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Reducing Regulatory Barriers to Small-Scale Distributed Generation in Montana

Prepared for

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Craig Rech served as student intern on this project and collected much of the information found in the Appendix on state and utility incentive programs across the US.

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1. Introduction

The state of Montana is approaching many decision points as it prepares itself to service the future energy needs of its geographically dispersed population. These decisions include costly investments in the aging rural electricity infrastructure during the next two decades, the structure of residential and commercial tariffs as the state continues down the road of deregulation or re-regulation, and investments in emerging distributed energy technologies that take advantage of our rich and diverse resource base in clean fuels, including natural gas, wind, solar, and biomass.

The primary goal of this project is to reduce regulatory and market barriers that could stifle widespread acquisition and installation of small-scale distributed generation (DG), including fuel cells. Aside from the remaining technical hurdles for these technologies, a significant common barrier to overcome for all small to medium scale distributed energy technologies is the high transaction cost relative to the cost of the technology itself. For these residential and commercial units, the cost of selling, siting, permitting, and servicing distributed generation accounts can quickly make the technologies uneconomic. If these emerging technologies are to penetrate the market, the total transaction cost per unit must be greatly reduced through streamlined business and regulatory processes.

The purpose of this report is to discuss research findings on current *regulatory* barriers and potential policies to overcome these barriers; a related report addresses *market* barriers and recommended solutions. The specific objectives of this project follow closely the Action Plan for Reducing Barriers to Distributed Generation, as defined in the NREL report, “Making Connections: Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects.” The specific objectives that relate to regulatory barriers include the following:

<u>Reduce Regulatory Barriers</u>

1. Define new regulatory principles that are compatible with distributed power choices in Montana’s competitive generation service territories as well as in regulated utility market service territories, and that are neutral with respect to incumbent utilities to foster growth of the distributed energy resources market.
2. Define regulatory tariffs and state and utility incentives to fit the new small- and medium-scale distributed power model.

3. Define new environmental labeling procedures or alternatives to streamline siting and permitting approvals.

The approach taken in this project was to prepare a matrix of state incentive programs as well as summary tables that allowed us to identify peer states to Montana and the leading states in terms of breadth of activities that encourage small-scale distributed generation. Since most of the emerging small-scale distributed generation is fueled by renewable sources, we first surveyed renewable energy incentives and programs around the country. Our primary source of information on state and utility incentives was the *Database of State Incentives for Renewable Energy* (DSIRE). This database summarizes financial incentives, access laws, net metering rules, and outreach programs for renewable electricity generation by state. We expanded the summary tables published by DSIRE based on information found at their website (www.dsireusa.org) and at state energy office websites.

We then reviewed published case studies and summaries of state and utility programs for combined heat and power technologies and ground source heat pumps to identify incentives that may apply to fuel cell products and other emerging, clean distributed generation technologies that are not necessarily fueled by renewable energy. EFI/ENERGY, Inc. has produced a listing of incentives for distributed energy resources for the federal government and all the states in their report, *The 2003 Guidebook of Funds and Incentives for Distributed Energy Resources, Version 3.0*. Another report by the American Council for an Energy-Efficient Economy (ACEEE) covers all financial incentives and loan programs for CHP technologies - *State Opportunities for Action: Review of States' Combined Heat and Power Activities* (September 2002).

A report published by the Geo-Heat Center under a US Department of Energy grant - *Ground-Source Heat Pump Case Studies and Utility Programs* (April 1995) - provides information on ground source heat pump incentives and programs. We also reviewed the European Heat Pump Association's *Strategy for Heat Pumps* report (March 2001) to identify any programs unique to Europe that could be transferred to the US.

The approach taken to understand barriers and potential solutions associated with *utility rate structures* was to interview in-state electric distribution utilities and cooperatives and review reports that were prepared for the National Renewable Energy Laboratory (NREL) and the National Association of Regulatory Utility Commissioners (NARUC). NREL and NARUC contracted with the Regulatory Assistance Project (RAP) to investigate different aspects of barriers to distributed generation, including rate design for electricity transmission and distribution companies. Our discussion in this report is based on RAP's findings as reported in *State Electricity Regulatory Policy and Distributed Resources: Accommodating Distributed Resource in Wholesale Markets*, October 2002 and *Profits and Progress Through Distributed Resources*, February 2000.

