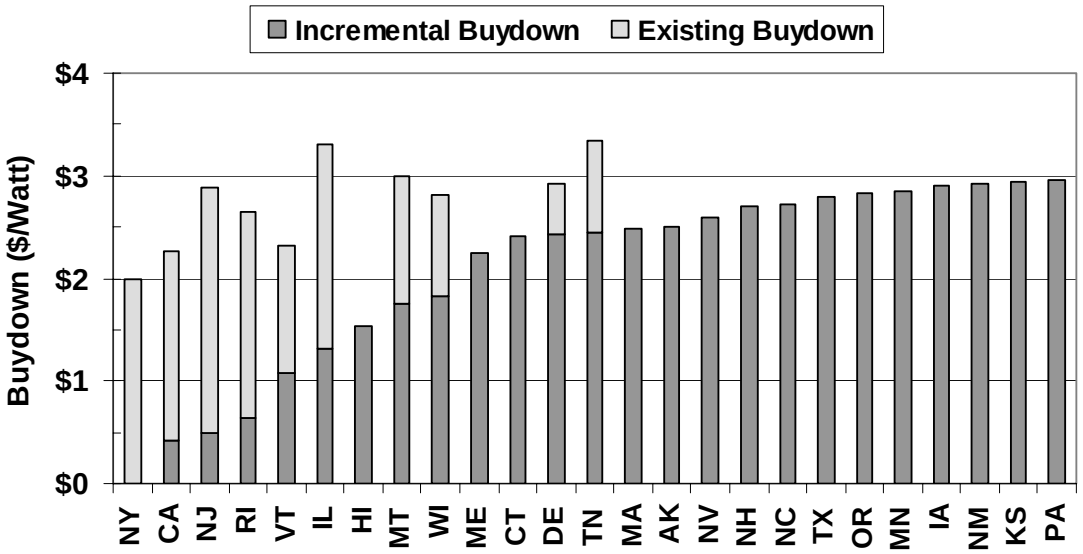

Figure 18. Incremental Buydown Amount Required for a $4.00/Watt BTC (Class 3 Resource)

Figure 19 shows the incremental rebate required to achieve a SP of 10 years, assuming an installed cost of $4.00/Watt (again for the 25 most favorable states, with full results included in Appendix D). At an installed cost of $4.00/Watt, all states require some incremental rebate to achieve a SP of 10 years. The lowest *incremental* rebate requirement is $0.41/Watt in New York, which – in combination with New York's existing 50 percent rebate – would bring the *total* rebate requirement in New York to $2.41. Hawaii has the lowest total rebate requirement at $2.13/Watt, $0.28 lower than New York's total required rebate.

[43] For Illinois, this includes the historic amount available through the state grant program for 10 kW wind systems.

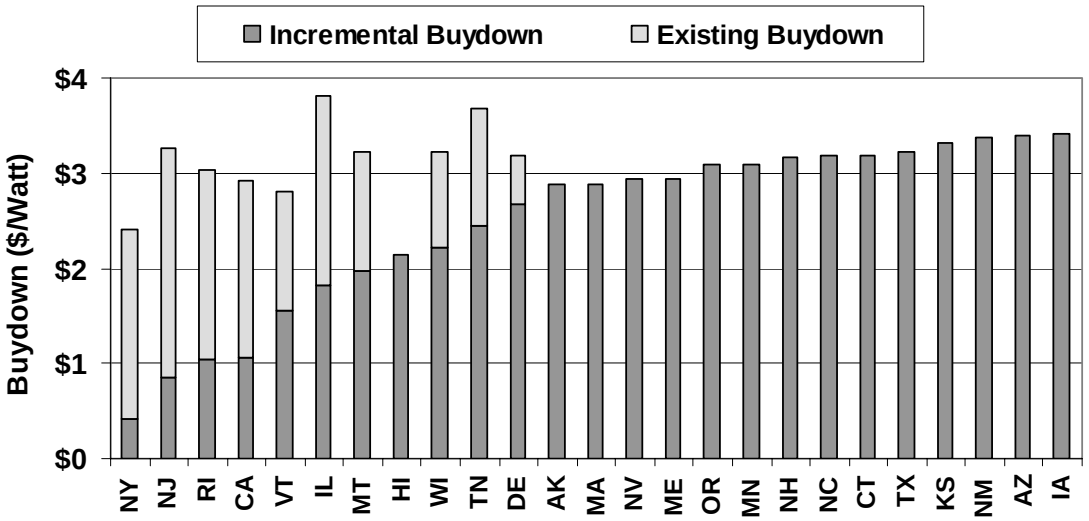

Figure 19. Incremental Buydown Amount Required for a 10 year SP (Installed Cost of $4.00/Watt, Class 3 Resource)

The execution details of cash incentive rewards, e.g. the taxability of cash rebates or the existence of declining incentive values over time, may have a large impact on program effectiveness. Utility rebates for renewable energy are currently exempt from federal income taxes, as part of the Energy Policy Act of 1992.[44] Figure 20 shows one example of the change in BTC and SP when a rebate is instead treated as income on federal and state income taxes, for a Class 3 site in New York.[45] If New York's cash rebate is considered taxable income, the BTC would decrease by almost $1.25/Watt and the SP would increase by 3 years (assuming an installed cost of $4.00/Watt for this 10 kW system). The fact that small wind rebates are non-taxable clearly enhances the customer value of these incentives dramatically.

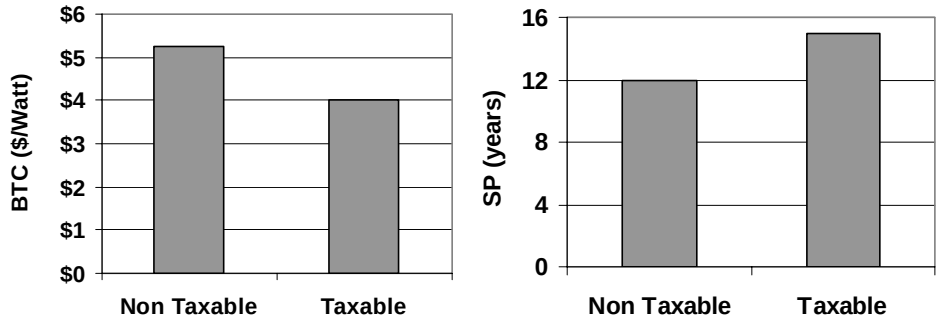

Figure 20. New York BTC and SP With and Without a Taxable Rebate (Class 3 Resource)

[44] *Energy Policy Act of 1992*, Public Law 102-486, 102nd Congress, 2nd Session (October 24, 1992).
[45] The New York state income tax bracket used in this analysis is 6.85 percent, and the federal income tax rate is 25 percent (for a combined effective rate of 30.1 percent, considering the deductibility of state income taxes from federal income taxes).

Figures 21 and 22 show the effect of California's declining rebate schedule on system BTC and SP. California first offered a rebate of $3.00/Watt, capped at 50 percent of installed costs, for small wind systems in 1998. In 2001, at the height of the California energy crisis, California increased the rebate level to $4.50/Watt with a maximum cap of 50 percent system cost. In 2003 this was changed to $2.50/Watt for the first 7.5 kW and $1.50/Watt for each additional kW, and these amounts were set to decline by $0.20/Watt every 6 months beginning July 1, 2003. The rebate amounts for January of 2003 through 2005 are included here.[46] Figure 21 shows that the 2003 rebate values result in the highest BTC at $4.00/Watt, and the 2002 and 2004 values result in approximately the same BTC ($3.53/Watt and $3.61/Watt, respectively). While the 2002 values offer the highest $/Watt rebate level, the 50 percent cap is limiting in this instance. The January 2005 rebate results in the lowest BTC at $3.23/Watt.

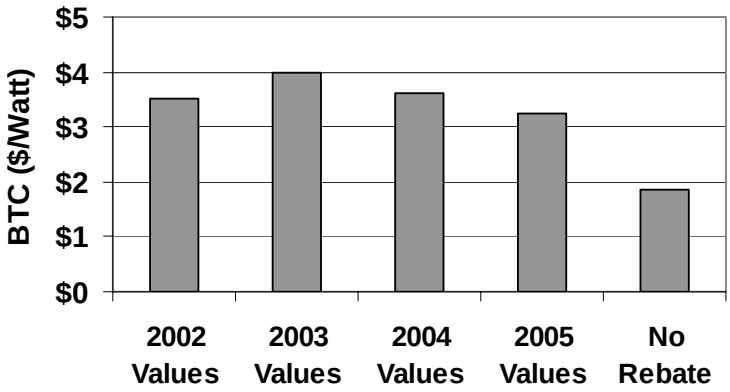

Figure 21. California BTC Under the Declining Rebate Schedule (Class 3 Resource)

Figure 22 shows that the SP period is also the most attractive under California's 2003 incentive values, at 14 years, at an assumed installed cost of $4.00/Watt. The 2004 and 2005 rebate values increase the payback period to 16 and 18 years, respectively. Again, the 50 percent cap is limiting in 2002, where the total rebate amounts to $2.00/Watt ($0.25/Watt less than for a 10 kW system in January 2003) and the payback period is 15 years. These results show that the scheduled decline of rebate amounts will have a moderate to large impact on the economics of small wind for California customers, presuming that installed costs do not comparably decline.

[46] For a 10 kW system this amounts to $2.25/Watt in January 2003, $1.85/Watt in January 2004, and $1.45/Watt in January 2005. The SWAT base-case uses January 2004 values.

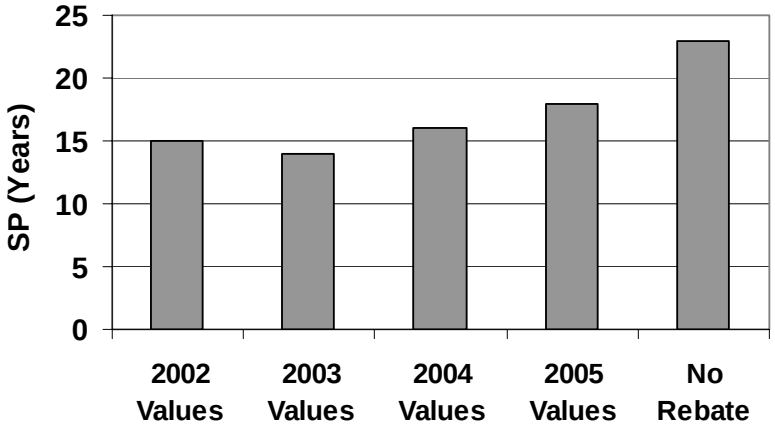

Figure 22. California SP Under the Declining Rebate Schedule (Class 3 Resource)

In addition to taxable rebates and declining rebate amounts, the change in state incentive values when rebates are awarded from multiple sources is an important consideration in the execution of grants or rebates. This topic is addressed as part of the USDA farm grant results in Section 4.4.

4.3 Federal Income Tax Credit

As part of federal energy and tax bills under discussion in 2003 and 2004, the U.S. Congress proposed a federal ITC for residential wind systems set at 30 percent of the system cost, with a maximum limit of $2,000.[47] Figure 23 shows the effect on state BTC of this proposed federal ITC, with and without the $2,000 cap. As shown, the federal ITC can make a significant difference to customer BTC. The $2,000 cap is severely binding for 10 kW systems, however, because such systems typically cost $40,000 to $50,000 installed. A 30 percent ITC with no cap, or with a higher cap, would be significantly more valuable to residential customers considering 10 kW wind systems. (Much smaller systems, which cost less overall, would not necessarily hit the $2,000 cap, so removal of the cap would not greatly impact those systems.)

[47] *Energy Policy Act of 2004*, 108th Congress, 2nd session. Received in Senate June 17, 2004.

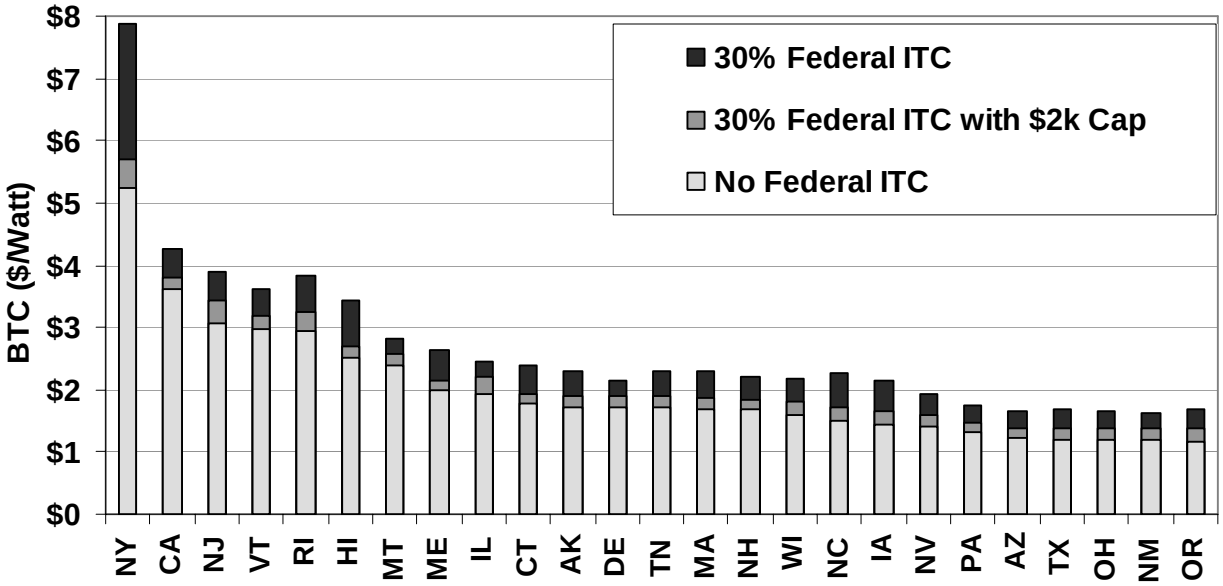

Figure 23. BTC With and Without a Federal ITC (Class 3 Resource)

Figure 24 shows states with SP periods under 25 years if customers receive the federal ITC, assuming an installed cost of $4.00/Watt. A federal ITC with no cap can greatly increase the number of states with paybacks less than 25 years, and among these states the federal ITC reduces the SP period by 3-5 years. With the $2,000 cap in place the effect is much less significant. The $2,000 cap decreases the payback period by 1 year in most cases, though Rhode Island sees a 2-year payback reduction. Four states (Hawaii, Maine, Alaska, and Massachusetts) show no difference in payback between a capped federal ITC and no ITC at all.[48]

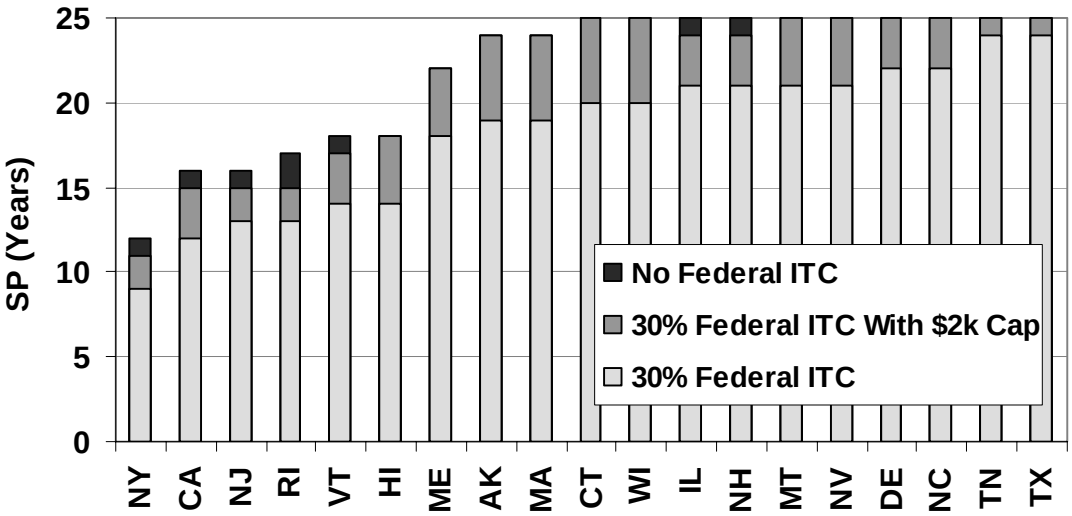

Figure 24. SP With and Without a Federal ITC ($4.00/Watt Installed Cost, Class 3 Resource)

[48] A capped federal ITC will improve the economics of small wind systems, but the effect is not large enough to reduce the payback period by an entire year.

4.4 USDA Farm Bill Grant

The federal government currently offers a rebate for small wind systems that is available through the USDA's Section 9006 grants. This rebate was made available as part of the 2002 Farm Bill and the grants are targeted towards farmers, ranchers, and small rural businesses who have demonstrated financial need and will use the system for rural applications. The rebate will cover up to 25 percent of total system costs and there is no upper limit on project size, though grant awards cannot exceed $500,000. USDA grants are awarded competitively, and this does not guarantee that the owner of a qualified system will be successful in securing a grant.

The grant amount that the USDA will award is not reduced by the presence of additional rebates that a customer may receive from their state, however, individual state rules differ on how much a customer can collect if they receive multiple cash incentives. Certain states decrease their incentive award if additional funds are collected from an outside source such as the USDA, while in other states multiple incentives add "cumulatively," that is, the state incentive amount does not decrease if a second incentive is collected. Table 4 includes a summary of the existing state rules for interaction among multiple rebates for the 9 states that offer cash rebates or grants.[49] Since the USDA grant has been available for a limited time and there have not been extensive awards, many states have not needed to clearly outline the procedure for multiple-grant interactions. The information in Table 4 is taken from state program contracts or application forms when available, and otherwise is the best available information from program managers and administrators.

Table 4. Treatment of Multiple Rebates in States with Grant or Rebate Programs

State	Treatment of Multiple Grants or Rebates
California	50 percent of incentives from an outside source must be subtracted from the state rebate amount.
Delaware	All additional incentives must be subtracted from the system cost before calculating the 50 percent rebate.
Illinois[50]	State funds would not be reduced.
Montana	State funds would not be reduced.
New Jersey	The $5.00/Watt rebate amount would not be reduced, but the maximum cap of 60 percent is based on the project costs minus any outside rebates.
New York	All additional incentives must be subtracted from the system cost before calculating the 50 percent rebate.
Rhode Island	State funds would not be reduced.
Vermont	State funds would not be reduced.
Wisconsin	State funds would not be reduced.

[49] Tennessee is excluded from Table 4 because TVA's cash incentive program is an electricity purchase agreement with the customer, not an up-front grant or rebate.

[50] The information included for Illinois is based on the current administration of the state grant program, although this 10 kW wind system would not be eligible for this incentive.

Figure 25 and Figure 26 show the increase in BTC when the 25 percent USDA farm bill grant is awarded for a small wind system. No direct information was found in the 2002 Farm Bill to indicate whether the grant amount awarded through the USDA is exempt as taxable income on a customer's federal and state income taxes, and results are presented here for both scenarios. The results in Figure 25 show BTC values if the grant amount is taxable, and results in Figure 26 assume that the USDA grant is tax-exempt. Results reflect the existing rules of interaction between state and federal grants as summarized in Table 4. In addition, the BTC results for a cumulative addition between state and USDA grants are shown for the states that currently reduce their grant amount if additional federal funds are collected.

