July 15, 2011

Executive Director and Secretary
Washington Utilities and Transportation Commission
1300 South Evergreen Park Drive SW
PO Box 47250
Olympia, WA 98504
records@utc.wa.gov

RE: Docket UE-110667, Study of the Potential for Distributed Energy in WA State

Dear Commissioners,

eFormative Options has been working in conjunction with the Pacific Northwest National Laboratory and the National Renewable Energy Laboratory on a U.S. Department of Energy-funded project to identify policy best practices for distributed wind technology and to help policy makers and utilities evaluate current and potential incentives using a pro forma model. Incorporating a customized feed from the Database of State Incentives for Renewables and Efficiency (DSIRE), the web-based Distributed Wind Policy Comparison Tool and accompanying Guidebook is designed to assist state, local and utility officials in understanding the financial impacts that different policy options have on distributed wind technologies.

The Policy Tool is populated with a variety of financial variables including turbine costs, electricity rates, policies, and financial incentives; economic variables including discount and escalation rates; as well as technical variables such as turbine power curves and wind speed that impact electricity production. The Policy Tool allows users to adjust many of the variables, including the policies themselves, to gauge the expected impact a policy could have on an example distributed wind project's cost of energy, net present value, internal rate of return (IRR) and simple payback. The beta Tool and review draft Guidebook are currently available by request; public versions will be posted soon at www.windpolicytool.org.

We applaud Washington State's leadership in supporting distributed energy development. However, as indicated in the attached materials prepared by my firm, our state has much room for improvement with policies and incentives available to support distributed wind. The financial return for a typical site in the state is not among the most favorable in the nation, even with incentives in effect. Without incentives, the economics for installing a small wind system are not yet compelling here, as installation costs are often higher than expected revenues. Still, for sites with strong wind resources, small wind can be a more cost effective option than solar or other on-site renewable technologies, and costs are expected to decline as the industry matures.

The economic outlook of the small wind industry is one of the bright spots in the U.S. economy. As the Commission studies the distributed energy sector, it should endeavor to capitalize on the success of the small wind market through the policies and incentives it institutes, or risk losing the benefits of the industry's growth. For example, Washington State has a much lower incentive level for distributed wind than what has been available in California, Oregon, and many other states, and Washington is missing out on reaping substantial economic benefits.

Improving the state's policies and incentives are essential to the success of the distributed wind industry here. Upfront payments are important in aiding consumer financing. A supplement to the state's existing performance-based incentive (PBI) could create a hybrid approach to issue partial payments upon construction based on estimated production using certified power curves and wind map calculations. Wisconsin's Focus on Energy program pioneered this estimated PBI model. However, such a program can be expensive to administer, which could reduce the amount of funds available for incentives. Scaling incentives based on AWEA Rated Power, wind map ratings and tower height could be a simpler approach to encourage proper siting. Reducing incentives gradually over time can also aid the market in reducing costs for consumers.

Requiring that small wind turbines are certified by an independent certification organization such as the Small Wind Certification Council (SWCC) in order to qualify for incentives is extremely important for several reasons. For one, it maintains the integrity of the industry. Certified equipment also provides the state with some certainty of turbine performance, so rate refunding is used prudently. Prompt deadlines need to be set for requiring certification to ensure manufacturers prioritize and complete testing in a timely manner. The number of turbines expected to be certified by the SWCC by January 1, 2012 will provide adequate selection for consumers. Manufacturers have been on notice for several years that certification requirements are forthcoming. While the SWCC maintains a Pending Applicant list, we do not suggest using that list for incentive qualification. Through the end of 2011, incentives should be limited to turbine models with power performance tests conforming to AWEA 9.1 – 2009 that have been verified by the SWCC.

Recommendations provided by the Local Energy Alliance of Washington (WALEA) and the Interstate Renewable Energy Council (IREC) under this docket would allow Washington state to expand distributed energy market growth and stimulate important economic activity for the state.

We are happy to provide any additional information to assist with your study. Thank you for your time and interest in this topic.

Sincerely,

Heather Rhoads-Weaver

Heather Rhoads-Weaver

Attachments: Policy & Market Trends Poster for WINDPOWER 2011
Improving Distributed Wind's Bottom Line: Policy Best Practices ASES Paper
Presentation from 2011 Small Wind Installer's Conference

Policy & Market Trends:
Improving Small Wind's Bottom Line

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"Best and Worst" State Policy Practices

A pro-forma based web calculator and guidebook are under development to quantify policy impacts and aid the U.S. Department of Energy in reaching its goal to expand the number of distributed wind turbines (DWT) deployed domestically fivefold by 2015.

The project's online policy comparison tool allows users to examine policies that have the most (and least) impact on improving the bottom line of wind turbines that provide electricity for on-site use (up to 100 kW). The tool and accompanying guidebook, to be released in mid-2011, show how various policy combinations impact project economics and are designed to aid policymakers in determining the cost-effectiveness of incentive programs.

To highlight attractive markets and policy targets that offer the quickest return on investment, the Guidebook ranks states based on their current distributed wind incentives and market environments, and calculates impacts on distributed wind project economics for various "what if" scenarios including potential levels of a national feed-in tariff (FIT).

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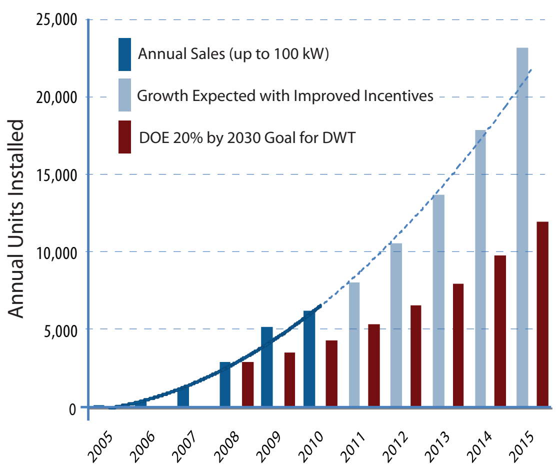
www.eformativeoptions.com/dwpolicytool

U.S. Grid-Connected Small Wind Turbines



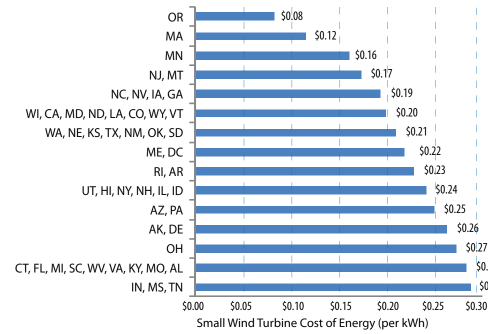
Incentives Driving Market Growth

The goal of the DOE Wind & Water Power Program's distributed wind energy activities is to expand the number of distributed wind turbines deployed in the U.S. market fivefold, from a 2007 baseline to 12,000 turbines installed in 2015. Distributed wind's market growth is on a strong trajectory to meet or surpass this goal, even though the total number of small wind turbines installed annually in the U.S. has declined during the recent economic slowdown. Growth rates in the grid-connected market have remained strong, and the average kW of installations has increased substantially due to larger average turbine sizes.

California and at least 18 other states have provided incentives for small wind turbines totaling nearly $38 million since 1999, funding more than 14 MW across more than 1,500 installations. In the same period, states have provided significantly more incentive funding for solar PV and often at higher payment levels per system.

While the federal investment tax credit expanded under the 2009 American Recovery and Reinvestment Act (ARRA) has aided the market, improved state incentives and interconnection policies have also played a role in building consumer demand. With continued and improved incentives and reduced regulatory barriers, distributed wind is poised to make an even more substantial contribution to DOE's 20% by 2030 vision.

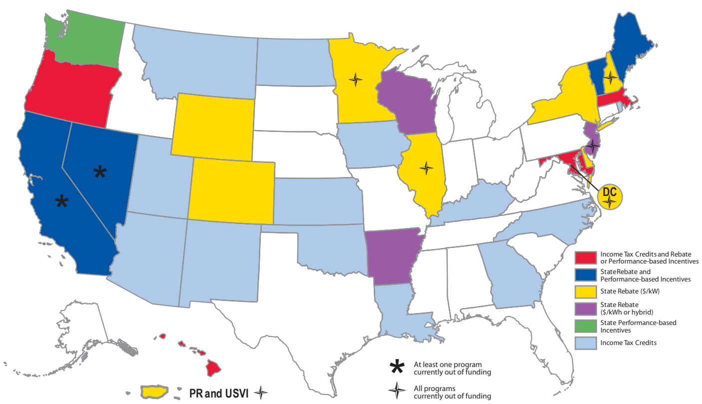
Cost of Energy Ranking: All Sectors



The cost of energy (COE) takes into account equipment and installation costs, taxes, rebates and performance-based incentives, grants, tax credits and deductions, depreciation and loan payments. Oregon's tax credit, rebate and lack of a state sales tax effectively lower the COE of distributed wind. On the other hand, IN, MS and TN offer no incentives that impact distributed wind's COE.

Model results shown above are averaged for the residential, non-taxed and commercial sectors with a representative wind turbine selected for each, based on current policies and incentives, assumptions and embedded formulas as of February 2011. Each state was assigned a default wind resource (low Class 2 to low Class 3 to reflect typical siting of distributed wind turbines) based on AWS Truepower's ranking. A complete list of assumptions used in the model is included with the web-based tool.

