

## **Encouraging the Domestic Small Turbine Market**

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## **ENCOURAGING THE DOMESTIC SMALL TURBINE MARKET**

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### **Abstract**

The state incentives for home-based renewables in the domestic market continue to grow and change creating opportunities for the small wind turbine market. Tracking the opportunities to get small wind turbines included in incentive policies and developing a proactive industry approach is important because market changes can occur anytime. There are near-term opportunities to work with states in developing their strategies for disbursing system benefit charges, adding tags to existing policies for other small renewables to include small wind, and developing state-wide net metering programs. Other opportunities to improve the domestic market exist but will be quite challenging to implement, such as: federal tax credits, state wind access laws, equipment verification for specific states, and leasing programs for small wind turbines.

### **Background**

As of this writing there are 14 states that have systems benefit charge (SBC) funds. Of those, seven states (California, New Jersey, New York, Montana, Rhode Island, Delaware, and Illinois) use the project development model, which provides “financial incentives such as production incentives and grants to directly subsidize and stimulate renewable energy project installation”<sup>1</sup>. These funds will provide significant opportunities for renewables in the next 11 years with total estimated funding of over \$3 billion dollars for all the states. There are 3 states (Ohio, Oregon, and New Mexico) that have not fully defined their administration and disbursement of SBC funds, although it looks like Ohio will develop a revolving loan program for home-based renewables.

The U.S. Department of Energy's (DOE's) Wind Powering America (WPA) Initiative, is committed to dramatically increasing the use of wind energy across the United States. Goals of the initiative include expanding opportunities for regional economic development, protecting local environments, reducing air pollution, lessening the risks of global climate change, and increasing energy security. One particular WPA goal is to increase the number of rural landowners who lease their land to developers of utility-grade wind farms. Another goal is to work with rural landowners to install small wind turbines for their use in reducing their electricity consumption from traditional energy sources.

### **Current Status of Small Turbine Market Development**

A table that compares state financial incentives for small turbines was produced to guide the WPA team in looking for near-term opportunities. This table defines the incentives and shows how long those incentives will last, how much funding is available for the incentives, the percentage and total acreage of rural land, and the quality of the state wind resource assessment map. This table can be found on

[http://www.eren.doe.gov/windpoweringamerica/pdfs/state\\_benefits.pdf](http://www.eren.doe.gov/windpoweringamerica/pdfs/state_benefits.pdf) and was last revised in November 2000.

Based on this table and personal knowledge of the domestic market, members of the American Wind Energy Association's (AWEA's) Small Wind Turbine Committee voted on a list of targeted states for which activities would be developed. The targeted states, starting with the highest priority, include: California, New Jersey, New York, Illinois, Pennsylvania, Minnesota, Washington, Vermont, Colorado, Massachusetts, Idaho, Arizona, and Rhode Island.

The Committee also voted on activities for each state and discussed barriers to the small turbine market at a roadmap meeting held in July 2000 in West Conshohocken, Pennsylvania. Based on their discussions and consensus, the members formed an action plan, called "Near-term Actions for Small Wind Turbines", shown in Table 1. The asterisks at the bottom of each cell represent the number of votes for that activity. There is no correlation between the different actions seen in the table, each action (market, policy, or technology) is an independent prioritized list of activities.

