How Volume Equipment Purchases Can Build Markets For Energy-Efficient Technologies

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Ever since the Energy Crisis of 1973-1974, the United States and other countries have tried to bring more energy-efficient appliances, equipment, and practices into the market place at a more rapid pace than unmodified market forces would permit. The process of overcoming market barriers, also known as market transformation, requires: 1) the potential for manufacturing better equipment at acceptable costs; 2) informed buyers and sellers; 3) appropriate catalyst(s) to spur market forces; and 4) financing. Governments can provide several of these preconditions by organizing early volume purchases of new technology. Two recent examples of volume purchase programs organized by Pacific Northwest National Laboratory illustrate both the potential of such programs to transform markets and the types of issues that must be addressed in developing a successful program.

Over the last 25 years, it has become increasingly clear while (high) energy prices clearly can play a strong role in accelerating progress in energy efficiency, the institutional aspects of technology adoption also bear close scrutiny. Practitioners of the art of inducing technology acceptance are focusing on overcoming institutional barriers, a process known as *market transformation.*

WHY IS IT NECESSARY TO TRANSFORM MARKETS?

In a more perfect world, the process of disseminating information about improved energy and environmental technologies would go much more smoothly. However, in the real world, most markets only approximate the ideal, frictionless marketplace of the Economics 101 textbook. Numerous sources of information "friction" occur in the marketplace, and the markets for renewable energy and energy efficiency devices are no exception.

Foley (1996) makes the point that to transform the markets for energy-using equipment, four elements are needed:

1) the potential for manufacturing better equipment at acceptable costs;
2) informed buyers and sellers;
3) appropriate catalyst(s) to spur market forces; and
4) financing.

There are several market barriers for this class of technologies that prevent Foley's vision of a healthy, functioning market. Part of following list was adapted from Bodenhs-Fer and Wohlgemuth (1997). *The first three items* in the list are largely problems that prevent the development of a pool of informed buyers and sellers. *The next five* are problems with developing appropriate market forces and signals. *The last two*, which are a subset of the five are reasons that financing may not be available in some circumstances even though a technology is viable otherwise.

- *inadequate information* regarding the very existence of emerging technologies

- *buyers and sellers both often lack experience* with these technologies, making the forecasting of performance, especially in individual installations, very difficult to project

- *high marketing and advertising costs* for manufacturers and distributors - this may especially be a problem for small renewable energy companies attempting to compete with entrenched multibillion dollar competitors

- *free-rider problems* - Individual consumers may be asked to accept additional costs for purchasing more efficient technologies, even though the benefits are shared equally in terms of environmental improvements or reduced energy costs for all citizens or consumers.

- *agent/principal problems* - The interests of the agent, for example the contractor making the decisions on which energy-consuming technologies to purchase for a building or the renter using those technologies do not necessarily coincide with those of the "principal" or owner who pays the energy bill.

- *financing preferences* - Renewable energy systems tend to be capital-intensive and require longer repayment periods than power sources with shorter payback periods. Perhaps even more important, potential (and often highly uncertain) energy savings must compete for financial resources where the risks and returns are better understood.

- Subsidies and other support for some conventional fuels (e.g., nuclear or coal) but not for alternatives.

One way in which these uncertainties have been reduced has been through direct regulation of the performance of end-use equipment. As long as the equipment can be manufactured at acceptable cost, regulations such as the Federal appliance standards and the energy codes promulgated by several states as part of, or along side of, their building codes reduce uncertainty in two ways.

First, the consumer is provided significant neutral market information concerning technology performance. Appliance standards also provide some enforcement of that performance.

Second, the manufacturer is clearer about how much efficiency to supply and is assured he will not be undercut by a competitor's cheaper, but less energy-efficient, equipment and building practices.

In the past, electric and gas utilities were able to provide a considerable boost to markets for energy technologies. They learned that in many cases, it was cheaper to "buy" more efficient water heaters, better windows, and attic insulation through direct customer rebates, billing

credits, and reduced rates than it was to build new generating plants.

This approach overcame several problems listed above. By directly recommending the specific technologies and also supplying incentives, rebates, or reduced energy charges necessary to purchase them, the utilities both overcame consumer uncertainty concerning performance of the technologies and reduced lenders' and utility customers' need to learn how energy efficiency compared with other competing investments.

