The Next Big Thing after CFLs

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ABSTRACT

How will energy efficiency programs make their savings if CFLs are disallowed? Nearly 60 percent of utility electric savings goals are met through lighting, and in the residential sector, CFLs savings dominate these lighting savings. Some commercial sector electric savings also comes from CFLs. CFL saturation has increased recently, prompting questions about whether energy efficiency programs should continue to promote CFLs and be allowed to claim credit for CFL savings in the future. Some observers suggest that programs should drop their support for plain vanilla CFLs since the market is functioning well for this product category. This paper will discuss the consequences of limiting program support for CFLs.

What is the next big thing, the measure(s) that will drive program savings as CFLs have done in the past? If programs transition out of CFLs, they may need to step up emphasis on multiple existing program components and start promoting new technologies as well, to fill the vast savings void. One option is to redirect resources to other lighting categories, such as high color temperature lighting, Cold Cathode CFLs, LEDs, Induction Lighting and Organic LEDs. Another promising area is early replacement of refrigerators and secondary refrigerator and freezer removal. Fuel switching in water heaters and dryers is another promising area. Issues with these technologies and programs include market penetration, counting net to gross savings, and how to increase the savings yield. Non-energy benefits include removal of non-CO2 Greenhouse Gases from the environment and the opportunities for funding such programs through carbon credits under a cap and trade system. Not a technology at all, behavior is also considered as a possible next big thing in stopping energy waste.

Introduction

For the last decade, the CFL has been the indisputable king of energy efficiency technologies, delivering most electric savings for utility energy efficiency programs. But will the CFL be a victim of its own success? Rebate and buy down programs may withdraw their support. Some programs have already ended their active intervention in CFL markets (Canseco, Rasmussen & Teja 2007). Going forward, regulators and other decision makers may not allow energy efficiency programs to claim credit for CFL savings.

The argument is that the CFL market, which is now strong, will increase CFL saturation effectively and efficiently without outside intervention. Thus, it would be a waste of public money to support CFLs further. Indeed, it is difficult to assess the importance of programs at this time. CFLs appear to be selling well without active programs. In Wisconsin for example, sales of CFLs outside of rebate or energy efficiency promotions were almost three times the program-induced sales in 2006. Would it make sense to reduce funding for CFLs in order to free up funding to promote other energy efficient technologies?

Withdrawing credit for CFL sales would be a sea change for energy efficiency programs. Programs depend heavily on CFLs to meet their energy savings goals. Using examples from Wisconsin, this paper will review the options for getting savings without the traditional CFL program. If CFLs cannot be credited, what is the "next big thing," the next technology or approach that programs can leverage to meet their energy savings goals?

If CFLs are Denied Credit: The Size of the Problem

Nearly 60 percent of utility electric savings goals are met through lighting. For example, Table 1 shows the role of lighting savings in Wisconsin's program.

Table 1. Electric Savings by Measure, WI Focus on Energy July 1, 2001 – December 31, 2009

	Residential	Business
CFLs	65%	16%
Other Lighting	8%	37%
Non-Lighting	27%	47%
Total	100%	100%

Source: PSCW 2010d

While CFL markets have matured considerably, there is still a long way to go to achieve market transformation. Even in regions where strong CFL promotions have been going on for a decade, saturation is only 20% (PSCW 2010a; Johnson & Gaffney 2009). Will progress in CFL markets stall? CFL shipments into the U.S. plateaued in 2007 and have been falling. Presumably, the fall signals that programs have finished reaching the easiest part of the market. One third of households still do not have any CFLs. Another third have few CFLs. Programs can focus on these ample opportunities. New factors contributing to the decline in CFL sales include the collapse of the real estate market and general downturn in the economy. However, other pressures may boost the CFL market soon. The Energy Independence and Security Act of 2007 (EISA) will require general service screw in lamps to reduce electric use by 25% compared to standard incandescent lamps. This will take effect between 2012 and 2014 and is expected to increase CFL sales.