2. Current Regulatory Situation

2.1 State and Utility Programs

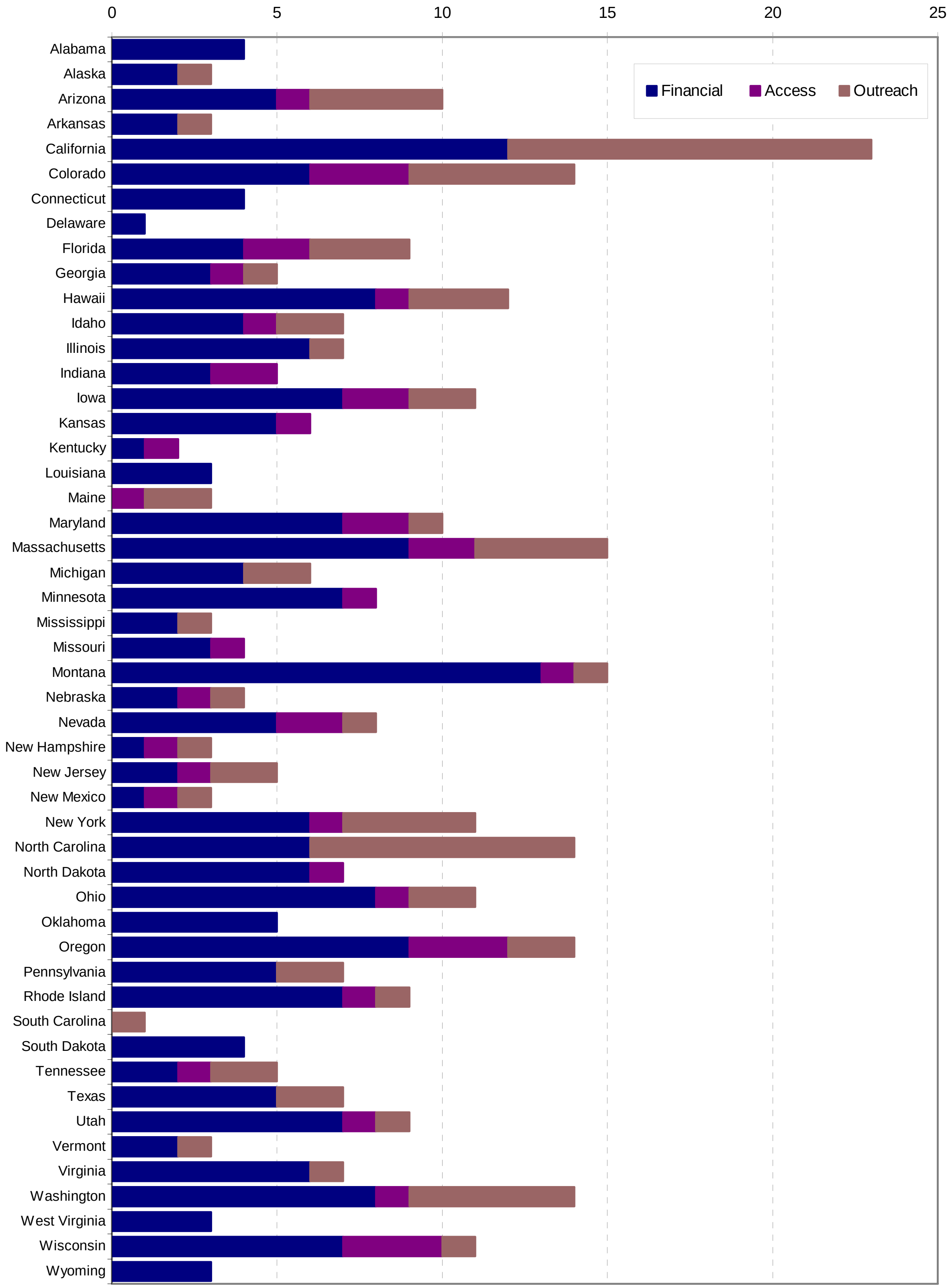
State Incentives and Programs

The inconsistency between states in the number of programs and policies that promote small-scale distributed generation – typically fueled by renewable energy - lies primarily in the financial and promotional categories. Most states now have net metering regulations and laws to protect access to renewable fuels that are required for on-site distributed generation, although the terms and conditions of these regulations and laws differ somewhat across states. Several states have training programs for installation and maintenance of distributed renewable energy equipment and some states require certification to perform these services. A table that shows the programs and regulations pertinent to each state is included in the Appendix.