The impact of a taxable USDA grant varies among states, because of the difference both in state baseline BTCs and state income tax rates. While a taxable USDA grant makes a noticeable impact on BTC, it causes only a few additional states to have a BTC over $2.50/Watt. The largest impact on BTC is in those states that have the combination of a high baseline BTC and a cumulative grant interaction, namely Vermont, Rhode Island, Wisconsin, and Illinois (if the state grant program were available for 10 kW wind systems). In New York, California, and New Jersey, the impact of a cumulative grant addition (i.e., allowing federal incentives to simply add to state incentives) would increase the BTC significantly over the existing rules for state-federal grant interactions. The value of the USDA grant is increased if it is tax-exempt, as shown in Figure 28.

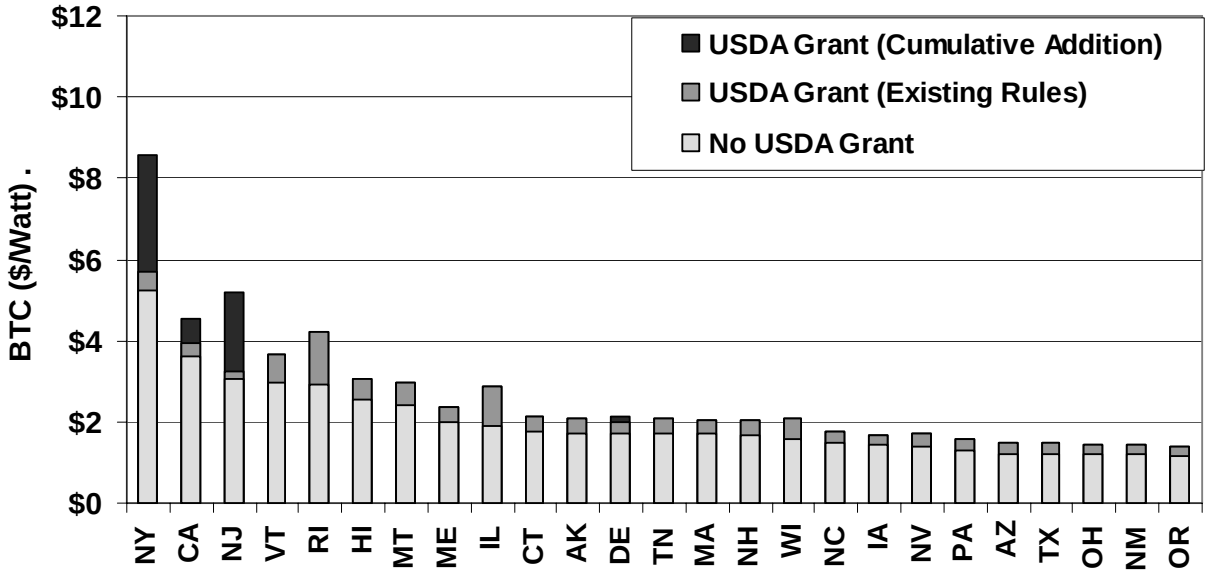

Figure 25. BTC Results With a Taxable USDA Farm Grant (Class 3 Resource)

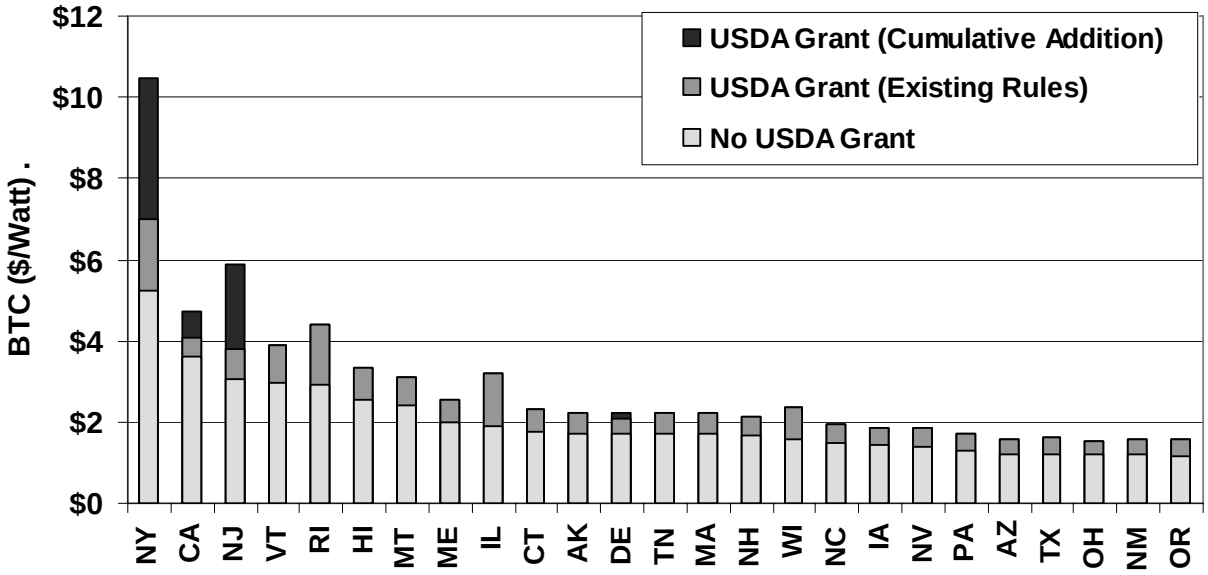

Figure 26. BTC Results With a Tax-Exempt USDA Farm Grant (Class 3 Resource)

Figure 27 and Figure 28 show the SP results for the USDA farm grant case, again for the two cases where a grant award is taxable and tax-exempt. States with resulting paybacks less than 25 years are shown. At an installed cost of $4.00/Watt, a taxable USDA grant can decrease the SP period by as much as 5 years (Rhode Island). Again, the grant has less of an effect on states without a pre-existing rebate program and on states that don't offer a cumulative addition of rebates, on the order of a 2–3 year reduction in payback. Results show that a tax-exempt grant award will further lower the payback period by 1-2 years over a taxable grant.

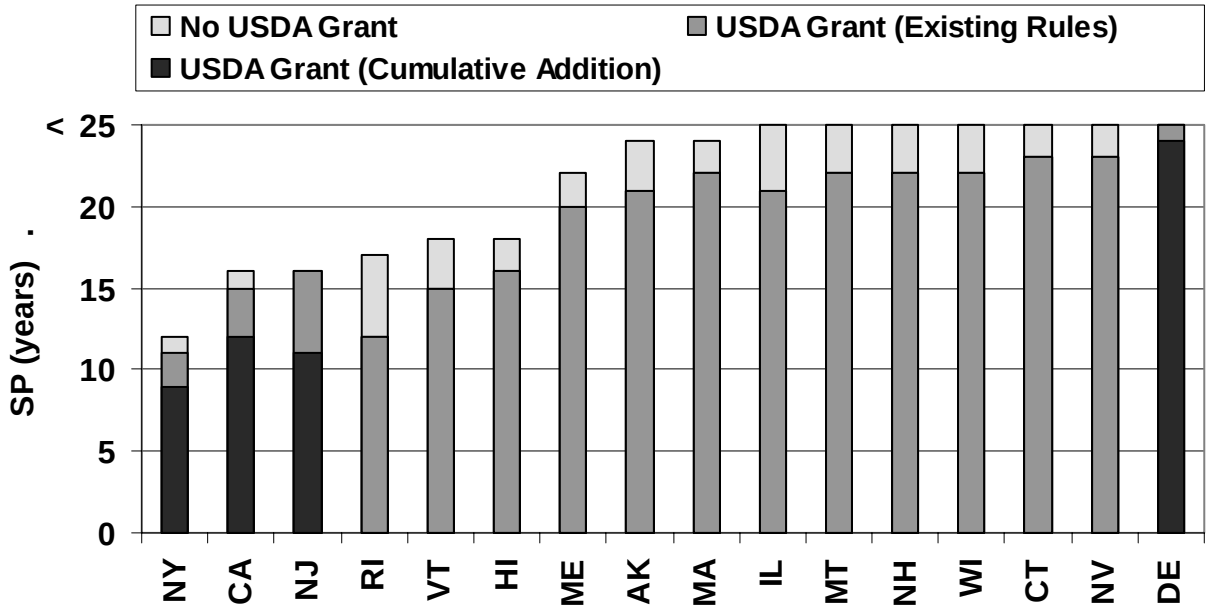

Figure 27. SP Results With a Taxable USDA Farm Grant (Class 3 Resource)

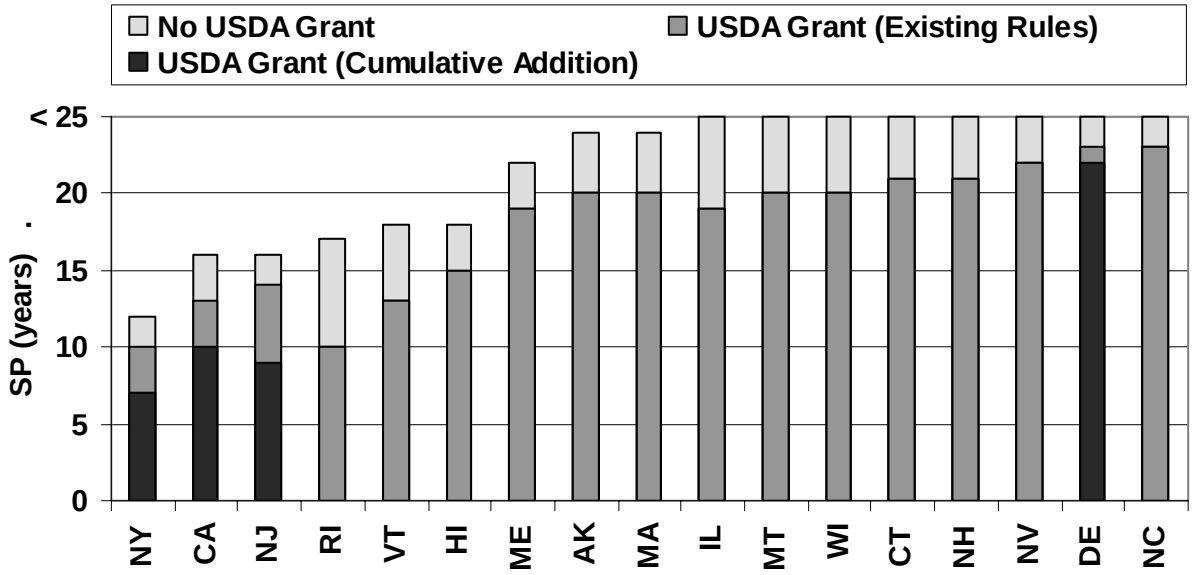

Figure 28. SP Results With a Tax-Exempt USDA Farm Grant (Class 3 Resource)

While the impact of the USDA grants can be significant, for many of the key farm states targeted by the program, the grant does little to move a small wind system into an economically attractive range. This is because, in general, the average electricity cost in these states is too low to make the purchase of a wind system cost-effective on economic grounds alone, and these states have – by and large – failed to develop aggressive state policy incentives for small wind. However, for off-grid customers, those with a higher-than-average electricity rate, or those able to sell tradable renewable certificates, a small wind system might be a viable investment with the assistance of the USDA grant. The effect of a (taxable) USDA grant on customer BTC for select farm states is shown in Figure 29.

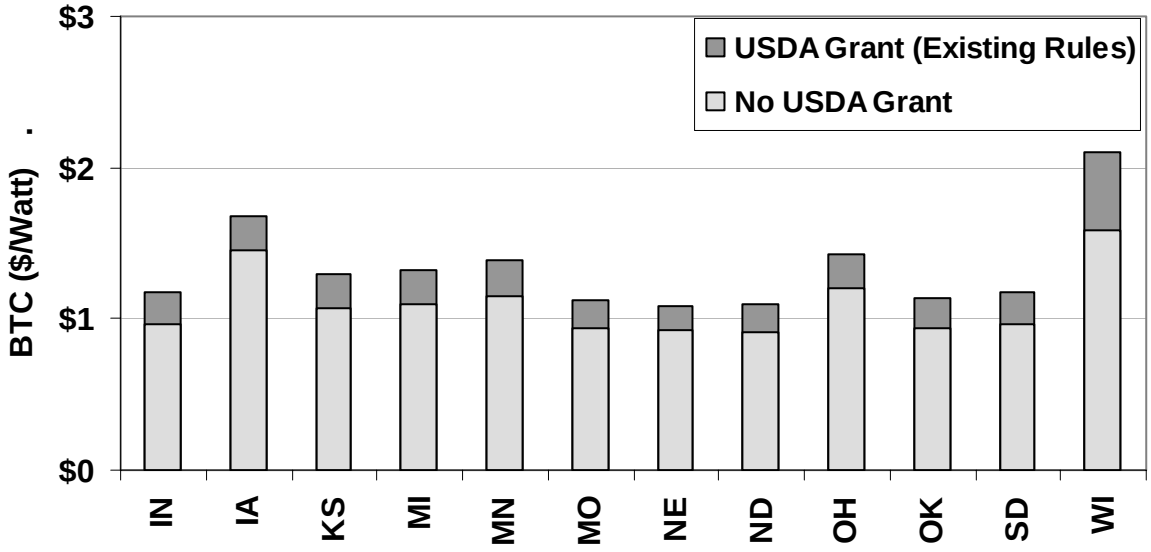

Figure 29. BTC Results With USDA Farm Grant for Select Farm States (Class 3 Resource)

4.5 Summary of Policy Incentive Cases

The combination of all existing state incentives makes a large contribution to the economic attractiveness of small wind systems in many states. Of all the existing financial incentive programs, cash incentives for small wind, currently available in 9 states (and previously available in Illinois as well), make the largest contribution to the economic attractiveness of a small wind investment. Cash incentives can increase the customer BTC by as much as 50 percent and lower the SP by as much as 8-10 years depending on system installed cost. The implementation details of cash incentive programs can also have a significant effect on customer economics. For example, if the New York rebate were taxable (rather than non-taxable) income, the BTC of a small wind system in that state would decrease by almost $1.25/Watt. In addition, cash incentive programs that are set to decline over time will lower the economic attractiveness of small wind systems if installed costs do not decline commensurately; the BTC of a small wind system in California was highest ($4.00/Watt) under 2003 incentive levels and will decline to $3.23/Watt under January 2005 incentive levels, though this amount is notably higher than the BTC of $1.86/Watt if no rebate were available.

Among the other existing state incentives (not including cash incentives), property tax exemptions are shown to have the largest effect on small wind economics, especially in states where the wind system is exempt for its entire lifetime. Property tax exemptions can reduce a customer's payback period by as much as 4 years. State ITC policies, in their current form, have a smaller effect on customer economics for the 10 kW system analyzed here, due to fairly restrictive maximum caps on the total dollar amount that can be claimed. The North Carolina ITC policy is the one exception because of its high maximum cap of $35,000. State sales tax exemptions and low-interest loan programs are also shown to have a moderate effect on customer economics. The one exception is New York's low-interest loan program, which can increase customer BTC by almost $1.00/Watt. Without any available incentives, a high retail electricity rate is the largest driver for favorable small wind economics, as shown in the earlier results for Hawaii and Maine. And finally, net metering programs give customers with small wind systems an important advantage, though most states with favorable economics for small wind systems already have net metering programs in place.

Possible federal incentives can significantly increase the economic attractiveness of small wind systems in states with favorable baseline conditions. A 30 percent federal ITC can decrease customer SP period by 4.5 years on average, for example, but the currently proposed $2,000 cap limits this reduction to 1-2 years for the 10 kW system analyzed here. The 25 percent USDA grant can decrease a system SP by as much as 5 years or increase the BTC by $1.25/Watt (assuming the grant is taxable income), but the effects of the USDA grant are highly variable across states and will depend on a state's baseline economics and on the interaction of available state rebate programs with the USDA grant. In addition, the USDA grant program is competitively awarded and has a moderate effect on most of the program's target states, which in general do not have favorable baseline economics for small wind systems.

Figure 30 shows a map of the statewide effect of federal incentives on the 10 kW system economics when wind resource geography is considered. Figure 6 in Section 3.4 similarly maps the regions where wind resource and state economic conditions produce a BTC over $2.00/Watt, for SWAT base-case assumptions. Figure 30 adds to that base-case map the regions where the

Federal ITC (with a $2,000 cap) or a taxable USDA grant will increase the BTC over $2.00/Watt. These regions are primarily the high wind class areas in Nevada, New Mexico, and parts of the Northeastern U.S. The USDA grant would give most rural regions in Illinois a BTC over $2.00/Watt if the state grant program were additionally available for 10 kW wind systems.

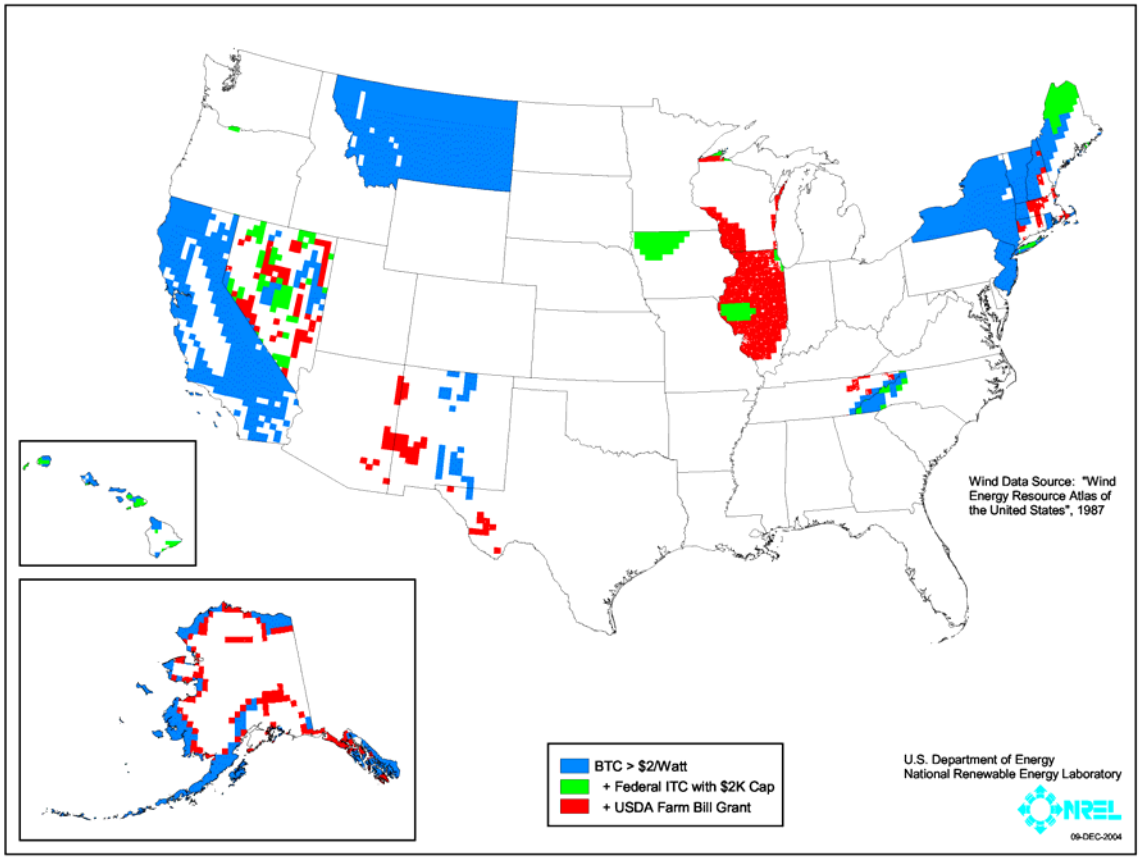

Figure 30. U.S. Regions With a BTC over $2.00/Watt with Federal Incentives

Figure 31 below shows the same federal incentive results for just the northeastern states, using high-resolution wind data from TrueWind and NREL.[51] The high-resolution wind data, which is currently available for select states, shows that the regions where the BTC is greater than $2.00/Watt are smaller than what is conveyed with the lower resolution data.