On the manufacturers' side of the market, the utility programs reduced the cost of consumer education and advertising and provided assistance in creating a market. This also transformed markets.

These methods, while still viable in some circumstances, are being supplemented and in some cases supplanted by more innovative use of market forces. Particularly in today's increasingly competitive energy supply environment in the United States, innovative solutions are desirable.

A DEFINITION OF MARKET TRANSFORMATION

In the early 1990s, many demand-side management professionals began to change their approach from one of encouraging individual utility customers to adopt energy-efficient measures to one of permanently removing the market barriers to adoption. The aim was to change the fundamental structure and functioning of markets for energy-efficient equipment. Over the course of several years, this new approach became known as market transformation (Prahl and Schlegel 1995).

As currently practiced, market transformation contains several possible elements. One is to utilize market forces to attract manufacturers into producing more advanced or high performance equipment and reducing their risk for doing so. This approach is sometimes initiated by consortia of utilities and other groups of purchasers (e.g., federal sector) or aggregators who can offer a market for some of the technologies.

Another element is to provide unbiased information about equipment performance and savings to induce buyers to purchase the equipment. A third element is to assemble a large early volume of purchases which will reduce manufacturers' unit production costs and sellers' unit selling costs.

While financing cannot be completely eliminated as an issue, large

volumes make possible lower prices and lower requirements for financing, thus overcoming high first-cost market barriers. All three of these elements are present in the case studies described below. Their relative importance can vary from program to program, but the key in each case is negotiating a volume purchase.

GETTING THE MANUFACTURERS TO BUILD EQUIPMENT

Two effective ways to persuade manufacturers to build something are: 1) offer to offset their development and manufacturing costs and 2) offer them a market. A successful program of the first type, offsetting costs, was the Golden Carrot® Program. In 1992, a group of electric utilities formed a consortium, the Super Efficient Refrigerator Program, Inc. (SERP). In July 1992, SERP issued a Request for Proposals to refrigerator manufacturers asking them to design, manufacture, and sell the most energy-efficient refrigerator possible while competing for a $30 million pot of incentive money. The manufacturer who promised the most energy savings at the lowest cost per kilowatt-hour saved was to win the entire pot (provided that the manufacturer could sell enough qualifying models within the service areas of the participating utilities).

To be eligible, bids had to be for CFC-free designs. In October 1992, SERP received fourteen bids, including a number of bids from major manufacturers. In December 1992, it selected two semifinalists, Frigidaire and Whirlpool. These manufacturers then built prototype units and submitted them to SERP for testing. Both prototypes used roughly 40 percent less energy than required under the 1993 federal efficiency standards. SERP selected a single winner in June 1993 -Whirlpool. The $30 million prize was paid as the efficient Whirlpool refrigerators were delivered to retail stores within the service areas of participating utilities (EPA 1993). Evaluations of the program include Sandahl et al. (1996) and Lee and Conger (1996).

The following are two examples of the second type of incentive, offering a market. Since 1990, the Department of Energy Efficiency at the Swedish National Board for Industrial and Technical Development (NUTEK) has been operating an innovative Technology Procurement Program, which supports the Swedish Government policy on the restructuring of Sweden's energy system.

One element of the program has focused on innovative technology procurement. NUTEK surveys buyers groups and collects performance objectives for specific end use equipment, which then are developed as product specifications. Next, a market is identified among the buyers' groups for equipment that meets the design objectives. Competitions are then held among the manufacturers.

For example, Nibe, from Markaryd in Southern Sweden, won a recent competition for residential hot water heaters. The winning heater saves about SEK 300 per year—compared to any other product currently available on the market. It costs SEK 8000 to SEK 9000, about the same as a standard water heater. The winning heater is rustproof and will last 20 years, compared with 10 to 20 years for today's water heater. NUTEK states that it also has several attractive control features (NUTEK 1997).

It has been estimated by NUTEK staff that doubling the volume of purchases when a technology is introduced reduces unit costs by about 20-30% (Engleryd 1997).