The chart in Figure 1 shows the number of distinct types of financial incentives and access laws, and the number of outreach programs by state. Types of financial incentives include personal and corporate tax credits for equipment costs and loan interest, sales tax exemptions for equipment, property tax exemptions and reduced assessments, rebates, grants, and loans at market or reduced rates. Types of access laws include easements, covenants, and ordinances.

Montana ranks high on financial incentive offerings but low on the number of outreach programs. California offers the most types of financial incentives and also the most state and local outreach programs. Other states across the nation that offer a breadth of financial incentive programs include Massachusetts, Maryland, New York, Rhode Island, and Wisconsin. States with numerous outreach programs include Arizona, California, Colorado, Massachusetts, New York, North Carolina, and Washington.

Figure 1: Number of different types of financial incentives, access laws, and outreach programs



The table in Figure 2 shows the similarity in a peer group of states across their portfolio of financial incentives, access laws, net metering rules, and outreach programs. We performed the comparison by qualitatively rating each program versus the standard set by Montana. If, for instance, a state had larger or more rebates than offered in Montana, the state was ranked as slightly or significantly better than the Montana standard. The peer group includes California, Maryland, Massachusetts, New York, Rhode Island, and Wisconsin.

Figure 2: Peer State Relative Comparison to Montana

	Personal Tax	Property Tax	Rebates	Grants	Loans	Net Metering	Access Laws	Outreach
Montana	√	√	√	√	√	O	O	O
California	√	√	√	√	√	O	<	>>
Maryland	√	√	√		√	<	>>	O
Massachusetts	√	√	√	√		>	>>	>
New York	√	√	√	√	√	>	O	>>
Rhode Island	√	√	√	√		>	O	O
Wisconsin		√	√	√	√	>>	>>	>>

"O" = Montana standard; ">" = slightly better or more than Montana; ">>" = significantly better or more than Montana; "<" = slightly worse or less than Montana.

Incentives for Combined Heat and Power

Fuel cells and other clean emerging energy technologies do not necessarily qualify for renewable energy incentives, although renewable sources are an option to fuel Stirling-cycle engines, microturbines, and fuel cells, for example. These clean technologies may qualify for combined heat and power incentives, however, if the thermal energy is captured and used on-site. Only a few states have financial incentives for combined heat and power technologies; Montana has none. Financial incentives include grants for research, development, and demonstration, co-funding of projects, below-market rate loans, tax credits based on equipment, production, and fuel, and faster depreciation for tax purposes. Hawaii issues revenue bonds to pay for its co-funded projects and to offer loans. Figure 3 provides a summary of state financial incentive programs.

Figure 3: Financial and Emissions Incentives for Combined Heat and Power

State	Financial Incentives	Output-Based Emissions
California	Grants for RD&D	Yes
Connecticut	None	Yes
Hawaii	Co-Fund Projects	No

State	**Financial Incentives**	**Output-Based Emissions**
	Low-Cost Loans Equipment Tax Credit Faster Depreciation (proposed)	
Indiana	Co-Fund Projects	No
Massachusetts	None	Yes
Michigan	Low-Cost Loans	No
Minnesota	None	Yes
New York	Grants for RD&D	Yes
Pennsylvania	None	Yes
Texas	None	Yes
Wisconsin	Production Tax Credit (proposed)	No

Source: Adapted from Table 2, page 5, *Opportunities for State Action: CHP Activities,* ACEEE.

As shown in Figure 3, several states also offer emissions incentives for combined heat and power. Distributed generation projects – including combined heat and power units – often must obtain permits for emissions. Several states are leading the nation in providing output-based emission standards as opposed to input-based. For example, Texas has emission standards based on output of energy (pounds/MWh) as opposed to input of fuel. Under this standard, combined heat and power units are issued a credit at the rate of 1 MWh for each 3.4 million BTUs of heat recovered. Thus, the emissions standard takes into account the energy efficient cogeneration of electrical power and thermal energy.

Incentives for Energy Efficient Heat Pumps

Another potential source of incentives for clean emerging technologies is utility or state energy efficiency programs, since emerging technologies may offer efficiency gains over central coal-fired generation and transmission. Over the past twenty years, many utilities have offered incentives for energy efficient heat pumps. These successful programs could serve as an example of program design for the energy efficient fuel cells of the future.