[51] High-resolution wind maps are not currently available for all states.

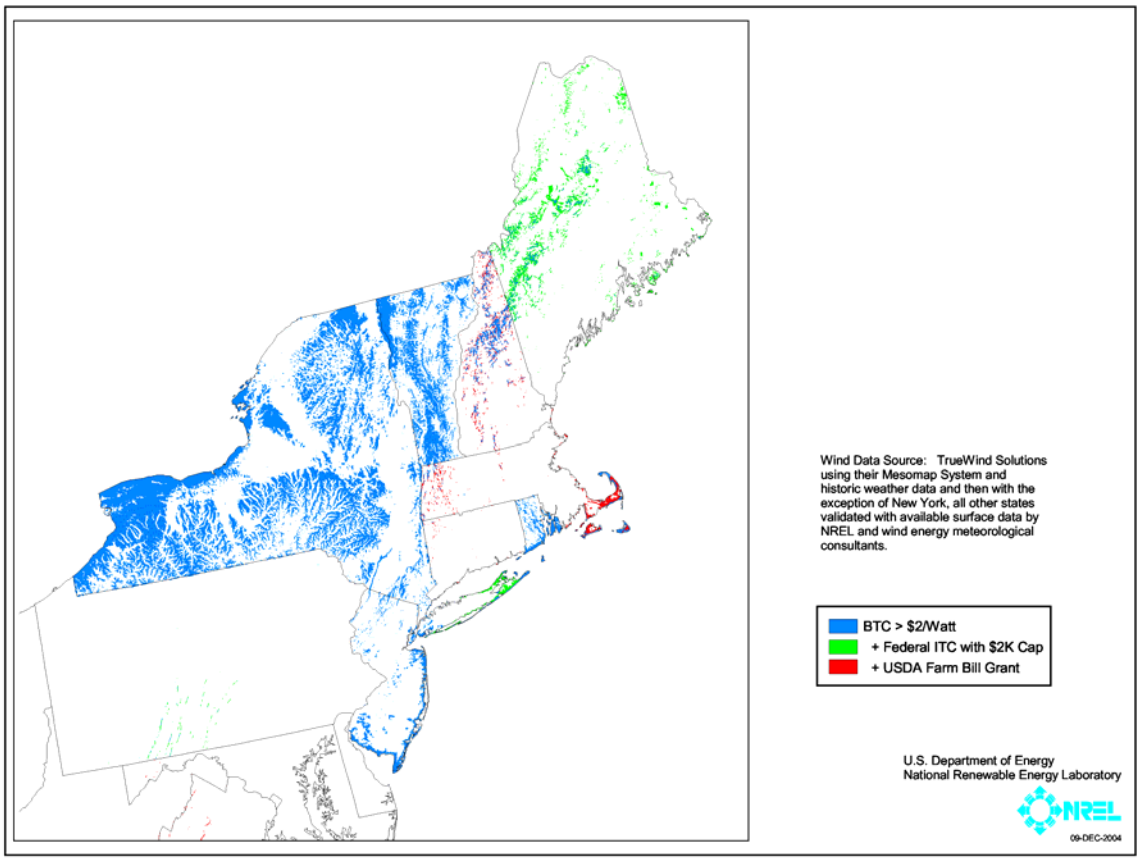

Figure 31. Northeastern U.S. Regions With a BTC over $2.00/Watt with Federal Incentives

5. Additional Sensitivity Results

Small wind system performance and economics are highly variable, depending on site- and turbine- specific factors, as well as system financing assumptions. The SWAT base-case assumptions outlined in Table 3 in Section 2.2 are approximate values, and would not be applicable to all installations. Additional sensitivities were performed for select economic, system performance, and financing assumptions, using a California Class 3 wind resource as the example case. This section presents results for the BTC analysis in the California market. Class 3 BTC results for all states are included in Appendix D.

5.1 Economic Assumption Sensitivities

Figure 32 presents the results from sensitivities on the following economic assumptions: O&M costs, customer required internal rate of return (IRR), and tiered electricity rates. The base-case assumptions of 1.5¢/kWh, an 8 percent IRR, and an average electricity rate of 12.2¢/kWh result in a BTC of $3.60/Watt in a Class 3 resource. Minimum and maximum O&M sensitivity values of 0.5¢/kWh and 3.0¢/kWh reflect the typical range of reported costs for small wind installations, but some installations will fall outside of this range, especially given the variation in environmental conditions and customer maintenance and upkeep of their wind system. The customer required rate of return varies from a high rate of 15 percent to a low rate of 2.5 percent. A customer return of 2.5 percent is equivalent to the average annual inflation rate, meaning a customer would not earn any additional revenue from investment in a wind system beyond maintaining the real dollar value of their investment by keeping pace with inflation. The California tiered electricity rates are taken from the Pacific Gas and Electric (PG&E) tiered electricity tariff for residential customers and the average retail rate of 16.1¢/kWh is calculated from a monthly electricity consumption equivalent to the turbine production at a Class 3 site in this analysis. [52]

[52] The average cost of electricity under tiered electricity rates was calculated from PG&E Schedule E-1 for residential service, filed on March 1, 2004. A baseline usage quantity of 470 kWh/month is assumed (as defined in Schedule E-1) and tiered rates increase to as much as 21.4¢/kWh for the highest tier.

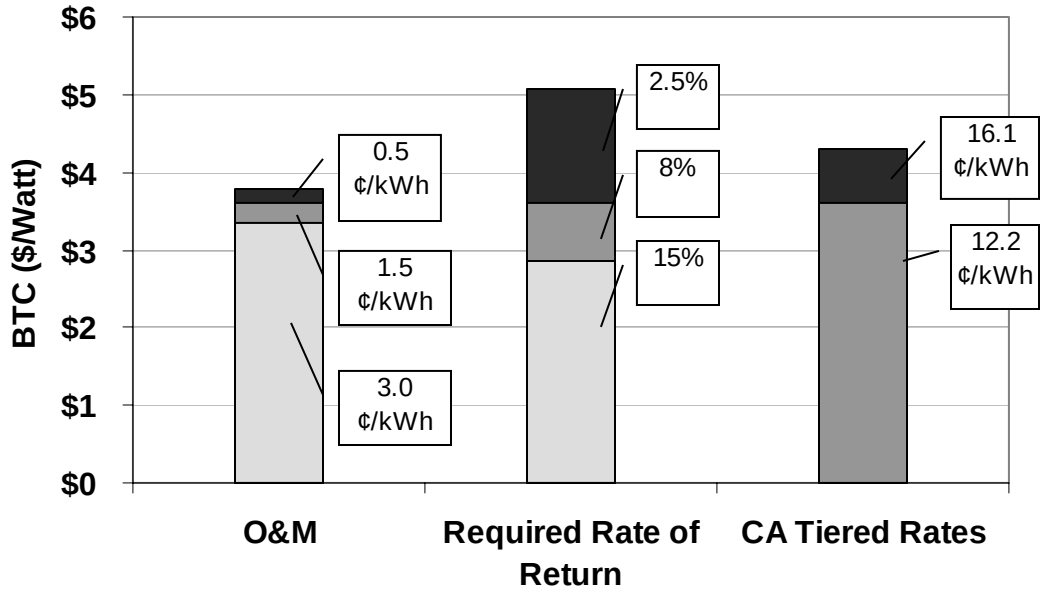

Figure 32. Economic Assumption Sensitivity Results (California Class 3 Resource)

These results show that customer BTC is especially sensitive to a change in average electricity rates and to the customer IRR, while O&M costs are shown to impact the BTC more moderately. The most significant effect comes from the change in assumed customer IRR. A 15 percent IRR drives the customer BTC down to $2.85/Watt, while a 2.5 percent IRR allows for a BTC over $5.00/Watt in this California Class 3 example. In California, and some other states, tiered electricity rates ensure that some customers will see much higher marginal electricity rates than the average. If a small wind system is able to offset an electricity rate that is 30 percent higher than the average statewide residential rate, the BTC increases by $0.70/Watt (to $4.29/Watt at a California Class 3 site). If O&M costs are reduced from the highest cost case (3.0¢/kWh) to the lowest cost case (0.5¢/kWh) the BTC increases by approximately $0.40/Watt.

5.2 Turbine Performance Sensitivities

Figure 33 shows results from three turbine performance sensitivity cases. Turbine lifetime is varied from 20 to 30 years, though shorter and longer lifetimes are certainly possible for some systems. Tower height is decreased to 20 meters from the base-case value of 30 meters, and turbine energy output is lowered accordingly. Lastly, the turbine energy output is decreased by 20 percent due to a possible loss of output from localized factors and equipment downtime.

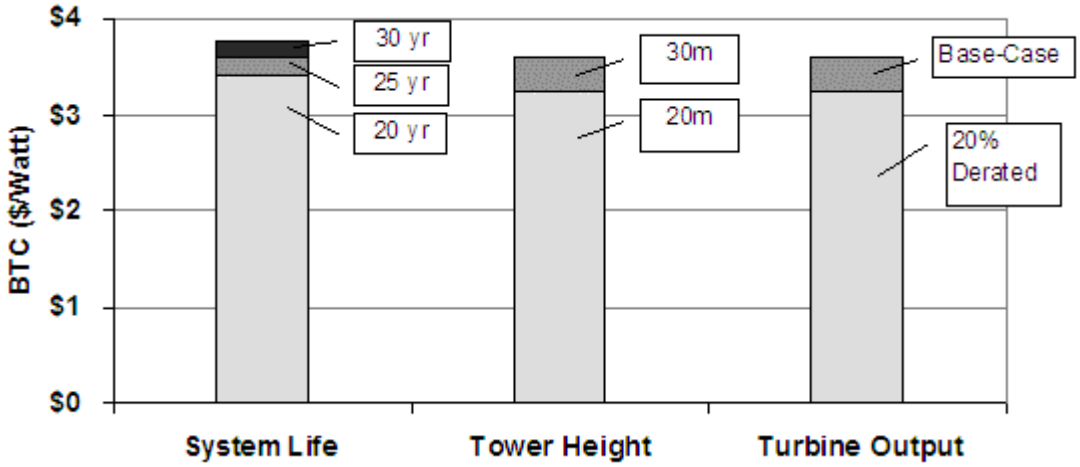

Figure 33. Turbine Performance Sensitivity Results (California Class 3 Resource)

The above sensitivity values for tower height and turbine output have an equivalent effect on BTC; each results in a change of customer BTC by $0.35/Watt. This is only slightly less than the $0.40/Watt change in BTC from the O&M sensitivity case above. Variation in system lifetime has less of an effect on customer BTC. A 5-year increase or decrease in system lifetime will change the BTC by approximately $0.20/Watt.

5.3 Alternative Financing Sensitivities

The base-case BTC results presented in Section 3 assume that systems are purchased in cash, unless a state low-interest loan program results in a higher BTC. Figure 34, below, presents sensitivity cases for different financing scenarios that may be available to a small wind customer. Table 5 summarizes the assumptions for the alternative financing cases.

Table 5. Assumptions for Alternative Financing Scenarios

Financing Scenario	Assumptions
Low-Interest Loan	10 year life and 2 percent interest rate
Personal Loan	10 year life and 8 percent interest rate
Home Mortgage	30 year life and 6 percent interest rate (with tax-deductible interest payments)

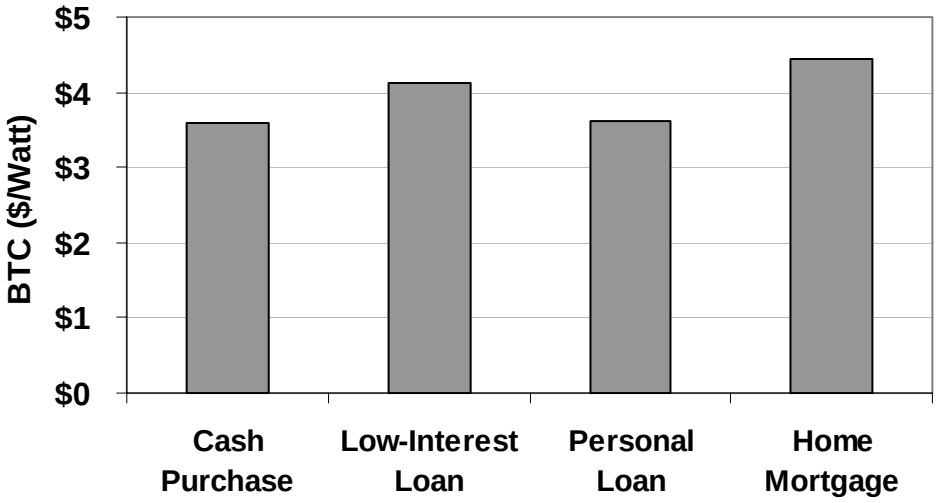

Figure 34. Alternative Financing Sensitivity Results (California Class 3 Resource)

Results demonstrate that financing assumptions can have a moderate impact on the BTC, which can vary by as much as $0.80/Watt. A cash purchase results in a customer BTC of $3.60/Watt, and this amount is increased under a low-interest loan or a home mortgage scenario. Interest rates under current state low-interest loan programs for small wind systems range from 0 to 6 percent, with an average of about 3 percent – slightly higher than the 2 percent interest rate assumed here.[53] The home mortgage financing option (30-year loan term and a 6 percent interest rate) increases the customer BTC to $4.44/Watt. This financing option offers an incremental benefit to the low-interest loan option due to the longer loan term and the effect of tax-deductible interest payments. The system BTC under a personal loan (10 year loan term and 8 percent interest rate) is approximately equivalent to a cash purchase, because the customer required rate of return is assumed to be 8 percent in the base-case scenario.

5.4 Summary of Additional Sensitivity Results

Wind turbine performance, financing, and economic assumptions can have a large effect on system BTC for this California Class 3 example case. The largest effects come from changes to the average customer electricity rate, the customer IRR, and the option to finance a wind system using a home mortgage. These variables change the customer BTC by $0.70/Watt to $1.50/Watt in California. O&M costs, system lifetime, and turbine electricity output are also influential, but these variables have a more moderate effect on customer BTC.

[53] Many state low-interest loan programs will vary with the market interest rate, and some offer different rates depending on customer eligibility.

6. Conclusion

Results from this analysis show that the economics of residential, grid-connected small wind systems are highly variable by state and wind resource class. Attractive markets for small residential wind systems are currently limited to a small number of states that typically have higher electricity rates and that provide aggressive state- and/or utility-based policy incentives. For the 10 kW system analyzed here, only New York currently provides a customer BTC, or market-hurdle value, above $4.00/Watt in a Class 3 wind resource regime. There are 6 additional states that have BTCs above $2.00/Watt at a Class 3 site: California, New Jersey, Vermont, Rhode Island, Hawaii, and Montana. If a Class 4 wind resource is available, then Maine, Illinois, Connecticut, Alaska, Tennessee, New Hampshire, Massachusetts, and Delaware hit a $2.00/Watt BTC.[54] In the current policy environment, significant wind system cost reductions would be necessary to stimulate widespread market acceptance. In a Class 3 wind resource and an assumed installed cost of $4.00/Watt, 9 states offer system paybacks less than 25 years, and that number increases to 30 states if installed costs hit $2.50/Watt with existing incentives in place.

A number of state policies could help further stimulate the market, but state cash incentives currently have the most significant impact, and will be a critical element of continued growth in the small wind market. Among the other existing state incentives, property tax exemptions are shown to have the largest effect on small wind economics, especially in states where the wind system is exempt for its entire lifetime. It is important to note, however, that property tax values can vary significantly within states, and that property tax payments are not generally a prime consideration in a customer's decision to purchase a wind system. Other policies such as state ITCs and low-interest loan programs can have a significant impact on customer BTC, but these policies are less important than cash incentives. The existence of net metering is also an important economic consideration for small wind systems, and the absence of net metering can degrade system economics. Most states with favorable baseline economic conditions for small wind, however, already have net metering programs in place.

Possible federal incentives can increase the economic attractiveness of small wind systems in states with favorable baseline conditions. A 30 percent federal ITC can decrease customer SP period by 4.5 years on average, for example, but the currently proposed $2,000 cap limits this reduction to 1-2 years for the 10 kW system analyzed here. With the addition of a capped federal ITC, Maine and Illinois will also have a BTC above $2.00/Watt in a Class 3 environment. The 25 percent USDA grant can decrease a system SP by as much as 7 years or increase the BTC by $1.75/Watt, but the effects of the USDA grant are highly variable across states and will depend on a state's baseline economics and on the interaction of available state rebate programs with the USDA grant. In addition, the USDA grant program is competitively awarded and has a moderate effect on most of the program's target farm states, which in general do not have favorable baseline economics for grid-connected small wind systems. If the USDA farm bill grant is awarded along with existing state incentives, 9 additional states (Maine, Illinois, Connecticut, Alaska, Delaware, Tennessee, Massachusetts, New Hampshire, and Wisconsin) will be added to the list of states with a BTC of over $2.00/Watt in a Class 3 wind resource.

[54] Illinois is included in this category only when the state grant program is applied to a 10 kW wind system.

The results of this analysis can help determine which states currently provide the most attractive markets for residential wind systems, or are the best candidates for targeted outreach and consumer education programs. In addition, these results help to quantify the impact of existing and proposed policy incentives on small wind economics in different states. This information may help policymakers and advocates explore the impact of different policy types and levels on customer economics, and thereby make decisions on how best to support the growth of the small wind industry.

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Appendix A. Existing State Incentives

The following table summarizes the state financial incentives included in this analysis. Data were collected from the Database of State Incentives for Renewable Energy, individual incentive program websites, or program contacts, and were compared to small wind incentive data collected by the National Renewable Energy Laboratory (NREL). The values in this table correspond to January 2004 incentive levels, meaning that programs with a declining incentive structure are taken at January 2004 values and that incentives are included if they were available in early 2004, even if program funds have since expired. The Illinois Renewable Energy Resource Program grant, which was being rewritten at the time of this analysis but had historically included 10 kW wind systems, is listed below although small wind systems are no longer eligible for state funds.