Impact of Policies and Incentives on Distributed Wind



A Shifting Landscape

Policy support for small wind has evolved during the last decade as the market has matured. In 1999, 25 states offered financial incentives for small wind; 24 of these provided tax incentives, one provided a rebate (CA), and one provided both (IL). Since then, small wind policies shifted from tax incentives towards rebates, performance incentives, and grants. The number of states with small wind tax incentives shrank from 24 in 1999 to 17 in 2010. In 2010, 23 states provided small wind rebates and/or performance-based incentives, and an additional 8 operated grant programs. AR, CO, GA, MN, UT, and VA used federal ARRA funding to offer small wind incentives. Several others, including ME, MD, VT and WY, supplemented existing small wind programs with ARRA funding. Unless states secure new funding mechanisms, most ARRA-funded programs will not continue. A few states, including OH, IL, and NH, saw funding gaps in 2010 that temporarily closed their incentive programs.

Policies Improving, But Still Need Work

Offsetting electricity use at retail rates through net metering, particularly with meter aggregation, can aid small wind economics. As of 2010, 43 states had established net metering policies, compared to 27 states that had established such policies as of 1999. However, only 13 states mandate true statewide net metering policies that apply to investor-owned utilities, rural electric cooperatives and municipal utilities; 19 state net metering policies apply only to investor-owned utilities whose primary customer base tends to correspond to urban and suburban areas, which in turn tend to have lower wind resources and additional zoning or permitting challenges when compared to rural areas.

In addition, 29 states have established renewable portfolio standards (RPS), and several of these policies specifically address distributed generation and directly affect the small wind market. For example, NY and NH fund their respective rebate programs through their RPS policies. Renewable energy credits (RECs) may also represent a revenue stream for distributed wind facilities both within compliance markets and voluntary markets throughout the U.S., particularly in states with RPS carve-outs for distributed generation (including AZ, CO, and NM).

Federal tax incentives for distributed wind have improved greatly in recent years. The federal government removed dollar caps in 2008 for Investment Tax Credits (ITC), so eligible homeowners and businesses are allowed to claim a full 30% ITC for qualified distributed wind energy property placed in service through 2016. In lieu of tax credits, the federal government offers U.S. Treasury Grants for commercial projects that begin construction before January 1, 2012. Also, in 2008 the Modified Accelerated Cost-Recovery System (MACRS) was expanded to include distributed wind in its 5-year schedule.

Federal grants and loans also play a role in the growth of distributed wind. The USDA operates several programs that provide grants and loans for distributed generation, including the Rural Energy for America Program (REAP), Rural Business Opportunity Grants, and the Value-Added Producer Grants program. Other federal programs, such as Energy Efficiency and Conservation Block Grant program (EECBG), and the Tennessee Valley Authority have supported distributed wind projects.

Small Wind Installed w/ State Cash Incentives, 1999-2010

MW Installed w/ Incentives	Incentive Funding		Units Installed with Incentives
3.7 MW	$8.6 M	CA	573
2.8 MW	$4.0 M	WI	115
416 kW	$1.1 M	VT	109
1.0 MW	$3.1 M	NY	108
1.2 MW	$3.0 M	OH	100
355 kW	$200k	WA	92
1.3 MW	$3.7 M	MA	82
355 kW	$520k	MD	67
151 kW	$516k	NV	49
400 kW	$1.1 M	MT	40
389 kW	$1.2 M	NJ	31
542 kW	$621k	IL	29
228 kW	$522k	OR	25
81 kW	$100k	CO	25
92 kW	$42k	ME	20
209 kW	$500k	MN	19
1.0 MW	$8.9 M	AK	10
103 kW	$280k	AR	7
35 kW	$176k	SC	1

Average size: 9.5 kW

Average funding: $25k/unit, $2.60/Watt

Range: $2.1k-$892k/unit

0 100 200 300 400 500 600

Units Installed with Incentives

Ranking State Policy Environments

The Distributed Wind Policy Comparison Tool measures the impact of various policy combinations on distributed wind turbine project economics and can rank the "best" and "worst" state markets. Each state's incentives can be modeled for a variety of ownership sectors, turbines and wind resources.

Based on user inputs of state and project sector, the tool is populated with default values based on current market conditions, reasonable assumptions, and its data link to the Database of State Incentives for Renewables & Efficiency (DSIRE). This customized, live data feed is regularly updated as incentives and policies evolve. The web tool provides users with the base-case scenario, and users may adjust numerous default values through a dashboard interface.

The tool calculates cost of energy (COE), net present value (NPV), internal rate of return (IRR), and simple payback for each scenario. It is helpful to examine all of the metrics because some incentives do not impact cash flows of distributed wind projects and others do not reduce system costs. For example, offsets of high-cost retail electricity and the sale of renewable energy credits (RECs) both improve cash flows (and the IRR), but those factors do not impact the COE.

The tool can be used to gauge how policy changes impact the economics of distributed wind, and subsequently its market growth. It also allows policy makers to determine the effectiveness of individual incentive programs. Designed for broad policy analysis, the model is not a project-specific siting tool and is not capable of addressing site-specific variables.

The case studies and interactive web tool provide valuable information on market opportunities, benefits, challenges, and needed improvements. In providing a simple and clear policy analysis tool that estimates financial performance and highlighting attractive state markets, the project is expected to enhance market expansion by increasing and refining the understanding of distributed wind costs, incentives, and key market opportunities.

By addressing key market challenges, this project is helping to ensure that public dollars supporting distributed wind are spent wisely to advance the market. With improved policies in place, wind turbines sited near the point of end-use can quickly ramp-up to meet local demand, allowing distributed wind to play an important role in reaching DOE's 20% wind by 2030 goal and our energy future.

Acknowledgements:

Additional project team members include: Trudy Forsyth and Tony Jimenez with National Renewable Energy Laboratory; Jennifer Banks, Laurel Varnado, Wade Fulghum, Maureen Quinlan and Brian Miles with North Carolina Solar Center; and Kurt Sahl, Alicia Healey, and Peter Asmus with eFormative Options.

The authors would like to thank the many individuals and organizations that assisted us by providing data, thoughtful comments and support. A special thanks to the U.S. DOE for providing funding for this work under Award DE EE0000503, specifically to Keith Bennett, Dwight Bailey, Jim Ahlgrimm, Michele DesAutels, Pam Brodie, and Melissa Luken. Thanks also to Mike Bergey of Bergey Windpower and Andy Kruse of Southwest Windpower for serving as in-kind cost-sharing partners, and to all the other manufacturers who provided detailed information on their small wind turbines. Additional information for this project was provided by state energy program managers. Numerous reviewers and advisers provided valuable feedback on draft materials.

Forsyth, T., P. Tu, and J. Gilbert (2000). Economics of Grid-Connected Small Wind Turbines in the Domestic Market. National Renewable Energy Laboratory, Golden CO. NREL Report No. CP-500- 26975 www.nrel.gov/docs/fy00osti/26975.pdf

Database of State Incentives for Renewables & Efficiency (DSIRE) www.dsireusa.org States with net metering policies that apply to all types of utilities: CA, DE, GA, HI, LA, ME, MD, MN, MT, NE, NH, OR, VT. States with rebates, PBIs, and/or grants during 2009-2010: AK, AR, CA, CO, CT, DE, GA, HI, IL, MA, MD, ME, MI, MN, MT, NC, NH, NJ, NV, NY, OH, OR, PA, RI, SC, TX, UT, VT, VA, WA, WI, WY.

Small Wind Certification Council www.smallwindcertification.org

US DOE web site: www1.eere.energy.gov/windandhydro/pdfs/41869.pdf

AWS Truepower state ranking: www.windpoweringamerica.gov/wind_maps.asp#potential

Wind and Hydropower Technologies Program. Wind Energy Multiyear Program Plan for 2007-2012 http://www1.eere.energy.gov/windandhydro/pdfs/40593.pdf

AWEA Small Wind Turbine Global Market Study 2010 www.awea.org/learnabout/smallwind/loader.cfm?csModule=security/getfile&PageID=4420

IMPROVING DISTRIBUTED WIND'S BOTTOM LINE: POLICY BEST PRACTICES

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ABSTRACT

This paper summarizes a financial analysis conducted to identify policy best practices as part of a project aiding the U.S. Department of Energy in reaching its goal to expand the number of distributed wind turbines deployed domestically fivefold by 2015. The project's web-based policy comparison tool allows users to examine policies that have the most (and least) impact on improving the bottom line of wind turbines up to 100 kW in capacity that provide electricity for on-site use. The tool and accompanying guidebook, to be released in mid-2011, show how various policy combinations impact project economics and aid policymakers in determining the cost-effectiveness of incentive programs. To highlight attractive markets and policy targets that offer the quickest return on investment, states are ranked based on their current distributed wind incentives and market environments, and impacts on distributed wind project economics are calculated for various levels of a national feed-in tariff (FIT).

