



# **DELIVERING ENERGY SAVINGS**

*Innovative Energy Efficiency Strategies  
for Rural Electric Cooperatives and  
Small Public Power Utilities*



**WESTERN RESOURCE**  
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This report was written by David Berry. The author wishes to acknowledge helpful advice and comments from John Wallace (Grand Canyon State Electric Cooperative Association), Bruce Driver, Nicole Theerasatiankul, and staff of Trico Electric Cooperative, Mohave Electric Cooperative, and Sulphur Springs Valley Electric Cooperative. This study was funded by a grant from Edwards Mother Earth Foundation.

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Western Resource Advocates' mission is to protect the West's land, air, and water.

Our lawyers, scientists, and economists:

- 1) advance clean energy to reduce pollution and global climate change
- 2) promote urban water conservation and river restoration
- 3) defend special public lands from energy development and unauthorized off-road vehicle travel.

We collaborate with other conservation groups, hunters and fishermen, ranchers, American Indians, and others to ensure a sustainable future for the West.



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## DELIVERING ENERGY SAVINGS

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### *Innovative Energy Efficiency Strategies for Rural Electric Cooperatives and Small Public Power Utilities*

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## EXECUTIVE SUMMARY

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This report provides ideas for innovative and practical energy efficiency programs for rural electric cooperatives and small public power utilities. It covers both measures and delivery strategies that have the potential to substantially reduce energy consumption.

Using energy more efficiently means using less energy to attain the same outcome – lighting, space cooling, water heating, motor power, and so forth. Greater efficiency can be achieved by substituting more advanced technology for older technology, by changing physical designs, and by changing behavior.

Cooperative and public power efficiency programs can offer a variety of measures for residential and nonresidential customers. Common measures include lighting upgrades, shade trees, efficient pool pumps, packages of low-cost efficiency measures, home performance programs, high efficiency motors and drives, more efficient space cooling equipment, more efficient refrigeration equipment, and design of energy-efficient buildings.

Unfortunately, savings from efficiency programs for residential and small business customers have often been disappointing because of low participation rates. Energy choices are the result of multiple drivers of behavior, including habit, attitudes, beliefs, values, social norms, consideration of costs and benefits, convenience, and available technology. Therefore, to significantly increase participation in energy efficiency programs, delivery strategies need to address a variety of motivations and obstacles. Multiple delivery strategies, combined in an internally consistent program, should create visibility for energy efficiency, overcome high up-front costs of some efficiency measures, change habits, utilize social networks to mobilize resources, seek economies of scale, create social norms, and lead by example. Effective delivery strategies include:

- Rebates and other financial incentives
- Large scale give-away programs
- Partnering with existing organizations
- Neighborhood programs
- Joint utility programs
- On-the-bill financing, and
- Peer comparisons



## INTRODUCTION

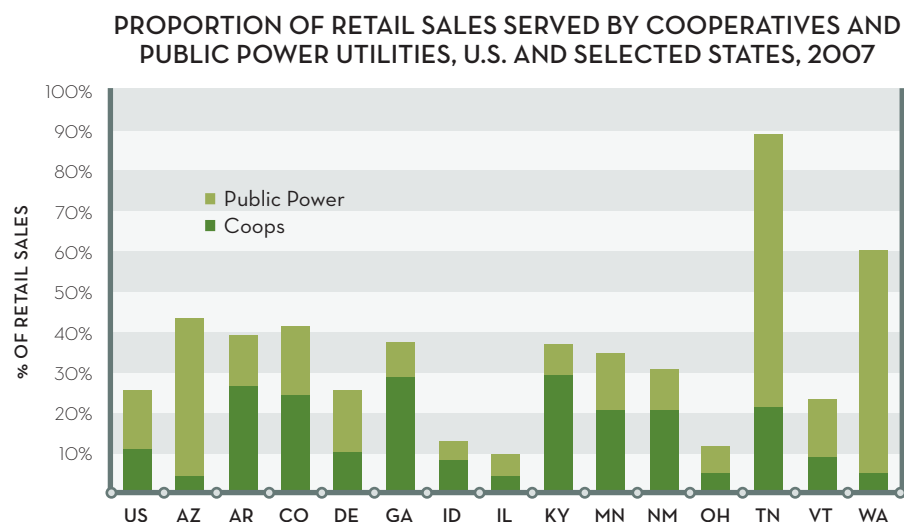
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Using energy more efficiently means using less energy to realize the same outcome – lighting, space cooling, water heating, motor power, and so forth. Greater efficiency can be achieved by substituting more advanced technology for older technology, by changing physical designs, and by changing behavior.

Energy efficiency is often less expensive than generating electricity with new or even some existing power plants. Moreover, it is usually not subject to price escalation once installed, and it generally has little or no environmental impact, in contrast to burning fossil fuels to generate electricity. Many energy efficiency programs are carried out by utilities, but other types of programs are also being implemented, including appliance standards, building codes, combined heat and power projects, and demonstration projects that lead by example.

Numerous cooperatives and municipal utilities have implemented efficiency programs but the level of energy savings may be low in some cases. To create significant savings with efficiency programs, it is necessary to reach large numbers of residential and business consumers and persuade them to take actions to use energy more efficiently. Thus, effective delivery strategies are crucial to success.

This report is written primarily for managers and directors of rural electric cooperatives and public power utilities who are seeking ways to improve the energy efficiency of their members and customers. It provides ideas for energy efficiency programs that have the potential to appreciably reduce energy consumption and covers both efficiency measures and delivery mechanisms.



**Figure 1.**

Nationally, cooperatives and public power utilities provide about 25% of all electricity sold in the U.S., but the proportion varies greatly from state to state. *Figure 1* shows the proportion of total retail sales of electricity made by cooperatives and public power utilities in the U.S. and for several states.<sup>1</sup>

There are approximately 2,000 public power utilities and about 900 cooperatives in the U.S., and many are small in comparison to investor owned utilities. The average investor owned utility in the U.S. serves about 480,000 retail customers. In contrast, the average public power utility serves about 10,000 retail customers and the average retail cooperative serves about 20,000 customers.