Utility financial incentive programs for ground source heat pumps include rebates per ton of capacity or co-funding projects, low-cost loans, service agreements, and discounted electric power rates for ground source heat pump customers. Rebates were provided to customers as well as to trade allies, such as contractors and equipment distributors. Figure 4 lists the different types of rebate programs. Participation in these utility programs included almost 19,000 ground source heat pump installations.

Figure 4: Utility Rebate Types for Ground Source Heat Pumps

Type	Recipient	Range of Rebate ($)	Mean Rebate ($)
Residential $/unit	Customer	150 – 1,000	382
Residential $/ton	Customer	75 – 333	208
Trade Ally $/unit	Trade Ally	100 – 350	200
Commercial $/ton	Customer	100 – 165	133
Fossil Fuel Retrofit	Customer	400 – 1,250	733
Electric Resistance Retrofit	Customer	750	750

Source: Adapted from Table 9, page 43, *Ground-Source Heat Pump Case Studies and Utility Programs,* Geo-Heat Center.

Utilities marketed these programs through advertising media, member services such as bill inserts and newsletters, dealers, builders, and education and demonstration programs. For example, 29% of Associated Electric Cooperative's ground source heat pump members were referred to the program through advertising, 38% through dealers, 5% through builders, 18% through member services, and 9% through a friend or relative.

Programs in Europe were also reviewed to identify any unique features over programs offered in the US. While the European Heat Pump Association recommended a communications plan and education on standards and best practices as part of its strategy for reducing CO_2 emissions through deployment of heat pump technologies, no financial incentives were recommended despite listing high initial cost as a barrier to energy efficient heat pumps.

2.2 Rate Structures

Electric distribution rate structures provide a disincentive for the utility to promote distributed generation if the revenue the utility receives from a customer varies by the amount of electricity distributed. But for the customer, the market does not offer a correct price signal unless the rate they pay for electricity does vary by the amount of electricity distributed. In Montana, rural electric cooperatives around the state typically have a significant monthly base charge to recoup residential and small commercial distribution costs (e.g., $17 per month) and minimal charges per amount of electricity consumed (kWh). This rate structure does not provide the customer with the correct price signals due to the high fixed cost rather than cost per unit of consumption, but the cooperative does not have a disincentive to promote distributed generation under this fixed-charge rate structure.

In contrast, Northwestern Energy charges a low fixed charge – less than $5.00 per month – and recoups most of its distribution costs through a variable monthly charge based on electricity consumption (e.g., 2.5 cents per kWh). In this case, Northwestern Energy's rate structure does provide a correct price signal to the customer, but the utility has a disincentive to promote distributed generation due to the loss of distribution revenue through the variable charge.

All of the utilities and cooperatives that we interviewed said that residential distributed generation will have a trivial impact on their rates unless market penetration of the technologies becomes significant. This impact on rates would occur if supply was significantly reduced or could no longer be balanced within a distribution sub-system. For these reasons, larger distributed generation devices that operate under supply agreements can pose non-trivial costs to cooperatives that operate smaller grids.

All cooperatives that we interviewed also explicitly stated that each distributed generation customer is expected to pay the full cost to the cooperative of interconnecting to the grid. These costs include the up-front engineering and connection costs, as well as on-going billing costs through a higher fixed charge per month. For an example of up-front costs, if a DG installation requires any infrastructure upgrade - perhaps at a substation 6 miles away – the DG owner would be responsible for paying all expenses up-front to complete this task rather than the costs of this upgrade being included in the rate base. For net metering customers of Northwestern Energy, many of the customer service and billing costs are borne by all customers in the rate class, while all costs for interconnecting and servicing small-scale distributed generation that is not net metered are borne by the customer.

For interconnected DG customers that are not net metered, a separate supply agreement is entered into with the service utility if the facility is a Qualifying Facility under PURPA; else the customer enters into an agreement with an independent power supplier. In this latter case, the DG customer is at risk, especially regarding fuel cost fluctuations if the generation plant is fueled by natural gas. One example of a program that helps mitigate this risk and further the installation of DG is New York State Electric and Gas Corporation's rate structure that offers lower rates for methane fuel stock for DG projects.