Table 1 - Summary of Near-term Actions for Small Wind Turbines

<b>Market Actions</b>	<b>Policy Actions</b>	<b>Technology Actions</b>
Develop standards that address market concerns: safety, reliability, noise * * * *	Develop a strategy to work with states on Small Wind Turbine (SWT) incentives (buy-downs, retail production tax credit, net metering etc. * * *	Continue research efforts unique to small wind including furling, durability, blade aerodynamics, noise and power electronics * * * * *
Develop an education and outreach strategy * *	Develop model zoning ordinances and blueprint template for zoning regulations. Seek national acceptance and get support of DOE/RO * * *	Develop request for proposal (RFP) for improving small wind turbine components and subsystems * * * * *
Develop new wind resource assessment maps for the domestic and international markets; Calculate the resource at 30m with a .25 shear factor; Prioritize the domestic maps by state market potential * *	Develop a policy for federal tax credits of SWT (large wind and photovoltaic [PV] currently have these) * * *	Research high reliability concerns like lightning, corrosion of blades, corrosion of guy wires, bearing lubrication issues, alternator winding insulation, electronics * * * *
Publish in cornerstone magazines such as <i>Scientific American</i> , highlight small wind vision and technology * *	Develop national net metering *	Develop RFP for improving balance of system components, particularly inverters [may be able to team with other Distributed Energy Resources (DER), fund under Office of Power Technology (OPT)?] * * * *
Increase market deployment of military applications by increasing funds * *	Develop a strategy to cover costs of complying to additional Public Utility Commission (PUC) requirements (wave form tests, UL 1741, etc.) *	Develop international standards that address safety of SWTs * *
Encourage international installations of SWT * *	DOE/Regional Office work with local zoning boards to feed siting rules through land-use guides and state access laws *	Develop a credible noise standard for SWTs * *

Develop lease strategy with SWT manufacturers *	Encourage GEF to support small wind projects *	Develop RFP to educate and evaluate SWT manufacturer's use of advanced manufacturing * *
Work with National Rural Electric Cooperative Association (NRECA), Agricultural offices, DER offices in educating and facilitating small turbine use *	Develop a creative way to subsidize SWT – could offer a large up-front tax credit with a 6-year grace period <b>(1/2*)</b>	Develop technology to mitigate noise both impedance matching and aerodynamic  * *
Encourage DOE to give small wind greater visibility through speeches, studies and policy initiatives *		Develop a national interconnection standard IEEE-929-2000  *
Provide technical assistance and advise to non-technical managers at World Bank and GEF *		Develop a test/analysis strategy to assess reliability, increase the number of deployment opportunities *
		Develop strategies to interconnect hybrid systems (work with other technologies) *
		Develop a white paper that addresses concerns from the utilities on interconnection (power quality, safety issues, etc.) <b>(1/2*)</b>
		Develop national interconnection standard <b>(1/2*)</b>

Some current activities address some of the actions listed in Table 1. For instance, work currently conducted under WPA could help address the second market barrier that was identified for action; "Develop an education and outreach strategy".

To further address the second market barrier, NREL staff identified four additional activities. First, an anemometer loan program could be implemented through states to help consumers better understand their wind resource. Second, a public information pamphlet could be created and distributed in both hard copy and electronic media. Third, states that have funds for resource assessment maps could be encouraged to further develop those maps with wind resource professionals. And fourth, develop an economic tool to help consumers understand the costs of a small turbine system.

Progress on each of these activities is as follows:

Anemometer Loan Program: The AWEA Small Wind Turbine committee did not endorse the anemometer loan activity because the wind resource needs are not as great as those required for utility-grade turbines and the length of time required to collect resource data may delay the turbine project.

Information pamphlet: A “Small Wind Electric Systems, A U.S. Consumer's Guide” was developed by NREL/DOE and initially distributed at Windpower 2001. The 23-page guide provides a description of wind energy and small turbine uses and answers the most common questions asked by consumers. In addition, it contains a U.S. wind resource assessment map that shows the approximate number of kilowatt-hours (kWh) per wind speed class. This is normalized by square meter (m<sup>2</sup>) of swept area. The guide also contains a glossary of terms and a list of

sources for more information on small wind turbines. Figure 1 shows the front cover for the national guide, "U.S. Consumer's Guide".



Figure 1 - Front Cover of the "Small Wind Electric Systems, A U.S. Consumer's Guide"

NREL plans to convert the national guide into state-specific guides by changing the cover of the "U.S. Consumer's Guide." Inside each state-specific guide cover there will be a state resource assessment map that shows productivity in kWh per m<sup>2</sup> of turbine swept area and a list of state incentives for small wind turbines. The back cover will contain a list of state contacts. As a minimum, the AWEA Small Turbine Committee's top priority states will have state-specific guides created when all of the state pieces of data are in place: good wind resource assessment map, list of state incentives, and a list of state contacts.