A second example of offering a market began in August, 1995 when the US Department of Defense launched a technology procurement process aimed at accelerating the commercialization of new, efficient technologies that can fill the gap between standard incandescent lamps and screw-base compact fluorescent lamps (CFLs). With an efficacy of only 12-15 lumens per watt (lpw) and an average life of 1000 hours, incandescents are expensive to operate and change out in many applications. Compact fluorescent lamps, on the other hand, are about four times as efficient and many last for about 10000 hours.

However, integral CFLs do not fit in many of the fixtures used today, and if burning hours are short it is difficult to achieve energy savings large enough to pay for the lamp. The DoD has been seeking a lamp "midway" between CFLs and incandescents. According to DoD, as many as 70% of DoD's existing sockets currently using "A-line" 60-100 watt incandescents may be suitable for the sought-after A-line CFL replacement. The quality of light must equal or exceed that of incandescents, and the lamps must have a minimum average life of 3000 hours.

The cost effectiveness is a crucial factor. DoD asked for a simple payback period of two years or less for the winning lamp, and this has been translated into dollar figures: For instance, a 25-lpw lamp must not cost more than US$3.00, a 40-lpw lamp not more than $4.85, a 60-lpw

lamp not more than $5.90, and a 70-lpw lamp not more than $6.20. (IAEEL 1995).

DoD is willing to buy several million units from the winning manufacturer, which automatically constitutes a market. To make the project even more attractive for manufacturers to bid on, DoD sought out other organizations to form a buyers' group, consisting, in particular, of organizations controlling residential facilities such as family housing, dormitories, lodging, and jails/prisons. The project was supported by the U.S. Environmental Protection Agency. However, so far, the procurement project has had difficulties getting the manufacturers to submit qualified bids (IAEEL 1997).

In a similar procurement approach, a European buyer group coordinated by the International Energy Agency's (IEA) Program on Co-operative Technology Procurement has issued similar functional specifications for a Replacement Incandescent Lamp that is at least 30 percent more efficient than standard incandescent lamps and lasts three times longer. The Technology Procurement Competition was launched in Hanover on April 16, 1997. Manufacturers can now compete for orders of several million lamps. If the competition is successful, the new lamp could be on the market in early 1999 (IAEEL 1996).

Agencies involved in the IEA project include the UK Building Research Establishment (BRE), the Swedish agency NUTEK, the Dutch Agency for Energy and the Environment (NOVEM), and the Finnish Information Centre for Energy Efficiency (MOTIVA). The project also is supported by the European Union. None of these government agencies are acting as buyers themselves. Instead, each agency is putting together a group of competent and important buyers, in their own country, such as hotel chains, public housing organizations, supermarket chains, lamp distributors, and electric utilities.

FINDING THE BUYERS AND SELLERS

Partnerships for Clothes Washer Volume Purchase

As part of the U.S. Department of Energy's (DOE) Energy Star Partnerships, Pacific Northwest National Laboratory (PNNL) on behalf of DOE issued a request for proposals (RFP) to companies interested in furnishing and delivering high-performance (horizontal axis) clothes wash-

ers to the City of Austin, Texas, and other volume purchase partners. In June 1997, PNNL issued a draft RFP and in July held a pre-bid meeting to solicit comments from washer manufacturers and suppliers.

PNNL issued the final RFP in September 1997 to a list of over 200 washer manufacturers, distributors, installers, and retailers. The RFP was posted in the Commerce Business Daily and local papers of the program's first partner, the City of Austin' Texas Planning, Environmental Conservation Services Department. It is important to note that this was a wide-open competitive procurement, a feature that is important to draw new suppliers into a given market. Suppliers of new products and services frequently come from new market entrants rather than established firms.

Pacific Northwest National Laboratory issued the RFP under the Procurement Policies Manual and Acquisition Guidelines, which are approved by the U.S. Department of Energy. The RFP was a two-part solicitation. Offerors could bid on Part A, Part B, or both. Part A required furnishing and delivering high-performance clothes washers to City of Austin retail customers. Installation at the point of use and removal of the old appliances were Part A requirements.