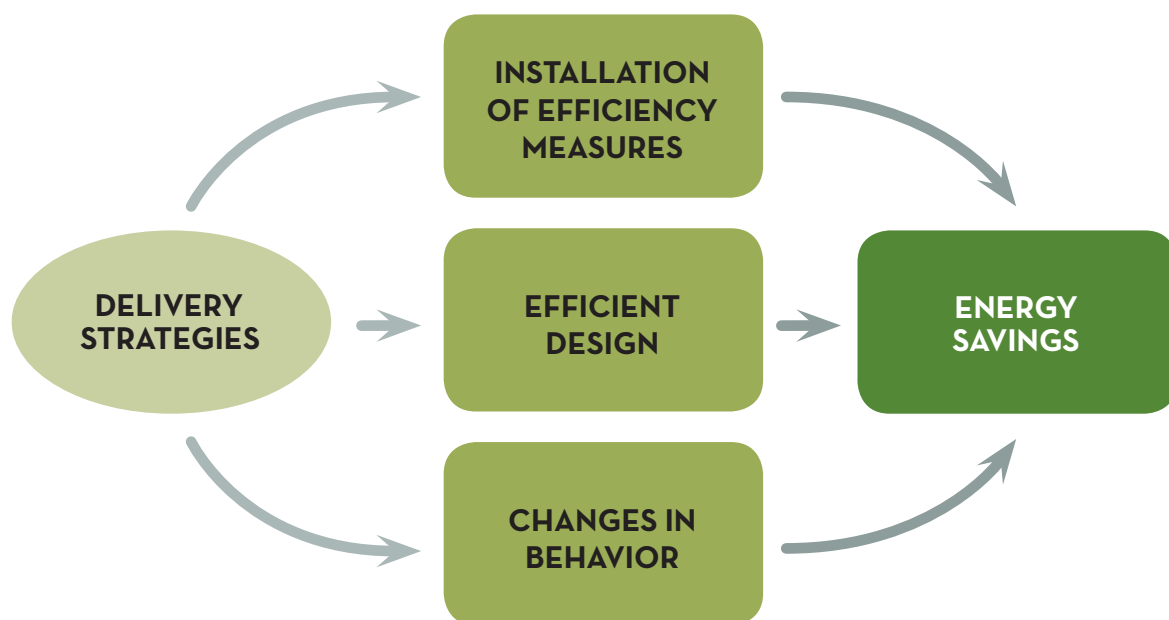
Given the typical small size of cooperatives and public power utilities, there are practical limitations on the design and implementation of energy efficiency programs. Among these limitations are small staffs, limited sales, possible absence of large commercial and industrial savings opportunities, limited budgets, and low population density for cooperatives serving rural areas, possibly resulting in higher efficiency program costs per participant.

*Figure 2* summarizes the elements of an energy efficiency program as discussed throughout the report.<sup>2</sup> Energy savings are derived from the installation of efficient lighting, space cooling, and other measures, from employing more efficient design, and from changes in behavior, which, in turn, are stimulated by delivery strategies. These elements of efficiency programs are discussed in subsequent sections which address:

<sup>1</sup> U.S. Energy Information Administration, *State Electricity Profiles 2007* (Washington, DC, 2009, DOE/EIA - 0348(01)/2). The large portion of public power in Arizona is mostly attributable to Salt River Project.

<sup>2</sup> For a review of the elements of designing an energy efficiency program, see Energy Center of Wisconsin, *Energy Efficiency Guidebook for Public Power Communities* (Madison, WI, October 2009), [www.ecw.org/publicpowerguidebook](http://www.ecw.org/publicpowerguidebook).

- Factors common to successful efficiency programs
- Efficient measures and designs
- Delivery strategies
- Financial impacts on utilities
- Conclusions



**Figure 2.** *Elements of an Energy Efficiency Program*



## ➤ FACTORS COMMON TO SUCCESSFUL EFFICIENCY PROGRAMS


The American Council for an Energy-Efficient Economy has reviewed numerous energy efficiency programs. Several factors appear to be central to successful program implementation. Among their findings are the following:<sup>3</sup>

- **Experience matters.** Learning-by-doing is an important contributor to program success. Many program managers have figured out what works and what doesn't, based on years of practical experience.
- **Credibility counts.** Personal contacts with customers are important in advancing energy efficiency. With regard to an agricultural efficiency program, ACEEE noted that the key to success was having representatives who had a farm background, understood agricultural problems, and were highly motivated. Such representatives are trusted by customers. Also, bringing in recognized outside experts on a particular industry who have worked to improve energy efficiency adds to program credibility.
- **Programs are becoming more comprehensive.** Efficiency programs are tending toward offering multiple measures using multiple delivery strategies instead of focusing on one measure at a time (e.g., lighting) and one delivery strategy at a time (e.g., rebates).
- **Collaboration with stakeholders increases chances of success.** Programs should be designed with input from customers, engineers, architects, designers, contractors and other trade allies, manufacturers, retailers, etc.
- **ENERGY STAR programs are good places to start.**<sup>4</sup> ENERGY STAR® is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. It has developed residential and business energy efficiency programs for: appliances, lighting, heating and cooling, office equipment and electronics, commercial building design, and new homes (covering insulation, windows, tight construction and ducts, heating, ventilation, and air conditioning, appliances, lighting, water heaters, and third party verification). A cooperative or municipal utility does not have to re-invent standards for efficiency measures because the ENERGY STAR program has already developed standards. And consumers can find efficient appliances, for example, by looking for ENERGY STAR labels.

<sup>3</sup> Dan York, Marty Kushler, and Patti White, *Compendium of Champions: Chronicling Exemplary Energy Efficiency Programs From Across the U.S.* (Washington, DC, American Council for an Energy-Efficient Economy, 2008, Report No. UO81), pp. 7-9, and agricultural programs appendix, pp. 1-10 to 1-11.

<sup>4</sup> See ENERGY STAR web site at [www.energystar.gov](http://www.energystar.gov).





Finally, the National Energy Efficiency Best Practices Study reviewed innovations in efficiency program design and concluded that performance and installation quality, especially for lighting, HVAC, and insulation, are important.<sup>5</sup> Some utilities emphasize quality installations as part of their efficiency programs.

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<sup>5</sup> Itron, Inc., *Energy Efficiency Best Practices: What's New?* National Energy Efficiency Best Practices Study (Oakland, CA, 2008), prepared for California Best Practices Advisory Committee. [www.eebestpractices.com](http://www.eebestpractices.com).

## ➤ EFFICIENT MEASURES AND DESIGNS

This section focuses on energy efficiency measures and energy efficient design as exemplified by programs undertaken by cooperatives and public power utilities. Delivery strategies are described in the following section.

To provide context, the list below summarizes major energy saving opportunities through 2030 identified by the Electric Power Research Institute.<sup>6</sup> The asterisks represent the largest savings potential nationally.

RESIDENTIAL OPPORTUNITIES	COMMERCIAL & INDUSTRIAL OPPORTUNITIES
Electronics*	Lighting*
Space Cooling*	Motors and drives*
Appliances*	HVAC*
Lighting*	Ventilation
Water heating	Process heating
Space heating	Water heating
	Refrigeration
	Other*

### LIGHTING

Lighting programs are widely used and large savings have been found by many utilities.<sup>7</sup> These programs consist of replacement of residential incandescent lamps with compact fluorescent lamps (CFLs) and replacement of older light fixtures in businesses with more efficient lighting. Lighting measures suitable for business customers include: efficient exit signs, occupancy sensors, day-lighting, CFLs, more efficient fluorescent fixtures, and de-lamping. More efficient lighting will also produce less heat and thereby reduce air conditioning loads.