In our discussions we only had one instance of a utility or cooperative that included distributed generation as part of its resource planning process. A rural cooperative is considering owning and servicing solar photovoltaic generators for stock watering applications in remote areas in which distribution from the grid is more expensive that stand-alone generation. The customer would receive service and a monthly bill just as if they were connected to the grid, but the generation unit would not be interconnected due to the high cost of running power lines to the location. No other utilities that we spoke with have included distributed generation as part of the Integrated Resource Planning process that includes analysis of supply and energy efficiency options for meeting electric power needs within its service territory at the lowest cost.

3. Regulatory Barriers and Recommended Solutions

Figure 5 lists a summary of important regulatory barriers that we identified along with our recommended solutions. We found that in almost all cases incentive programs are offered to consumers but not to the natural trade ally – the dealer, distributor, and energy service company that sells to the consumer. Furthermore, these incentive programs are sometimes offered through electric distribution utilities and cooperatives, which under their current rate structures have a disincentive to see widespread adoption of DG technologies. We also found that clean generation technologies, such as microturbines, fuel cells, and Stirling-cycle engines, fall through the cracks of traditional programs set up for either renewable energy technologies or energy efficient technologies.

Figure 5: Summary of Important Regulatory Barriers

Regulatory barriers to penetration of technologies	**Proposed solutions**
o Market ally is not incentivized or helped	o Develop financial incentive programs for allies that can include pass-through money to consumers

Regulatory barriers to penetration of technologies	Proposed solutions
o Incentive programs require interconnection	o Do not require interconnection for incentive programs; promote grid isolation applications to directly serve end-use loads and plug-n-play building codes for new construction.
o Clean technologies fall through the cracks	o Select technologies for incentives based on pollution per unit of output; incentivize clean generation technologies (e.g., fuel cells and Stirling engines) similar to energy efficient technologies
o Utility rate structures are a disincentive	o Revenue rate caps under performance based ratemaking creates no disincentive for utilities to promote DG;
o IRP does not include DG planning	o Include DG planning in T&D IRP process to identify and create DG incentive zones
o Customer is not educated - Montana is top tier in financial incentive programs but much lower in educational programs	o Implement educational programs that are successful in other states, especially those that work in conjunction with trade allies

Our proposed solutions include introducing educational and incentive programs that work through trade allies, developing more educational programs that emphasize a lifestyle message targeted to specific consumer segments, changing the business process for program incentives so that the consumer is dealing with just one entity during the transaction, moving away from the emphasis on grid interconnection to grid isolation, setting up incentive programs based on pollution per unit of output to catch the technologies that currently fall through the cracks, and changing utility rates structures and the Integrated Resource Planning process to encourage economic applications of DG.

3.1 State Education and Incentive Programs

Add Educational Programs

Montana ranks towards the bottom in the number of state and utility educational programs for renewable energy and distributed generation. We recommend adding education programs that work with trade allies to communicate lifestyle and budgeting messages to consumers.

- *Trade Ally Materials:* Trade allies include energy service companies and distributed generation dealers and distributors. These companies typically have an engineering or equipment sales culture and focus rather than a mass marketing mentality. For small-scale DG applications, however, the purchase decision is often not based on economics, but on individual preferences for reducing pollution and living sustainably. Understandably, engineers and equipment dealers are focused on hitting economic targets (e.g., price per kW) to get a sale rather than selling based on lifestyle preferences. For this reason, we recommend that the state develop a generic line of educational materials that can be used by all trade allies to communicate benefits to mass markets. These materials could include mailers to generate leads and information sheets that accompany price quotes to help close sales of clean distributed energy technologies.

- *Educational Message*: As alluded to above, for mass market customers the decision to purchase distributed generation equipment for their home or business is often based on their individual preferences and their budgets, rather than on the specific economics of the application. The Roper Organization has classified the green consumer market into five segments, with True-Blue Greens and Greenback Greens preferring "green" purchases over polluting alternatives (see the Roper Green Gauge Report):
  - *True-Blue Greens*: These consumers believe they can make a positive environmental impact through their actions, and are twice as likely to buy green products and three times as likely to avoid products with a questionable environmental reputation. They are the oldest, wealthiest, and most influential of all of the segments, and are the most likely to be married women with children under thirteen.
  - *Green-Back Greens:* These consumers are not as active on green issues, but choose instead to express their beliefs with money. They are the youngest of the segments, with high white-collar salaries and the most education.
  - *Sprouts:* These consumers do not believe they can make a difference in solving environmental problems, so they rarely take part in environmental activities or pay more to buy green products. They reflect the median American population in most of their demographics.
  - *Grousers*: These consumers believe that the environment is someone else's problem. They have below average education and income levels.
  - *Basic Browns*: These consumers are not involved in environmental issues and do not consider environmental attributes when making purchasing decisions. They tend to be men with blue-collar jobs.