Why Were CFLs So Dominant?

Speculating about why CFLs were so dominant in achieving energy efficiency may provide some clues about the technology characteristics needed to be the "next big thing." Table 2 below shows a list of characteristics of CFLs that may have contributed to their effectiveness as a tool for energy efficiency programs in the past decade. A few other technologies are included for comparison.

Table 2. Characteristics of CFL and Other Technologies

Characteristic	CFLs	Refrigerator/ Freezer	Water Heaters	Clothes Dryers	Plug Load
Addresses a technology ubiquitous in homes and businesses	▲	▲	▲	▲	▲
Short lifetime of predecessor, readily available alternative	▲	△	△	△	▲
Low per-unit cost. Can change one or two at a time, low capital cost	▲	△	△	△	
Universal base, can use even when it is not a perfect solution	▲	△	△	△	▲
Little seasonality of operation	▲				
Easy to store for replace-on-failure	▲	△	△	△	
Cuts peak demand	▲	▲	▲		
DIY. No professional installer required	▲	△	△	△	
Business sector crossover	▲	▲	▲	△	▲

▲= Yes   △= No

Replacing CFL Savings

Energy efficiency programs will have to work hard to replace the savings they achieved with CFLs. Most likely programs will need to diversify the technologies they promote. The search for the next big thing(s) could be viewed in a short term (two year) and medium term (five year) perspectives. Table 3 below shows some of the measures that will be discussed in this paper, compared to the equivalent savings in terms of CFLs. A CFL was assumed to have an annual savings of 43.5 kWh per year (PSCW 2010c).

Table 3. Example of Measure Savings in CFL Equivalents

	Savings (kWh per year)	Number of CFL equivalents
CFL	43.5	1
Behavior program for one household	305	7
Early refrigerator replacement	700	16
Water heater fuel switch	2,890	66
Electric dryer fuel switch	500	12
TV or computer monitor	11-76	2

Short Term – Specialty CFLs

Over the next two years, specialty CFL and non-CFL lighting technologies could be the next big thing. Fortunately, energy efficiency programs already know a great deal about promoting certain types of lighting and can keep their dealer relationships in place with only modest tweaks. However, there is opportunity to expand these programs and build completely new ones, especially in the commercial sector. Programs can further improve and diversify their distribution methods by promoting to business sectors and building types that have not been reached yet. Programs could focus on business sectors that are heavy users of incandescents and have long hours of use, such as retail. The savings result will be quicker than placing the same lighting in a residential setting.

The savings potential for "plain vanilla" CFLs still dwarfs all other residential opportunities. However, "specialty" lamp categories do present considerable opportunity. So far, most CFLs sold have been bare, twist-style CFLs in standard sizes to replace 60w or 100w incandescent lamps. For example, in Wisconsin homes only 6% of CFLs installed are specialty-type CFLs (PSCW 2010a). In the future, specialty CFLs could play a larger role in achieving savings. On Wisconsin, sockets currently filled with *specialty incandescents* include 13 million floodlights, eight million candelabra base, and 7.7 million globes. Virtually all of these could be converted to specialty CFLs. While each opportunity is small, the cumulative impact could be large. In California homes, nearly 200 million sockets currently contain incandescent equivalents of specialty lamp types, about half of which are being used in locations with relatively high expected hours-of-use and low switch rates (Johnson & Gaffney 2009).

Barriers to specialty CFLs in the past were low consumer awareness and poor availability of the product in stores. Now, more CFL and LED alternatives are available for these applications, and programs can work on raising awareness. Program designers should note that EISA will not affect certain specialty bulb categories, including: reflector, 3-way, candelabra shaped, bug lights, or very low or high wattage incandescents. Shifting resources to better promote specialty CFLs would be a logical extension of existing CFL programs.