1. DISTRIBUTED WIND INCENTIVES: AN OVERVIEW

State and federal policies and incentives for distributed wind[1] have evolved during the last decade as the distributed wind market has matured. In 1999, 25 states offered financial incentives that supported distributed wind installations; 24 of these states provided tax incentives, one provided a rebate (California), and one provided both a rebate and tax incentive (Illinois).[2] Since then, policies for distributed wind have shifted from tax incentives towards rebates (also known as buy-downs), performance incentives, and grants. The number of states with tax incentives for distributed wind shrank from 24 in 1999 to 17 in 2010. Twenty-three states[3] plus Washington D.C., Puerto Rico, and the U.S. Virgin Islands provided rebates and/or performance-based incentives in 2010 for distributed wind installations, and an additional eight states operated grant programs.[4]

Six of those states (Arkansas, Colorado, Georgia, Minnesota, Utah, and Virginia), plus Puerto Rico and the U.S. Virgin Islands used federal funding made available through the American Recovery and Reinvestment Act of 2009 (ARRA) State Energy Program (SEP) to offer incentives for distributed wind. Several states, including Maine, Maryland, Vermont and Wyoming, supplemented existing programs that supported distributed wind with ARRA funding. Most of the ARRA-funded programs have already expired or will expire soon, and unless the states secure new funding mechanisms, these programs will not be continued. Ohio's distributed wind incentive program was the only state-funded program that closed in 2010 because the state's Advanced Energy Fund expired under state law. Other states, such as Illinois and New Hampshire, saw funding gaps in 2010 that temporarily closed their incentive programs.[5]

As of 2010, 43 states (and Washington D.C., Puerto Rico, and the U.S. Virgin Islands) had established net metering policies, compared to 27 states that had established such policies as of 1999. However, only 13 states[6] mandate true statewide net metering policies that apply to investor-owned utilities, rural electric cooperatives and municipal utilities; 19 state net metering policies apply only to investor-owned utilities whose primary customer base tends to correspond to urban and suburban areas, which in turn tend to have lower wind resources and additional zoning or permitting challenges when compared to rural areas. More recent additions to the distributed wind policy landscape include meter aggregation within net metering policies, incentive designs based on actual or estimated production instead of capacity, and Property Assessed Clean Energy (PACE), which to date has been applied only a handful of times for distributed wind installations and is currently in flux as a viable policy option.

In addition, many state incentive programs require that turbines and/or installers be certified in order for a project to qualify for funding. The Energy Trust of Oregon and Wisconsin's Focus on Energy program are the first to require certification from the Small Wind Certification Council (SWCC) in order for turbines to be eligible for incentives (starting January 1, 2012). The New York State Energy Research and Development Authority (NYSERDA) accepts SWCC certification for qualification for rebates, and the Massachusetts Clean Energy Center (MassCEC) now requires either SWCC certification or NYSERDA qualification. Programs in California, Colorado, Iowa, Maine, Maryland, Minnesota, Nevada, and Vermont have indicated their intention to follow suit.[7]

Another policy relevant to the distributed wind market is the renewables portfolio standard (RPS). Twenty-nine states have established RPS policies, and several of these policies specifically address distributed generation and directly affect the distributed wind market. For example, New York and New Hampshire fund their respective rebate programs through their RPS policies. Renewable energy credits (RECs) may also represent a revenue stream for distributed wind facilities both within compliance markets and voluntary markets throughout the United States, particularly in states with RPS carve-outs for distributed generation (including Arizona, Colorado, and New Mexico). It should be noted that some incentive programs and some net metering policies require that the distributed generator relinquish RECs to the program administrator or utility in order to receive the incentive or participate in net metering. In these situations, the distributed wind generator would not be able to sell those RECs separately.

On the federal side, tax incentives for distributed wind have improved greatly in recent years. The federal government removed dollar caps in 2008 for Investment Tax Credits (ITC), so eligible homeowners and businesses are allowed to claim a full 30% ITC for qualified distributed wind energy property placed in service through 2016. In lieu of tax credits, the federal government offers U.S. Treasury Grants for commercial projects that begin construction before the January 1, 2012. Also, in 2008 the Modified Accelerated Cost-Recovery System (MACRS) was expanded to include distributed wind in its five-year schedule.

Federal grants and loans are also playing a role in the growth of distributed wind. The USDA operates several programs that provide grants and loans for distributed generation, including the Rural Energy for America Program (REAP), Rural Business Opportunity Grants, and the Value-Added Producer Grants program. Other federal programs, such as Energy Efficiency and Conservation Block Grant program (EECBG), and the Tennessee Valley Authority have supported distributed wind projects.

1.1 Project Background

"Power Through Policy: 'Best Practices' for Cost-Effective Distributed Wind" is a Department of Energy (DOE)-funded project to identify distributed wind technology policy best practices and help utilities and policymakers examine their effectiveness using a pro forma model. The project is one of 53 awarded with funding in part provided through ARRA to address market challenges identified in DOE's "20% Wind Energy by 2030" report.[8] Project team members include eFormative Options, Pacific Northwest National Laboratory, National Renewable Energy Laboratory (NREL), and the North Carolina Solar Center.

The project's main deliverables include the web-based Distributed Wind Policy Comparison Tool and accompanying guidebook, to be released in mid-2011. The guidebook will summarize the findings of the project's distributed wind best practices research and include case studies in a comprehensive format written primarily for state-level decision makers – the target audience. The tool and guidebook are designed to help policymakers, utilities and advocates advance the market for on-site wind generation across the nation. The project is focused on addressing key market challenges and helping to ensure public dollars supporting distributed wind are spent wisely. With improved policies in place, wind turbines sited near the point of end-use can quickly ramp-up to meet local demand, allowing distributed wind to play an important role in reaching DOE's 20% wind by 2030 goal and in our energy future.

1.2 Distributed Wind Policy Comparison Tool

The web-based Distributed Wind Policy Comparison Tool allows users to examine policies that have the most (and least) impact on improving the bottom line of wind turbines up to 100 kW in capacity that provide electricity for on-site use, with the goal of expanding the distributed wind market through an improved U.S. policy environment.

1.3 Purpose of Tool

The web tool's financial pro forma model measures the impact of various policy combinations on distributed wind turbine project economics and can be used to rank the "best" and "worst" state markets. The model allows each state's incentives to be modeled for a variety of ownership sectors, turbines and wind resources. The tool calculates cost of energy (COE), net present value (NPV), internal rate of return (IRR), and simple payback for each scenario. Designed for broad policy analysis, the model is not a project-specific siting tool and is not capable of addressing site-specific variables.

Based on the initial inputs of state and project sector (residential, non-taxed or commercial), the tool is populated with default values based on current market conditions, reasonable assumptions, and a link to a customized, live data feed from the Database of State Incentives for Renewables & Efficiency (DSIRE) that is regularly updated as incentives and policies evolve. The web tool provides users with the base-case scenario, and users may adjust numerous default values through a dashboard interface. Enabling adjustable inputs allows the tool to stay current and flexible as state policies and market conditions change. While primarily aimed at providing users an easy way to understand the anticipated financial outcome, the dashboard environment allows "what if" scenarios to be evaluated very quickly. This feature will allow electric utilities, policy decision makers, and others to view and understand the impact of various factors, such as tariff rates and REC prices, on specific project scenarios. Also, modeling different combinations of these variables (and adjusting the variables themselves) allows users to see the effects that distinct policy options have on the COE and project economics and to identify optimal combinations of policy options that maximize cost-effectiveness of distributed wind turbines.

1.4 Inputs and Assumptions

The tool's inputs include income and sales tax rates, income tax credits (federal and state), income tax deductions, wind turbine performance, estimated project costs, and tower heights, capital cost rebates and performance-based incentives, discount rates for net present value calculations, cost-escalation rates, depreciation, interconnection and permitting costs, state production tax credits (PTC), RECs, wind power class resources and state net metering policies. Federal and state grants are not included. Given the competitive nature of grants, there is a great deal of uncertainty that a particular project would receive such an award and therefore, grants are excluded. The lone exception is the U.S. Treasury Grant (in lieu of the federal ITC), which is included. The federal PTC is excluded because this tool is intended to model project economics assuming on-site consumption of energy generated by distributed wind turbines. (To qualify for the federal PTC, energy must be sold to an unrelated third-party.) State PTCs, where applicable, are included. The model does not attempt to capture and monetize state property tax incentives because site-specific property tax rates (which are locally determined) and property values must be known.

The model assumes that project owners may claim all of the available tax credits and deductions in the year such incentives are awarded. In other words, the project owner's tax liability is always greater than tax incentives. Also, the model makes assumptions regarding what is considered taxable income, and what is tax-deductible.

Not all turbines within the model are eligible for incentives in every state, based on state-specific turbine certification requirements. However, the model does not take those certification requirements into account and for comparison purposes treats all turbines as eligible as long as size eligibility requirements are met.

A state is considered to have a state-wide net metering policy only if net metering is consistently offered by the rural electric cooperatives, municipal utilities, and investor-owned utilities operating in that state. The net metering rate is assumed to be the full retail rate in these cases. For states without net metering, or for which net metering policies only apply to certain utilities, the assumption is that the electricity generated would only receive the avoided-cost rate from the utility (estimated at 41% of retail value).

Each turbine/tower combination is assigned default zoning/permitting and interconnection costs based on team research and feedback from turbine manufacturers and installers. While many states have established interconnection policies, teasing out costs (which are usually correlated with turbine size) from those policies was challenging. In reality, different states, counties, municipalities and even utilities have specific (and highly variable) costs associated with zoning, permitting and interconnection. Documenting those costs and including them in this model are beyond the scope of the project.