To obtain large savings from lighting programs, it is necessary to conduct the program on a massive scale with thousands of participants. Just installing a few hundred CFLs by itself will not help a utility avoid any significant fuel, operating, or capital costs.

<sup>6</sup> Electric Power Research Institute, *Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S. (2010-2030)* (Palo Alto, CA, 2009).

<sup>7</sup> Martin Kushler, Dan York, and Patti White, *Meeting Aggressive New State Goals for Utility-Sector Energy Efficiency: Examining Key Factors Associated with Higher Savings* (Washington, DC, American Council for an Energy-Efficient Economy, 2009, Report No. U091).

## SHADE TREES

Shade trees are a salient design solution for energy efficiency. They can reduce the heat gain in buildings, thereby decreasing air conditioning load. Western Resource Advocates reviewed estimates of energy savings from shade trees in the low desert areas of Arizona and California and found that the median savings estimate is 214 kilowatt-hours (kWh) per year per mature tree; three trees shading a house would save about 642 kWh per year. Savings in other areas would be different. To maximize air conditioning energy savings, shade trees for the Southwest should have a broad spreading form and a dense crown, and should shade windows if possible. Trees should be planted within 15 feet of the west, east, or south side of the house, the west side being considered the best for energy savings.<sup>8</sup>

Shade tree programs have the potential to save significant amounts of electricity if thousands of trees are planted. Because trees take several years to mature and cast enough shade to significantly reduce electricity use, energy savings will occur well into the future and are not immediate, in contrast to measures like CFLs.

Utilities usually do not have the time or expertise to implement a tree planting program by themselves. Rather, a utility shade tree program is typically implemented by a nonprofit organization that specializes in tree planting, has established processes for recruiting homeowner participants and volunteer tree planters, has developed other outreach activities, and educates individuals to properly plant and care for their trees. Two well known programs are those of the Sacramento Municipal Utility District (SMUD) implemented by the Sacramento Tree Foundation and the Roseville Electric program implemented by the Roseville Urban Forest Foundation.<sup>9</sup> Some cooperatives also have tree planting programs – for example, Trico and Mohave Electric Cooperatives in Arizona currently conduct their Operation Cool Shade programs in partnership with county and city governments.

## EFFICIENT POOL PUMPS

Many homes have swimming pools and utilize pool pumps. Arizona Public Service Company (APS) estimates that, in a typical Arizona desert home with a pool, a 1.5 horsepower pool pump motor running eight hours per day will use approximately 4,800 kWh a year. Currently, almost all APS residential customers with swimming pools have inefficient single speed circulation pump motors and

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<sup>8</sup> Western Resource Advocates, *Phoenix Green: Designing a Community Tree Planting Program for Phoenix, Arizona* (Boulder, CO, 2009). On tree form, see E. Gregory McPherson and Eileen Dougherty, "Selecting Trees for Shade in the Southwest," *Journal of Arboriculture* 15 (1989): 35-43.

<sup>9</sup> Sacramento Municipal Utility District, "Free Shade Trees," <http://www.smud.org/en/residential/trees/Pages/index.aspx>. Sacramento Tree Foundation, "We Live in an Urban Forest," <http://www.sactree.com/>. City of Roseville, CA., "Roseville Shade Tree Program," [http://www.roseville.ca.us/electric/shade\\_tree/default.asp](http://www.roseville.ca.us/electric/shade_tree/default.asp). Roseville Urban Forest Foundation, <http://www.rosevilletrees.org/>.

either no timers or timers that cannot adjust the pump to run at different times in different seasons. APS estimated that a variable speed pool pump would save about 2,000 kWh per year, a 2 speed pool pump would save about 1,000 kWh per year, and a digital smart pool timer (to run the pump during off-peak hours only) would save about 1,000 kWh per year.<sup>10</sup> Thus, where swimming pools are common, a cooperative or municipal utility could reduce energy consumption with a pool pump program. Programs that seek to replace old pool pumps with 2 speed, 4 speed, or variable speed or variable flow pumps have been implemented by Gainesville Regional Utilities and by Pasadena Water & Power.<sup>11</sup>

## **PACKAGE OF LOW-COST RESIDENTIAL EFFICIENCY MEASURES**

Most housing units have multiple opportunities for saving energy. Thus, providing a package of several energy efficiency services at one time would have the potential for reducing energy consumption more than a program that focuses on just one end use such as lighting. Further, addressing multiple opportunities for energy efficiency at one time cuts down on transaction costs such as installation visits.

In a direct installation residential program, a package of efficiency measures is installed for the residents when efficiency program staff visit the home, often to conduct an energy audit. In a conservation kit program, residential customers are given multiple measures for household members to install themselves.

Measures for direct installation or to put in a conservation kit could include low-use faucet aerators and low-flow showerheads which save water and energy (for heating water). APS estimates that a low-flow showerhead could save 240 kWh per year and a low-use faucet aerator could save 80 kWh per year.<sup>12</sup> Other measures included in the package could be CFLs, water heater wraps, water pipe insulation, weather stripping, air conditioner filters, and setback thermostats.<sup>13</sup> These packages should be coupled with an active delivery mechanism, as described below.

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<sup>10</sup> Arizona Public Service Company, Request for Approval of 2010 Energy Efficiency Implementation Plan, filed in Arizona Corporation Commission Docket No. E-01345A-08-0172, July 15, 2009, Attachment 1, p. 10.

<sup>11</sup> See Gainesville Regional Utilities, "Pool Pump Rebate," <http://www.gru.com/YourHome/Conservation/Energy/Rebates/pool.jsp>. Pasadena Water & Power, "PWP Efficient Pool Pump Rebate Program," <http://www.ci.pasadena.ca.us/waterandpower/poolpump/default.asp>

<sup>12</sup> Arizona Public Service Company, Request for Approval of 2010 Energy Efficiency Implementation Plan, filed in Arizona Corporation Commission Docket No. E-01345A-08-0172, July 15, 2009, Attachment 2, p. 6. Besides saving on water heating costs, reduced water consumption will decrease the amount of energy consumed to pump and treat water and wastewater.

<sup>13</sup> Southwest Energy Efficiency Project, "Low Cost Energy Efficiency Measures: Neighborhood Blitz, Direct Install and Conservation Kit Programs" (Boulder, CO, 2005).

## COMPREHENSIVE RESIDENTIAL PROGRAMS

Comprehensive home performance programs can be applied to existing homes. They start with a detailed energy audit including blower door and duct blaster tests and a visual inspection. The low-cost package of measures described above would be provided and additional, more expensive, measures would be recommended, as needed. These measures could include duct sealing, air sealing, insulation plus air sealing, shade screens, efficient pool pumps, and HVAC replacement.