Other resources can help programs, too. The "Lighting for Tomorrow" contest has identified dimmable twist-style and flood-style CFLs that have high quality and performance, with a reasonable price point. The "SuperLamp" initiative is developing a better dimmable covered CFL. Programs can also build on continual new technology developments, such as dimmable cold cathode CFLs that are more available now than a few years ago.

Watt Watchers and Amps Anonymous: It's All About Behavior

Increasingly, energy efficiency programs are contemplating an old source of energy savings potential: human behavior change. No devices are needed to reap these savings. In fact, behavior change is often necessary to reap the full savings potential of new technology. The aggregate size of savings available through behavior change is large. Furthermore, changing behavior is not necessarily as difficult as may be assumed. However, it is important to use the behavioral science that is available and to recognize humans' emotional motivations and roles as social actors (Ehrhardt-Martinez, Laitner & Reed 2008).

For example, loss aversion trumps gains in happiness. Bounded rationality means that "simple" works and that too much information can overwhelm and de-motivate. A lottery type reward system is more effective than one that guarantees small gains, because there is a bias in the human psychology toward the likelihood of small probability events actually happening, and happening to "me." This means that it is difficult to motivate someone to get up off the couch to turn off a light or other device that will ensure savings of several pennies on their electric bill. There is also a procrastination tendency. Humans live in the present and the current self is favored over the future self. This means that the current self wants the future self to get things done like turning off an unused light. The problem occurs when tomorrow comes and the future self becomes the current self and wants the person they will become on the third day (tomorrow's tomorrow) to turn off the lights. Humans are also creatures of habit and social norms. Good habits can be repeated enough, and then made to stick, just like bad habits that persist.

Program designers can take a cue from coaches, trainers and counselors in other fields to ensure the success of behavior modification efforts that seek energy conservation. For example, social accountability can be used to modify behavior. Oprah's "no phone zone" challenge is an interesting recent example of a behavior change campaign similar to the CFL campaigns "Change a Light" or "Operation Porchlight" in Canada. Lessons can be learned from many behavior campaigns related to serious health risks such as obesity and smoking. Fortunately, saving energy is far easier for most of us than losing weight or quitting smoking. Furthermore, behavioral programs may have a synergistic effect when combined with other efforts. Oprah's pledge is reinforcing policymakers drive to legislate against texting and driving, and First Lady Michelle Obama's no childhood obesity drive could be changing the policy dynamic on nutrition labeling. Similarly, energy efficiency behavioral programs may also reinforce public support for future mandatory programs to reduce energy use through technology and policy changes.

The major challenge of behavioral programs is to address the persistence problem. One example of a behavioral program is estimated to have the potential to reduce a household's electric consumption by 305 kWh per year (Allcott & Mullainathan 2010).

Medium Term – LEDs, Induction Lighting, T-8s

Over the next three to five years, some of the lighting technologies to focus on include LEDs and induction lighting. Energy Star guidelines for LEDs will enhance the ability to market LEDs as reliable products with great energy savings potential. Since they are newly available, free ridership should be small. One limitation is cost. In 2-3 years, the cost will be $25 for non-dimmable and $50 for dimmable LED lamps for general lighting applications. LEDs will be most applicable initially in special applications such as replacing MR-16 halogen spot lights, decorative lighting, grocery refrigerator case lighting, and commercial signage. LED traffic signals were an early opportunity that has been largely realized. Now, LEDs and induction lighting show promise for parking lot and street lighting.

With the right attention, other lighting technologies could be bigger players, particularly in the commercial sector. One might expect the biggest opportunity in this sector to be upgrading fluorescent office lighting. However, progress in this area has been slow. In many cases, CFL savings appears to overshadow savings from T8s. Why?