Part B required bidders to furnish and deliver high-performance clothes washers in wholesale lots to eligible volume purchase partners, which we called "local partners." These include government agencies, housing authorities, utilities, educational institutions, nonprofit institutions, energy providers, energy-services providers, builders, owner/operators of commercial or multifamily buildings, and public sector agencies. Under Part B, bidders were asked to provide a cost for delivering truckload quantities of appliances to a single delivery point in each local partner's service area.

The minimum performance criteria for the clothes washer listed in the RFP were as follows:

Energy factor - 3.25 ft^3/kWh/cycle minimum
Water factor - 9.5 gal/ft^3/cycle maximum
Moisture remaining after cycle - 55% by weight maximum
Tub volume - 2.5 ft^3 minimum
Foot print -Standard residential full size (floor space of 29 × 29 in. maximum)
Warranty - Two-year warranty minimum.

In addition, bidders were asked to describe marketing support, consumer financing, and other after-sales service.

Evaluation criteria for selecting the winning proposal were included in the RFP. Life-cycle cost, which included the clothes washer's operating and purchase costs, accounted for eighty percent (80%) of a bidder's score. The quality and length of warranty programs and other after-sales service comprised another ten percent (10%) of the score. The remaining ten percent (10%) was based on features of the proposed marketing program.

Based on the evaluation, the City of Austin chose to use Part B for its program; therefore, PNNL did not award Part A to any of the bidders. In December 1997, PNNL negotiated a purchase agreement with Sides Supply, Inc. of San Antonio, Texas, the winning bidder for Part B, and signed a basic ordering agreement (BOA) through which the City of Austin and other local partners can purchase high-performance clothes washers and dryers.

The cost is $517 per washer, including delivery. Matching dryers are also available for $284 per electric dryer and $326 per gas dryer. These prices are for delivery within the continental United States. Washers and dryers may be combined in truckload orders. For delivery to Alaska, Hawaii, and Puerto Rico, the base costs are the same, plus a delivery fee of $3800 per shipping container, which will hold up to ninety-four (94) clothes washers or dryers. These additional shipping costs are thus about $41 per unit. The prices represent a saving to consumers of between $200 and $400 per unit, relative to normal retail prices for the winning horizontal axis washer. These prices approach the retail price of conventional (and much less efficient) vertical axis machines.

The City of Austin has contracted with two local appliance retailers to implement their program at a price of $579/washer plus delivery. In addition, the City is also providing rebates of up to $180/washer direct to the purchasers. To date, over 150 washers have been delivered to City of Austin customers. An additional 3 qualified buyer groups, including the City of San Antonio, Texas, have agreed to purchase large quantities of clothes washers and dryers.

Thus, the market has been transformed in four respects, following Foley's four criteria: 1) the potential for manufacturing better equipment at acceptable costs; 2) informed buyers and sellers; 3) appropriate catalyst(s) to spur market forces; and 4) financing.

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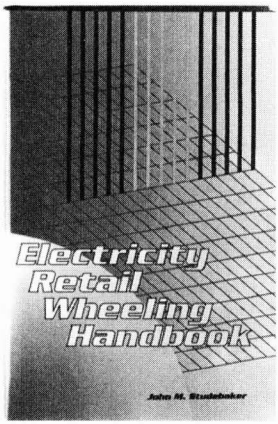

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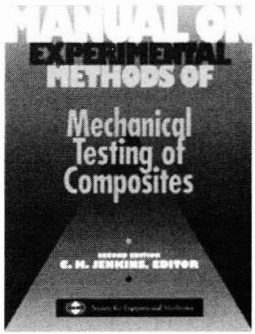

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First, potential exists for manufacturing better equipment at acceptable costs. Manufacturers had already demonstrated the technical capability to produce highly efficient equipment. At the time the program began, two American manufactures were producing eligible equipment, and a third was planning on unveiling a new product. The solicitation may have helped spur the third manufacturer to upgrade the washing machine cycles to meet program requirements. In short, publishing technical criteria that came with a potential market may have given the third manufacturer a target for improving product performance.

In addition to the technical question of potential, is the notion of acceptable costs. The volume purchase provided a mechanism by which suppliers could reduce first costs and these reductions could be passed on to consumers. These reduced costs, in turn, provide a catalyst as described in the third criteria, to spur market forces.