Comprehensive home performance programs can also be applied to new construction. For example, ENERGY STAR new homes must be at least 15% more energy efficient than homes built to the 2004 International Residential Code and may include additional features that make them 20% to 30% more efficient than conventional new homes.<sup>14</sup> Savings are obtained from effective insulation, high-performance windows, tight construction and ducts, efficient heating and cooling equipment, and efficient lighting, appliances, and water heaters. The energy efficiency features of ENERGY STAR new homes are verified by third-party energy raters.

Improving the energy efficiency of the whole house requires educating home owners; training for HVAC contractors, builders, electricians, plumbers, insulation installers, and city code inspectors; and educating lenders and appraisers.<sup>15</sup> Financial incentives for qualified contractors may be used to encourage their participation.

## BUSINESS AND SCHOOL PROGRAMS

In general, opportunities for efficiency savings at business establishments include efficient lighting, motors and drives, space cooling, and refrigeration. The opportunities depend on the specific businesses and on the condition and quality of their buildings and equipment. Some cooperatives and municipal utilities serve very large business customers, such as colleges or military bases. These types of customers may be able to reduce energy consumption by thousands of megawatt-hours (MWh) per year. For example, Nolin Rural Electric Cooperative worked with Fort Knox to identify and finance energy efficiency projects such as geothermal heat pumps and efficient lighting, motors, and windows which resulted in annual savings of 13,800 MWh.<sup>16</sup>

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<sup>14</sup> "Features of ENERGY STAR Qualified New Homes," [http://www.energystar.gov/index.cfm?c=new\\_homes.nh\\_features](http://www.energystar.gov/index.cfm?c=new_homes.nh_features).

<sup>15</sup> Brian Dreiling, Midwest Energy, Inc., "Energy Efficiency Program," presentation at the Kansas Wind & Renewable Energy Conference, Topeka, KS, September, 2008, [http://www.kcc.state.ks.us/energy/kwrec\\_08/presentations/C3\\_Dreiling.pdf](http://www.kcc.state.ks.us/energy/kwrec_08/presentations/C3_Dreiling.pdf).

<sup>16</sup> U.S. Department of Energy, Energy Efficiency and Renewable Energy, "Case Study - Fort Knox Strikes Energy-Savings Gold in Partnership with Utility," [http://www1.eere.energy.gov/femp/financing/uescs\\_csknox.html](http://www1.eere.energy.gov/femp/financing/uescs_csknox.html).

Schools consume electricity around the clock and throughout the year, with the highest demand occurring during class hours. The same types of efficiency measures suitable for business customers are generally applicable in schools as well.

Schools and businesses also offer an opportunity to combine efficiency programs with distributed renewable energy projects such as photovoltaics and solar hot water. For example, in Arizona, Navopache Electric Cooperative installed a 50 kW photovoltaic system on Blue Ridge High School and Sulphur Springs Valley Electric Cooperative installed 41 photovoltaic facilities on schools.

Appropriate maintenance of space cooling and heating equipment and automatic lighting controls is necessary, and to maintain these systems, building services managers must have proper training, manuals, spare parts, and budgets.<sup>17</sup> Finally, some school efficiency programs emphasize changes in behavior as well as equipment upgrades. These programs look for low-cost or no-cost savings opportunities to be implemented by the operations staff and by students.<sup>18</sup>

## PROGRAMS FOR AGRICULTURAL CUSTOMERS

Many of the business efficiency measures described above would apply to agricultural operations – e.g., lighting and efficient motors and drives.<sup>19</sup> Because of the great variation in agricultural activities across the country, efficiency programs must be tailored to the predominant types of agriculture in each region. Two examples are summarized below:

- Interstate Power and Light Company in Iowa offers rebates for efficient dairy equipment, fan and ventilation systems, water heaters, lighting, and low-pressure irrigation systems.<sup>20</sup>
- Oregon Trail Electric Cooperative offers rebates for improving the efficiency of irrigation systems to save water and energy. Rebates are available for irrigation system parts and equipment and for more efficient pump motors.<sup>21</sup>

<sup>17</sup> Princeton Energy Resources International, HPowell Energy Associates, and Alliance to Save Energy, *School Operations and Maintenance: Best Practices for Controlling Energy Costs* (Rockville, MD, Westford, MA, and Washington, DC, 2004), prepared for the U.S. Department of Energy, p. 2.

<sup>18</sup> Joseph Hallberg, "Energy: The Green Remedy for Today's School Districts," *School Business Affairs*, July/August 2008: 28-30.

<sup>19</sup> See, for example, Scott Sanford, "Energy-Efficient Agricultural Lighting," (Madison, WI, University of Wisconsin Cooperative Extension A3784-14, 2003). Mike Morris and Vicky Lynn, "Energy Saving Tips for Irrigators," National Sustainable Agriculture Information Service, 2006, [www.attra.ncat.org](http://www.attra.ncat.org). Scott Sanford, "Variable Speed Milk Pumps," (Madison, WI, University of Wisconsin Cooperative Extension A3784-7, 2003).

<sup>20</sup> Interstate Power and Light Company, an Alliant Energy Company, "2009 Iowa Agricultural Energy-Efficiency Program," <http://www.alliantenergy.com/wcm/groups/wcm.internet/documents/contentpage/017134.pdf>.

<sup>21</sup> Oregon Trail Electric Cooperative, "Irrigation Sprinkler and Pump Motor," <http://www.oregontrailelectriccoop.com/irrigationSprinklerPumpMotor.aspx>.



Some farms may also be suitable for distributed renewable energy. For example, animal waste could be used to generate electricity for on-farm use.

### HIGH VISIBILITY DEMONSTRATION PROJECTS

Public buildings and utility headquarters offer an opportunity to demonstrate energy efficient designs and to lead by example. For instance, Midstate Electric Cooperative in Oregon constructed an administration building certified as LEED® (Leadership in Energy and Environmental Design) Gold.<sup>22</sup> Energy efficiency features of the building include: heavily insulated walls, high-performance windows, efficient lighting and day-lighting, a geothermal heat pump, an energy management control system, and a 7 kW photovoltaic system.