A new program approach is needed to catalyze the energy efficient commercial fluorescent T8 lighting market. The ingredients for success are in place, including test protocols, commercially-available products, and decent savings and paybacks. The energy saving potential is large. Information from 2004-05 indicates that high performance T8s were 5% of the T8 market, while reduced wattage T8 systems comprised another 10% (CEE 2008). This implies that 85% of purchases in this market were lost opportunities at that time. High Performance T8 systems have an annual savings potential in the US of 16.5 TWh or 16,500,000 kWh, assuming that all T12s and standard T8s were replaced. Alternatively, using a different technology of reduced wattage T8s, the lighting energy used by commercial T12 and T8 lighting could be reduced by 17.25 TWh to 24.65 TWh, or 35-50%. High color temperature lighting can be bundled with a T8 upgrade to further increase savings, where this type of light is acceptable. While new data on the current situation will be available soon, it appears that installing the best T8s still has great savings potential. Could a new program approach change this?

Medium Term – Refrigerators and Freezers

Refrigeration is another familiar savings opportunity that deserves closer examination. Increasing the replacement and removal of residential refrigerators and freezers could yield significant savings. Unfortunately, energy efficiency programs have not been able to promote refrigerator replacement consistently in recent years. Program rebates for these products had dwindled in some regions until being revived recently by the national stimulus program, ARRA.

Accelerating early replacement is a promising approach. With *early* replacement, 700 kWh savings per unit is possible, while many rebate programs now save only 100kWh per replacement because they focus on replacing refrigerators at the end of their lives, or replace-on-failure. Replacing a typical unit consuming 1200 kWh per year early with a 500 kWh unit yields 700 kWh in savings (Dalhoff 2008). At the high end, one Oregon early replacement program saved an average of 1,146 kWh for every refrigerator replaced (Ferington & Scott 2008). Programs can increase savings by providing higher incentives for better-than-ENERGY STAR performing units (such as CEE Tiers 2 and 3). Whirlpool now produces a 19 cubic-foot freezer-on-top unit that uses less than 350 kWhs per year. Incorporating freezers into programs is another opportunity.

While the low income sector may differ somewhat, it provides useful suggestions of what might be possible in the general residential sector. To give a sense of the size of opportunity, in Wisconsin, the low income weatherization program is replacing refrigerators in nearly half the homes they serve. The program uses the general rule of replacing refrigerators manufactured prior to 1993, or those with R12 refrigerant. The program allows the computerized NEAT audit tool to override this rule, in those cases where the NEAT audit is used. Refrigerators younger than 1993 could be cost effectively replaced in many cases (Pigg 2008). A study looked at 380 NEAT audits from the Wisconsin low income weatherization program and found that it was cost effective to replace three-fourths of refrigerators 10-14 years old and 29% of refrigerators 5-9 years old. Wisconsin's weatherization program has also found it cost effective to replace freezers in one tenth of the homes they serve (using non-DOE funding). DOE should modify its guidelines for low income weatherization programs to allow use of DOE funds to replace freezers, as they do with refrigerators.

Refrigerator recycling can remove unneeded units from the grid and/or partner with a replacement program. Refrigerator recycling programs in California yielded gross savings of 960 kWh to 1,130 kWh per unit (CPUC 2010, SMUD 2007). Removal particularly remains a promising opportunity. Even in the households recycling programs reach, there remains additional potential for removing secondary refrigerators from the grid. Survey data suggests that over a third of households in Southern California still retained a secondary refrigerator after participating. Furthermore, many participants did not know that keeping these secondary units operating cost them a considerable sum (SCE 2010).

Program tweaks could boost savings. Techniques to further promote refrigerator and freezer replacement and removal include targeting all refrigerators and freezers at a home, including units in garages, porches and basements; providing higher payments for removal; and allowing upright freezers to be replaced with chest or upright models given certain cost guidelines. Wisconsin's weatherization program offers a $100 bounty for removal of a refrigerator or freezer. For replacements, further energy and cost savings come from specifying refrigerators that are top freezer automatic defrost with no through the door ice or water and no automatic ice-maker, matching unit size to household size, and acquiring in bulk to keep the prices down. Recycling is important to keep wasteful units off the secondary market. Better informing customers of the cost of operating a second unit might help also.