The model was pre-populated with specific turbines at varying hub heights, selected based on their U.S. market share and progress toward SWCC certification. Specifications are based on manufacturer documentation and standards. Turbine power curves are manufacturersupplied or those tested and verified by NREL. Ultimately, the project would like to include SWCC-certified power curves in the model when they become available. The power curves assume standard conditions (0 feet elevation, sea level air density) reflecting how manufacturers' curves are typically presented.

Wind power resource options are limited to low and mid Class 2 (average 5.1 – 5.5 m/s at 30 m hub height[9]), low and mid Class 3 (average 5.8 – 6.1 m/s at 30 m), and low Class 4 (average 6.4 m/s at 30 m), with each state assigned a default wind resource class based on AWS Truepower's ranking.[10]

A complete list of assumptions used in the model is included with the web-based tool.

2. CASE STUDIES

While the guidebook will include a variety of case studies, two case studies were prepared for this paper. The first case study ranks all the states based on their current incentives and policies. The other exercise demonstrates the impact a national FIT would have on distributed wind project economics across the states. Both case studies were assembled based on incentives and policies as of February 2011.

For these case studies, the economics for each state and each sector were established with base case assumptions as follows:

- The typical wind resource assigned to each state is based on state wind resource maps. These wind resources are either low Class 2, mid Class 2, or low Class 3 to represent the fact that distributed wind turbines are typically not located in high wind resource areas.
- The Commercial sector default wind turbine is the Northwind 100 kW, with a 121-foot (37 m) tower.
- The Non-Taxed sector (Governmental and Non-profit entities) default wind turbine is the Endurance E3120 50 kW, with a 140-foot (43.7 m) tower.
- The Residential sector default wind turbine for these case studies[11] is the Southwest Windpower Skystream 2.4 kW, with a 70-foot (21.3 m) tower.

2.1 State Ranking

To rank the states, the IRR and COE results from each sector were averaged for each state (Figures 1 and 2). In cases where the IRR was indeterminable (i.e., there were no positive cash flows over the 20 year project life), an IRR value of 0% was assigned to use in the average calculations.

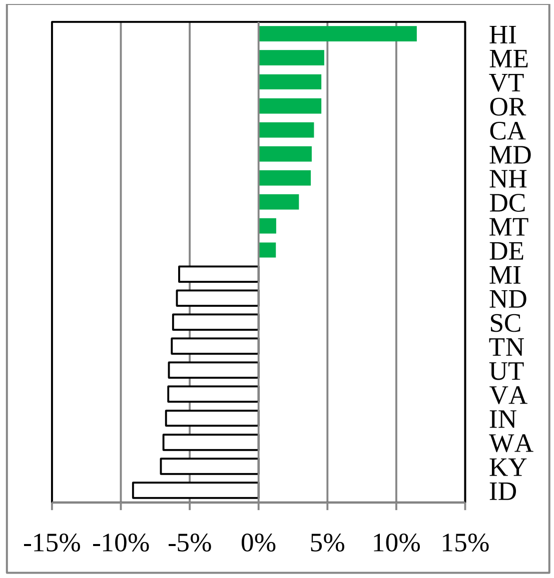

Fig. 1 Average IRR results of base case scenarios of current policies and incentives.

With respect to average IRR across the sectors, the top 10 states are Hawaii, Maine, Vermont, Oregon, California, Maryland, New Hampshire, the District of Columbia, Montana, and Delaware. The bottom 10 states are North Dakota, South Carolina, Michigan, Tennessee, Utah, Virginia, Indiana, Washington, Kentucky, and Idaho.

It is not surprising that Hawaii comes out on top given that its retail electric rates are the highest in the county. Hawaii also has statewide net metering and a tax credit. The remaining top nine states have favorable economics as well given relatively high electric rates (with the exception of Oregon and Montana) as well as a combination of favorable policies and incentives. All of the top ten states have actual statewide net metering policies. With the exception of Vermont, all of the top ten states also have RPS policies. (Vermont's RPS policy is technically a goal.) Eight of these states provide rebates for distributed wind. And, several of the top ten states offer at least two financial incentives available for distributed wind installations.

Idaho has the worst average IRR in the United States; it also has the lowest electricity rates for each sector and does not have a statewide net metering policy. Idaho does offer a tax deduction, but no additional incentives for distributed wind projects. Net metering is not available statewide for any of the states with the lowest IRR. Only two of the bottom states (Michigan and Washington) have RPS policies, and three states (North Dakota, Utah, Virginia) have non-binding RPS goals. The remaining bottom five states have not established an RPS policy. Regarding financial incentives offered in these states, only Washington offers a cash incentive, which is performance-based and limited to $5,000 per year for wind. South Carolina and Virginia do not offer any financial incentives for distributed wind. Michigan, North Dakota, Tennessee and Indiana offer property tax incentives, but property taxes are not included in this analysis. North Dakota, Utah, Kentucky and Idaho provide either an income tax credit or a tax deduction. Finally, Utah, Washington and Idaho offer sales tax incentives for distributed wind. Despite these incentives, the average IRR results for these states are not favorable.

With respect to average COE across the sectors, the top 10 states are Oregon, Massachusetts, Minnesota, Montana, New Jersey, Georgia, Iowa, Nevada, North Carolina and Vermont. The bottom 10 are Kentucky, Virginia, West Virginia, South Carolina, Michigan, Florida, Connecticut, Tennessee, Mississippi and Indiana (Fig. 2).

It is important to examine both metrics because some incentives do not impact the cash flows of a distributed wind project and others do not reduce the costs of the system. For example, the sale of RECs improves the cash flows of a project, but it does not impact the COE. The COE takes into account equipment and installation costs and taxes, rebates (capacity-based and production-based), grants, income tax credits and deductions, and the tax shield effect of depreciation and loan interest payments.

Oregon's tax credit, rebate and lack of a state sales tax effectively lower the COE of distributed wind in that state. Alternately, Indiana offers no incentives that impact the COE.

2.2 Impact of Feed-in Tariff

The next case study demonstrates the impact a national FIT would have on distributed wind project economics across the U.S. states by presenting the residential sector results from a few states chosen to represent different regions of the country. When a project owner elects to participate in a FIT program, the owner is typically not eligible to also participate in a net metering program. In addition, the RECs associated with the energy sold through a FIT are typically transferred as part of the FIT. Therefore, the FIT case study assumes no net metering or REC sales in any of the states.

Figure 3 and Table 1 show the results of the different FIT rates on the residential sector for each of the selected states with each state's assigned typical wind resource. The residential sector wind turbine is the Southwest Windpower Skystream 2.4 kW, with a 70-foot (21.3 m) tower. Given that the FIT is not a cost, but a revenue stream, it does not affect the scenario's COE. The project economic metrics improve as the amount of the FIT increases.

For states with few or no distributed wind policies or incentives and modest wind resources, such as Virginia, it takes a FIT of $0.50/kWh, similar to the level offered in the UK, to achieve positive project economics. For states with strong incentives and wind resources, such as Minnesota, it is possible to achieve positive project economics with a lower FIT rate.

Fig. 2 Average COE results of base case scenarios of current policies and incentives.

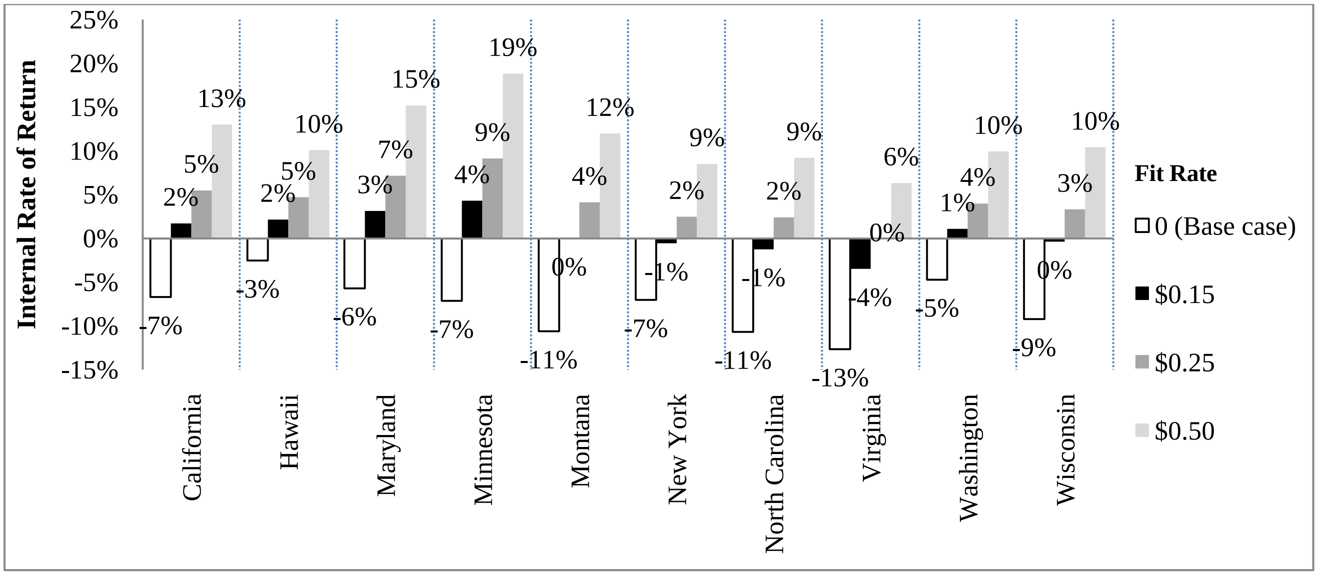

Fig. 3 Select IRR Results of modeling FIT rates vs. base case for the residential sector.