Figure 2 – Front and Back Cover of the New Mexico Consumer’s Guide

Resource Assessment Maps: A plan is currently in place to refine the wind resource assessment maps for states that currently do not have adequate maps. Hiring a wind resource assessment professional to develop these detailed resource assessment maps would be a sound use of available state funds. There are some states that currently have very good resource assessment maps that would not need improvement. Figure 3 shows the 1987 version of the Illinois wind resource assessment map. Figure 4 shows the current version (2001) of the Illinois wind resource assessment map. Note that in the current version the map resolution has improved as well as the addition of a legend for consumers in units of kWh/m<sup>2</sup> of swept area. This legend gives the productivity of the wind in kWh per year, followed by the wind density and wind speed, both at a 10m height. The productivity value is based on the assumption that the turbine tower height is 80 feet (24m).

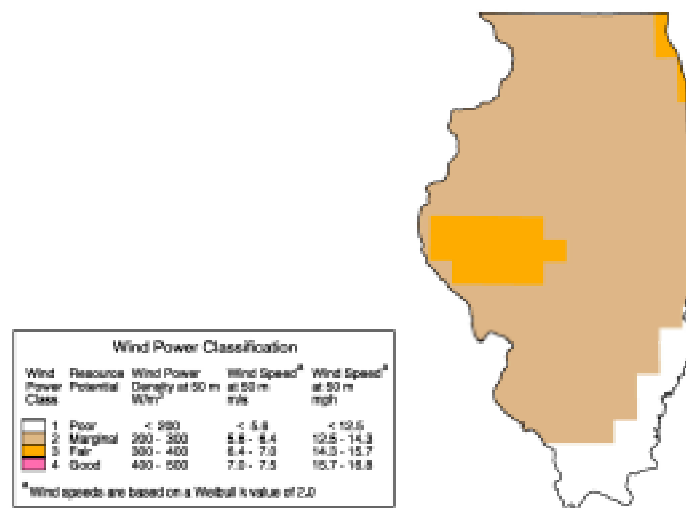


Figure 3 shows the Illinois wind resource assessment map from 1987

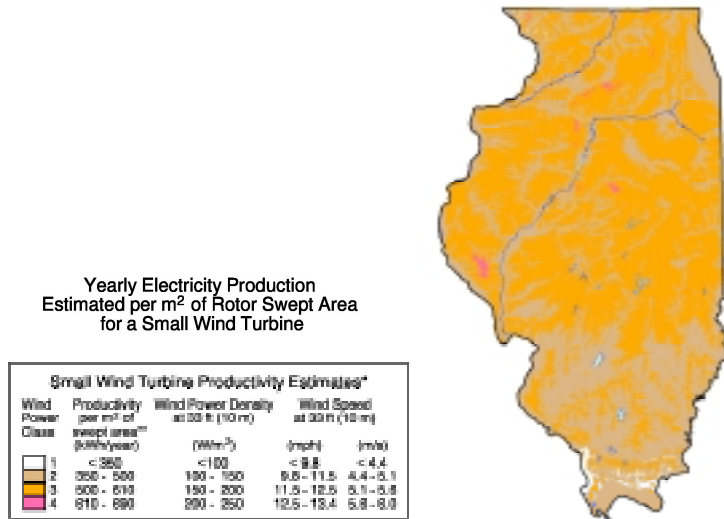


Figure 4 – shows the Illinois wind resource assessment map from 2001 (small turbine emphasis)

Figure 5 shows the U.S. wind resource assessment map for small wind turbines with the new legend.