Programs could move toward more aggressive promotion by using direct install, targeted direct mail, or other hybrid program outreach approaches that do not rely on passive in-store rebates alone. Programs can further shore up savings by targeting high use facilities such as child care centers, community-based residential facilities, pre-release and halfway houses, and shelters. Multi-family buildings and even commercial businesses with residential-type refrigerators should be included to maximize participation. Retail rebates for higher efficiency units could be tied to a bounty payment for old units picked-up free of charge at the time of new refrigerator delivery.

Medium Term – Fuel Switching

Fuel switching is another opportunity for the medium term. Switching water heaters and clothes dryers from electric to natural gas or propane promises considerable savings. Vermont estimates that over 44% of their achievable electric savings in the residential sector through 2015 could come from fuel switching of electric water heaters (VDPS 2007). In Wisconsin, homes with natural gas service and electric water heaters amount to 16% of all single family homes, but the switching is not often done at time of water heater replacement (ECW 2000). To speed up the conversion, programs could target for conversion all electric water heaters in homes where gas is available, regardless of age of the water heater. Small commercial facilities could be included in such a program. Gas usage may be reduced further by installing a tankless or condensing gas water heater replacement. The new availability of the Energy Star label for water heaters will be a useful tool for identifying and promoting the most efficient water heater replacements. Programs are anticipating the availability of residential sized gas condensing water heaters, and these hold particular promise for broad scale energy saving. Switching from an electric water heater to a .64 EF power vented natural gas water heater would produce an average electric savings of 2,890 kWh per year per unit, with a gas penalty of 136 therms per year. (PSCW 2009).

Savings estimates may be conservative, since 60 degrees F is the assumed input temperature for water. Water may actually be coming in colder in the winter in many cases. Thus energy use for current electric hot water heaters may be higher than estimated in winter, masked by PRISM (Princeton Scorekeeping Method) analysis using averages. Thus, there may be more winter seasonal use of hot water and less use of space heating than is generally believed.

For homes without piped gas, switching to solar hot water or heat pump water heating has good potential. With the 30% federal tax credit for solar combined with state and utility incentives, it is not uncommon for solar water heaters to receive more than a 50% subsidy on the first cost. Solar thermal systems priced around $10,000 and meeting a solar fraction of 0.7 are typical for northern climates with even better results seen in southern states.

All of the major water heater manufacturers now have heat pump water heaters which dramatically cut electric use. This is a great option for homes not served with piped gas and who lack good solar access and/or financial subsidy for solar. The cost, and need for a cool basement and sound issues are considerations however.

In 2001, 45 percent of U.S. households had electric clothes dryers, amounting to about 5.8 percent of total residential electric usage (EIA 2001). An electric clothes dryer used 914 kWh per year on average in 2003, according to a Canadian government web site. However, preliminary estimates by DOE are considerably lower, about 450-500 kWh/yr. (DOE 2010). Shipment data from the Association of Home Appliance Manufacturers (AHAM) since 1970 suggests that almost three-quarters of clothes dryers in Wisconsin are electric, but a large share of these homes have gas service. This represents a significant opportunity for fuel switching. Replacing an electric dryer with gas would reduce electric use but impose a gas penalty. DOE estimates the penalty to be 1.45-1.65 MMBtu or 14.5-16.5 therms. Because washers and dryers are paired together and are usually replaced simultaneously, fuel switching programs could also provide an incentive to switch to Energy Star or better clothes washers that also use less water. These units cut drying time in half with centrifugal force during the spin-wash cycle.

Medium Term – Plug Loads and Electronics

Plug load and electronics are another opportunity. This is a significant, but little-understood area. In Wisconsin about 20% of home electricity usage comes from plug-in devices. As a component of that, 12% of electric use is from electronics in particular, including TVs, computers, etc. One problem in addressing these technologies is the rapid evolution in the products and the diversity of product types. Furthermore, energy efficiency programs have little familiarity with exploiting this opportunity. One challenge for programs addressing plug load is the uncertainty about persistence due to the behavioral component. “Computer power management,” is an approach to program the computer to go into a low power “sleep” mode while not being actively used and has shown some promise over the last five or ten years. Smart power strips are a similar technology approach to achieve a similar goal for plug-in devices. Using upstream approaches and targeting the business sector first might make sense. Targeting either a home TV, monitor, or computer for savings would yield savings of 11-76 kWh per unit (PSCW 2010b).