Photos courtesy of Great River Energy

*Great River Energy headquarters building*

Great River Energy, a generation and transmission cooperative, constructed a new high performance headquarters building that was certified as meeting LEED Platinum standards. The building was designed to use about half the energy of a comparable facility built to state code requirements and about 90% less water. Great River Energy estimated that the new headquarters building cost about 10% more than a conventional building. Among its energy features are a lake-source geothermal heating and cooling system, day-lighting, a 72 kW photovoltaic system, and a 200 kW wind turbine. Other energy efficiency measures include dimming ballasts and motion sensors for lights, plus windows with high-performance coating to limit heat gain from sunlight. Because of the non-standard design of the building, Great River



<sup>22</sup> Midstate Electric Cooperative, "LEED® Gold Certified Administration Building," <http://www.midstateelectric.coop/about-midstate/leed-building/>



Energy had to work closely with city officials to address such concerns as on-site wind generation and the environmental impacts of the in-lake geothermal heat pump.<sup>23</sup>

The Orlando Utilities Commission's headquarters building is a LEED Gold building that has, among other features, reflective roofing material to reduce heat gain, high-efficiency glass, photovoltaic panels, solar hot water, and day-lighting.<sup>24</sup>

In 2005, Omaha Public Power District, the City of Omaha, and Habitat for Humanity built an energy-efficient, ENERGY STAR house. The house was available for educational purposes during construction.<sup>25</sup>

There is some general information on the costs and savings for LEED buildings. The New Buildings Institute found that, on average, energy use in LEED buildings was about 25% to 30% lower than national average energy use for similar buildings, where energy use is measured in Btu per square foot per year.<sup>26</sup> With regard to costs, a study for the U.S. General Services Administration estimated LEED construction cost impacts for a new courthouse range from slight savings to about an 8% cost premium depending on the LEED rating (Certified, Silver or Gold).<sup>27</sup> More generally, the cost premium of green buildings seems to be quite small – the construction firm Davis Langdon concluded that green buildings and conventional buildings cost about the same, on average.<sup>28</sup>

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23 Great River Energy, "A White Paper on Building for LEED Platinum Certification," 2009. <http://www.greatriverenergy.com/aboutus/ourleedbuildings/leedwhitepaper.pdf>

24 OUC, "The Greenest Building In Downtown," [http://www.ouc.com/en/news\\_and\\_information\\_ctr/green\\_bldg\\_and\\_sustainability/reliable\\_plaza.aspx](http://www.ouc.com/en/news_and_information_ctr/green_bldg_and_sustainability/reliable_plaza.aspx)

25 Nebraska Energy Office, "Habitat for Humanity Goes Green in Omaha," [http://www.neo.ne.gov/neq\\_online/dec2005/dec2005.bytes.htm](http://www.neo.ne.gov/neq_online/dec2005/dec2005.bytes.htm).

26 New Buildings Institute, *Energy Performance of LEED® for New Construction Buildings* (White Salmon, WA, 2008), report to U.S. Green Building Council, <http://www.usgbc.org/ShowFile.aspx?DocumentID=3930>. The national average data are from the Energy Information Administration Commercial Building Energy Consumption Survey. Another analysis of the same data found that, on average, LEED buildings used 18-39% less energy per square foot than similar conventional buildings, but that 28-35% of LEED buildings used more energy than similar conventional buildings: Guy R. Newsham, Sandra Mancini, and Benjamin J. Birt, "Do LEED-Certified Buildings Save Energy? Yes, but ..." *Energy and Buildings* 41 (August 2009): 897-905.

27 Steven Winter Associates, GSA LEED Cost Study, October 2004, report to U.S. General Services Administration.

28 Davis Langdon, *The Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption*, July 2007, <http://www.davislangdon.com/upload/images/publications/USA/The%20Cost%20of%20Green%20Revisited.pdf>

## ➤ DELIVERY STRATEGIES

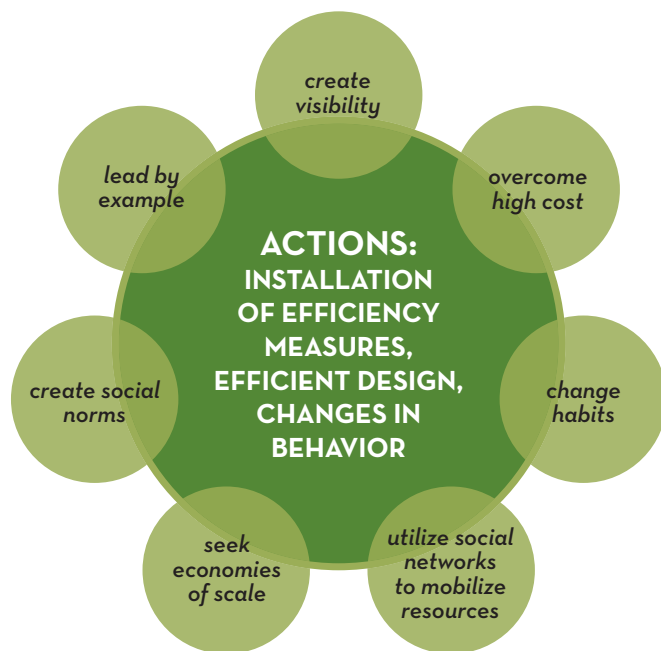
Energy choices are influenced by multiple factors, including habit, attitudes, beliefs, values, social norms, costs and benefits, convenience, and available technology.<sup>29</sup> Therefore, to significantly increase participation in energy efficiency programs, delivery strategies need to address a variety of motivations and obstacles. Financial incentives alone may not capture all the savings that could be attained because they focus only on the costs and benefits of efficiency measures but do not address the role of trust or habit in making appliance or building shell decisions, for example.

To be effective in saving energy, delivery strategies should address the factors influencing energy choices by creating visibility for energy efficiency, overcoming high up-front costs, changing habits, utilizing social networks to mobilize resources, seeking economies of scale, creating social norms, and leading by example. *Figure 3* summarizes the relationships among these delivery tactics, depicted as the outer ring of circles, and the specific actions sought in an efficiency program – installation of efficiency measures, efficient design, and changes in behavior, shown in the center.

This section reviews applications of these tactics through rebates and other financial incentives, large scale give-away programs, partnerships with existing organizations, neighborhood programs, joint utility programs, on-the-bill financing, and peer comparisons. Creating visibility through demonstration projects was discussed in the previous section.

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<sup>29</sup> Paul C. Stern, “Changing Behavior in Households and Communities: What Have We Learned?” in National Research Council, *New Tools for Environmental Protection: Information, Education, and Voluntary Measures* (Washington, DC, National Academies Press, 2002), pp. 201-211. See also Kevin Maréchal, “An Evolutionary Perspective on the Economics of Energy Consumption: The Crucial Role of Habits,” *Journal of Economic Issues* 43 (2009): 69-88.