TABLE 1. RESULTS OF MODELING FIT RATES VS. BASE CASE FOR THE RESIDENTIAL SECTOR

FIT Rate,		California	Hawaii	Maryland	Minnesota	Montana	New York	North Carolina	Virginia	Washington	Wisconsin
	Wind Resource	Low Class 2	Low Class 2	Low Class 2	Mid Class 2	Low Class 3	Low Class 2	Low Class 2	Low Class 2	Low Class 2	Low Class 2
	COE, $/kWh	$0.27	$0.38	$0.24	$0.19	$0.28	$0.38	$0.26	$0.42	$0.30	$0.31
0 (Base case)	**NPV, $**	($6,888)	($7,893)	($5,785)	($6,641)	($11,336)	($9,975)	($9,531)	($12,825)	($9,023)	($8,677)
	IRR	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)
	Simple Payback,	> 20	> 20	> 20	> 20	> 20	> 20	> 20	> 20	> 20	> 20
$0.15	**NPV, $**	($2,990)	($4,028)	($1,834)	($1,201)	($5,741)	($6,122)	($5,693)	($8,864)	($4,903)	($4,811)
	IRR	2%	2%	3%	4%	0%	-1%	-1%	-4%	1%	0%
	Simple Payback,	17	17	15	14	> 20	> 20	> 20	> 20	18	> 20
$0.25	**NPV, $**	($392)	($1,452)	$799	$2,427	($2,011)	($3,553)	($3,135)	($6,223)	($2,155)	($2,233)
	IRR	5%	5%	7%	9%	4%	2%	2%	0%	4%	3%
	Simple Payback,	12	13	11	9	14	16	16	> 20	14	15
$0.50	**NPV, $**	$6,105	$4,990	$7,384	$11,495	$7,314	$2,870	$3,261	$378	$4,712	$4,210
	IRR	13%	10%	15%	19%	12%	9%	9%	6%	10%	10%
	Simple Payback,	7	9	6	5	8	10	9	11	9	8

3. SUMMARY

The two case studies provided demonstrate how the tool can both provide insight into a "what if" scenario and also allow the current status of incentives to be examined. Federal and state polices and incentives evolve regularly. The tool can be used to gauge how those changes impact the economics of distributed wind, and subsequently its market growth, and allow policy makers to determine the effectiveness of individual incentive programs, thereby addressing market challenges identified in the DOE "20% Wind Energy by 2030" report.

The goal of the DOE Wind & Water Power Program's distributed wind energy activities is to expand the number of distributed wind turbines (1 kilowatt to 1 Megawatt) deployed in the U.S. market fivefold, from a baseline of 2,400 turbines installed in 2007 to 12,000 turbines installed by 2015.[12] Distributed wind's market growth is on a strong trajectory to meet or surpass this goal, even despite the fact that the number of 1-100 kW wind turbines installed in the U.S. in 2009 was down 20% from 2008. (The average kW of installations increased due to larger average turbine sizes.)[13]

By measuring the impact of various policy combinations on the cost of energy and highlighting attractive state markets for small wind turbines, this project's web tool and guidebook will assist to advance on-site wind energy and promote market growth. The case studies and interactive web tool provide valuable information on market opportunities, benefits, challenges, and needed improvements. In providing a simple and clear policy analysis tool that estimates financial performance, the project is expected to enhance market expansion by increasing and refining the understanding of distributed wind costs, incentives, and key market opportunities.

4. ACKNOWLEDGEMENTS

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Additional information for this project was provided by state energy program managers. Numerous reviewers and advisers provided valuable feedback on draft materials.

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[1] Defined for this project as grid-connected wind turbines up to and including 100 kilowatts (kW)
[2] Forsyth, T., P. Tu, and J. Gilbert (2000). Economics of Grid-Connected Small Wind Turbines in the Domestic Market. National Renewable Energy Laboratory, Golden CO. NREL Report No. CP-500-26975 www.nrel.gov/docs/fy00osti/26975.pdf
[3] AR, CA, CO, DE, GA, HI, IL, ME, MD, MA, MN, NV, NH, NJ, NY, OH, OR, UT, VT, VA, WA, WI, WY.
[4] Database of State Incentives for Renewables & Efficiency (DSIRE) www.dsireusa.org
[5] Ibid.
[6] The 13 states with net metering policies that apply to all types of utilities are CA, DE, GA, HI, LA, ME, MD, MN, MT, NE, NH, OR, VT; DSIRE
[7] Small Wind Certification Council January 2011 newsletter www.smallwindcertification.org
[8] The full report is available on the US DOE web site: www1.eere.energy.gov/windandhydro/pdfs/41869.pdf
[9] 30 m = approximately 98 feet; model assumes shear factor of 0.18, typical for areas with low surface roughness; shear at actual sites varies from 0.1 - 0.3
[10] AWS Truepower state ranking: www.windpoweringamerica.gov/wind_maps.asp#potential
[11] The web-based Policy Comparison Tool also offers the Bergey Excel 10 kW with a 100-foot (30.5 m) tower as an alternate default wind turbine selection for the Residential sector
[12] Wind and Hydropower Technologies Program. Wind Energy Multiyear Program Plan for 2007-2012 www1.eere.energy.gov/windandhydro/pdfs/40593.pdf
[13] AWEA Small Wind Turbine Global Market Study 2010 http://www.awea.org/learnabout/smallwind/loader.cfm?csModule=security/getfile&PageID=4420

Improving the Bottom Line:

Comparing Policy Impacts on Turbines from Leading Manufacturers

Heather Rhoads-Weaver

eFormative options LLC

U.S. DOE Award DE EE0000503 Team: Trudy Forsyth & Tony Jimenez, NREL; Alice Orrell, PNNL; Jen Banks, Amanda Vanega & Laurel Varnado, NCSC; Kurt Sahl & Matt Gagne, EFO

Pacific Northwest NATIONAL LABORATORY

NREL NATIONAL RENEWABLE ENERGY LABORATORY

NORTH CAROLINA SOLAR CENTER

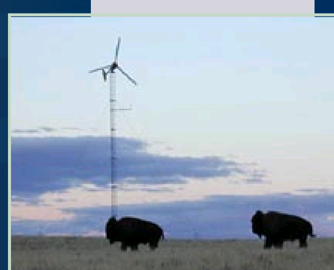
June 2011 Small Wind Installers Conference

Power through Policy

Ranking States . . . and Turbines

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

- "20% by 2030" grant-funded project supporting DOE goal to increase DWT 5-fold by 2015
- Policy Comparison Tool & Guidebook show cost-effectiveness of incentives
- Users only need to select 2 inputs:
  - State & ownership sector
- Model then populates with default values based on inputs
  - DSIRE quantitative policy data feed
  - Defaults can be adjusted on dashboard
- Designed for analysis of policies, "what if" scenarios
  - *Not project-specific, not a siting tool!*



Policy Tool Questionnaire Highlights

- **60 Respondents:**
  - 29 incentive programs, 19 manufacturers, 12 owners
- **What do constituents ask most about?**
  - Payback
  - Up-front costs
  - Wind resource
  - Noise / environmental impact
- **What do customers ask most about?**
  - Payback period
  - Up-front costs
  - Wind resource
  - Cost of Energy
- **Why more solar than small wind?**
  - Solar easier to install & permit
  - Wind is harder to site
  - Different incentives (S-RECs, solar RPS carve-outs, tariffs)

LimeSurvey
the open source survey application
...refreshingly easy and free

Policy Tool Questionnaire Highlights

- **Manufacturers: Top markets (most sales as of early 2010)**
  - Texas
  - California
  - Iowa
  - Maine
  - Massachusetts

- **Manufacturers: Most important policies for growing market share**
  - Production incentives / feed-in-tariffs (FITs)
  - Federal tax credits
  - Zoning / local wind ordinances
  - Net metering
- **Owners: Most important incentives and policies**
  - Federal tax credits
  - Net metering rules
  - Rebates / Grants
- **Owners: Challenges**
  - Obtaining local approval
  - Finding experienced installers
  - Manufacturer reliability