To supplement upstream approaches, end user program delivery could include enlisting the mobile professionals who currently help residential users solve their computer problems. They could be called “geeks stopping power leaks.” Perhaps the same crew could harvest mop-up lighting savings while on site. The service could be sold as a home electronics tune-up, a direct install approach.

Medium Term – The Doctrine of Shock, Natural Disaster Strikes

7-11-2009, 3:30 a.m.: Two inches of hail suddenly falls in ten minutes on suburbs in Northeast Madison, WI. A day later the insurance industry declares a disaster area and storm chasers arrive in droves along with a few local TV media camera crews. Over the next three months, almost every home is re-roofed and about two-thirds receive new siding, paid for through insurance claims.

The several hundred homes in and around the Sandberg Bluff of NE Madison, WI (where one author lives) were constructed in the 1960s, most with 1.5 inch thick fiber glass batts floated into the above-grade 2x4 exterior walls. The batts were only tacked to the wall headers and footers with no staples used to tack the sides of the batts to the studs, rendering this modest insulation essentially useless. Witnessing and speaking with several dozen roofing and siding contractors trolling and working in the neighborhood, not a single insulation contractor was ever to be seen. Less than 10 percent of homes that received new siding had extra insulation installed (unless ¼ inch thick fanfold wrap is considered an insulation retrofit). Zero percent of homeowners in the neighborhood used the opportunity to blow in new insulation into the existing above-grade wall cavities prior to re-siding. The author tried informing neighbors of the situation but got responses such as, “my contractor is taking care of insulation,” or “I don’t have the money to add insulation,” or “we just added some insulation in the attic” or “I thought the walls had insulation already.” During the post-disaster reconstruction phase the author talked with a dozen WI contractors installing jobs and not a single one of them was aware that Wisconsin Focus on Energy provides rebates for insulation. Most considered the ¼ inch thick fanfold or house-wrap (used as a moisture barrier) as “real insulation.”

Madison WI experiences over 7,000 heating-degree-days per year. Considering that more building shell remodeling occurred in the several months following this hail storm than had occurred in the 45 years prior in that neighborhood, energy efficiency program managers should have a way to respond when these kinds of opportunities knock, and do so with boots on the ground, and rebate application forms in hand (Riggert 2009).

Crisis is opportunity for energy efficiency programs, as was demonstrated in the 2001 California energy crisis, the avalanche in Juneau, and other situations. Small scale disasters such as floods and tornadoes frequently compel occupants in a particular area to retrofit their homes. This is an important and time-sensitive opportunity to install energy efficiency technologies on a broad scale.

Discussion

CFLs have many characteristics that made them successful in achieving energy savings quickly. They capitalized on the sheer wastefulness of the most ubiquitous lighting source in the country, the incandescent light lamp. That low hanging fruit might be hard to find anew. It seems unlikely that any single technology on the horizon can do what CFLs did. However, it is important to remember that CFLs meteoric rise was built on a foundation of many years of energy efficiency program support prior to 2000. In a sense, this same technology nurturing may be just now preparing the “next big thing” to burst on the scene.

CFLs may appear so successful partly because other programs have been so unsuccessful. Why were these non-CFL programs so weak? Why is lighting still delivering most energy savings when there are so many other opportunities?

In spite of their success, there has been a countervailing tendency to undervalue CFL programs. Why does the success of CFLs continue to surprise us? Perhaps it is because of the human tendency to believe in, and focus on, a single, large “silver bullet” technology. The impact of each individual CFL is small, although the cumulative impact of CFL programs is large. Thus, the victory of the small CFL has surprised even energy efficiency insiders. What were we missing then that we could be missing again now in considering other technologies?