Table A-1. State-by-State Incentives for Small Wind

State	Cash Incentive	Income Tax Credit	Income Tax Deduction	Property Tax Exemption[a]	Sales Tax Exemption	Net Metering[b]	Low-Interest Loan
Alabama						No	
Alaska						No	
Arizona		25% of system cost or $1k for yr.1			$5k of equipment exempt	Yes	
Arkansas						Yes	
California	$2.1k for the first 7.5 kW, $1.1k for each additional kW[c]	7.5% system cost after other deductions[d]				Yes	
Colorado						No	
Connecticut				Local		Yes	Up to $15k, 10 yr, 1-6%[e]
Delaware	50% system cost max. $5k total					Yes	
Florida						No	
Georgia						Yes	
Hawaii		20% system cost max. $1.5k				Yes	

State	Cash Incentive	Income Tax Credit	Income Tax Deduction	Property Tax Exemption[a]	Sales Tax Exemption	Net Metering[b]	Low-Interest Loan
Idaho			40% system cost yr.1, 20% system costs yr. 2-4. Not to exceed $5k in any year or $20k total			Yes	Up to $10k, 5yr, 4%
Illinois	50% system cost max. $2k per kW or $50k total[f]			Conventional		Yes	
Indiana				Exempt		Yes	
Iowa				Local[g]	Exempt	Yes	1/2 system cost, 20yr, 0%, max $250k
Kansas				Exempt		No	
Kentucky						No	
Louisiana						Yes	
Maine						Yes	
Maryland						Yes[h]	
Massachusetts		15% system cost max. $1k		Local for 20 yr	Exempt	Yes	
Michigan						No	
Minnesota				Exempt	Exempt	Yes	45% system cost or $24k, 8yr, 4%[i]
Mississippi						No	
Missouri						No	
Montana	$1.25k per kW max. $12.5 k[j]	$500		Exempt for 10 years[k]		Yes	$10k, 5yr, 5%[l]
Nebraska						No	1/2 system cost, 0%
Nevada				Exempt	Pay only 2% state sales tax	Yes	
New Hampshire				Local		Yes	
New Jersey	$5k per kW max. 60% system cost[m]				Exempt	Yes	

State	Cash Incentive	Income Tax Credit	Income Tax Deduction	Property Tax Exemption[a]	Sales Tax Exemption	Net Metering[b]	Low-Interest Loan
New Mexico						Yes	
New York	50% system cost max. $100k total[n]			Exempt		Yes	10yr, 4% below market[o]
North Carolina		35% system cost max. $10.5k				No	
North Dakota		3% system cost for 5 years		Exempt for 5 years		No	
Ohio						Yes	$25k, 5yr, 1/2 market
Oklahoma						Yes	
Oregon		$0.60 per kWh saved during yr 1 max. $1.5k		Exempt		Yes	4yr, 4% (bond terms)[p]
Pennsylvania						Yes	
Rhode Island	$2k per kW max. 50% system cost	5% system cost max. $750[q]		Conventional	Refund	Yes	
South Carolina						No	
South Dakota				Exempt for 3 years		No	
Tennessee	$500 total signing bonus and power purchased at $0.15 per kWh produced for 10 years[r]					No	
Texas				Exempt		No	
Utah		25% system cost max. $2k				Yes	
Vermont	$2.5k per kW, max. 40% system cost or $12.5k total			Local	Exempt	Yes	
Virginia						Yes	
Washington					Exempt	Yes	
West Virginia						No	

State	Cash Incentive	Income Tax Credit	Income Tax Deduction	Property Tax Exemption[a]	Sales Tax Exemption	Net Metering[b]	Low-Interest Loan
Wisconsin	$0.95 per annual estimated kWh for Bergey Excel[s] max. $35k or 25% system cost			Exempt		Yes	$20k, 10yr, 1.99%[t]
Wyoming						Yes	
Total # Programs	**10**	**11**		**18**	**9**	**33**	**10**

[a] "Exempt" means the cost of the system is not included in property valuation for tax purposes; "Local" means local authorities have the option to exempt wind systems; "Conventional" means the system is valued at the cost of a conventional system.
[b] Net metering programs operate either statewide or for customers within select utilities. For this analysis, a state is considered to have a net metering program if one is available to the whole state or if the participating utilities encompass a large portion of the state or population.
[c] Value as of January 1, 2004; equivalent to $1,850 per kW for a 10 kW system.
[d] Value as of January 1, 2004; the lesser of 7.5 percent of system cost or $4,500 per kW.
[e] Rates are based on annual income, property location, and family size (http://www.chif.org/owner_borrowers/index.shtml).
[f] The Illinois program was recently revised, and currently there is no grant available for 10 kW wind systems through the Renewable Energy Resources Program Grants.
[g] The valuation of the wind energy system is 0 percent of cost for year one and increases 5 percent every year to a maximum of 30%.
[h] Effective October 1, 2004.
[i] Loans apply only to farmers.
[j] Rebate for customers of Northwestern Energy through system-benefits charge program. Funds have been spent for 2004 and it is uncertain if residential customers will be included in future appropriations.
[k] Exempt for systems up to $20,000 for single family homes.
[l] Rates are set annually and 5 percent is the rate for 2004.
[m] Rebate amount and maximum cap are set to decline based on the total capacity of systems installed under this program. The allowable installed capacity for these rebate values is set at 6.23 MW. See http://www.njcep.com/html/2_incent.html.
[n] For systems up to 10 kW. Source: www.nyserda.org/energyresources/smallwind.html.
[o] Loan terms effective July 1, 2003 (www.nyserda.org).
[p] The Oregon SELP program authorizes bonds to be sold to finance renewable energy loans. The loan terms match the terms of the bonds and these values are current for November 2003. The loan interest rate varies with the loan life, and these terms are the most favorable combination on an economic basis (assuming 5 percent discount rate). http://www.energy.state.or.us/loan/rate.htm.
[q] Percent of tax credit declines steeply from 2000 through 2004. 5 percent is the value applicable to systems claimed in 2004.
[r] This is a Tennessee Valley Authority incentive. For more information see http://www.tva.com/greenpowerswitch/partners/.
[s] Wisconsin cash-back reward program calculates the rebate amount based on estimated annual energy production of the purchased turbine. http://www.focusonenergy.com
[t] Customers can not claim both the Wisconsin Focus on Energy cash back reward program and the low-interest loan program.

Appendix B. Additional State Input Assumptions

This appendix includes the following input assumptions that vary by state: state sales tax rate, state income tax rate, average residential electricity price, and average state elevation.

Table A-2. State-by-State Input Assumptions

State	Sales Tax Rate (%)[a]	Income Tax Rate (%)[b]	Property Tax Rate (%)[c]	Residential Electricity Price ($/kWh)[d]	Average Elevation (m)[e]
Alabama	4%	5.00%	0.61%	$0.071	153
Alaska	--	0.00%	1.78%	$0.120	580
Arizona	5.60%	4.27%	1.18%	$0.082	1251
Arkansas	5.13%	6.50%	1.00%	$0.073	198
California	7.25%	9.30%	1.11%	$0.122	885
Colorado	2.90%	0.00%	0.89%	$0.075	2074
Connecticut	6%	4.50%	1.60%	$0.109	153
Delaware	--	5.95%	1.20%	$0.086	18
Florida	6%	0.00%	1.68%	$0.082	31
Georgia	4%	6.00%	1.47%	$0.076	183
Hawaii	4%	8.25%	0.80%	$0.160	924
Idaho	5%	7.80%	1.77%	$0.068	1525
Illinois	6.25%	3.00%	2.35%	$0.083	183
Indiana	6%	3.40%	1.20%	$0.069	214
Iowa	5%	8.98%	1.98%	$0.084	336
Kansas	5.30%	6.45%	1.24%	$0.076	610
Kentucky	6%	6.00%	1.08%	$0.057	229
Louisiana	4%	6.00%	1.20%	$0.074	31
Maine	5%	8.50%	2.25%	$0.131	183
Maryland	5%	4.75%	1.35%	$0.076	107
Massachusetts	5%	5.30%	1.54%	$0.108	153
Michigan	6%	4.00%	2.05%	$0.085	275
Minnesota	6.50%	7.85%	1.29%	$0.075	366
Mississippi	7%	5.00%	1.05%	$0.074	92
Missouri	4.23%	6.00%	1.00%	$0.070	244
Montana	--	11.00%	1.88%	$0.074	1037
Nebraska	5.50%	6.84%	2.37%	$0.067	793
Nevada	6.50%	0.00%	1.06%	$0.095	1678
New Hampshire	--	0.00%	2.99%	$0.120	305
New Jersey	6%	6.37%	2.36%	$0.104	76
New Mexico	5%	8.20%	0.82%	$0.087	1739
New York	4%	6.85%	2.30%	$0.137	305
North Carolina	4.50%	7.83%	1.26%	$0.082	214
North Dakota	5%	3.03%	1.90%	$0.065	580
Ohio	5%	4.03%	1.65%	$0.082	259
Oklahoma	4.50%	7.00%	1.09%	$0.070	397
Oregon	--	9.00%	1.35%	$0.071	1007
Pennsylvania	6%	2.80%	1.85%	$0.096	336
Rhode Island	7%	0.00%	1.73%	$0.103	61

State	Sales Tax Rate (%)[a]	Income Tax Rate (%)[b]	Property Tax Rate (%)[c]	Residential Electricity Price ($/kWh)[d]	Average Elevation (m)[e]
South Carolina	5%	7.00%	1.22%	$0.077	107
South Dakota	4%	0.00%	2.03%	$0.075	671
Tennessee	7%	0.00%	1.28%	$0.065	275
Texas	6.25%	0.00%	2.32%	$0.083	519
Utah	4.75%	7.00%	0.68%	$0.068	1861
Vermont	5%	5.12%	2.07%	$0.127	305
Virginia	4.50%	5.75%	1.14%	$0.078	290
Washington	6.50%	0.00%	1.23%	$0.062	519
West Virginia	6%	6.50%	0.93%	$0.063	458
Wisconsin	5%	6.30%	2.55%	$0.083	320
Wyoming	4%	0.00%	0.80%	$0.071	2044

[a] Federation of Tax Administrators
[b] Federation of Tax Administrators (calculated for an annual household income of $100,000)
[c] Calculated from a sample of property tax rates in 800 U.S. cities (http://verticals.yahoo.com/cities/categories/proptaxrate.html)
[d] "Current and Historical Monthly Retail Sales, Revenue, and Average Revenue per Kilowatt-Hour by State and by Sector," *Energy Information Administration*. Values from May 2002 through April 2003 were averaged to produce annual average electricity rates.
[e] Statistical Abstract of the United Sates (2002).

Appendix C. Turbine Performance Input Assumptions

The wind turbine annual energy output used in this analysis is based on the Bergey Excel 10 kW grid-intertie system. Output was estimated using the WindCad Turbine Performance Model developed by Bergey Windpower. The power curve for the Bergey Excel system is shown in Figure A-1. This power output was derated by a 15 percent turbulence factor for a more accurate representation of measured system field performance.

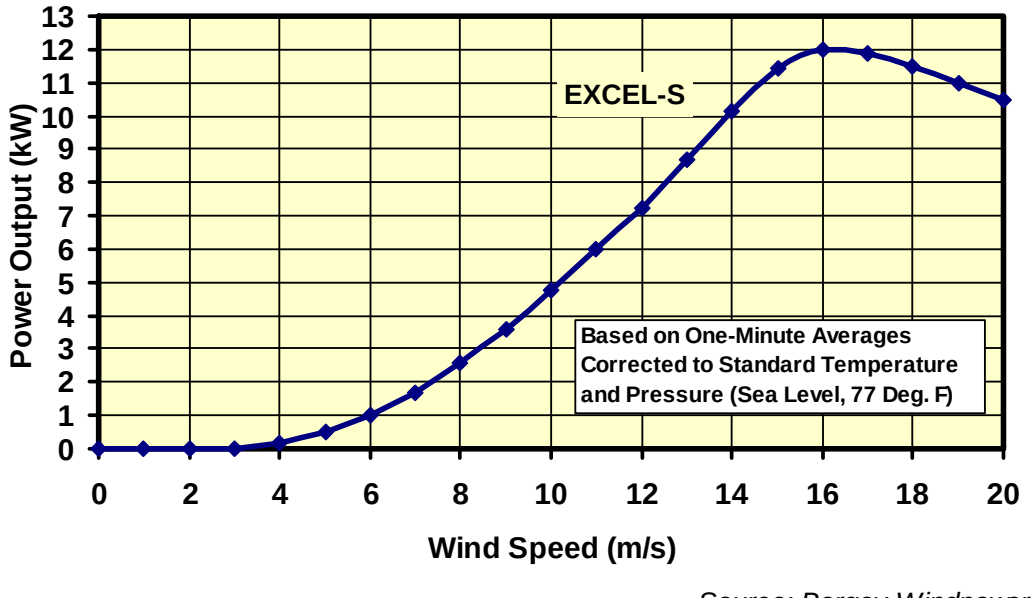

Figure A-1. Bergey Excel-S Power Curve

Annual energy production was calculated for wind Classes 2-7 by taking the median speed in each wind class and assuming a Rayleigh (Weibull K=2) wind speed distribution. The base-case scenario assumes a 30-meter tower height. Table A-3 shows the median wind speed and annual energy production values by wind class.

Table A-3. Median Wind Speed and Annual Energy Production by Wind Class

Wind Class	Median Wind Speed (m/s)	Total Annual Energy Production for 10 kW Bergey Excel (kWh/yr)
2	5.5	10,319
3	6.2	14,232
4	6.75	17,523
5	7.2	20,262
6	7.8	23,843
7	9.65	32,984

In addition, annual energy production is lowered for each state according to the average state elevation (average state elevation values are given in Appendix B). Figure A-2 shows the

resulting SWAT inputs for turbine annual energy production by wind resource class and elevation for the 10 kW system used in this analysis.

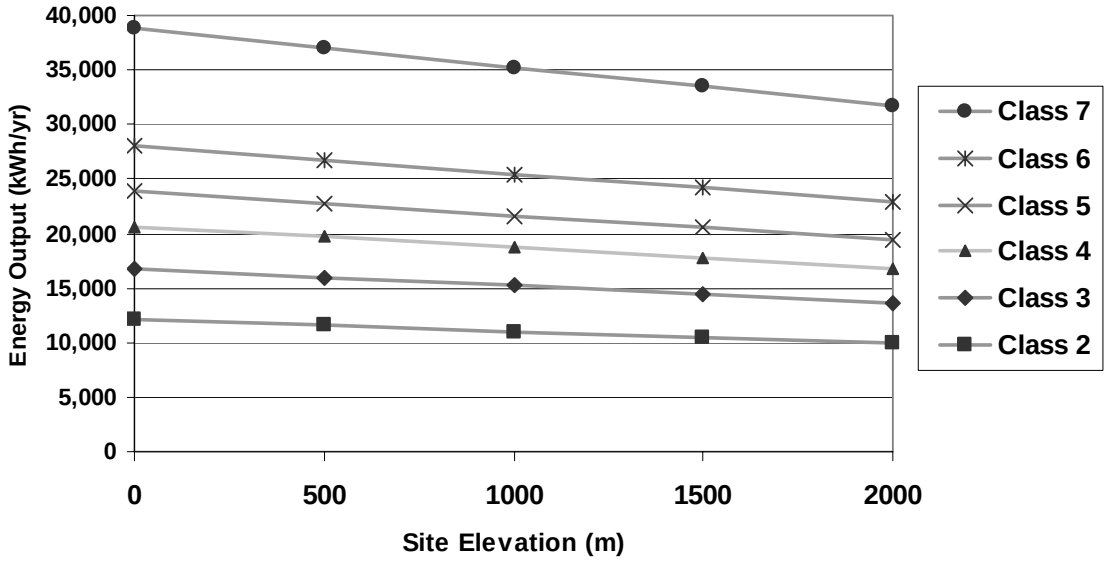

Figure A-2. Turbine Annual Energy Production by Wind Resource Class and Elevation

Appendix D. Detailed Tables of Results

This appendix contains detailed results tables for the cases presented in Sections 3, 4, and 5 of this report. Results are presented for all 50 states and for wind resource Classes 2 through 4. SP results are presented for installed costs of $4.00/Watt and $2.50/Watt, and only include payback values that are less than the 25-year life of the system.

The following tables are included:

Table A-4. Base-Case Results for BTC and SP for Wind Classes 2-4

State	Break-Even Turnkey Cost ($/Watt)			Simple Payback (years)					
				$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.72	$0.99	$1.22	--	--	--	--	--	22
Alaska	$1.25	$1.72	$2.12	--	24	21	22	17	14
Arizona	$0.90	$1.22	$1.48	--	--	--	--	23	20
Arkansas	$0.72	$1.00	$1.23	--	--	--	--	--	22
California	$3.09	$3.60	$4.03	21	16	13	8	6	5
Colorado	$0.70	$0.96	$1.18	--	--	--	--	--	22
Connecticut	$1.30	$1.77	$2.16	--	--	22	23	18	15
Delaware	$1.38	$1.72	$2.01	--	--	24	24	18	15
Florida	$0.83	$1.14	$1.41	--	--	--	--	24	21
Georgia	$0.76	$1.05	$1.29	--	--	--	--	--	22
Hawaii	$1.86	$2.53	$3.09	23	18	15	16	12	10
Idaho	$0.72	$1.00	$1.21	--	--	--	--	--	24
Illinois	$1.39	$1.92	$2.36	--	--	22	23	17	14
Indiana	$0.70	$0.96	$1.18	--	--	--	--	--	22
Iowa	$1.05	$1.45	$1.78	--	--	--	--	24	20
Kansas	$0.77	$1.06	$1.31	--	--	--	--	24	21
Kentucky	$0.52	$0.72	$0.88	--	--	--	--	--	--
Louisiana	$0.74	$1.03	$1.26	--	--	--	--	--	22
Maine	$1.44	$1.99	$2.44	--	22	19	20	16	13
Maryland	$0.77	$1.06	$1.31	--	--	--	--	--	21
Massachusetts	$1.25	$1.70	$2.08	--	24	21	22	17	14
Michigan	$0.80	$1.10	$1.35	--	--	--	--	--	21
Minnesota	$0.83	$1.15	$1.41	--	--	--	--	23	20
Mississippi	$0.74	$1.02	$1.25	--	--	--	--	--	22
Missouri	$0.68	$0.93	$1.15	--	--	--	--	--	23
Montana	$2.10	$2.40	$2.65	--	--	23	18	13	11
Nebraska	$0.67	$0.92	$1.14	--	--	--	--	--	--
Nevada	$1.01	$1.40	$1.72	--	--	23	24	19	16
New Hampshire	$1.22	$1.69	$2.08	--	--	21	22	17	15
New Jersey	$2.23	$3.07	$3.78	21	16	13	14	10	8
New Mexico	$0.87	$1.19	$1.47	--	--	--	--	22	19
New York	$3.80	$5.24	$6.45	15	12	10	11	8	7
North Carolina	$1.08	$1.50	$1.84	--	--	25	24	19	16
North Dakota	$0.66	$0.91	$1.13	--	--	--	--	--	24
Ohio	$0.87	$1.20	$1.47	--	--	--	--	25	21
Oklahoma	$0.68	$0.94	$1.15	--	--	--	--	--	23
Oregon	$0.88	$1.17	$1.42	--	--	--	--	24	21
Pennsylvania	$0.95	$1.31	$1.62	--	--	--	--	22	18
Rhode Island	$2.13	$2.93	$3.59	21	17	14	14	11	9
South Carolina	$0.79	$1.09	$1.34	--	--	--	--	24	21
South Dakota	$0.70	$0.96	$1.19	--	--	--	--	--	24
Tennessee	$1.26	$1.71	$2.10	--	--	--	--	19	13
Texas	$0.88	$1.21	$1.49	--	--	--	--	22	19
Utah	$0.76	$1.01	$1.21	--	--	--	--	--	23
Vermont	$2.16	$2.98	$3.47	23	18	15	14	11	9
Virginia	$0.79	$1.08	$1.33	--	--	--	--	24	21
Washington	$0.58	$0.80	$0.99	--	--	--	--	--	--
West Virginia	$0.59	$0.82	$1.01	--	--	--	--	--	--
Wisconsin	$1.14	$1.58	$1.94	--	--	22	23	18	15
Wyoming	$0.65	$0.90	$1.11	--	--	--	--	--	24