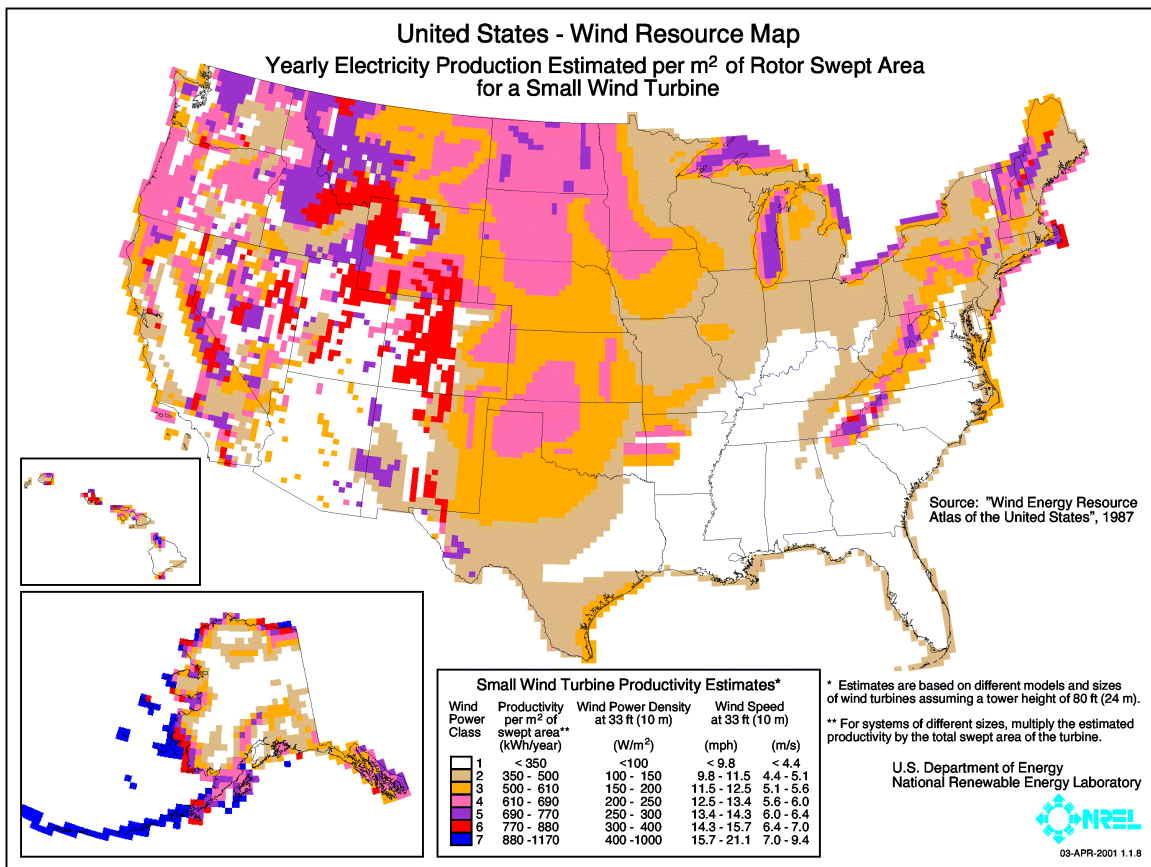


Figure 5- U.S. Wind Resource Assessment Map for Small Wind Turbines



Economic tool: The "U.S. Consumer's Guide" references a spreadsheet tool that will help consumers estimate the number of years required for simple payback. This spreadsheet tool is in development at the time of this writing and will be made available to consumers through the NWTC web site. For more exact payback numbers, information on a number of other variables should be gathered. These variables include the exact wind resource; the exact cost of electricity to the consumer (demand charge, peak and off-peak kWh charges, etc.); how the turbine system will be financed, the tax implications of that financing; and available small turbine incentives.

### Existing Incentives

Current U.S. incentives for small turbines include net metering or billing, property and sales tax incentives, and buydowns or rebate programs. An analysis presented at the Windpower Conference in 1999 showed a reduction in simple payback of approximately 6 years when a 50% buydown of the installed turbine system was combined with net metering rules.<sup>2</sup> This was contrasted with net metering where the excess generated was paid at the average retail rate.

Figure 6 shows a summary of the different incentives (buydown, net metering, and no property tax) and their affects on simple payback. The number of years for simple payback is a function of the wind speed, annual energy production from the turbine, the manufacturer's power curve, and the installed turbine system costs. The cost bars include multiple small turbines and their associated costs as part of this analysis. Simple payback does not account for any discounting or inflation and the assumption for these comparisons is that the turbine system is paid for in full up front.