DSIRE™

Database of State Incentives for Renewables & Efficiency

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

IREC Interstate Renewable Energy Council

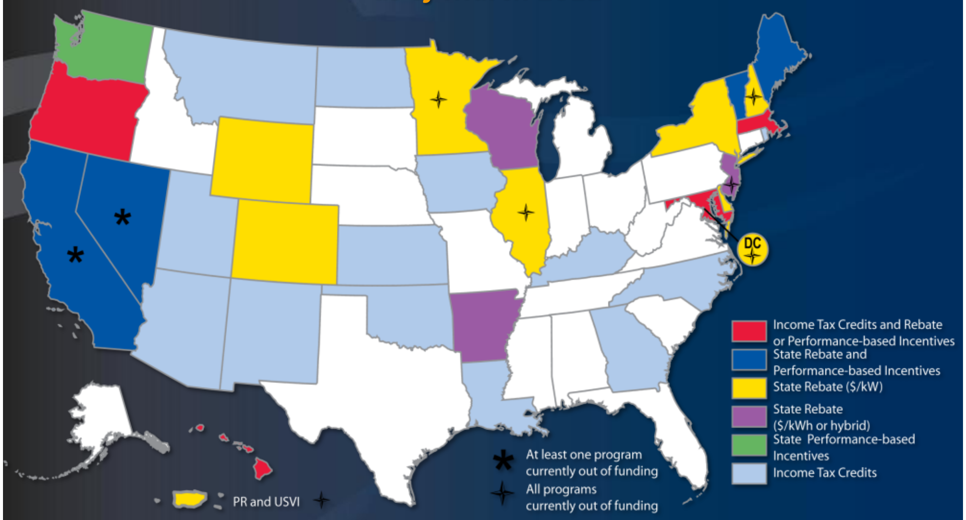
North Carolina Solar Center

Growth of Small Wind Incentives: *A Shifting Landscape*

Incentive	1999	Now
States w/ Rebates	2	16
States w/ Tax Incentives	24	17 (tax credits) 25 (sales/property)
Performance-Based Cash Incentives	0	6
Net Metering	27	43 (14 statewide, 19 IOUs only)
Total # of States with Incentives	**32 (7 net metering only)**	**45 (13 net metering only)**

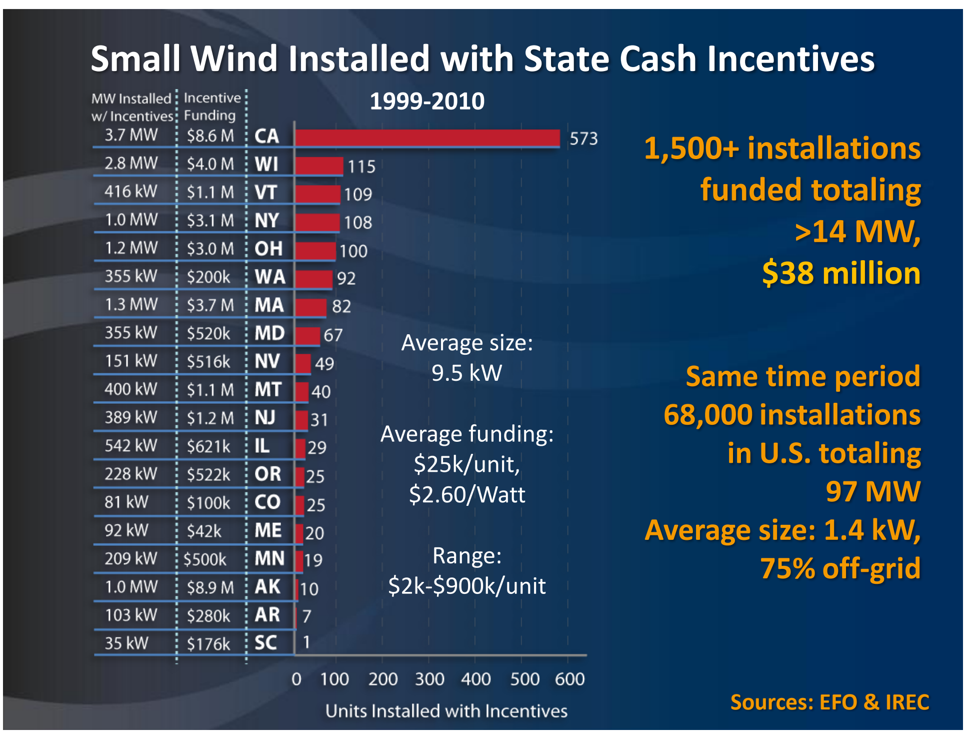
Small Wind State Rebates, PBIs & Tax Credits

as of March 2011



www.dsireusa.org

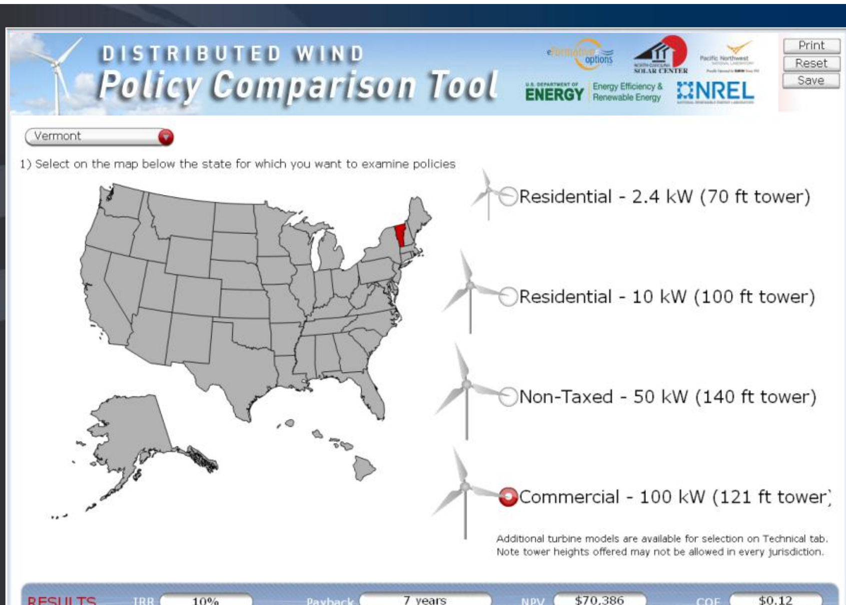

Policies Improving, but Still Need Work
Recent Developments in Small Wind Incentives
CALIFORNIA
The Golden State
NEW YORK
THE EMPIRE STATE
VERMONT
Green Mountain State
OREGON
RHODE ISLAND
Ocean State
ARKANSAS
The Natural State
WISCONSIN
America's Dairyland
NEW JERSEY
Garden State


Small Wind Installed with State Cash Incentives
1999-2010
MW Installed w/ Incentives
Incentive Funding
3.7 MW $8.6 M CA 573
2.8 MW $4.0 M WI 115
416 kW $1.1 M VT 109
1.0 MW $3.1 M NY 108
1.2 MW $3.0 M OH 100
355 kW $200k WA 92
1.3 MW $3.7 M MA 82
355 kW $520k MD 67
151 kW $516k NV 49
400 kW $1.1 M MT 40
389 kW $1.2 M NJ 31
542 kW $621k IL 29
228 kW $522k OR 25
81 kW $100k CO 25
92 kW $42k ME 20
209 kW $500k MN 19
1.0 MW $8.9 M AK 10
103 kW $280k AR 7
35 kW $176k SC 1
0 100 200 300 400 500 600
Units Installed with Incentives
Average size: 9.5 kW
Average funding: $25k/unit, $2.60/Watt
Range: $2k-$900k/unit
1,500+ installations funded totaling >14 MW, $38 million
Same time period 68,000 installations in U.S. totaling 97 MW
Average size: 1.4 kW, 75% off-grid
Sources: EFO & IREC