Table A-5. Base Case Results for LCOE for Wind Classes 2-4

State	Levelized Cost of Energy ($/kWh)					
	$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.33	$0.24	$0.20	$0.21	$0.16	$0.13
Alaska	$0.35	$0.26	$0.21	$0.22	$0.17	$0.14
Arizona	$0.37	$0.27	$0.23	$0.24	$0.17	$0.14
Arkansas	$0.34	$0.25	$0.21	$0.22	$0.16	$0.13
California	$0.21	$0.16	$0.13	$0.09	$0.07	$0.06
Colorado	$0.40	$0.29	$0.24	$0.26	$0.19	$0.16
Connecticut	$0.35	$0.26	$0.21	$0.22	$0.17	$0.14
Delaware	$0.29	$0.21	$0.17	$0.17	$0.13	$0.11
Florida	$0.35	$0.26	$0.21	$0.22	$0.17	$0.14
Georgia	$0.34	$0.25	$0.21	$0.22	$0.16	$0.14
Hawaii	$0.35	$0.26	$0.21	$0.22	$0.16	$0.14
Idaho	$0.39	$0.29	$0.24	$0.25	$0.18	$0.15
Illinois	$0.22	$0.16	$0.13	$0.14	$0.11	$0.09
Indiana	$0.33	$0.24	$0.20	$0.21	$0.16	$0.13
Iowa	$0.34	$0.25	$0.21	$0.22	$0.16	$0.14
Kansas	$0.34	$0.25	$0.20	$0.22	$0.16	$0.13
Kentucky	$0.34	$0.25	$0.21	$0.22	$0.16	$0.14
Louisiana	$0.33	$0.25	$0.20	$0.21	$0.16	$0.13
Maine	$0.36	$0.26	$0.22	$0.23	$0.17	$0.14
Maryland	$0.34	$0.25	$0.21	$0.22	$0.16	$0.14
Massachusetts	$0.33	$0.24	$0.20	$0.21	$0.16	$0.13
Michigan	$0.36	$0.27	$0.22	$0.23	$0.17	$0.14
Minnesota	$0.31	$0.23	$0.19	$0.20	$0.15	$0.13
Mississippi	$0.34	$0.25	$0.21	$0.22	$0.16	$0.14
Missouri	$0.34	$0.25	$0.21	$0.22	$0.16	$0.13
Montana	$0.25	$0.18	$0.15	$0.12	$0.09	$0.08
Nebraska	$0.38	$0.28	$0.23	$0.24	$0.18	$0.15
Nevada	$0.36	$0.27	$0.22	$0.23	$0.17	$0.14
New Hampshire	$0.36	$0.27	$0.22	$0.23	$0.17	$0.14
New Jersey	$0.17	$0.13	$0.10	$0.11	$0.08	$0.07
New Mexico	$0.39	$0.29	$0.24	$0.25	$0.19	$0.15
New York	$0.18	$0.13	$0.11	$0.12	$0.09	$0.07
North Carolina	$0.29	$0.21	$0.18	$0.17	$0.13	$0.11
North Dakota	$0.32	$0.23	$0.19	$0.20	$0.15	$0.13
Ohio	$0.35	$0.26	$0.21	$0.23	$0.17	$0.14
Oklahoma	$0.35	$0.25	$0.21	$0.22	$0.16	$0.14
Oregon	$0.33	$0.24	$0.20	$0.21	$0.15	$0.13
Pennsylvania	$0.36	$0.27	$0.22	$0.23	$0.17	$0.14
Rhode Island	$0.18	$0.14	$0.11	$0.12	$0.09	$0.08
South Carolina	$0.34	$0.25	$0.21	$0.22	$0.16	$0.13
South Dakota	$0.36	$0.26	$0.22	$0.23	$0.17	$0.14
Tennessee	$0.27	$0.18	$0.14	$0.15	$0.09	$0.06
Texas	$0.34	$0.25	$0.20	$0.22	$0.16	$0.13
Utah	$0.38	$0.28	$0.23	$0.24	$0.18	$0.15
Vermont	$0.25	$0.19	$0.15	$0.15	$0.11	$0.09
Virginia	$0.34	$0.25	$0.21	$0.22	$0.16	$0.14
Washington	$0.34	$0.25	$0.21	$0.22	$0.16	$0.13
West Virginia	$0.35	$0.26	$0.21	$0.22	$0.17	$0.14
Wisconsin	$0.26	$0.19	$0.16	$0.16	$0.12	$0.10
Wyoming	$0.40	$0.29	$0.24	$0.26	$0.19	$0.16

Table A-6. Base-Case Without State Incentives (BTC & SP, Wind Classes 2-4)

State	Break-Even Turnkey Cost ($/Watt)			Simple Payback (years)					
				$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.72	$0.99	$1.22	--	--	--	--	--	22
Alaska	$1.25	$1.72	$2.12	--	24	21	22	17	14
Arizona	$0.83	$1.15	$1.42	--	--	--	--	23	20
Arkansas	$0.72	$1.00	$1.23	--	--	--	--	--	22
California	$1.29	$1.77	$2.18	--	24	21	22	17	14
Colorado	$0.70	$0.96	$1.18	--	--	--	--	--	22
Connecticut	$1.20	$1.65	$2.03	--	--	22	23	18	15
Delaware	$0.91	$1.25	$1.54	--	--	--	--	21	18
Florida	$0.83	$1.14	$1.41	--	--	--	--	24	21
Georgia	$0.76	$1.05	$1.29	--	--	--	--	--	22
Hawaii	$1.76	$2.43	$2.99	24	19	16	17	13	10
Idaho	$0.62	$0.86	$1.06	--	--	--	--	--	--
Illinois	$0.78	$1.07	$1.32	--	--	--	--	--	22
Indiana	$0.65	$0.90	$1.11	--	--	--	--	--	24
Iowa	$0.81	$1.11	$1.37	--	--	--	--	25	21
Kansas	$0.72	$1.00	$1.23	--	--	--	--	--	23
Kentucky	$0.52	$0.72	$0.88	--	--	--	--	--	--
Louisiana	$0.74	$1.03	$1.26	--	--	--	--	--	22
Maine	$1.44	$1.99	$2.44	--	22	19	20	16	13
Maryland	$0.77	$1.06	$1.31	--	--	--	--	--	21
Massachusetts	$1.18	$1.63	$2.01	--	--	22	23	18	15
Michigan	$0.80	$1.10	$1.35	--	--	--	--	--	21
Minnesota	$0.73	$1.00	$1.24	--	--	--	--	--	23
Mississippi	$0.74	$1.02	$1.25	--	--	--	--	--	22
Missouri	$0.68	$0.93	$1.15	--	--	--	--	--	23
Montana	$0.73	$1.01	$1.24	--	--	--	--	--	22
Nebraska	$0.57	$0.79	$0.97	--	--	--	--	--	--
Nevada	$0.96	$1.32	$1.62	--	--	25	--	21	18
New Hampshire	$1.22	$1.69	$2.08	--	--	21	22	17	15
New Jersey	$1.04	$1.43	$1.76	--	--	25	--	20	17
New Mexico	$0.87	$1.19	$1.47	--	--	--	--	22	19
New York	$1.40	$1.93	$2.38	--	23	19	20	16	13
North Carolina	$0.84	$1.15	$1.42	--	--	--	--	23	20
North Dakota	$0.58	$0.80	$0.98	--	--	--	--	--	--
Ohio	$0.79	$1.08	$1.33	--	--	--	--	25	21
Oklahoma	$0.68	$0.94	$1.15	--	--	--	--	--	23
Oregon	$0.65	$0.90	$1.11	--	--	--	--	--	23
Pennsylvania	$0.95	$1.31	$1.62	--	--	--	--	22	18
Rhode Island	$1.12	$1.55	$1.91	--	--	23	24	19	16
South Carolina	$0.79	$1.09	$1.34	--	--	--	--	24	21
South Dakota	$0.68	$0.93	$1.15	--	--	--	--	--	24
Tennessee	$0.59	$0.82	$1.01	--	--	--	--	--	24
Texas	$0.78	$1.07	$1.32	--	--	--	--	--	22
Utah	$0.63	$0.87	$1.07	--	--	--	--	--	24
Vermont	$1.38	$1.90	$2.34	--	23	20	21	16	13
Virginia	$0.79	$1.08	$1.33	--	--	--	--	24	21
Washington	$0.58	$0.80	$0.99	--	--	--	--	--	--
West Virginia	$0.59	$0.82	$1.01	--	--	--	--	--	--
Wisconsin	$0.76	$1.04	$1.28	--	--	--	--	--	22
Wyoming	$0.65	$0.90	$1.11	--	--	--	--	--	24

Table A-7. Incremental Increase in LCOE Without State Incentives (Wind Classes 2-4)

State	Incremental Levelized Cost of Energy ($/kWh)					
	$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Alaska	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Arizona	$0.01	$0.01	$0.00	$0.01	$0.01	$0.00
Arkansas	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
California	$0.16	$0.11	$0.09	$0.15	$0.11	$0.09
Colorado	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Connecticut	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Delaware	$0.04	$0.03	$0.02	$0.04	$0.03	$0.02
Florida	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Georgia	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hawaii	$0.01	$0.01	$0.00	$0.01	$0.01	$0.00
Idaho	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
Illinois	$0.15	$0.11	$0.09	$0.09	$0.07	$0.05
Indiana	$0.02	$0.01	$0.01	$0.01	$0.01	$0.01
Iowa	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
Kansas	$0.02	$0.01	$0.01	$0.01	$0.01	$0.01
Kentucky	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Louisiana	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Maine	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Maryland	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Massachusetts	$0.02	$0.01	$0.01	$0.01	$0.01	$0.01
Michigan	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Minnesota	$0.04	$0.03	$0.02	$0.02	$0.02	$0.01
Mississippi	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Missouri	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Montana	$0.12	$0.08	$0.07	$0.12	$0.08	$0.07
Nebraska	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Nevada	$0.02	$0.01	$0.01	$0.01	$0.01	$0.01
New Hampshire	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
New Jersey	$0.19	$0.14	$0.11	$0.12	$0.09	$0.07
New Mexico	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
New York	$0.18	$0.13	$0.11	$0.12	$0.08	$0.07
North Carolina	$0.05	$0.04	$0.03	$0.05	$0.03	$0.03
North Dakota	$0.05	$0.04	$0.03	$0.03	$0.02	$0.02
Ohio	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Oklahoma	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Oregon	$0.03	$0.02	$0.02	$0.02	$0.02	$0.01
Pennsylvania	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Rhode Island	$0.17	$0.12	$0.10	$0.11	$0.08	$0.06
South Carolina	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
South Dakota	$0.01	$0.01	$0.01	$0.01	$0.01	$0.00
Tennessee	$0.08	$0.08	$0.07	$0.08	$0.08	$0.08
Texas	$0.04	$0.03	$0.02	$0.02	$0.02	$0.01
Utah	$0.01	$0.01	$0.01	$0.01	$0.01	$0.01
Vermont	$0.11	$0.08	$0.06	$0.08	$0.06	$0.05
Virginia	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Washington	$0.02	$0.01	$0.01	$0.01	$0.01	$0.01
West Virginia	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Wisconsin	$0.11	$0.08	$0.07	$0.07	$0.05	$0.04
Wyoming	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Table A-8. Base-Case Without Cash Incentives (BTC & SP, Wind Classes 2-4)

State	Break-Even Turnkey Cost ($/Watt)			Simple Payback (years)					
				$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.72	$0.99	$1.22	--	--	--	--	--	22
Alaska	$1.25	$1.72	$2.12	--	24	21	22	17	14
Arizona	$0.90	$1.22	$1.48	--	--	--	--	23	20
Arkansas	$0.72	$1.00	$1.23	--	--	--	--	--	22
California	$1.35	$1.86	$2.30	--	23	20	21	16	14
Colorado	$0.70	$0.96	$1.18	--	--	--	--	--	22
Connecticut	$1.30	$1.77	$2.16	--	--	22	23	18	15
Delaware	$0.91	$1.25	$1.54	--	--	--	--	21	18
Florida	$0.83	$1.14	$1.41	--	--	--	--	24	21
Georgia	$0.76	$1.05	$1.29	--	--	--	--	--	22
Hawaii	$1.86	$2.53	$3.09	23	18	15	16	12	10
Idaho	$0.72	$1.00	$1.21	--	--	--	--	--	24
Illinois	$0.78	$1.07	$1.32	--	--	--	--	--	22
Indiana	$0.70	$0.96	$1.18	--	--	--	--	--	22
Iowa	$1.05	$1.45	$1.78	--	--	--	--	24	20
Kansas	$0.77	$1.06	$1.31	--	--	--	--	24	21
Kentucky	$0.52	$0.72	$0.88	--	--	--	--	--	--
Louisiana	$0.74	$1.03	$1.26	--	--	--	--	--	22
Maine	$1.44	$1.99	$2.44	--	22	19	20	16	13
Maryland	$0.77	$1.06	$1.31	--	--	--	--	--	21
Massachusetts	$1.25	$1.70	$2.08	--	24	21	22	17	14
Michigan	$0.80	$1.10	$1.35	--	--	--	--	--	21
Minnesota	$0.83	$1.15	$1.41	--	--	--	--	23	20
Mississippi	$0.74	$1.02	$1.25	--	--	--	--	--	22
Missouri	$0.68	$0.93	$1.15	--	--	--	--	--	23
Montana	$0.87	$1.18	$1.43	--	--	--	--	23	20
Nebraska	$0.67	$0.92	$1.14	--	--	--	--	--	--
Nevada	$1.01	$1.40	$1.72	--	--	23	24	19	16
New Hampshire	$1.22	$1.69	$2.08	--	--	21	22	17	15
New Jersey	$1.04	$1.43	$1.76	--	--	24	25	20	17
New Mexico	$0.87	$1.19	$1.47	--	--	--	--	22	19
New York	$1.90	$2.62	$3.23	25	20	17	18	14	12
North Carolina	$1.08	$1.50	$1.84	--	--	25	24	19	16
North Dakota	$0.66	$0.91	$1.13	--	--	--	--	--	24
Ohio	$0.87	$1.20	$1.47	--	--	--	--	25	21
Oklahoma	$0.68	$0.94	$1.15	--	--	--	--	--	23
Oregon	$0.88	$1.17	$1.42	--	--	--	--	24	21
Pennsylvania	$0.95	$1.31	$1.62	--	--	--	--	22	18
Rhode Island	$1.16	$1.60	$1.95	--	--	22	23	18	15
South Carolina	$0.79	$1.09	$1.34	--	--	--	--	24	21
South Dakota	$0.70	$0.96	$1.19	--	--	--	--	--	24
Tennessee	$0.59	$0.82	$1.01	--	--	--	--	--	--
Texas	$0.88	$1.21	$1.49	--	--	--	--	22	19
Utah	$0.76	$1.01	$1.21	--	--	--	--	--	23
Vermont	$1.38	$1.90	$2.34	--	22	19	20	15	13
Virginia	$0.79	$1.08	$1.33	--	--	--	--	24	21
Washington	$0.58	$0.80	$0.99	--	--	--	--	--	--
West Virginia	$0.59	$0.82	$1.01	--	--	--	--	--	--
Wisconsin	$0.86	$1.18	$1.45	--	--	--	--	22	19
Wyoming	$0.65	$0.90	$1.11	--	--	--	--	--	24

Table A-9. Base-Case Without State Income Tax Credits (BTC & SP, Wind Classes 2-4)

State	Break-Even Turnkey Cost ($/Watt)			Simple Payback (years)					
				$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.72	$0.99	$1.22	--	--	--	--	--	22
Alaska	$1.25	$1.72	$2.12	--	24	21	22	17	14
Arizona	$0.83	$1.15	$1.42	--	--	--	--	23	20
Arkansas	$0.72	$1.00	$1.23	--	--	--	--	--	22
California	$3.04	$3.52	$3.93	21	16	14	9	6	5
Colorado	$0.70	$0.96	$1.18	--	--	--	--	--	22
Connecticut	$1.30	$1.77	$2.16	--	--	22	23	18	15
Delaware	$1.38	$1.72	$2.01	--	--	24	24	18	15
Florida	$0.83	$1.14	$1.41	--	--	--	--	24	21
Georgia	$0.76	$1.05	$1.29	--	--	--	--	--	22
Hawaii	$1.76	$2.43	$2.99	24	19	16	17	13	10
Idaho	$0.69	$0.95	$1.15	--	--	--	--	--	--
Illinois	$1.39	$1.92	$2.36	--	--	22	23	17	14
Indiana	$0.70	$0.96	$1.18	--	--	--	--	--	22
Iowa	$1.05	$1.45	$1.78	--	--	--	--	24	20
Kansas	$0.77	$1.06	$1.31	--	--	--	--	24	21
Kentucky	$0.52	$0.72	$0.88	--	--	--	--	--	--
Louisiana	$0.74	$1.03	$1.26	--	--	--	--	--	22
Maine	$1.44	$1.99	$2.44	--	22	19	20	16	13
Maryland	$0.77	$1.06	$1.31	--	--	--	--	--	21
Massachusetts	$1.18	$1.63	$2.01	--	25	21	22	17	15
Michigan	$0.80	$1.10	$1.35	--	--	--	--	--	21
Minnesota	$0.83	$1.15	$1.41	--	--	--	--	23	20
Mississippi	$0.74	$1.02	$1.25	--	--	--	--	--	22
Missouri	$0.68	$0.93	$1.15	--	--	--	--	--	23
Montana	$2.06	$2.36	$2.60	--	--	23	19	14	11
Nebraska	$0.67	$0.92	$1.14	--	--	--	--	--	--
Nevada	$1.01	$1.40	$1.72	--	--	23	24	19	16
New Hampshire	$1.22	$1.69	$2.08	--	--	21	22	17	15
New Jersey	$2.23	$3.07	$3.78	21	16	13	14	10	8
New Mexico	$0.87	$1.19	$1.47	--	--	--	--	22	19
New York	$3.80	$5.24	$6.45	15	12	10	11	8	7
North Carolina	$0.84	$1.15	$1.42	--	--	--	--	23	20
North Dakota	$0.61	$0.84	$1.03	--	--	--	--	--	--
Ohio	$0.87	$1.20	$1.47	--	--	--	--	25	21
Oklahoma	$0.68	$0.94	$1.15	--	--	--	--	--	23
Oregon	$0.77	$1.06	$1.30	--	--	--	--	25	21
Pennsylvania	$0.95	$1.31	$1.62	--	--	--	--	22	18
Rhode Island	$2.06	$2.85	$3.50	22	17	14	15	11	9
South Carolina	$0.79	$1.09	$1.34	--	--	--	--	24	21
South Dakota	$0.70	$0.96	$1.19	--	--	--	--	--	24
Tennessee	$1.26	$1.71	$2.10	--	--	--	--	19	13
Texas	$0.88	$1.21	$1.49	--	--	--	--	22	19
Utah	$0.63	$0.87	$1.07	--	--	--	--	--	24
Vermont	$2.16	$2.98	$3.47	23	18	15	14	11	9
Virginia	$0.79	$1.08	$1.33	--	--	--	--	24	21
Washington	$0.58	$0.80	$0.99	--	--	--	--	--	--
West Virginia	$0.59	$0.82	$1.01	--	--	--	--	--	--
Wisconsin	$1.14	$1.58	$1.94	--	--	22	23	18	15
Wyoming	$0.65	$0.90	$1.11	--	--	--	--	--	24