Foley's other criteria were also affected to a lesser extent. The competition itself, by emphasizing important performance and market services criteria for selection, provides important neutral information to buyers of the level of performance to expect from the technology. Moreover, as more units are installed, word-of-mouth discussion of performance quickly supplements and replaces manufacturers' claims.

Sellers are also learning about the actual level of interest in their equipment. Financing is easier for buyers because of the reduction in price, financing packages, and rebates offered by the manufacturer, and rebates are being offered or proposed by at least some of the later local partners. With the ample availability of credit cards and other financing mechanisms, financing by itself has not appeared to be a critical factor to consumer participation.

Making the Deal - The Devil Still is in the Details

There were several key features of the clothes washer volume purchase that make it a unique experiment in market transformation. First, in contrast to some earlier programs such as that of the New York State Housing Authority to purchase efficient apartment-size refrigerators, neither the City of Austin, nor DOE, nor PNNL offered to guarantee a minimum sales volume or to buy the washers. Thus, public money was not directly involved in the agreement. The agreement is actually a framework that sets the maximum prices and other contract conditions by which the winning seller agreed to make the clothes washers avail-

able in bulk to individual private retail customers in return for program promotion by the local partner, PNNL, and DOE. All purchases are actually private transactions.

Several lessons were learned in the process of developing this agreement.

1. For best results seek the broadest possible competition for providing the technology. Despite the fact that we advertised the procurement in draft and final form in the *Commerce Business Daily*, mailed copies to every known manufacturer of high-performance machines, sent copies to a list of over 200 potential suppliers in Austin, and conducted a potential bidders meeting in Austin, the winning proposal actually came from a wholesaler/distributor who was not contacted by PNNL. This distributor was alerted by a manufacturer. The other proposals that were actually submitted also came from out-of-state wholesaler/distributors.

2. It is important to consider variations in marketing channels among the competitors. At least one major manufacturer declined to bid because, under its marketing relationships with its franchise retailers, it was unable to provide a low volume purchase price in selected markets without also offering the same price to all its other franchise retailers. Depending on what marketing channels exist for specific energy-efficient products, this may or may not be a "show-stopper" issue. In our case it did not stop the show because other manufacturers were in a position to be more flexible.

3. Understand the competitive climate. In Austin, the prospect of having the city government engaged in volume purchase activities upset some retailers who felt that the city was unfairly competing with them. This objection held up the agreement for several weeks. This is not a problem that local partners will always be able to resolve successfully; however, the partners can minimize the problem by pointing out that volume purchase is a *temporary* arrangement calculated to introduce technologies, after which the normal retail channels could expect to supply later units. Indeed, the agreements in place with PNNL for the clothes washer procurement expired the end of 1998. Also, the partners can reduce hard feelings by conduct-

ing their own local open competition to provide local delivery and repair services, as was done by Austin.

4. Be aware that the franchisees for competing manufacturers may not be able to match prices with the volume purchase winner(s) and may resent the new source of competition. If volume purchase is successful, however, this will put some competitive pressure on the supply channels for the rival equipment. This is actually an intended effect.

There also may be a lesson to be learned in the type of company that won the competition. For example, Sides Supply is an independent distributor, rather than a factory distribution center. This gets around the institutional problem faced by some manufacturers of being unable to offer different prices to different retail distributors. 2) Frigidaire offers Gibson as a second brand name, which permits some price experimentation. This reduced the risk of lowering costs for some consumers -and then having consumers expect lower prices across the board. Frigidaire's marketing strategy with Gibson gave them flexibility to act like an outsider, although they were the first American company to introduce the high-performance washer. They are also fourth or fifth in market share and therefor perhaps more willing to risk the program.

Small-Dimension Screw-Base Compact Fluorescent Lamp Volume Purchase

PNNL also is organizing a consortium of private multi-family owner/operators (PMFOs) for rapid adoption of new and emerging high-performance appliances and building equipment. For the first major activity of the consortium, PNNL recommended a volume purchase of CFLs for exterior and common area lighting. PMFOs own and operate apartment buildings that have multiple incandescent lamps operated in outdoor and common areas at least 12 hours per day, 365 days per year.