**Figure 3.** *Delivery tactics and actions*

## REBATES AND OTHER FINANCIAL INCENTIVES

Rebate programs and other financial incentives address the high initial cost of some energy efficiency measures and draw attention to the potential for energy savings. These incentives can be used in conjunction with other delivery programs to motivate adoption of efficiency measures. Several examples of incentive programs are listed below:

- Seattle City Light offers rebates for small business. For example, it provided a rebate of \$1,005 for a \$2,294 project to improve the efficiency of lighting at a restaurant and paid a \$480 rebate for a \$626 project to upgrade lighting at an insurance agency.<sup>30</sup> In this case the use of rebates is part of the utility's neighborhood efficiency programs (described below).
- Pasadena Water & Power offers a rebate of \$200 or more for replacing an old pool pump with a qualifying 2 speed, 4 speed, or variable speed pump. The customer purchases a qualifying pump and submits a form to obtain the rebate.<sup>31</sup>
- Austin Energy offers a Home Performance program with an ENERGY STAR certificate that verifies completion of all efficiency improvements recommended in a home energy analysis. The efficiency improvements pertain

<sup>30</sup> Seattle City Light Smart Business Program, "Case Studies: 14 Carrot Café and Allstate Insurance Agency," [http://efficiencyworks.adhostclient.com/wp-content/uploads/2010/01/web\\_14carrotscl.pdf](http://efficiencyworks.adhostclient.com/wp-content/uploads/2010/01/web_14carrotscl.pdf)

<sup>31</sup> Pasadena Water & Power, "PWP Efficient Pool Pump Rebate Program." <http://www.ci.pasadena.ca.us/waterandpower/poolpump/default.asp>

to residential HVAC equipment, air duct sealing, window treatments (shade screens, films, or low-E windows), and attic insulation. Rebates for installing home performance measures are available up to 20% of the cost, capped at \$1,575. Rebates are available for: air conditioners or heat pumps (14 SEER/11.5 EER or greater), duct repair and sealing, attic insulation, window treatments, caulking and weather stripping, and attic radiant barriers. Low-interest loans for these improvements are also available.<sup>32</sup> In 2008, Austin Energy completed over 2000 whole house retrofits and saved over 4.3 MW of demand.<sup>33</sup>

Also, rebates for purchasing ENERGY STAR appliances (e.g., washers or refrigerators) are commonly used by cooperatives and municipal utilities.<sup>34</sup> And many cooperatives and municipal utilities offer a payment (usually about \$30) for an old, working refrigerator so as to remove second refrigerators and thereby reduce energy consumption.

## LARGE SCALE GIVE-AWAY PROGRAMS

To change consumers' habits, an effective delivery strategy is to simply give low-cost measures to large numbers of customers or install low-cost measures for free for large numbers of customers. In 2008, Delta Montrose Electric Association distributed over 90,000 CFLs to members by mailing coupons redeemable for six free ENERGY STAR-qualified CFLs at a major retailer and distributing CFLs at various events.<sup>35</sup> Lansing Board of Water and Light also has a give-away program for CFLs – residential customers may request a kit containing four free CFLs, but the program exhausted its supply of CFLs in 2009.<sup>36</sup> The Sacramento Municipal Utility District, in partnership with the Sacramento Tree Foundation, gives away free shade trees; since 1990, the SMUD program has planted 450,000 trees.<sup>37</sup> Give-away programs are often included as an element of other delivery strategies, as described below.

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<sup>32</sup> Austin Energy, "Home Performance with ENERGY STAR Certificate," <http://www.austinenergy.com/Energy%20Efficiency/Programs/homePerfCertificate.htm>.

<sup>33</sup> U.S. Environmental Protection Agency and U.S. Department of Energy, ENERGY STAR, "Austin Energy, Austin, Texas: ENERGY STAR Award for Sustained Excellence," [http://www.energystar.gov/index.cfm?fuseaction=pt\\_awards.showAwardDetails&esa\\_id=369](http://www.energystar.gov/index.cfm?fuseaction=pt_awards.showAwardDetails&esa_id=369)

<sup>34</sup> For example, see North Attleboro Electric Department, "2010 Appliance Rebate Program," [http://www.naelectric.com/documents/2010\\_appliance\\_rebate\\_fact\\_sheet.pdf](http://www.naelectric.com/documents/2010_appliance_rebate_fact_sheet.pdf).

<sup>35</sup> Delta Montrose Electric Association, *Power Lines* (newsletter), July 2008. <http://www.dmea.com/Default.aspx?tabid=56>.

<sup>36</sup> Lansing Board of Water & Light, "Free CFLs for BWL Customers," <http://209.123.65.59/CFLightbulbs/>

<sup>37</sup> Sacramento Municipal Utility District, "Free Shade Trees," <http://www.smud.org/en/residential/trees/Pages/index.aspx>.

## PARTNERING WITH EXISTING ORGANIZATIONS

A cooperative or municipal utility can turn to existing organizations to help deliver efficiency measures. These existing organizations have built up social capital over time and created trust within their social networks; the social capital is an asset that may be used to mobilize resources to foster energy efficiency.

A study of a neighborhood energy efficiency program in Omaha<sup>38</sup> found that working with and through established organizations, such as neighborhood associations, churches, schools, and service organizations, can be effective because the organization is regarded as a credible source of information. Neighborhood networks, newsletters, and meetings can be used to provide information about an energy efficiency program and to recruit participants. As another example, the American Council for an Energy-Efficient Economy found that a low income weatherization program in Texas was successful because of the participation of religious and neighborhood nonprofit organizations that encouraged consumers to become involved in the program.<sup>39</sup>

Utility shade tree programs are frequently implemented by partner organizations that have established social networks and have the means to mobilize resources to plant thousands of trees each year through volunteer participation (see *Table 1*). The tree planting organization, typically a nonprofit organization, is responsible for enrolling participants, educating participants on tree planting and maintenance, and, in many cases, obtaining the trees. The utility partner provides funding for the program, including any subsidies for trees.

Programs for agricultural customers could be marketed through existing organizations that have established trusted relationships with the farming community. Agricultural extension services at state universities are one possible partner for delivering energy efficiency programs and many of these services have already prepared information on energy efficiency for agricultural enterprises.

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<sup>38</sup> Daniel Lawse, *Morton Meadows Neighborhood Energy Savings Program*, 2008, pp. 33-34, report to fulfill Masters of Community and Regional Planning, University of Nebraska at Lincoln.

<sup>39</sup> Martin Kushler, Dan York, and Patti White, *Meeting Essential Needs: The Results of a National Search for Exemplary Utility-Funded Low-Income Energy Efficiency Programs* (Washington, DC, American Council for an Energy-Efficient Economy, 2005, Report No. UO53), pp. 108-111.

**Table 1.** Examples of Utility Partnerships for Shade Tree Programs<sup>40</sup>

UTILITY	PARTNERSHIP	UTILITY FUNDING AND RESULTS
Alliant Energy	Branching Out in partnership with Trees Forever	<ul style="list-style-type: none"> <li>• 1,141,529 trees planted</li> <li>• Project matching funds = \$2,346,314</li> </ul>
Alliant Energy	Operation ReLeaf in partnership with the Iowa Department of Natural Resources and Iowa County Conservation Boards	<ul style="list-style-type: none"> <li>• 45,300 trees</li> <li>• Customer pays \$25 and Alliant Energy subsidizes the remaining cost</li> </ul>
Roseville Electric	Roseville Shade Tree Program in partnership with Roseville Urban Forest Foundation	<ul style="list-style-type: none"> <li>• 14,000 trees</li> <li>• Up to \$30 bill credit per qualifying tree</li> </ul>
Tucson Electric Power	Partnership with Trees for Tucson	<ul style="list-style-type: none"> <li>• 57,500 trees planted</li> <li>• Utility subsidy reduces tree price to \$8</li> </ul>
Sacramento Municipal Utility District	Partnership with Sacramento Tree Foundation	<ul style="list-style-type: none"> <li>• 450,000 shade trees planted</li> <li>• Free shade trees for residential customers</li> </ul>

## NEIGHBORHOOD PROGRAMS

Neighborhood programs concentrate the delivery of efficiency measures in a geographically limited area and may enable a utility to increase participation rates through neighborhood social networks. This approach has been used with low income programs but it is more generally applicable.<sup>41</sup> For a cooperative serving a rural area, a neighborhood may be a small town.