Table A-10. Base-Case Without Property Tax Incentives (BTC & SP, Wind Classes 2-4)

State	Break-Even Turnkey Cost ($/Watt)			Simple Payback (years)					
				$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.72	$0.99	$1.22	--	--	--	--	--	22
Alaska	$1.25	$1.72	$2.12	--	24	21	22	17	14
Arizona	$0.90	$1.22	$1.48	--	--	--	--	23	20
Arkansas	$0.72	$1.00	$1.23	--	--	--	--	--	22
California	$3.10	$3.61	$4.04	21	16	13	8	6	5
Colorado	$0.70	$0.96	$1.18	--	--	--	--	--	22
Connecticut	$1.30	$1.77	$2.16	--	--	22	23	18	15
Delaware	$1.38	$1.72	$2.01	--	--	24	24	18	15
Florida	$0.83	$1.14	$1.41	--	--	--	--	24	21
Georgia	$0.76	$1.05	$1.29	--	--	--	--	--	22
Hawaii	$1.86	$2.53	$3.09	23	18	15	16	12	10
Idaho	$0.72	$1.00	$1.21	--	--	--	--	--	24
Illinois	$1.39	$1.92	$2.36	--	--	22	23	17	14
Indiana	$0.65	$0.90	$1.11	--	--	--	--	--	24
Iowa	$1.05	$1.45	$1.78	--	--	--	--	24	20
Kansas	$0.72	$1.00	$1.23	--	--	--	--	--	23
Kentucky	$0.52	$0.72	$0.88	--	--	--	--	--	--
Louisiana	$0.74	$1.03	$1.26	--	--	--	--	--	22
Maine	$1.44	$1.99	$2.44	--	22	19	20	16	13
Maryland	$0.77	$1.06	$1.31	--	--	--	--	--	21
Massachusetts	$1.25	$1.70	$2.08	--	24	21	22	17	14
Michigan	$0.80	$1.10	$1.35	--	--	--	--	--	21
Minnesota	$0.78	$1.07	$1.32	--	--	--	--	--	22
Mississippi	$0.74	$1.02	$1.25	--	--	--	--	--	22
Missouri	$0.68	$0.93	$1.15	--	--	--	--	--	23
Montana	$1.95	$2.24	$2.48	--	--	24	21	16	13
Nebraska	$0.67	$0.92	$1.14	--	--	--	--	--	--
Nevada	$0.96	$1.32	$1.62	--	--	25	--	21	18
New Hampshire	$1.22	$1.69	$2.08	--	--	21	22	17	15
New Jersey	$2.23	$3.07	$3.78	21	16	13	14	10	8
New Mexico	$0.87	$1.19	$1.47	--	--	--	--	22	19
New York	$2.94	$4.06	$4.99	20	15	12	13	10	8
North Carolina	$1.08	$1.50	$1.84	--	--	25	24	19	16
North Dakota	$0.63	$0.87	$1.07	--	--	--	--	--	--
Ohio	$0.87	$1.20	$1.47	--	--	--	--	25	21
Oklahoma	$0.68	$0.94	$1.15	--	--	--	--	--	23
Oregon	$0.82	$1.09	$1.32	--	--	--	--	--	23
Pennsylvania	$0.95	$1.31	$1.62	--	--	--	--	22	18
Rhode Island	$2.13	$2.93	$3.59	21	17	14	14	11	9
South Carolina	$0.79	$1.09	$1.34	--	--	--	--	24	21
South Dakota	$0.68	$0.93	$1.15	--	--	--	--	--	24
Tennessee	$1.26	$1.71	$2.10	--	--	--	--	19	13
Texas	$0.78	$1.07	$1.32	--	--	--	--	--	22
Utah	$0.76	$1.01	$1.21	--	--	--	--	--	23
Vermont	$2.16	$2.98	$3.47	23	18	15	14	11	9
Virginia	$0.79	$1.08	$1.33	--	--	--	--	24	21
Washington	$0.58	$0.80	$0.99	--	--	--	--	--	--
West Virginia	$0.59	$0.82	$1.01	--	--	--	--	--	--
Wisconsin	$0.97	$1.34	$1.64	--	--	--	--	22	19
Wyoming	$0.65	$0.90	$1.11	--	--	--	--	--	24

Table A-11. Base-Case Without Sales Tax Exemptions (SP, Wind Classes 2-4)

State	Simple Payback (years)					
	$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	--	--	--	--	--	22
Alaska	--	24	21	22	17	14
Arizona	--	--	--	--	23	20
Arkansas	--	--	--	--	--	22
California	21	16	13	8	6	5
Colorado	--	--	--	--	--	22
Connecticut	--	--	22	23	18	15
Delaware	--	--	24	24	18	15
Florida	--	--	--	--	24	21
Georgia	--	--	--	--	--	22
Hawaii	23	18	15	16	12	10
Idaho	--	--	--	--	--	24
Illinois	--	--	22	23	17	14
Indiana	--	--	--	--	--	22
Iowa	--	--	--	--	25	21
Kansas	--	--	--	--	24	21
Kentucky	--	--	--	--	--	--
Louisiana	--	--	--	--	--	22
Maine	--	22	19	20	16	13
Maryland	--	--	--	--	--	21
Massachusetts	--	--	22	22	18	15
Michigan	--	--	--	--	--	21
Minnesota	--	--	--	--	24	21
Mississippi	--	--	--	--	--	22
Missouri	--	--	--	--	--	23
Montana	--	--	23	18	14	11
Nebraska	--	--	--	--	--	--
Nevada	--	--	23	24	19	16
New Hampshire	--	--	21	22	17	15
New Jersey	23	18	15	16	12	9
New Mexico	--	--	--	--	22	19
New York	15	12	10	11	8	7
North Carolina	--	--	25	24	19	16
North Dakota	--	--	--	--	--	24
Ohio	--	--	--	--	25	21
Oklahoma	--	--	--	--	--	23
Oregon	--	--	--	--	24	21
Pennsylvania	--	--	--	--	22	18
Rhode Island	23	18	15	16	12	10
South Carolina	--	--	--	--	24	21
South Dakota	--	--	--	--	--	24
Tennessee	--	--	--	--	19	13
Texas	--	--	--	--	22	19
Utah	--	--	--	--	--	23
Vermont	24	18	16	15	11	9
Virginia	--	--	--	--	24	21
Washington	--	--	--	--	--	--
West Virginia	--	--	--	--	--	--
Wisconsin	--	--	22	23	18	15
Wyoming	--	--	--	--	--	24

Table A-12. Base-Case Without Low-Interest Loan Programs (BTC, Wind Classes 2-4)

State	Break-Even Turnkey Cost ($/Watt)		
	Class 2	Class 3	Class 4
Alabama	$0.72	$0.99	$1.22
Alaska	$1.25	$1.72	$2.12
Arizona	$0.90	$1.22	$1.48
Arkansas	$0.72	$1.00	$1.23
California	$3.10	$3.61	$4.04
Colorado	$0.70	$0.96	$1.18
Connecticut	$1.20	$1.65	$2.03
Delaware	$1.38	$1.72	$2.01
Florida	$0.83	$1.14	$1.41
Georgia	$0.76	$1.05	$1.29
Hawaii	$1.86	$2.53	$3.09
Idaho	$0.65	$0.90	$1.11
Illinois	$1.39	$1.92	$2.36
Indiana	$0.70	$0.96	$1.18
Iowa	$0.81	$1.11	$1.37
Kansas	$0.77	$1.06	$1.31
Kentucky	$0.52	$0.72	$0.88
Louisiana	$0.74	$1.03	$1.26
Maine	$1.44	$1.99	$2.44
Maryland	$0.77	$1.06	$1.31
Massachusetts	$1.25	$1.70	$2.08
Michigan	$0.80	$1.10	$1.35
Minnesota	$0.78	$1.07	$1.32
Mississippi	$0.74	$1.02	$1.25
Missouri	$0.68	$0.93	$1.15
Montana	$2.04	$2.33	$2.57
Nebraska	$0.57	$0.79	$0.97
Nevada	$1.01	$1.40	$1.72
New Hampshire	$1.22	$1.69	$2.08
New Jersey	$2.23	$3.07	$3.78
New Mexico	$0.87	$1.19	$1.47
New York	$3.14	$4.34	$5.34
North Carolina	$1.08	$1.50	$1.84
North Dakota	$0.66	$0.91	$1.13
Ohio	$0.79	$1.08	$1.33
Oklahoma	$0.68	$0.94	$1.15
Oregon	$0.80	$1.07	$1.29
Pennsylvania	$0.95	$1.31	$1.62
Rhode Island	$2.13	$2.93	$3.59
South Carolina	$0.79	$1.09	$1.34
South Dakota	$0.70	$0.96	$1.19
Tennessee	$1.26	$1.71	$2.10
Texas	$0.88	$1.21	$1.49
Utah	$0.76	$1.01	$1.21
Vermont	$2.16	$2.98	$3.47
Virginia	$0.79	$1.08	$1.33
Washington	$0.58	$0.80	$0.99
West Virginia	$0.59	$0.82	$1.01
Wisconsin	$1.14	$1.58	$1.94
Wyoming	$0.65	$0.90	$1.11

Table A-13. Net Metering with 10%, 20%, and 30% Excess Generation (BTC)

State	Break-Even Turnkey Cost ($/Watt)								
	10 % Excess			20 % Excess			30 % Excess		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.67	$0.92	$1.13	$0.61	$0.84	$1.04	$0.56	$0.77	$0.95
Alaska	$1.14	$1.57	$1.94	$1.03	$1.43	$1.76	$0.93	$1.28	$1.57
Arizona	$0.90	$1.22	$1.48	$0.90	$1.22	$1.48	$0.90	$1.22	$1.48
Arkansas	$0.72	$1.00	$1.23	$0.72	$1.00	$1.23	$0.72	$1.00	$1.23
California	$3.10	$3.61	$4.04	$3.10	$3.61	$4.04	$3.10	$3.61	$4.04
Colorado	$0.64	$0.89	$1.09	$0.59	$0.82	$1.01	$0.54	$0.75	$0.92
Connecticut	$1.30	$1.77	$2.16	$1.30	$1.77	$2.16	$1.30	$1.77	$2.16
Delaware	$1.38	$1.72	$2.01	$1.38	$1.72	$2.01	$1.38	$1.72	$2.01
Florida	$0.76	$1.05	$1.30	$0.70	$0.96	$1.19	$0.64	$0.88	$1.08
Georgia	$0.76	$1.05	$1.29	$0.76	$1.05	$1.29	$0.76	$1.05	$1.29
Hawaii	$1.86	$2.53	$3.09	$1.86	$2.53	$3.09	$1.86	$2.53	$3.09
Idaho	$0.72	$1.00	$1.21	$0.72	$1.00	$1.21	$0.72	$1.00	$1.21
Illinois	$1.39	$1.92	$2.36	$1.39	$1.92	$2.36	$1.39	$1.92	$2.36
Indiana	$0.70	$0.96	$1.18	$0.70	$0.96	$1.18	$0.70	$0.96	$1.18
Iowa	$1.05	$1.45	$1.78	$1.05	$1.45	$1.78	$1.05	$1.45	$1.78
Kansas	$0.71	$0.98	$1.21	$0.65	$0.90	$1.11	$0.60	$0.82	$1.01
Kentucky	$0.49	$0.67	$0.83	$0.45	$0.62	$0.77	$0.42	$0.58	$0.71
Louisiana	$0.74	$1.03	$1.26	$0.74	$1.03	$1.26	$0.74	$1.03	$1.26
Maine	$1.44	$1.99	$2.44	$1.44	$1.99	$2.44	$1.44	$1.99	$2.44
Maryland	$0.71	$0.98	$1.21	$0.65	$0.90	$1.11	$0.60	$0.82	$1.01
Massachusetts	$1.25	$1.70	$2.08	$1.25	$1.70	$2.08	$1.25	$1.70	$2.08
Michigan	$0.73	$1.01	$1.24	$0.67	$0.92	$1.14	$0.61	$0.84	$1.03
Minnesota	$0.83	$1.15	$1.41	$0.83	$1.15	$1.41	$0.83	$1.15	$1.41
Mississippi	$0.68	$0.94	$1.16	$0.63	$0.87	$1.07	$0.57	$0.79	$0.97
Missouri	$0.63	$0.86	$1.06	$0.58	$0.80	$0.98	$0.53	$0.73	$0.90
Montana	$2.09	$2.39	$2.63	$2.09	$2.39	$2.63	$2.09	$2.39	$2.63
Nebraska	$0.62	$0.86	$1.06	$0.57	$0.79	$0.97	$0.53	$0.72	$0.89
Nevada	$1.01	$1.40	$1.72	$1.01	$1.40	$1.72	$1.01	$1.40	$1.72
New Hampshire	$1.22	$1.69	$2.08	$1.22	$1.69	$2.08	$1.22	$1.69	$2.08
New Jersey	$2.23	$3.07	$3.78	$2.23	$3.07	$3.78	$2.23	$3.07	$3.78
New Mexico	$0.87	$1.19	$1.47	$0.87	$1.19	$1.47	$0.87	$1.19	$1.47
New York	$3.80	$5.24	$6.45	$3.80	$5.24	$6.45	$3.80	$5.24	$6.45
North Carolina	$1.00	$1.38	$1.70	$0.92	$1.26	$1.56	$0.83	$1.15	$1.41
North Dakota	$0.62	$0.85	$1.05	$0.57	$0.78	$0.97	$0.52	$0.72	$0.89
Ohio	$0.87	$1.20	$1.47	$0.87	$1.20	$1.47	$0.87	$1.20	$1.47
Oklahoma	$0.68	$0.94	$1.15	$0.68	$0.94	$1.15	$0.68	$0.94	$1.15
Oregon	$0.88	$1.17	$1.42	$0.88	$1.17	$1.42	$0.88	$1.17	$1.42
Pennsylvania	$0.95	$1.31	$1.62	$0.95	$1.31	$1.62	$0.95	$1.31	$1.62
Rhode Island	$2.13	$2.93	$3.59	$2.13	$2.93	$3.59	$2.13	$2.93	$3.59
South Carolina	$0.73	$1.01	$1.24	$0.67	$0.92	$1.14	$0.61	$0.84	$1.04
South Dakota	$0.65	$0.89	$1.10	$0.59	$0.82	$1.01	$0.54	$0.75	$0.92
Tennessee	$1.24	$1.69	$2.07	$1.22	$1.66	$2.04	$1.20	$1.64	$2.01
Texas	$0.81	$1.11	$1.37	$0.74	$1.02	$1.26	$0.67	$0.92	$1.14
Utah	$0.76	$1.01	$1.21	$0.76	$1.01	$1.21	$0.76	$1.01	$1.21
Vermont	$2.16	$2.98	$3.47	$2.16	$2.98	$3.47	$2.16	$2.98	$3.47
Virginia	$0.79	$1.08	$1.33	$0.79	$1.08	$1.33	$0.79	$1.08	$1.33
Washington	$0.58	$0.80	$0.99	$0.58	$0.80	$0.99	$0.58	$0.80	$0.99
West Virginia	$0.55	$0.76	$0.94	$0.51	$0.71	$0.87	$0.47	$0.65	$0.80
Wisconsin	$1.14	$1.58	$1.94	$1.14	$1.58	$1.94	$1.14	$1.58	$1.94
Wyoming	$0.65	$0.90	$1.11	$0.65	$0.90	$1.11	$0.65	$0.90	$1.11

Table A-14. Net Metering with 10%, 20%, and 30% Excess Generation ($4.00/Watt SP)

State	$4.00/Watt Installed Cost Simple Payback (years)								
	10 % Excess			20 % Excess			30 % Excess		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	--	--	--	--	--	--	--	--	--
Alaska	--	--	22	--	--	24	--	--	--
Arizona	--	--	--	--	--	--	--	--	--
Arkansas	--	--	--	--	--	--	--	--	--
California	21	16	13	21	16	13	21	16	13
Colorado	--	--	--	--	--	--	--	--	--
Connecticut	--	--	22	--	--	22	--	--	22
Delaware	--	--	24	--	--	24	--	--	24
Florida	--	--	--	--	--	--	--	--	--
Georgia	--	--	--	--	--	--	--	--	--
Hawaii	23	18	15	23	18	15	23	18	15
Idaho	--	--	--	--	--	--	--	--	--
Illinois	--	--	22	--	--	22	--	--	22
Indiana	--	--	--	--	--	--	--	--	--
Iowa	--	--	--	--	--	--	--	--	--
Kansas	--	--	--	--	--	--	--	--	--
Kentucky	--	--	--	--	--	--	--	--	--
Louisiana	--	--	--	--	--	--	--	--	--
Maine	--	22	19	--	22	19	--	22	19
Maryland	--	--	--	--	--	--	--	--	--
Massachusetts	--	24	21	--	24	21	--	24	21
Michigan	--	--	--	--	--	--	--	--	--
Minnesota	--	--	--	--	--	--	--	--	--
Mississippi	--	--	--	--	--	--	--	--	--
Missouri	--	--	--	--	--	--	--	--	--
Montana	--	--	23	--	--	23	--	--	23
Nebraska	--	--	--	--	--	--	--	--	--
Nevada	--	--	23	--	--	23	--	--	23
New Hampshire	--	--	21	--	--	21	--	--	21
New Jersey	21	16	13	21	16	13	21	16	13
New Mexico	--	--	--	--	--	--	--	--	--
New York	15	12	10	15	12	10	15	12	10
North Carolina	--	--	--	--	--	--	--	--	--
North Dakota	--	--	--	--	--	--	--	--	--
Ohio	--	--	--	--	--	--	--	--	--
Oklahoma	--	--	--	--	--	--	--	--	--
Oregon	--	--	--	--	--	--	--	--	--
Pennsylvania	--	--	--	--	--	--	--	--	--
Rhode Island	21	17	14	21	17	14	21	17	14
South Carolina	--	--	--	--	--	--	--	--	--
South Dakota	--	--	--	--	--	--	--	--	--
Tennessee	--	--	--	--	--	--	--	--	--
Texas	--	--	--	--	--	--	--	--	--
Utah	--	--	--	--	--	--	--	--	--
Vermont	23	18	15	23	18	15	23	18	15
Virginia	--	--	--	--	--	--	--	--	--
Washington	--	--	--	--	--	--	--	--	--
West Virginia	--	--	--	--	--	--	--	--	--
Wisconsin	--	--	22	--	--	22	--	--	22
Wyoming	--	--	--	--	--	--	--	--	--