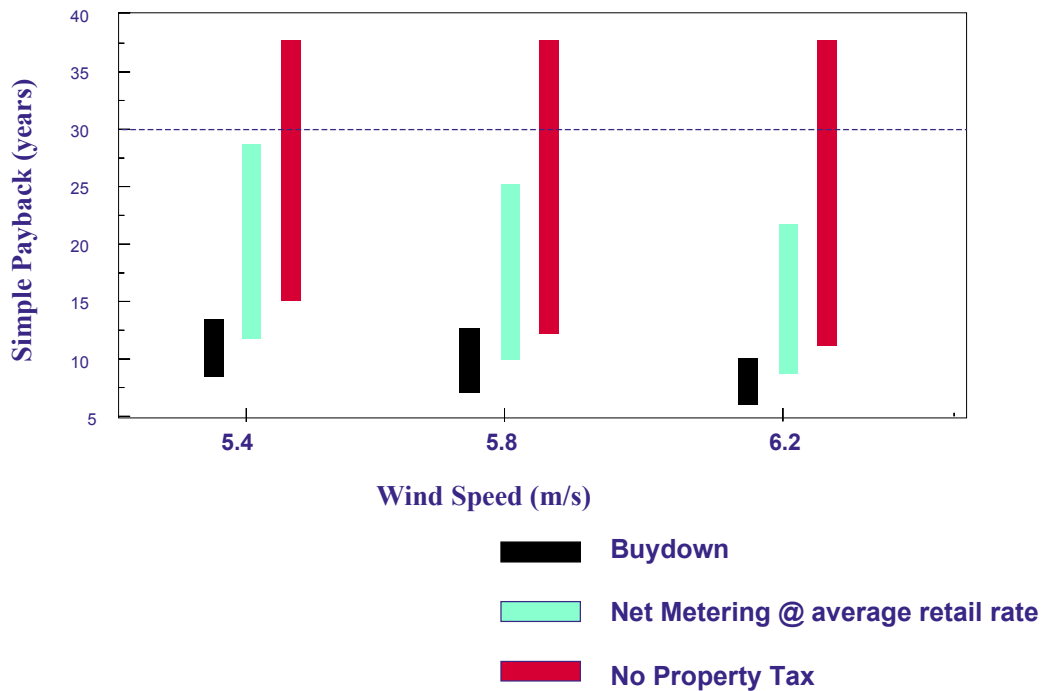


Figure 6 - Simple Payback Comparison of Small Turbine Incentives

If you combine the reduction in simple payback with the fact that the buydown offers an immediate reduction in installed turbine costs, the buydown becomes the most powerful market incentive.

At present, 30 states have net metering for wind; four states have buydown or rebate programs for small wind; and 21 states have some type of tax incentive. Figure 7 shows a graphic depiction of these incentives. Note that the best incentive, buydown, is shown in gray with a number, which is referenced in the notes at the bottom of the map. The worst incentive, which is no incentive, is shown in the white. The incentive values in the legend at the bottom of the map increase as you go from left to right. The numbers on the state indicate the maximum size turbine allowed under net metering. Not all of the states that show net metering have statewide net metering. This is a consequence of not having net metering legislated. Instead, the public utilities commission (PUC) directs state utilities to merely offer net metering. One strong disadvantage of PUC dictating is that they do not offer net metering to rural cooperatives and other small utilities customers located in rural areas where small wind turbines are likely to be installed.