Seattle City Light has a neighborhood power project that focuses on one neighborhood at a time. The utility distributes free CFLs, aerators, and showerheads, plus conducts free home inspections. Lighting rebates are offered for small business.<sup>42</sup> Besides energy savings, the neighborhood programs address water use, wastewater, and solid waste. Between 1995 and 2008, there have been 13 neighborhood power projects. As an example, in the West Seattle Neighborhood Power Project, 12,000 CFLs were distributed, 450 aerators and efficient showerheads were distributed, 100 small businesses had efficient lighting installed, 188 audits were conducted, and energy conservation workshops were held.<sup>43</sup>

## JOINT UTILITY PROGRAMS

Small utilities working by themselves often cannot undertake large-scale efficiency projects. They may not have the staff to do so or the funding to pay someone else to design or implement a large program. In addition, they would not

<sup>40</sup> Table taken from Western Resource Advocates, *Phoenix Green: Designing a Community Tree Planting Program for Phoenix, Arizona* (Boulder, CO, 2009).

<sup>41</sup> Southwest Energy Efficiency Project, "Low Cost Energy Efficiency Measures: Neighborhood Blitz, Direct Install, and Conservation Kit Programs" (Boulder, CO, 2005).

<sup>42</sup> Seattle City Light, "Neighborhood Power Project", <http://www.seattle.gov/light/conserves/neighborhood/Power/>.

<sup>43</sup> Seattle City Light, "2006/7 Accomplishments, West Seattle Neighborhood Power Project."



be able to achieve economies of scale or scope or have sufficient market clout to get good prices on efficient equipment. However, programs offered jointly by several small utilities may be able to achieve these economies. Generation and transmission cooperatives can play a central role in developing joint programs for their retail cooperatives who, in turn, offer the programs to their retail members.

The 20 cooperatives served by the Electric Cooperatives of South Carolina (ECSC) are working together in a CFL give-away program called "Do the Light Switch." The purpose of the program is to distribute seven million CFLs to residential members over a 10 year period. In the first year of the program, each residential member received, through the mail, two CFLs and information on CFLs. In 2009, each residential member was to receive one CFL by mail.<sup>44</sup>

### ON-THE-BILL FINANCING

On-the-bill financing reduces or eliminates up-front customer costs for relatively expensive efficiency projects such as insulation, air sealing, and installation of more efficient heating and cooling systems. Participants pay for the efficiency measures on their monthly electric bills; their reduced energy consumption offsets the monthly charge for the measures.

An example is Midwest Energy's How\$mart program for residential and small commercial customers.<sup>45</sup> A participant in this program begins with an energy audit which may include duct testing, blower door tests, infrared scans, insulation inspections, and HVAC size calculations. Eligible efficiency measures must be a permanent part of the structure and do not include CFLs or appliances. Contractors bid to perform the recommended work, and the customer provides bids to the utility for recommended measures. After the measures are installed, the utility pays the contractor and adds a surcharge to the customer's bill to recover the payment. In Midwest Energy's program, the monthly surcharge is less than the savings.<sup>46</sup> As of September 2008, 60 projects were completed and 130 were pending. The average project cost about \$4,500.

Capital for the program comes from the Kansas Housing Resources Corporation, with 0% interest, and from internal funds from Midwest Energy which do have carrying costs. Midwest Energy also adds a fee to help cover auditing costs. The

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<sup>44</sup> The Electric Cooperatives of South Carolina, "Do the Light Switch," [www.ecsc.org/index.php?option=com\\_content&task=view&id=294&Itemid=3070](http://www.ecsc.org/index.php?option=com_content&task=view&id=294&Itemid=3070)

<sup>45</sup> Michael Volker, "How\$mart: Tearing Down Barriers to Energy Efficiency," presentation at the Kansas Wind and Renewable Energy Conference, September 24, 2008. See also: "How\$mart®," <http://www.mwenergy.com/howsmart.aspx>; "Improve Your Home's Energy with How\$mart," [http://www.mwenergy.com/documents/howsmart/How\\$mart.pdf](http://www.mwenergy.com/documents/howsmart/How$mart.pdf).

<sup>46</sup> The surcharge is tied to the location, not the customer.



interest rate inherent in the combined financing is about 4%.<sup>47</sup>

New Hampshire Electric Cooperative (NHEC) offers an on-the-bill financing program, called SmartSTART, for energy efficiency retrofits for commercial and industrial customers. NHEC pays for the efficiency measures and the customers repay NHEC on their monthly electric bills (plus a monthly program charge). The repayment amount is less than the value of the energy savings so customers see a benefit immediately. If a participating member moves, the repayment obligation transfers to the new occupant of the site with the efficiency measures. If an efficiency measure fails and cannot be repaired, the repayment obligation ceases. The program can be used for lighting retrofits, weatherization, and other approved efficiency measures. As of October 2008, there were 23 open loans. NHEC caps its exposure at \$1 million at any time.<sup>48</sup>

Lastly, the Fort Knox projects described above were delivered through on-the-bill financing in which the customer repays the loan over a 10 year period as part of the electricity bill. The project costs are offset by energy savings. Capital was provided by the National Rural Utilities Cooperative Finance Corporation.<sup>49</sup>

## PEER COMPARISONS

Information programs that provide report cards to residential customers comparing their electricity use with similar customers are potentially useful. The expectation is that peer comparisons will create a social norm for energy efficiency so that customers change their habits and reduce electricity use. In a pilot peer comparison program conducted for the Sacramento Municipal Utility District, average annual energy savings for residential participants were about 250 kWh (about 2.2%).<sup>50</sup> It is not known what actions recipients of the report cards took – they may have altered their behavior (for example, turning out lights or raising the thermostat during the summer) or installed more efficient devices such as CFLs. Long term persistence of savings has not yet been evaluated.

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<sup>47</sup> Merrian Fuller, *Enabling Investments in Energy Efficiency: A Study of Energy Efficiency Programs that Reduce First-Cost Barriers in the Residential Sector*, Master's Thesis, Energy and Resources Group, University of California, Berkeley, 2009.