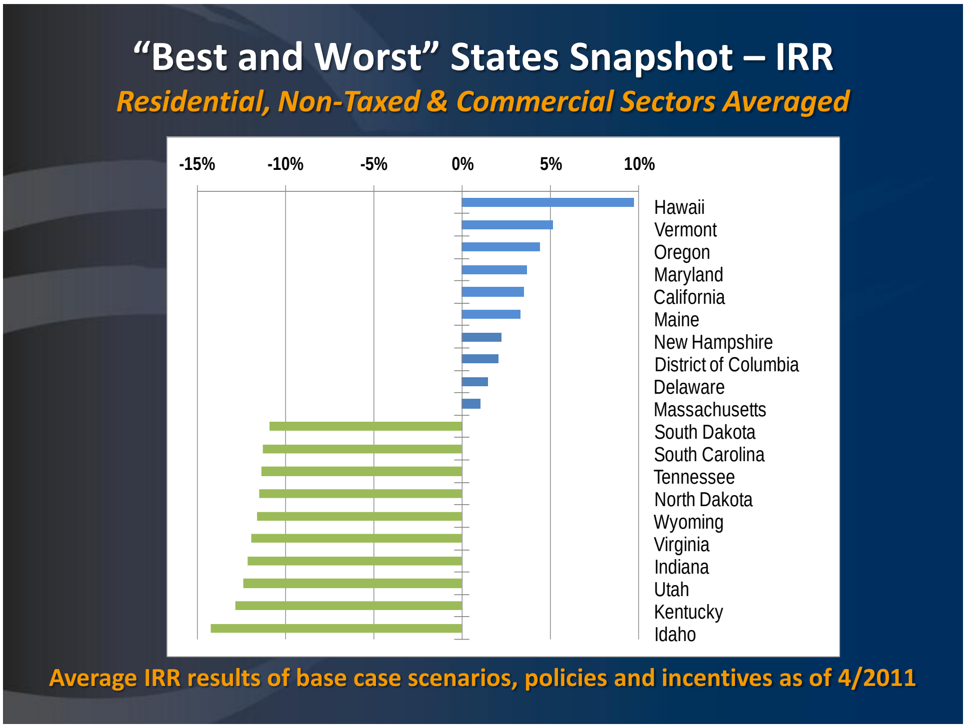
Power Through Policy Tool

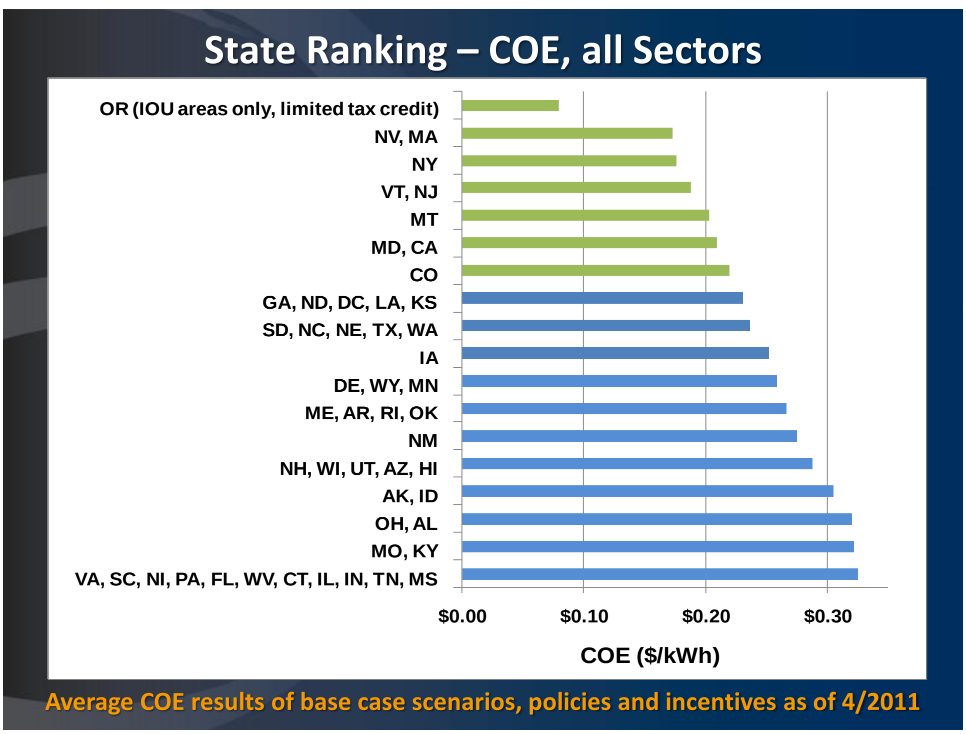
- **Using default values and pre-determined inputs, calculates:**
  - Cost of Energy (COE)
  - Project Net Present Value (NPV)
  - Project Internal Rate of Return (IRR)
  - Simple Payback (years)
- **Inputs – Turbines**
  - 8 manufacturers
  - 9 turbines
  - 14 options

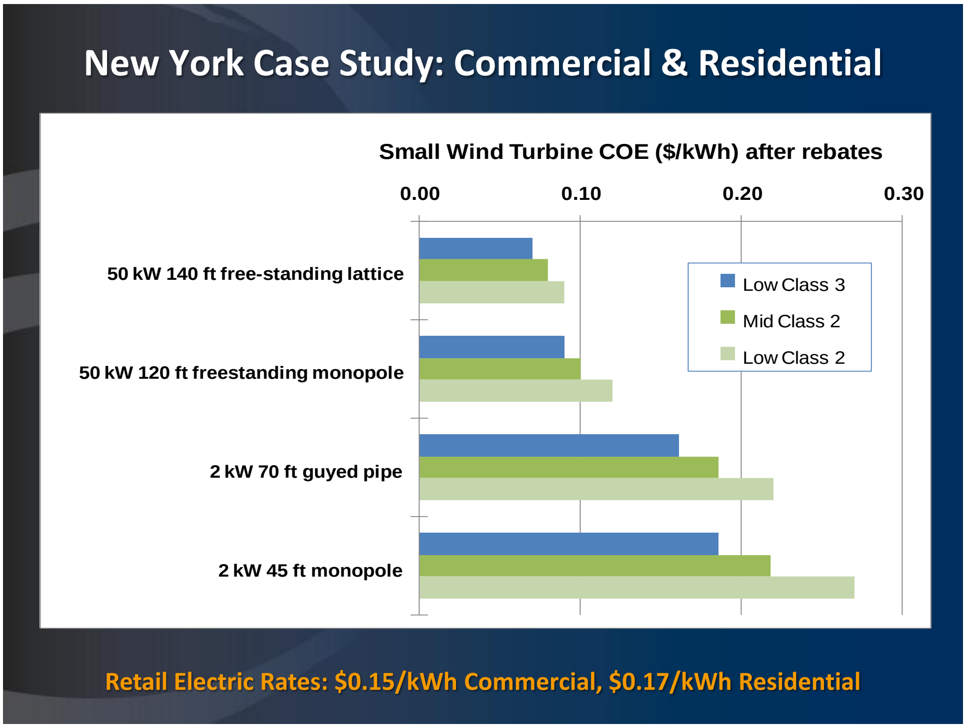
SOUTHWEST WINDPOWER
Endurance wind power
xzeres
BERGEY WINDPOWER
Northern POWER SYSTEMS
PROVEN ENERGY ESTABLISHED IN 1980
WTIC WIND TURBINE INDUSTRIES CORP.
Gaia-Wind

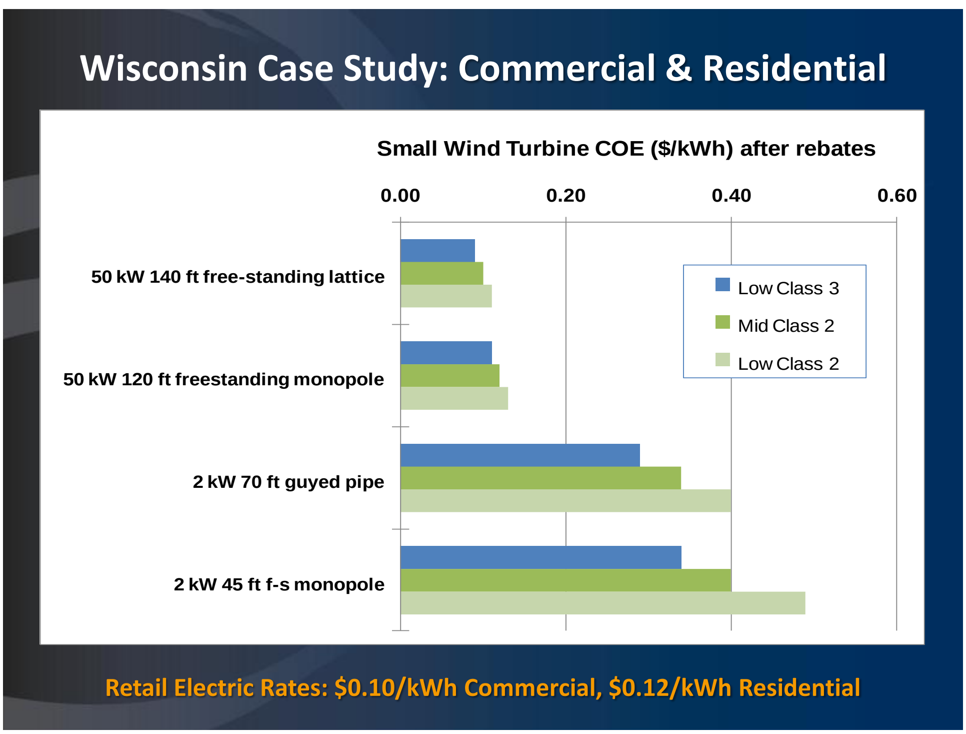


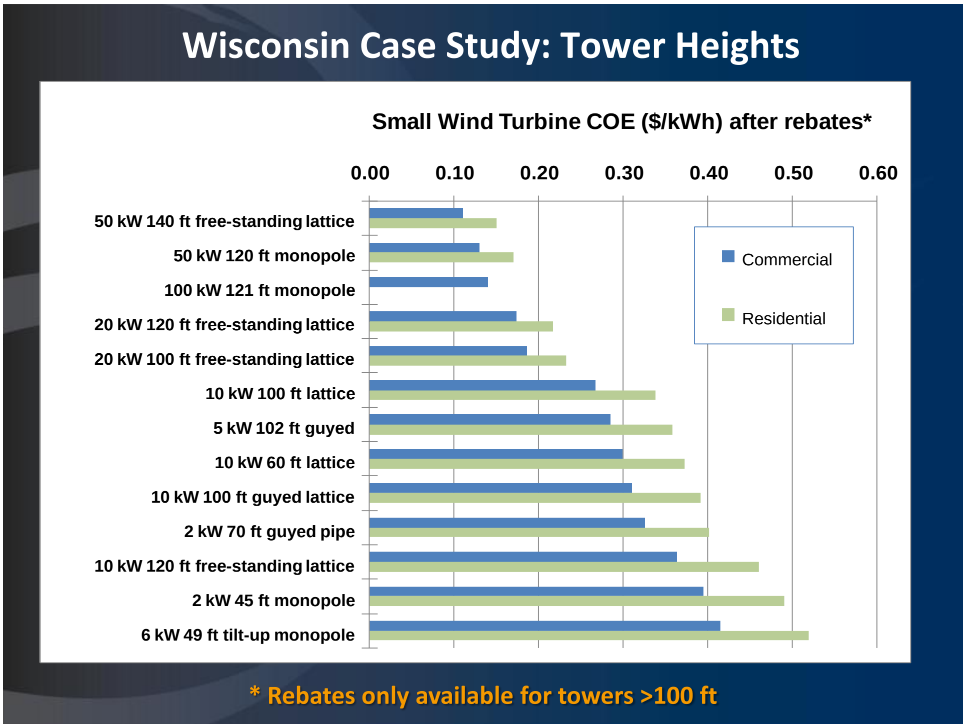
Sign up to receive announcement when Tool goes live:
www.eformativeoptions.com/dwpolicytool