  According to Jacquelyn Ottman, a leading green marketing consultant to major household brands in the US, these green consumers have a strong need for information, control, and to make a difference (Ottman, J.A. 1993, *Green Marketing,* p.33-40). Ottman goes on to emphasize that the real challenge facing marketers is that these same consumers have a need to maintain their lifestyle, unlike the environmental consumers of the 1970's who focused on "low-consumption approaches" (p. 41). The environmental consumers of today want "technology-driven solutions that allow them to maintain their lifestyles" (p. 41). We recommend that the educational materials developed for renewable and clean energy technologies emphasize the pollution reduction benefits of these technologies. This information on the social benefits matches the consumer's need for control and to make a difference. This message is different than an emphasis on economic calculations; economics are a factor to be considered, but not the driving factor for decisions made by these consumer segments. Just as when consumers buy a major energy-using appliance or a car, economics often are a secondary, budget consideration after a particular item contains the necessary set of features that a consumer wants.

Modify Financial Incentive Programs

Montana ranks towards the top in terms of its portfolio of state and utility financial incentive programs. But through our research we found that the financial incentive programs offered in the state prolong sales cycles for trade allies, require grid interconnection that may not be economical, and create a transaction process that often involves the customer plus four other parties. We also found that emerging non-renewable fueled distribution generation technologies - which can be low polluting and energy efficient – are not covered by any of the current incentive programs despite having social benefits. To improve the effectiveness of the programs and catch all socially beneficial technologies, we recommend that the current programs be modified to include the following concepts:

- *Partner with Trade Allies:* The current programs offer incentives directly to the customer, requiring that the customer fill out an application and in some cases provide quotes from vendors for the equipment and installation. We recommend that this transaction process be changed such that the incentives flow through trade allies to the customer as a line item deduction in the cost of the equipment and installation on the price quote to the customer. By partnering with the trade allies, efficiencies are gained in the transaction process since the program can be implemented through companies that will serve to accelerate consumer knowledge about the program. For standard installations that comply with the program requirements, the state can set up an electronic transaction process with these allies to quickly approve each application. The trade ally can then reduce their price to the customer on the price quote, so that the program incentive is passed along very transparently and with no learning curve and extra time commitment to fill out an application by the customer. The state can require mandatory training on the program requirements for an ally to participate for these fast track customer incentives. The related report on market barriers and recommended solutions provides more details on the entire customer-energy service company transaction process that incorporates this trade ally incentive program structure.

- *Promote Grid Isolation:* The state and utility financial incentives for renewable distributed generation require grid interconnection. We recommend modifying this requirement to allow grid isolated installations to qualify for program incentives. Grid isolated installations directly serve a load at the site with the grid power as backup, but do not allow for flow of electricity back to the grid. For small-scale distributed generation, especially household scale in the range of 1-5 kW capacity, the amount of electricity that is generated and put back on to the grid is typically trivial, while the fixed cost for interconnecting and metering/billing can be significant. Grid isolated installations, on the other hand, should reduce transaction times and costs for the customer without sacrificing the benefits of on-site, clean or renewable generation. Grid isolated installations have another benefit: the cost of a project that is sized to directly serve a load with the grid providing backup is more likely to fit a household budget than a project that is sized larger to meet all but the peak needs of a facility. And this grid isolated concept fits well with market tests being conducted on replacing furnaces with combined heat and power units that are sized based on thermal requirements rather than electric load requirements.

- *Align with Household Budgets:* The household budgeting process may not be compatible with size requirements for incentive programs. One key to selling to mass markets is understanding how households and small businesses do their budgeting. For households, the budget reduces to either (1) an analysis of monthly payments for a big ticket item or (2) a prioritization of wants. For example, a household's decision to buy a solar PV generator may be a choice between purchasing a pool table, a vacation, a big screen TV, or the generator. To fit this type of household budgeting process based on consumer preferences across all household items, the financial incentives need to allow for and encourage scalable purchases of any size. In the example above, the consumer may decide to buy a 240 watt PV system and a pool table rather than a 1,000 watt system with no pool table. By designing an incentive system that is compatible with this budgeting process, more consumers may take the initial step into clean on-site power generation that they can then add to over the years.