Table A-15. Net Metering with 10%, 20%, and 30% Excess Generation ($2.50/Watt SP)

State	$2.50/Watt Installed Cost Simple Payback (years)								
	10 % Excess			20 % Excess			30 % Excess		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	--	--	23	--	--	25	--	--	--
Alaska	23	18	15	25	20	17	--	21	18
Arizona	--	23	20	--	23	20	--	23	20
Arkansas	--	--	22	--	--	22	--	--	22
California	8	6	5	8	6	5	8	6	5
Colorado	--	--	24	--	--	--	--	--	--
Connecticut	23	18	15	23	18	15	23	18	15
Delaware	24	18	15	24	18	15	24	18	15
Florida	--	--	22	--	--	23	--	--	--
Georgia	--	--	22	--	--	22	--	--	22
Hawaii	16	12	10	16	12	10	16	12	10
Idaho	--	--	24	--	--	24	--	--	24
Illinois	23	17	14	23	17	14	23	17	14
Indiana	--	--	22	--	--	22	--	--	22
Iowa	--	24	20	--	24	20	--	24	20
Kansas	--	--	22	--	--	24	--	--	--
Kentucky	--	--	--	--	--	--	--	--	--
Louisiana	--	--	22	--	--	22	--	--	22
Maine	20	16	13	20	16	13	20	16	13
Maryland	--	--	23	--	--	24	--	--	--
Massachusetts	22	17	14	22	17	14	22	17	14
Michigan	--	--	23	--	--	24	--	--	--
Minnesota	--	23	20	--	23	20	--	23	20
Mississippi	--	--	24	--	--	--	--	--	--
Missouri	--	--	25	--	--	--	--	--	--
Montana	18	14	11	18	14	11	18	14	11
Nebraska	--	--	--	--	--	--	--	--	--
Nevada	24	19	16	24	19	16	24	19	16
New Hampshire	22	17	15	22	17	15	22	17	15
New Jersey	14	10	8	14	10	8	14	10	8
New Mexico	--	22	19	--	22	19	--	22	19
New York	11	8	7	11	8	7	11	8	7
North Carolina	--	20	17	--	22	18	--	23	20
North Dakota	--	--	--	--	--	--	--	--	--
Ohio	--	25	21	--	25	21	--	25	21
Oklahoma	--	--	23	--	--	23	--	--	23
Oregon	--	24	21	--	24	21	--	24	21
Pennsylvania	--	22	18	--	22	18	--	22	18
Rhode Island	14	11	9	14	11	9	14	11	9
South Carolina	--	--	22	--	--	24	--	--	--
South Dakota	--	--	25	--	--	--	--	--	--
Tennessee	--	19	13	--	20	13	--	21	13
Texas	--	24	20	--	--	22	--	--	23
Utah	--	--	23	--	--	23	--	--	23
Vermont	14	11	9	14	11	9	14	11	9
Virginia	--	24	21	--	24	21	--	24	21
Washington	--	--	--	--	--	--	--	--	--
West Virginia	--	--	--	--	--	--	--	--	--
Wisconsin	23	18	15	23	18	15	23	18	15
Wyoming	--	--	24	--	--	24	--	--	24

Table A-16. Incremental Cash Incentive Level to reach $4.00/Watt BTC or 10 year SP

State	$4.00/Watt BTC Incremental Cash Incentive ($/Watt)			10 Year SP Incremental Cash Incentive ($/Watt)					
				$4.00/Watt Installed Cost			$2.50/Watt Installed Cost		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$3.39	$3.11	$2.87	$3.69	$3.45	$3.25	$2.07	$1.84	$1.64
Alaska	$3.03	$2.51	$2.07	$3.31	$2.88	$2.51	$1.64	$1.21	$0.84
Arizona	$3.30	$2.96	$2.68	$3.68	$3.40	$3.17	$1.99	$1.71	$1.48
Arkansas	$3.45	$3.16	$2.92	$3.80	$3.55	$3.35	$2.13	$1.89	$1.68
California	$0.96	$0.41	$0.00	$1.51	$1.06	$0.68	$0.00	$0.00	$0.00
Colorado	$3.47	$3.19	$2.96	$3.74	$3.51	$3.32	$2.11	$1.89	$1.69
Connecticut	$2.95	$2.42	$2.00	$3.58	$3.19	$2.85	$1.85	$1.45	$1.12
Delaware	$2.79	$2.43	$2.12	$2.98	$2.68	$2.42	$1.37	$1.07	$0.81
Florida	$3.47	$3.13	$2.84	$3.91	$3.62	$3.38	$2.16	$1.87	$1.63
Georgia	$3.49	$3.18	$2.92	$3.82	$3.57	$3.35	$2.13	$1.88	$1.66
Hawaii	$2.23	$1.54	$0.95	$2.71	$2.13	$1.65	$1.08	$0.51	$0.02
Idaho	$3.63	$3.33	$3.07	$4.04	$3.82	$3.63	$2.31	$2.08	$1.89
Illinois	$1.64	$1.31	$1.03	$2.09	$1.82	$1.59	$1.04	$0.76	$0.53
Indiana	$3.30	$3.04	$2.82	$3.66	$3.44	$3.26	$2.07	$1.85	$1.67
Iowa	$3.35	$2.90	$2.52	$3.70	$3.41	$3.17	$2.03	$1.74	$1.50
Kansas	$3.23	$2.94	$2.69	$3.56	$3.31	$3.10	$1.98	$1.73	$1.52
Kentucky	$3.68	$3.47	$3.29	$4.03	$3.86	$3.71	$2.35	$2.17	$2.03
Louisiana	$3.46	$3.16	$2.91	$3.78	$3.52	$3.31	$2.11	$1.86	$1.64
Maine	$2.86	$2.25	$1.74	$3.43	$2.94	$2.53	$1.66	$1.17	$0.76
Maryland	$3.46	$3.15	$2.89	$3.83	$3.57	$3.35	$2.14	$1.88	$1.66
Massachusetts	$2.98	$2.49	$2.08	$3.27	$2.88	$2.55	$1.63	$1.24	$0.91
Michigan	$3.56	$3.22	$2.94	$4.00	$3.72	$3.48	$2.22	$1.94	$1.71
Minnesota	$3.17	$2.85	$2.59	$3.34	$3.09	$2.88	$1.84	$1.59	$1.38
Mississippi	$3.45	$3.15	$2.90	$3.88	$3.63	$3.42	$2.18	$1.93	$1.72
Missouri	$3.50	$3.23	$3.00	$3.80	$3.57	$3.38	$2.15	$1.92	$1.73
Montana	$2.08	$1.75	$1.50	$2.23	$1.98	$1.77	$0.58	$0.33	$0.12
Nebraska	$3.83	$3.54	$3.29	$4.23	$4.02	$3.85	$2.44	$2.23	$2.06
Nevada	$2.99	$2.60	$2.28	$3.25	$2.93	$2.67	$1.72	$1.40	$1.14
New Hampshire	$3.24	$2.70	$2.25	$3.61	$3.17	$2.81	$1.82	$1.39	$1.03
New Jersey	$0.93	$0.49	$0.12	$1.22	$0.86	$0.56	$0.41	$0.05	$0.00
New Mexico	$3.27	$2.92	$2.64	$3.65	$3.37	$3.13	$2.00	$1.72	$1.49
New York	$0.10	$0.00	$0.00	$0.89	$0.41	$0.01	$0.08	$0.00	$0.00
North Carolina	$3.17	$2.72	$2.35	$3.57	$3.18	$2.86	$1.85	$1.47	$1.15
North Dakota	$3.53	$3.26	$3.04	$3.82	$3.59	$3.40	$2.16	$1.93	$1.74
Ohio	$3.44	$3.08	$2.78	$3.89	$3.62	$3.39	$2.16	$1.89	$1.66
Oklahoma	$3.51	$3.24	$3.01	$3.83	$3.60	$3.41	$2.17	$1.94	$1.74
Oregon	$3.12	$2.83	$2.58	$3.31	$3.09	$2.90	$1.81	$1.59	$1.40
Pennsylvania	$3.36	$2.96	$2.63	$3.85	$3.53	$3.26	$2.09	$1.77	$1.50
Rhode Island	$1.13	$0.64	$0.24	$1.43	$1.04	$0.71	$0.51	$0.12	$0.00
South Carolina	$3.41	$3.09	$2.83	$3.78	$3.52	$3.29	$2.10	$1.83	$1.61
South Dakota	$3.55	$3.27	$3.03	$3.86	$3.61	$3.41	$2.17	$1.93	$1.73
Tennessee	$2.94	$2.45	$2.04	$3.02	$2.45	$1.96	$1.30	$0.72	$0.23
Texas	$3.12	$2.79	$2.51	$3.51	$3.23	$2.99	$1.92	$1.64	$1.40
Utah	$3.38	$3.10	$2.89	$3.73	$3.47	$3.29	$2.08	$1.83	$1.66
Vermont	$1.66	$1.08	$0.59	$2.01	$1.55	$1.16	$0.58	$0.11	$0.00
Virginia	$3.41	$3.09	$2.83	$3.75	$3.49	$3.27	$2.09	$1.82	$1.60
Washington	$3.65	$3.42	$3.22	$3.79	$3.60	$3.43	$2.18	$1.98	$1.82
West Virginia	$3.57	$3.34	$3.14	$3.94	$3.74	$3.58	$2.27	$2.07	$1.90
Wisconsin	$2.14	$1.82	$1.55	$2.53	$2.22	$1.99	$1.29	$1.02	$0.79
Wyoming	$3.50	$3.24	$3.02	$3.80	$3.59	$3.41	$2.17	$1.95	$1.77

Table A-17. Federal ITC With and Without $2,000 Max. Limit (BTC Classes 2-4)

State	Break-Even Turnkey Cost ($/Watt)					
	No Maximum Limit			$2,000 Maximum Limit		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.98	$1.35	$1.67	$0.90	$1.17	$1.40
Alaska	$1.67	$2.30	$2.83	$1.42	$1.89	$2.29
Arizona	$1.22	$1.65	$2.01	$1.07	$1.39	$1.66
Arkansas	$0.98	$1.36	$1.67	$0.90	$1.17	$1.40
California	$3.57	$4.28	$4.88	$3.28	$3.79	$4.22
Colorado	$0.95	$1.30	$1.61	$0.87	$1.14	$1.36
Connecticut	$1.77	$2.38	$2.90	$1.49	$1.95	$2.33
Delaware	$1.68	$2.15	$2.54	$1.55	$1.89	$2.18
Florida	$1.11	$1.53	$1.89	$1.00	$1.31	$1.58
Georgia	$1.02	$1.41	$1.74	$0.93	$1.22	$1.46
Hawaii	$2.54	$3.44	$4.21	$2.04	$2.70	$3.26
Idaho	$1.02	$1.36	$1.63	$0.92	$1.18	$1.38
Illinois	$1.79	$2.46	$3.03	$1.69	$2.21	$2.66
Indiana	$0.96	$1.33	$1.63	$0.88	$1.14	$1.37
Iowa	$1.56	$2.16	$2.66	$1.27	$1.67	$2.00
Kansas	$1.07	$1.47	$1.82	$0.96	$1.25	$1.50
Kentucky	$0.71	$0.97	$1.20	$0.70	$0.89	$1.06
Louisiana	$1.01	$1.39	$1.71	$0.92	$1.20	$1.44
Maine	$1.92	$2.64	$3.25	$1.61	$2.15	$2.61
Maryland	$1.04	$1.43	$1.76	$0.94	$1.23	$1.48
Massachusetts	$1.68	$2.28	$2.79	$1.42	$1.87	$2.25
Michigan	$1.06	$1.46	$1.80	$0.96	$1.26	$1.52
Minnesota	$1.18	$1.63	$2.01	$1.03	$1.35	$1.61
Mississippi	$1.00	$1.38	$1.70	$0.91	$1.19	$1.43
Missouri	$0.92	$1.27	$1.56	$0.85	$1.11	$1.32
Montana	$2.41	$2.79	$3.10	$2.28	$2.56	$2.80
Nebraska	$0.94	$1.30	$1.60	$0.86	$1.12	$1.33
Nevada	$1.40	$1.94	$2.38	$1.20	$1.58	$1.91
New Hampshire	$1.60	$2.21	$2.72	$1.38	$1.84	$2.23
New Jersey	$2.83	$3.90	$4.80	$2.58	$3.42	$4.13
New Mexico	$1.18	$1.63	$2.01	$1.04	$1.37	$1.65
New York	$5.72	$7.89	$9.71	$4.25	$5.69	$6.90
North Carolina	$1.64	$2.26	$2.78	$1.31	$1.72	$2.07
North Dakota	$0.93	$1.28	$1.58	$0.86	$1.11	$1.32
Ohio	$1.21	$1.67	$2.05	$1.06	$1.38	$1.66
Oklahoma	$0.92	$1.27	$1.57	$0.86	$1.11	$1.33
Oregon	$1.27	$1.68	$2.04	$1.08	$1.37	$1.62
Pennsylvania	$1.27	$1.75	$2.16	$1.12	$1.48	$1.78
Rhode Island	$2.79	$3.82	$4.38	$2.44	$3.24	$3.90
South Carolina	$1.07	$1.48	$1.82	$0.97	$1.27	$1.52
South Dakota	$0.94	$1.30	$1.60	$0.87	$1.14	$1.36
Tennessee	$1.68	$2.30	$2.82	$1.43	$1.89	$2.27
Texas	$1.21	$1.67	$2.06	$1.06	$1.39	$1.67
Utah	$1.05	$1.38	$1.65	$0.95	$1.19	$1.39
Vermont	$2.82	$3.62	$4.21	$2.42	$3.20	$3.64
Virginia	$1.07	$1.47	$1.81	$0.96	$1.26	$1.51
Washington	$0.79	$1.09	$1.34	$0.76	$0.98	$1.16
West Virginia	$0.81	$1.11	$1.37	$0.77	$1.00	$1.18
Wisconsin	$1.58	$2.18	$2.69	$1.39	$1.82	$2.19
Wyoming	$0.89	$1.23	$1.51	$0.83	$1.08	$1.29

Table A-18. Federal ITC With and Without $2,000 Max. Limit ($4.00/Watt SP Classes 2-4)

State	$4.00/Watt Installed Cost Simple Payback (years)					
	No Maximum Limit			$2,000 Maximum Limit		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	--	--	24	--	--	--
Alaska	25	19	16	--	24	20
Arizona	--	--	22	--	--	--
Arkansas	--	--	25	--	--	--
California	16	12	10	19	15	12
Colorado	--	--	25	--	--	--
Connecticut	--	20	17	--	25	21
Delaware	--	22	19	--	--	23
Florida	--	--	24	--	--	--
Georgia	--	--	24	--	--	--
Hawaii	18	14	11	23	18	15
Idaho	--	--	--	--	--	--
Illinois	--	21	18	--	24	21
Indiana	--	--	24	--	--	--
Iowa	--	--	23	--	--	--
Kansas	--	--	23	--	--	--
Kentucky	--	--	--	--	--	--
Louisiana	--	--	25	--	--	--
Maine	23	18	15	--	22	19
Maryland	--	--	24	--	--	--
Massachusetts	25	19	16	--	24	20
Michigan	--	--	25	--	--	--
Minnesota	--	--	22	--	--	--
Mississippi	--	--	25	--	--	--
Missouri	--	--	--	--	--	--
Montana	--	21	18	--	--	22
Nebraska	--	--	--	--	--	--
Nevada	--	21	18	--	--	22
New Hampshire	--	21	17	--	24	21
New Jersey	18	13	11	20	15	12
New Mexico	--	25	21	--	--	--
New York	12	9	7	14	11	9
North Carolina	--	22	18	--	--	24
North Dakota	--	--	--	--	--	--
Ohio	--	--	24	--	--	--
Oklahoma	--	--	--	--	--	--
Oregon	--	--	23	--	--	--
Pennsylvania	--	25	21	--	--	--
Rhode Island	17	13	11	20	15	13
South Carolina	--	--	24	--	--	--
South Dakota	--	--	--	--	--	--
Tennessee	--	24	17	--	--	--
Texas	--	24	21	--	--	--
Utah	--	--	--	--	--	--
Vermont	18	14	12	22	17	14
Virginia	--	--	24	--	--	--
Washington	--	--	--	--	--	--
West Virginia	--	--	--	--	--	--
Wisconsin	--	20	17	--	25	21
Wyoming	--	--	--	--	--	--

Table A-19. Federal ITC With and Without $2,000 Max. Limit ($2.50/Watt SP Classes 2-4)

State	$2.50/Watt Installed Cost Simple Payback (years)					
	No Maximum Limit			$2,000 Maximum Limit		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	--	20	17	--	24	21
Alaska	17	13	10	21	16	13
Arizona	23	18	15	--	22	18
Arkansas	--	20	17	--	25	21
California	6	4	3	6	5	4
Colorado	--	21	18	--	25	21
Connecticut	18	14	12	22	17	14
Delaware	18	14	11	22	17	14
Florida	25	19	16	--	23	19
Georgia	--	20	17	--	24	20
Hawaii	12	9	7	15	11	9
Idaho	--	23	19	--	--	23
Illinois	19	14	11	21	16	13
Indiana	--	20	17	--	25	21
Iowa	25	19	16	--	23	19
Kansas	24	19	16	--	23	20
Kentucky	--	--	23	--	--	--
Louisiana	--	20	17	--	24	21
Maine	16	12	10	19	15	12
Maryland	--	20	17	--	24	20
Massachusetts	17	13	11	21	16	13
Michigan	--	20	17	--	24	20
Minnesota	23	18	15	--	22	19
Mississippi	--	20	17	--	25	21
Missouri	--	22	18	--	--	22
Montana	13	10	8	16	11	9
Nebraska	--	--	22	--	--	--
Nevada	19	14	12	23	18	15
New Hampshire	18	14	11	21	17	14
New Jersey	11	8	6	12	9	7
New Mexico	22	17	15	--	21	18
New York	8	6	5	9	7	6
North Carolina	17	13	10	23	18	15
North Dakota	--	22	18	--	--	23
Ohio	--	20	17	--	24	20
Oklahoma	--	21	18	--	--	22
Oregon	23	18	15	--	23	19
Pennsylvania	22	17	14	--	21	17
Rhode Island	11	8	6	13	9	8
South Carolina	25	19	16	--	23	20
South Dakota	--	22	18	--	--	22
Tennessee	19	10	8	--	17	10
Texas	22	17	14	--	21	18
Utah	--	21	18	--	--	22
Vermont	11	8	6	13	9	8
Virginia	25	19	16	--	23	20
Washington	--	24	20	--	--	24
West Virginia	--	24	20	--	--	25
Wisconsin	18	14	11	21	17	14
Wyoming	--	22	18	--	--	22

Table A-20. Taxable USDA Farm Grant (BTC & SP, Wind Classes 2-4)

Values in parentheses are the results from a cumulative grant addition if the state currently has restrictions on grant interactions.