To be fair, the full success of CFL programs is difficult to quantify. Even now as most CFL sales are outside of programs in some states, program support is still important to getting large chain stores to carry CFLs, according to some distributors. Programs are needed to shore up retailer relationships. Reducing program support for CFLs too early could lead to a backslide in lighting markets, compromising the significant gains already made.

CFLs success is also hidden because their savings are counted in other programs, such as "whole house" programs. One unfortunate consequence of the undervaluing of CFLs however is that they were not always promoted in tandem with other programs. For example, Energy Star Homes could go on the market with incandescents in every socket. Many business and industrial programs sidestepped any effort to pitch CFLs to their customers. Not all opportunities, even within existing programs, were used to harvest CFL savings. Future programs can learn from this experience.

After contemplating the cost and difficulty of alternatives, policy makers may wish to reconsider dropping credit for CFLs as a premature move. Residential lighting will continue to be one of the largest, cheapest sources of energy and CO_2 savings. CFL socket share is still low. For standard bulb types from 40w to 100w, EISA will cut out some of the most wasteful incandescents. However, there will still be a significant performance gap between the minimum EISA requires and CFLs. Manufacturers are positioning certain halogens and other bulbs to meet EISA minimums, but their lifetimes are only 1,000 hours. Thus, there may still be a role for energy efficiency programs in promoting standard CFLs even after EISA takes effect. There is considerable energy saving potential remaining on the table. The invisible hand of the market may not achieve results certainly or quickly enough. Waiting for the market to reach these sockets could prove more costly than acting more decisively in the short term. CFL promotions could be revived in a different form, with incentives available only for the most efficient, better-than-ENERGY STAR CFLs. Deeper, direct install approaches provide more savings certainty and could meet national goals for job creation as well. Alternatively, utilities may wish to resume the giveaway programs once used to build electric load, this time giving away CFLs to reduce load. This may be a less expensive and less difficult way to get energy savings while energy efficiency programs are transitioning their support to the next big thing, which could be a technology identified in this paper.

This paper has identified some of the technologies that could deliver energy savings in the short and medium term. After five years, other longer-term dynamics may come into play. The cost of carbon may go up, avoided cost may move to the level set by renewables, and discount rates may be set in policy rather than controlled by the financial market risks. By then, technologies discussed here may be covered by minimum standards and required law. If that happens, programs would be free to redirect their resources to major retrofit opportunities. Up until now, short-sighted payback rules have hampered support and reduced program credit for measures such as insulation, which can have a lifetime of many decades. In the future, programs may be free to pursue much deeper savings opportunities. If state and federal (FERC) requirements for least cost power are enforced, regulated power suppliers would have to provide DSM and energy efficiency where it is cheaper than traditional supplies. TRC-covered technologies could be seen as mandatory, and utilities would be ordered to capture that. Voluntary energy efficiency programs could then focus on measures beyond the TRC baseline.

Summary

Several characteristics made CFLs the technology of choice for delivering significant energy savings in the past. CFLs are inexpensive, easy to install by individuals, and long-lasting compared to the equipment replaced. CFLs were a simple decision for families and businesses. They were a maintenance rather than a capital budget item. CFLs remain a very low cost way for programs to obtain savings. However, should there be limitations to promoting CFLs in the future, energy efficiency programs may want to look for measures with some of the same qualities as CFLs when deciding what to promote next. Measures with particular potential for saving energy in the next five years include specialty CFLs, other lighting, behavior programs, refrigerator and freezer replacement and removal, water heater fuel switching, and plug load measures Some of program delivery approaches to consider include direct install, rebates, and community-based, storm-chaser approaches. Implementing these approaches will position the energy efficiency community to make a much larger adjustment that could be coming, to a new world of national energy policy based on carbon emissions control.

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