<sup>48</sup> New Hampshire Electric Cooperative, "SmartSTART," [http://www.nhec.com/businessenergysolutions\\_smartstart.php](http://www.nhec.com/businessenergysolutions_smartstart.php). Ray Gosney, "NHEC Perspectives on Energy Efficiency and Sustainable Energy," presentation to New Hampshire Energy Efficiency and Sustainable Energy Board, October 17, 2008. <http://www.puc.nh.gov/EESE%20Board/101708Mtg/NH%20Electric%20Co-op%20Presentation.pdf>.

<sup>49</sup> This financing is available to federal agencies. See U.S. Department of Energy, "Case Study – Fort Knox Strikes Energy-Savings Gold in Partnership with Utility," [http://www.eere.energy.gov/femp/financing/uescs\\_csknox.html](http://www.eere.energy.gov/femp/financing/uescs_csknox.html).

<sup>50</sup> Summit Blue Consulting, *Impact Evaluation of Positive Energy SMUD Pilot Study* (Boulder, CO, May 26, 2009), report to Positive Energy. Ian Ayres, Sophie Raseman, and Alice Shih, "Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage," Yale Law School, 2009.

## COMBINED DELIVERY STRATEGIES

As indicated at the beginning of this section, consumer decisions are driven by multiple factors. Therefore, to increase savings from energy efficiency programs, it is desirable to combine program delivery tactics and strategies. Some possible combinations are:

- Partnerships with community organizations + neighborhood programs (e.g., for shade trees and low-cost residential and small business measures)
- Give-away programs + peer comparison report cards (e.g., providing CFLs, conservation kits, and report cards for residential customers)
- Give-away programs + joint utility programs (e.g., the South Carolina CFL program)

## COORDINATION WITH TRADE ALLIES

Trade allies are often important actors in an efficiency program. These allies can include, for example, retailers who sell efficient lighting or appliances; manufacturers of efficient equipment; architects and designers; home builders; contractors who market and install efficient measures like high SEER central air conditioners or efficient pool pumps; and contractors who inspect and repair ductwork. The entire supply chain must function if efficient measures are to be installed. Additionally, the workforce throughout the supply chain must be adequately trained to acquire, market, and properly install efficient equipment. Thus, an element of a delivery strategy is coordination with trade allies in the supply chain.

Because work with trade allies is often industry-specific and because actual delivery of efficiency measures may require specialized knowledge and marketing skills, utilities frequently out-source delivery activities to firms specializing in efficiency program implementation or in working with manufacturers and distributors of efficient devices. Doing so may deliver greater savings at lower cost than the staff of a cooperative or municipal utility can achieve.

## ➤ FINANCIAL IMPACTS ON UTILITIES

Cooperatives and public power utilities will experience program costs as they implement efficiency programs – administrative costs, the value of incentives, and the like. In mature efficiency programs, the cost to the utility of saved energy has been around \$0.02 to \$0.04 per kWh saved (2006 dollars), but costs can be higher than this.<sup>51</sup> Costs appear to be affected by economies of scale and scope and by learning-by-doing. Typically, program costs are recovered in rates, often by using a system benefit charge or similar charge.

In addition, utilities will face a decline in revenues as kWh sales decrease. Some of the revenue decline will be matched by a decrease in variable costs (e.g., reduced fuel costs or reduced environmental regulation compliance costs). But the decline in revenues may also reduce the ability of a cooperative or public power utility to recover fixed costs, given current rate designs. The magnitude of unrecovered fixed costs (also called lost net revenues) is often controversial because there are many factors affecting revenues and avoided costs, and they cannot be clearly sorted out. These factors include customer growth, changes in consumption in response to price changes, and changes in weather. In addition, as energy efficiency impacts take hold, a utility will be able to avoid or defer acquiring new generating capacity which will affect revenue requirements and rates going forward.

Determining the proper recovery of unrecovered fixed costs is a difficult task. Policy is likely to evolve as the issues become better understood.

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<sup>51</sup> Kenji Takahashi and David Nichols, “The Sustainability and Costs of Increasing Efficiency Impacts: Evidence from Experience to Date,” presentation at the 2008 ACEEE Summer Conference, 2008, <http://www.synapse-energy.com/Downloads/SynapsePresentation.2008-08.0.Sustainability-and-Costs-of-Efficiency-Impacts.S0051.pdf>. Arizona Public Service Company’s proposed 2010 energy efficiency implementation plan is expected to incur utility program costs of about \$0.014 per lifetime kWh saved: Arizona Public Service Company, Request for Approval of 2010 Energy Efficiency Implementation Plan, filed in Arizona Corporation Commission Docket No. E-01345A-08-0172, July 15, 2009.

## ➤ CONCLUSIONS

Managers and directors of cooperatives and municipal utilities who are seeking to develop their energy efficiency programs can draw upon the experience of others. This report has described programs of some leading cooperatives and municipal utilities to improve the energy efficiency of their customers and members. These programs seek to deploy a range of efficiency measures using both traditional financial incentives and innovative delivery strategies. A summary is presented in *Table 2*.

The most important factor in achieving high levels of savings with energy efficiency programs is an effective delivery strategy that will result in large numbers of participants. The row entitled “Tactics” in *Table 2* indicates how each delivery strategy works.

In general, participation in efficiency programs will increase if multiple delivery mechanisms are combined into an internally consistent strategy to create visibility for energy efficiency, overcome high up-front costs, change habits, utilize social networks to mobilize resources, seek economies of scale, and create social norms.

**Table 2.** *Examples of Efficiency Measures and Delivery Strategies*

DELIVERY STRATEGIES									
	REBATES AND OTHER FINANCIAL INCENTIVES	GIVE-AWAY PROGRAMS	PARTNERSHIPS WITH COMMUNITY ORGANIZATIONS	NEIGHBORHOOD PROGRAMS	JOINT UTILITY PROGRAMS	ON-THE-BILL FINANCING	PEER COMPARISON REPORT CARD	LEADING BY EXAMPLE	
<b>Tactics</b>	Overcomes high up-front cost; creates visibility	Changes habits; creates visibility	Utilizes social networks to mobilize resources	Utilizes social networks to mobilize resources	Seeks economies of scale	Overcomes high up-front cost	Creates social norms; changes habits	Creates visibility	
<b>Lighting measures</b>	Seattle City Light	Delta Montrose, ECSC, Lansing BWL		Seattle City Light	ECSC				
<b>Shade trees</b>	Roseville Electric	SMUD	SMUD, Roseville Electric						
<b>Pool pumps</b>	Pasadena W&P, Gainesville Regional Utilities								
<b>Low-cost package (CFLs, aerators, showerheads, etc.)</b>		Seattle City Light		Seattle City Light					
<b>Home performance (high cost measures)</b>	Austin Energy					Midwest Energy			
<b>Business and school measures</b>						Nolin REC, NHEC			
<b>Agricultural measures</b>	Oregon Trail Elec. Coop.								
<b>General efficiency improvement (behavioral changes or installation of efficient devices)</b>							SMUD		
<b>Demonstration projects</b>								Midstate EC, Great River Energy, Orlando UC, Omaha PPD	



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