- *Base on Pollution per Unit of Output:* The justification for incentives for small-scale clean distributed generation comes from the social benefit of reduced pollution compared to centralized coal-fired plants and natural gas fired turbines. This pollution reduction could result from either (1) a more energy efficient process that does not have transmission losses, (2) emerging distributed generation technologies that are more energy efficient, and (3) emerging distributed generation technologies that produce fewer pollutants per unit of output. Energy efficient building shell and appliance technologies, combined heat and power, and renewable and clean distributed generation technologies are all based on this same social benefit lowering pollution while maintaining or improving our standard of living. We recommend that the State Energy Office consider basing all of their distributed generation and energy efficiency financial incentives on one common metric. This change would accomplish a couple of objectives. First, the clean distributed generation technologies that currently fall through the cracks would qualify for incentives as appropriate based on their social benefit. Second, combined heat and power applications that greatly increase efficiencies would be encouraged where appropriate. Third, customers and trade allies would be properly incentivized to select the most appropriate combination of energy efficient appliances and renewable and clean fossil-fueled generation. By basing incentives on an emissions per unit of output standard, the incentive programs would be compatible with the market selecting the cost-effective combination of technologies to reduce emissions.

3.2 Regulatory Design for Electric Distribution Utilities

Rates can provide a disincentive for distributed generation, depending upon the design of the rate structure. If we assume that the goal is to deploy distributed generation resources on a cost-effective basis using a systems approach, then the objective of the rate design is to provide the correct price signals to the market so that the electrical system is maintained and operated at minimal cost.

The Regulatory Assistance Project report mentioned above discusses features of rate structures that are consistent with this objective. In general, rate structures built on averaged rates across time and geographic space do not promote cost-effective deployment of distributed generation. In addition, distribution rates that are based on throughput over a utility's wires are not incentive compatible with cost-effective distributed generation deployment.

Rate structures for distribution utilities and retailers should include the following three components to be incentive compatible with cost-effective deployment.

1. <u>Time-of-use supply rates</u> – Averaged rates across time-of-use mask the true supply cost of electric power during the peak periods of the day. For intermittent distributed generation fueled by solar and wind, the generation may coincide with the time periods when supply costs are higher. Time-of-use rates would de-average prices across time and thus would provide the correct information necessary for performing economic analysis of distributed generation.

2. <u>Locational buy-back credit</u> – The cost of distribution service differs by location, but rates are averaged across the entire distribution grid. One method for de-averaging distribution rates to more closely match the true avoided cost is to offer locational buy-back credits. For example, in areas that have low to moderate growth and (a) are capacity constrained, or (b) have aging infrastructure, or (c) require new infrastructure service, a buy-back credit could be offered within the load zone at a cost to the utility that is equal to or less than the cost of replacing or building new distribution infrastructure. With the locational buy-back credit, the avoided cost information is provided to decision-makers so that analyses for distributed generation within that location reflect the true distribution cost savings.

3. <u>Revenue cap rates</u> – Utilities charge customers for distribution costs either through a fixed monthly charge or per unit of usage/demand, or some combination of the two. From a distributed generation and energy efficiency standpoint, these different rate structures clearly affect the utility's incentive for promoting and the customer's incentive for making cost-effective investments on the customer side of the meter. Fixed charges promote inefficient consumption since the customer faces zero marginal costs of consumption, resulting in reliability degradation. The utility is indifferent to distributed generation investments on the customer side of the meter under a fixed charge rate. Under a price per unit of usage/demand,

the customer has an incentive for cost-effective investment, but the utility has a disincentive to promote such investment since a reduction of throughput over its line reduces its profits. As more states and utilities go to performance-based rates, distribution costs are recovered through charges per unit of electricity supplied under a price or revenue cap rate structure. The price cap rate structure results in a disincentive to utilities to promote customer investments in distributed generation, since profits are still tied to throughput across its wires. The revenue cap rate structure, however, provides no disincentive to the utility and the proper economic incentive to customers to invest in cost-effective distributed generation. Under a revenue cap structure, the utility is essentially operating under a fixed charge per customer, while at the same time the price observed by the customer is a charge per unit of consumption. Thus for the customer, investments in distributed generation reduce their power bill while for the utility, short-term profits remain independent of throughput over its wires.

Appendix

Matrix of State Programs and Regulations
Small-Scale Distributed Renewable Energy