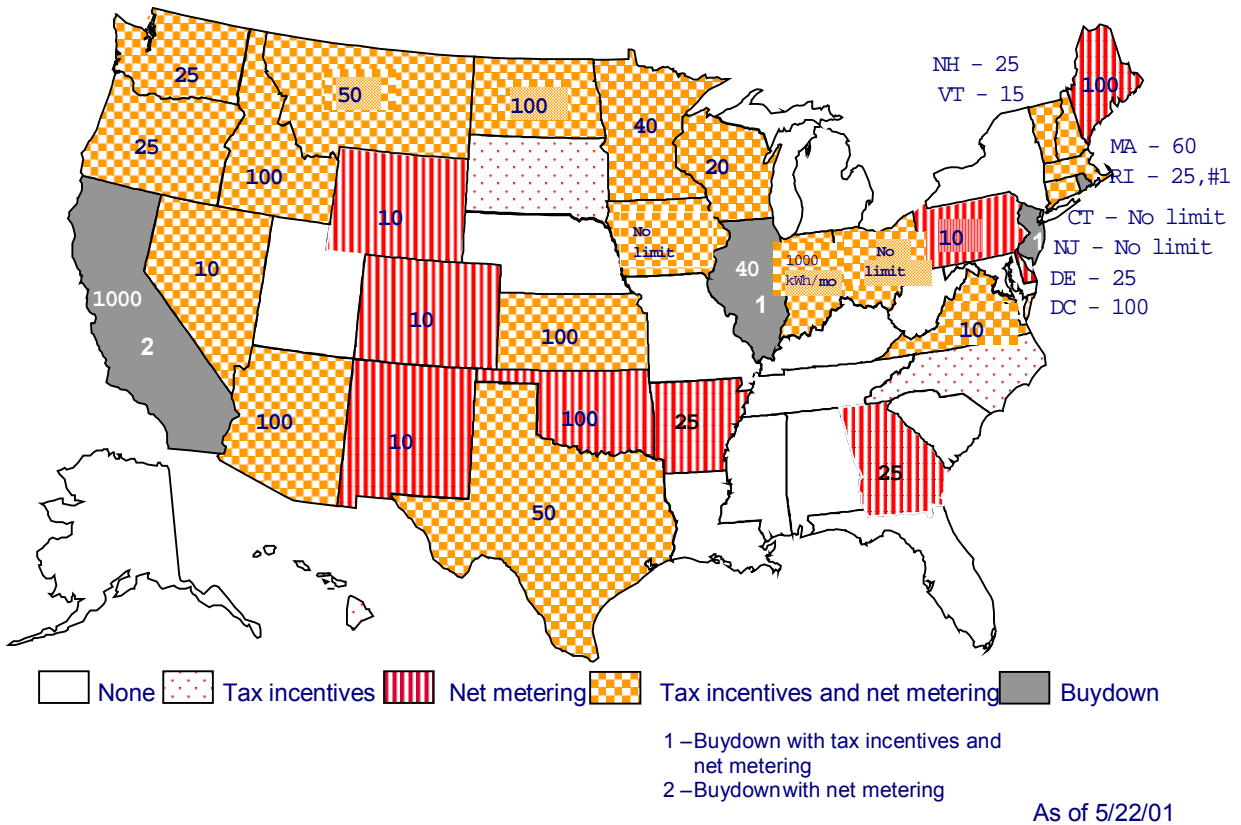


Figure 7 – Existing U.S. Incentive Map for Residential Wind

## Near-Term Opportunities

In the near-term there will be opportunities for the AWEA Small Turbine Committee to proactively develop a domestic strategy. One place to start would be to get net metering legislated so the rural electric cooperatives (RECs) have net metering programs. Another place would be to follow the solar industry by getting “and small wind” added to existing incentive policies that currently exclude wind. This is particularly true for Maryland, New York, Florida and Washington. For those states that have SBC funds, staying current with those funds and the small turbine incentives is critical to understanding the economic details of the domestic market. It is also important to influence states that don’t currently have strategies in place to disburse SBC funds, towards buydown or rebate incentives

Figure 8 shows some of the near-term opportunities. Those states marked with "AWEA" are the states targeted by AWEA's Small Turbine Committee and WPA will develop Consumer's Guides, better wind resource assessment maps, and a detailed simple payback financial tool. Although California is targeted by AWEA, the map shows no activity planned for this state. This is because California already has actions in place to develop a Consumer's Guide, better wind resource assessment maps, and a detailed financial tool. However, because states often change their renewable strategies, we should keep a vigilant eye on what is happening in order to redirect our state activities to accommodate those changes as needed.