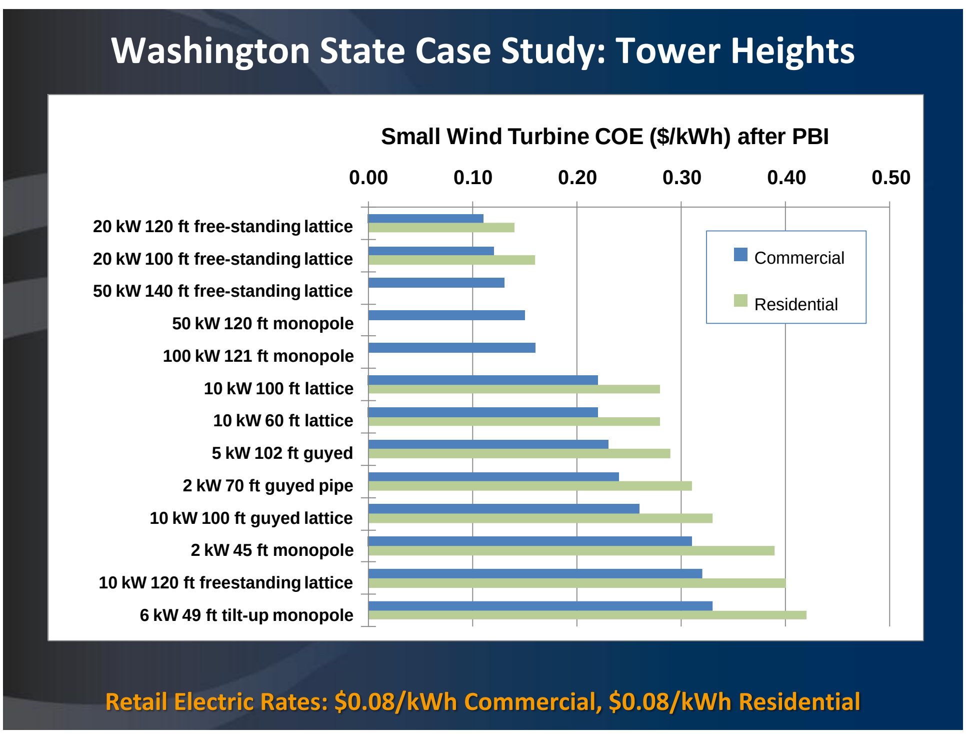

"Best and Worst" States Snapshot – IRR
Residential, Non-Taxed & Commercial Sectors Averaged
-15%
-10%
-5%
0%
5%
10%
Hawaii
Vermont
Oregon
Maryland
California
Maine
New Hampshire
District of Columbia
Delaware
Massachusetts
South Dakota
South Carolina
Tennessee
North Dakota
Wyoming
Virginia
Indiana
Utah
Kentucky
Idaho
Average IRR results of base case scenarios, policies and incentives as of 4/2011


State Ranking – COE, all Sectors
OR (IOU areas only, limited tax credit)
NV, MA
NY
VT, NJ
MT
MD, CA
CO
GA, ND, DC, LA, KS
SD, NC, NE, TX, WA
IA
DE, WY, MN
ME, AR, RI, OK
NM
NH, WI, UT, AZ, HI
AK, ID
OH, AL
MO, KY
VA, SC, NI, PA, FL, WV, CT, IL, IN, TN, MS
$0.00
$0.10
$0.20
$0.30
COE ($/kWh)
Average COE results of base case scenarios, policies and incentives as of 4/2011

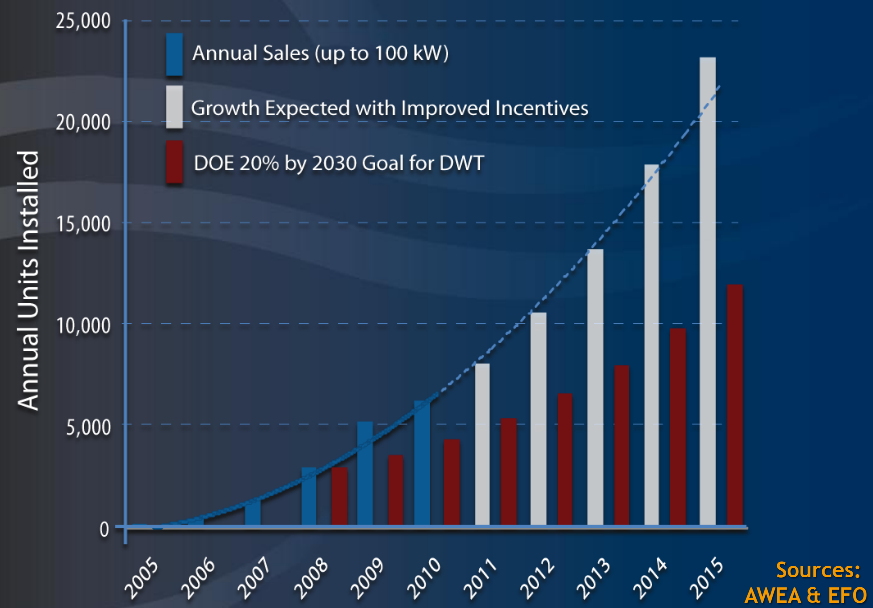

New York Case Study: Commercial & Residential
Small Wind Turbine COE ($/kWh) after rebates
0.00
0.10
0.20
0.30
50 kW 140 ft free-standing lattice
50 kW 120 ft freestanding monopole
2 kW 70 ft guyed pipe
2 kW 45 ft monopole
Low Class 3
Mid Class 2
Low Class 2
Retail Electric Rates: $0.15/kWh Commercial, $0.17/kWh Residential


Wisconsin Case Study: Commercial & Residential
Small Wind Turbine COE ($/kWh) after rebates
0.00
0.20
0.40
0.60
50 kW 140 ft free-standing lattice
50 kW 120 ft freestanding monopole
2 kW 70 ft guyed pipe
2 kW 45 ft f-s monopole
Low Class 3
Mid Class 2
Low Class 2
Retail Electric Rates: $0.10/kWh Commercial, $0.12/kWh Residential


Wisconsin Case Study: Tower Heights
Small Wind Turbine COE ($/kWh) after rebates*
0.00
0.10
0.20
0.30
0.40
0.50
0.60
50 kW 140 ft free-standing lattice
50 kW 120 ft monopole
100 kW 121 ft monopole
20 kW 120 ft free-standing lattice
20 kW 100 ft free-standing lattice
10 kW 100 ft lattice
5 kW 102 ft guyed
10 kW 60 ft lattice
10 kW 100 ft guyed lattice
2 kW 70 ft guyed pipe
10 kW 120 ft free-standing lattice
2 kW 45 ft monopole
6 kW 49 ft tilt-up monopole
Commercial
Residential
* Rebates only available for towers >100 ft


Washington State Case Study: Tower Heights
Small Wind Turbine COE ($/kWh) after PBI
0.00
0.10
0.20
0.30
0.40
0.50
20 kW 120 ft free-standing lattice
20 kW 100 ft free-standing lattice
50 kW 140 ft free-standing lattice
50 kW 120 ft monopole
100 kW 121 ft monopole
10 kW 100 ft lattice
10 kW 60 ft lattice
5 kW 102 ft guyed
2 kW 70 ft guyed pipe
10 kW 100 ft guyed lattice
2 kW 45 ft monopole
10 kW 120 ft freestanding lattice
6 kW 49 ft tilt-up monopole
Commercial
Residential
Retail Electric Rates: $0.08/kWh Commercial, $0.08/kWh Residential

Expanded Incentives Key to Market Growth



eFormative options LLC

Market Analysis

- Economic impacts
- Data collection/research

Development Consulting

- Launching new ventures
- Grantwriting

Public Affairs

- Community outreach
- Turnout for hearings

Project Management

- Strategic planning
- Facilitation, consensus

Heather Rhoads-Weaver

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- James Lee, CEC
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- Dave Ryan, NCAT
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- Alma Rivera, NJ
- Mark Mayhew & Allison Capello, NYSERDA
- Preston Boone & Manny Anunike, OH
- Erin Johnston, Darrin Kite & Aeron Teverbaugh, OR
- Erika Myers, SC
- Gabrielle Stebbens, VEIC
- Rich Hasselman & Mick Sagrillo, WI FOE
- Phil Lou, WSU

Data collection team: 3 dozen and growing!

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