State	Break-Even Turnkey Cost ($/Watt)			Simple Payback (years)					
				$4.00/Watt			$2.50/Watt		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.87	$1.20	$1.48	--	--	--	--	23	19
Alaska	$1.51	$2.09	$2.57	--	21	18	19	14	12
Arizona	$1.09	$1.47	$1.79	--	--	25	--	20	17
Arkansas	$0.87	$1.20	$1.48	--	--	--	--	23	20
California	$3.40 ($3.91)	$3.94 ($4.53)	$4.39 ($5.04)	20 (17)	15 (12)	12 (10)	7 (5)	5 (3)	4 (3)
Colorado	$0.85	$1.17	$1.45	--	--	--	--	23	20
Connecticut	$1.56	$2.14	$2.60	--	23	19	20	16	13
Delaware	$1.55 ($1.71)	$1.97 ($2.12)	$2.32 ($2.47)	-- (--)	25 (24)	21 (21)	21 (20)	16 (15)	13 (13)
Florida	$1.01	$1.39	$1.71	--	--	--	--	21	18
Georgia	$0.91	$1.26	$1.55	--	--	--	--	22	19
Hawaii	$2.24	$3.05	$3.72	21	16	13	14	10	8
Idaho	$0.85	$1.17	$1.44	--	--	--	--	--	22
Illinois	$2.08	$2.87	$3.53	--	21	17	18	13	11
Indiana	$0.85	$1.18	$1.45	--	--	--	--	23	20
Iowa	$1.21	$1.67	$2.06	--	--	--	--	21	18
Kansas	$0.94	$1.30	$1.60	--	--	--	--	21	18
Kentucky	$0.63	$0.87	$1.07	--	--	--	--	--	--
Louisiana	$0.90	$1.24	$1.52	--	--	--	--	23	19
Maine	$1.71	$2.36	$2.91	--	20	17	18	14	11
Maryland	$0.93	$1.28	$1.58	--	--	--	--	22	19
Massachusetts	$1.50	$2.04	$2.50	--	22	18	19	15	12
Michigan	$0.96	$1.32	$1.62	--	--	--	--	22	19
Minnesota	$1.01	$1.39	$1.71	--	--	25	--	20	17
Mississippi	$0.89	$1.23	$1.52	--	--	--	--	23	20
Missouri	$0.82	$1.13	$1.39	--	--	--	--	24	21
Montana	$2.64	$2.99	$3.26	--	22	19	13	9	8
Nebraska	$0.78	$1.08	$1.33	--	--	--	--	--	25
Nevada	$1.26	$1.73	$2.13	--	23	20	21	16	14
New Hampshire	$1.46	$2.02	$2.48	--	22	19	20	15	13
New Jersey	$2.37 ($3.78)	$3.26 ($5.21)	$4.02 ($6.42)	21 (16)	16 (11)	13 (9)	14 (10)	10 (7)	8 (5)
New Mexico	$1.04	$1.44	$1.77	--	--	24	--	20	17
New York	$4.14 ($6.21)	$5.70 ($8.56)	$7.02 ($10.53)	14 (11)	11 (9)	9 (7)	10 (8)	7 (6)	6 (5)
North Carolina	$1.27	$1.75	$2.15	--	--	21	22	17	14
North Dakota	$0.80	$1.10	$1.36	--	--	--	--	--	21
Ohio	$1.04	$1.43	$1.76	--	--	--	--	22	19
Oklahoma	$0.82	$1.13	$1.39	--	--	--	--	24	21
Oregon	$1.06	$1.41	$1.71	--	--	--	--	21	18
Pennsylvania	$1.15	$1.58	$1.95	--	--	23	24	19	16
Rhode Island	$3.27	$4.20	$4.62	16	12	10	10	7	6
South Carolina	$0.95	$1.31	$1.62	--	--	--	--	22	18
South Dakota	$0.85	$1.17	$1.44	--	--	--	--	24	21
Tennessee	$1.54	$2.09	$2.56	--	--	22	23	13	9
Texas	$1.09	$1.50	$1.84	--	--	23	24	19	16
Utah	$0.90	$1.22	$1.46	--	--	--	--	24	20
Vermont	$2.99	$3.68	$4.28	19	15	12	11	8	6
Virginia	$0.95	$1.31	$1.61	--	--	--	--	22	18
Washington	$0.71	$0.98	$1.21	--	--	--	--	--	22
West Virginia	$0.72	$0.99	$1.22	--	--	--	--	--	23
Wisconsin	$1.53	$2.11	$2.59	--	22	18	19	15	12
Wyoming	$0.80	$1.11	$1.36	--	--	--	--	24	21

Table A-21. Tax-Exempt USDA Farm Grant (BTC & SP, Wind Classes 2-4)

Values in parentheses are the results from a cumulative grant addition if the state currently has restrictions on grant interactions.

State	Break-Even Turnkey Cost ($/Watt)			Simple Payback (years)					
				$4.00/Watt			$2.50/Watt		
	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4	Class 2	Class 3	Class 4
Alabama	$0.95	$1.31	$1.61	--	--	--	--	21	18
Alaska	$1.62	$2.23	$2.74	--	20	17	18	13	11
Arizona	$1.18	$1.59	$1.94	--	--	23	24	19	16
Arkansas	$0.95	$1.31	$1.61	--	--	--	--	22	18
California	$3.51 (4.05)	$4.09 (4.72)	$4.57 (5.29)	18 (14)	13 (10)	11 (8)	6 (2)	4 (2)	3 (0)
Colorado	$0.91	$1.26	$1.55	--	--	--	--	22	19
Connecticut	$1.69	$2.31	$2.80	--	21	18	19	15	12
Delaware	$1.64 (1.80)	$2.09 (2.25)	$2.47 (2.62)	-- (--)	23 (22)	20 (19)	19 (18)	15 (14)	12 (11)
Florida	$1.07	$1.48	$1.82	--	--	25	--	20	17
Georgia	$0.99	$1.36	$1.68	--	--	--	--	21	18
Hawaii	$2.45	$3.32	$4.06	19	15	12	13	9	8
Idaho	$0.93	$1.29	$1.56	--	--	--	--	24	20
Illinois	$2.31	$3.19	$3.92	25	19	15	16	12	9
Indiana	$0.93	$1.28	$1.57	--	--	--	--	21	18
Iowa	$1.35	$1.86	$2.29	--	--	24	--	20	17
Kansas	$1.03	$1.42	$1.75	--	--	24	--	20	17
Kentucky	$0.68	$0.94	$1.16	--	--	--	--	--	24
Louisiana	$0.97	$1.34	$1.65	--	--	--	--	21	18
Maine	$1.86	$2.56	$3.15	24	19	16	17	13	11
Maryland	$1.00	$1.38	$1.70	--	--	--	--	21	18
Massachusetts	$1.62	$2.21	$2.70	--	20	17	18	14	11
Michigan	$1.03	$1.42	$1.74	--	--	--	--	21	18
Minnesota	$1.11	$1.53	$1.88	--	--	23	24	19	16
Mississippi	$0.97	$1.33	$1.64	--	--	--	--	22	18
Missouri	$0.89	$1.22	$1.51	--	--	--	--	23	19
Montana	$2.73	$3.11	$3.41	--	20	17	9	7	6
Nebraska	$0.86	$1.18	$1.45	--	--	--	--	--	24
Nevada	$1.35	$1.86	$2.30	--	22	19	20	15	13
New Hampshire	$1.56	$2.15	$2.64	--	21	18	19	14	12
New Jersey	$2.75 (4.25)	$3.79 (5.87)	$4.67 (7.22)	18 (13)	14 (9)	11 (7)	12 (7)	8 (5)	7 (3)
New Mexico	$1.14	$1.57	$1.93	--	--	23	24	19	16
New York	$5.07 (7.60)	$6.99 (10.48)	$8.60 (12.90)	12 (9)	10 (7)	8 (6)	8 (6)	6 (4)	5 (4)
North Carolina	$1.41	$1.94	$2.39	--	23	20	20	16	13
North Dakota	$0.87	$1.20	$1.47	--	--	--	--	24	20
Ohio	$1.12	$1.55	$1.91	--	--	--	--	21	18
Oklahoma	$0.89	$1.23	$1.51	--	--	--	--	23	19
Oregon	$1.18	$1.56	$1.89	--	--	24	24	19	16
Pennsylvania	$1.23	$1.70	$2.09	--	--	22	23	18	15
Rhode Island	$3.64	$4.42	$4.89	14	10	8	9	6	5
South Carolina	$1.03	$1.43	$1.76	--	--	25	--	20	17
South Dakota	$0.91	$1.26	$1.55	--	--	--	--	23	19
Tennessee	$1.62	$2.22	$2.72	--	--	20	21	12	9
Texas	$1.17	$1.61	$1.98	--	--	22	23	18	15
Utah	$1.00	$1.33	$1.59	--	--	--	--	22	19
Vermont	$3.23	$3.91	$4.48	17	13	11	10	7	5
Virginia	$1.03	$1.42	$1.75	--	--	25	--	20	17
Washington	$0.76	$1.05	$1.29	--	--	--	--	25	21
West Virginia	$0.78	$1.08	$1.32	--	--	--	--	--	22
Wisconsin	$1.71	$2.36	$2.91	--	20	17	17	13	11
Wyoming	$0.86	$1.19	$1.46	--	--	--	--	23	20

Table A-22. Turbine Performance Sensitivity Cases (BTC, Class 3)

State	Break-Even Turnkey Cost ($/Watt)			
	20 Year System Lifetime	30 Year System Lifetime	20m Tower Height	20% Decrease in Turbine Output
	Class 3	Class 3	Class 3	Class 3
Alabama	$0.88	$1.08	$0.80	$0.79
Alaska	$1.53	$1.87	$1.39	$1.38
Arizona	$1.08	$1.32	$0.99	$0.99
Arkansas	$0.89	$1.08	$0.81	$0.80
California	$3.41	$3.77	$3.25	$3.24
Colorado	$0.85	$1.05	$0.77	$0.77
Connecticut	$1.58	$1.93	$1.45	$1.44
Delaware	$1.58	$1.82	$1.48	$1.47
Florida	$1.02	$1.24	$0.92	$0.91
Georgia	$0.93	$1.13	$0.84	$0.84
Hawaii	$2.25	$2.74	$2.06	$2.04
Idaho	$0.88	$1.08	$0.81	$0.80
Illinois	$1.74	$2.06	$1.55	$1.54
Indiana	$0.85	$1.04	$0.77	$0.77
Iowa	$1.30	$1.56	$1.17	$1.16
Kansas	$0.95	$1.16	$0.86	$0.85
Kentucky	$0.64	$0.78	$0.58	$0.57
Louisiana	$0.91	$1.11	$0.83	$0.82
Maine	$1.76	$2.16	$1.60	$1.59
Maryland	$0.95	$1.15	$0.86	$0.85
Massachusetts	$1.51	$1.85	$1.38	$1.37
Michigan	$0.98	$1.19	$0.89	$0.88
Minnesota	$1.02	$1.25	$0.93	$0.92
Mississippi	$0.91	$1.10	$0.82	$0.81
Missouri	$0.83	$1.01	$0.75	$0.75
Montana	$2.28	$2.48	$2.19	$2.18
Nebraska	$0.83	$0.99	$0.75	$0.74
Nevada	$1.23	$1.53	$1.13	$1.12
New Hampshire	$1.50	$1.83	$1.36	$1.35
New Jersey	$2.76	$3.31	$2.48	$2.46
New Mexico	$1.05	$1.31	$0.96	$0.96
New York	$4.60	$5.76	$4.23	$4.19
North Carolina	$1.33	$1.62	$1.21	$1.20
North Dakota	$0.82	$0.98	$0.74	$0.73
Ohio	$1.07	$1.29	$0.97	$0.96
Oklahoma	$0.83	$1.01	$0.76	$0.75
Oregon	$1.04	$1.27	$0.97	$0.96
Pennsylvania	$1.16	$1.43	$1.06	$1.05
Rhode Island	$2.62	$3.17	$2.37	$2.35
South Carolina	$0.97	$1.18	$0.88	$0.87
South Dakota	$0.87	$1.04	$0.78	$0.77
Tennessee	$1.63	$1.78	$1.39	$1.38
Texas	$1.07	$1.31	$0.98	$0.97
Utah	$0.90	$1.09	$0.84	$0.83
Vermont	$2.65	$3.19	$2.40	$2.38
Virginia	$0.97	$1.18	$0.88	$0.87
Washington	$0.71	$0.88	$0.65	$0.64
West Virginia	$0.73	$0.89	$0.66	$0.66
Wisconsin	$1.39	$1.72	$1.27	$1.26
Wyoming	$0.79	$0.99	$0.73	$0.72

Table A-23. Economic Sensitivity Cases (BTC, Class 3)

State	Break-Even Turnkey Cost ($/Watt)			
	0.5¢/kWh O&M Costs	3.0¢/kWh O&M Costs	2.5% Required Rate of Return	15% Required Rate of Return
	Class 3	Class 3	Class 3	Class 3
Alabama	$1.17	$0.72	$1.80	$0.57
Alaska	$1.88	$1.48	$3.06	$1.00
Arizona	$1.37	$0.98	$2.16	$0.72
Arkansas	$1.18	$0.73	$1.79	$0.58
California	$3.78	$3.35	$5.08	$2.85
Colorado	$1.11	$0.74	$1.75	$0.55
Connecticut	$1.95	$1.52	$2.99	$1.35
Delaware	$1.90	$1.45	$2.69	$1.20
Florida	$1.32	$0.88	$2.02	$0.67
Georgia	$1.22	$0.79	$1.86	$0.61
Hawaii	$2.69	$2.27	$4.53	$1.48
Idaho	$1.16	$0.74	$1.61	$0.68
Illinois	$2.22	$1.47	$3.21	$1.17
Indiana	$1.15	$0.68	$1.77	$0.55
Iowa	$1.67	$1.12	$2.16	$0.97
Kansas	$1.24	$0.80	$1.95	$0.61
Kentucky	$0.89	$0.45	$1.29	$0.42
Louisiana	$1.20	$0.76	$1.84	$0.60
Maine	$2.15	$1.73	$3.55	$1.14
Maryland	$1.24	$0.80	$1.90	$0.62
Massachusetts	$1.87	$1.44	$3.03	$0.99
Michigan	$1.26	$0.85	$1.93	$0.65
Minnesota	$1.34	$0.85	$1.97	$0.72
Mississippi	$1.20	$0.75	$1.83	$0.59
Missouri	$1.11	$0.67	$1.67	$0.54
Montana	$2.55	$2.14	$3.13	$2.06
Nebraska	$1.11	$0.65	$1.44	$0.61
Nevada	$1.56	$1.16	$2.62	$0.78
New Hampshire	$1.84	$1.45	$2.96	$0.98
New Jersey	$3.43	$2.53	$5.15	$1.86
New Mexico	$1.35	$0.96	$2.19	$0.68
New York	$5.69	$4.57	$8.14	$3.92
North Carolina	$1.72	$1.16	$2.70	$0.86
North Dakota	$1.10	$0.63	$1.63	$0.53
Ohio	$1.38	$0.91	$1.92	$0.83
Oklahoma	$1.11	$0.68	$1.68	$0.54
Oregon	$1.36	$0.89	$1.91	$0.82
Pennsylvania	$1.48	$1.06	$2.35	$0.76
Rhode Island	$3.25	$2.44	$4.59	$1.72
South Carolina	$1.27	$0.83	$1.96	$0.63
South Dakota	$1.13	$0.72	$1.68	$0.57
Tennessee	$1.89	$1.46	$2.59	$1.17
Texas	$1.39	$0.94	$2.23	$0.69
Utah	$1.16	$0.77	$1.74	$0.59
Vermont	$3.20	$2.59	$4.49	$1.74
Virginia	$1.26	$0.82	$1.95	$0.63
Washington	$0.97	$0.55	$1.45	$0.46
West Virginia	$0.99	$0.56	$1.48	$0.47
Wisconsin	$1.82	$1.21	$2.91	$0.90
Wyoming	$1.05	$0.68	$1.65	$0.51

Table A-24. Alternate Financing Sensitivity Cases (BTC, Class 3)

State	Break-Even Turnkey Cost ($/Watt)			
	Low-Interest Loan	Personal Loan	Home Mortgage	Cash Payment
	Class 3	Class 3	Class 3	Class 3
Alabama	$1.27	$0.99	$1.41	$0.99
Alaska	$2.17	$1.72	$2.33	$1.72
Arizona	$1.55	$1.22	$1.70	$1.22
Arkansas	$1.27	$1.00	$1.42	$1.00
California	$4.13	$3.61	$4.44	$3.60
Colorado	$1.23	$0.96	$1.32	$0.96
Connecticut	$2.09	$1.77	$2.29	$1.77
Delaware	$2.05	$1.72	$2.22	$1.72
Florida	$1.44	$1.14	$1.55	$1.14
Georgia	$1.33	$1.05	$1.47	$1.05
Hawaii	$3.23	$2.53	$3.63	$2.53
Idaho	$1.15	$1.00	$1.29	$1.00
Illinois	$2.34	$1.92	$2.52	$1.92
Indiana	$1.24	$0.96	$1.37	$0.96
Iowa	$1.67	$1.45	$1.79	$1.45
Kansas	$1.38	$1.06	$1.54	$1.06
Kentucky	$0.92	$0.72	$1.01	$0.72
Louisiana	$1.31	$1.03	$1.45	$1.03
Maine	$2.49	$1.99	$2.78	$1.99
Maryland	$1.35	$1.06	$1.48	$1.06
Massachusetts	$2.15	$1.70	$2.37	$1.70
Michigan	$1.38	$1.10	$1.51	$1.10
Minnesota	$1.39	$1.15	$1.57	$1.15
Mississippi	$1.30	$1.02	$1.43	$1.02
Missouri	$1.19	$0.93	$1.32	$0.93
Montana	$2.62	$2.39	$2.80	$2.40
Nebraska	$1.05	$0.92	$1.35	$0.92
Nevada	$1.81	$1.40	$1.96	$1.40
New Hampshire	$2.09	$1.69	$2.24	$1.69
New Jersey	$3.72	$3.07	$4.02	$3.07
New Mexico	$1.53	$1.19	$1.72	$1.19
New York	$5.61	$5.24	$6.30	$5.24
North Carolina	$2.07	$1.50	$2.43	$1.50
North Dakota	$1.20	$0.91	$1.32	$0.91
Ohio	$1.37	$1.20	$1.50	$1.20
Oklahoma	$1.20	$0.94	$1.33	$0.94
Oregon	$1.38	$1.17	$1.57	$1.17
Pennsylvania	$1.65	$1.31	$1.80	$1.31
Rhode Island	$3.62	$2.93	$3.86	$2.93
South Carolina	$1.39	$1.09	$1.55	$1.09
South Dakota	$1.22	$0.96	$1.31	$0.96
Tennessee	$2.16	$1.71	$2.32	$1.71
Texas	$1.57	$1.21	$1.70	$1.21
Utah	$1.29	$1.01	$1.44	$1.01
Vermont	$3.49	$2.98	$3.71	$2.98
Virginia	$1.38	$1.08	$1.53	$1.08
Washington	$1.02	$0.80	$1.10	$0.80
West Virginia	$1.05	$0.82	$1.16	$0.82
Wisconsin	$2.04	$1.58	$2.28	$1.58
Wyoming	$1.15	$0.90	$1.24	$0.90