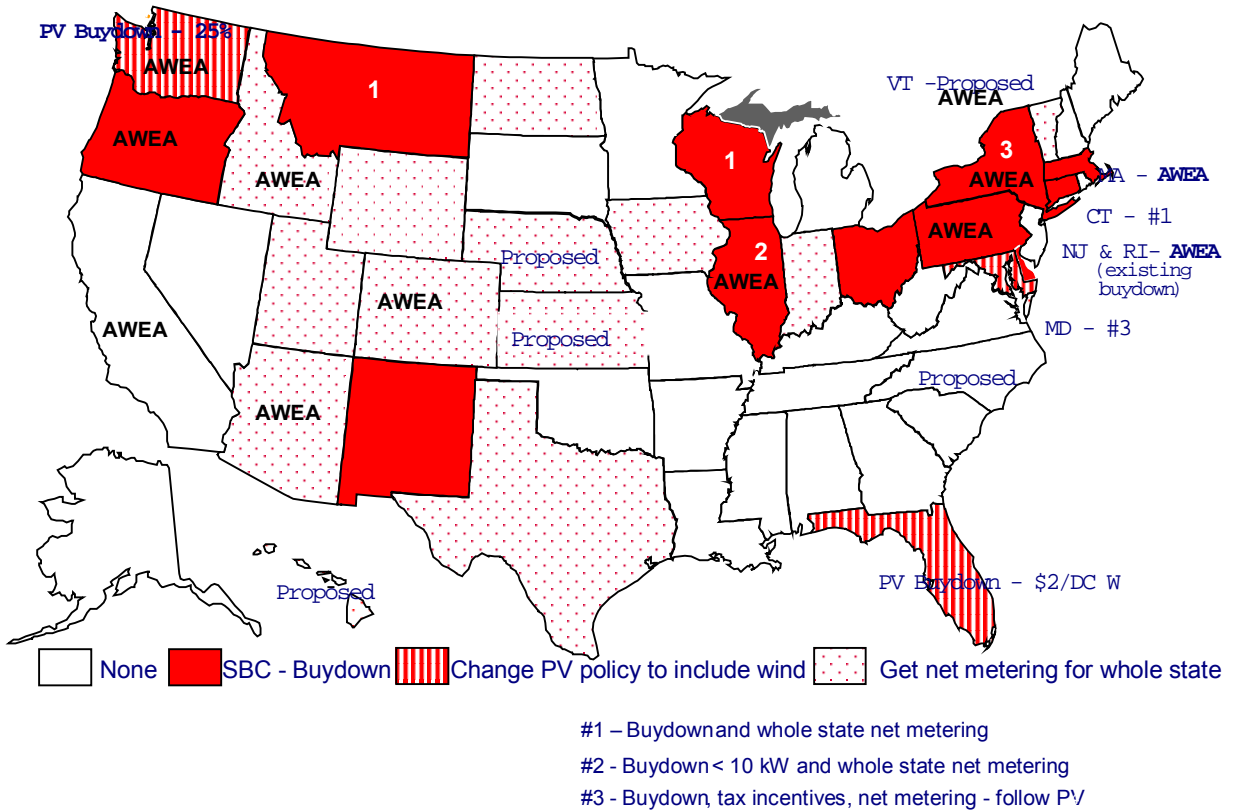


Figure 8 – U.S. Near-Term Opportunities

Other activities that may help develop the U.S. small turbine market include developing:

- utility line extension analyses;
- state wind access laws that could supersede county zoning issues, which are currently the biggest market barrier across the United States;
- a turbine equipment verification program to verify power performance, noise, duration, and system safety; and
- a lease programs for small turbines.

However, these activities may be difficult to implement so careful consideration should be given prior to working on implementation.

## **Conclusion**

In closing, the domestic market for small wind turbines is growing due to incentives that have been developed at the state level. These incentives have not been fully developed, or implemented and some incentives target only some of the home-based renewables such as PV, solar hot water, geothermal, microhydro, etc. Can different renewable organizations lobby together to influence the development of state incentives for all home-based renewables?

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## **References**

- 1 . Bollinger, Mark; Wisner, Ryan. "Clean Energy Funds: An Overview of State Support for Renewable Energy", April 2001.
2. Forsyth, T; Tu, P; and Gilbert, J "Economics of Grid-Connected Small Wind Turbines in the Domestic Market", June 1999

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