A significant market opportunity exists for those companies that can successfully produce a screw-base CFL of similar size and performance [lumen output, color rendition index (CRI), etc.] as existing A-19 incandescent bulbs. A significant barrier to consumers' acceptance of CFLs has been that previous generations of these lamps do not fit existing light fixtures, usually due to their length being considerably greater

than the standard A-19 bulb.

Although it can be shown that for many situations it is extremely cost-effective to replace incandescent fixtures, the great majority of PMFOs and other consumers have chosen not to do so. Recently, however, several companies have begun to manufacture and sell CFLs that fit a much larger number of existing incandescent light fixtures.

This volume purchase was designed to help overcome two significant market barriers to the more general adoption of CFLs: 1) the fact that many CFLs do not fit in fixtures designed to accommodate incandescent lamps, and 2) the relatively high price of the lamps (between $12 and $20 per lamp).

A demonstration procurement program was expected to help introduce the new, small-dimensioned screw-base CFLs to the marketplace. The size of the orders under the demonstration program were expected to provide a more attractive price than would otherwise be available.

It also was expected that volume purchase will bring in many first-time CFL users who are currently unaware of the small-dimensioned screw-base CFL technology but would use it if they did not have to worry about specifying the technology and if the price was attractive. Because volume is being built for the new lamps and because the attributes of the lamps were actually negotiated, the potential exists for manufacturing better equipment at acceptable costs (Foley's criterion 1).

An attractive feature of the CFL volume purchase is that it can create better informed buyers and sellers (Foley's criterion 2). Some other market transformation programs have been oriented toward developing markets for pin-based CFLs, or have insisted on high-durability (in excess of 10,000 hours rated life) and low signal distortion (power factor > 0.9, total harmonic distortion < 0.3), based on engineering recommendations rather than market research.

From extensive interviews of the potential buyers and electric utilities, PNNL discovered that 1) screw-base lamps were strongly preferred; 2) there was a significant willingness to trade off some durability for a lower price; and 3) harmonic distortion generally did not appear to be a significant performance issue, particularly with consumers.

What is more, in our interviews the manufacturers showed significant flexibility about product attributes, being willing to introduce new models of lamps to the marketplace that met the buyers' specifications. We were able to avoid the pitfalls in some previous technology procure-

ment programs that failed because technological/cost requirements were unrealistic.

Essentially, we negotiated a set of ambitious but achievable technological goals between buyers and sellers for lamps and knew before issuing the RFP that lamps meeting the specifications could be manufactured for an attractive price. A key lesson in this process is that designing a market transformation program to push technology performance requires significant and substantive interaction with prospective buyers and suppliers—in this case, the multifamily owner-operators and the lamp manufacturers.

Three manufacturers were selected for the first phase of the project (to run 5 months), who offered delivered prices ranging from $5.85 to $10.45 per lamp delivered, with purchases available as small as a six-pack. This represented a 50% lower price than has been available before and should do much to ease consumer resistance. Expected sales in the first phase were 5,000-15,000 lamps. Sales in the first two months exceeded 50,000 lamps.

The appropriate catalyst(s) to spur market forces also are in place (Foley's criterion 3). One of the strong selling points of the CFL program is the warranty feature. A standard warranty agreement was negotiated with the manufacturers that considerably reduces the risk for the customer. The agreement reads as follows:

> Seller(s) shall provide a standard warranty service package fully covering CFL performance and failure for one (1) year from date of purchase. In addition, seller(s) are encouraged to offer superior warranty service and maximum convenience to customers; for example, including agreements with retailers to accept for refund or replacement inoperable CFLs that are returned by customers, or prepaid shipping agreements with express package delivery firms. Customers shall not be financially responsible for returning any CFL to the manufacturer to exercise warranty rights if a fully functioning CFL is returned within 30 days, or if a CFL fails to perform to the technical specifications... within one (1) year of purchase.

Features of the warranty programs also include a 1-800- number that buyers can access to obtain prepaid shipping of defective lamps back to the manufacturer. Thus, buyers can try the product obligation-

free for 30 days, and defects will be covered for up to one year, with virtually no inconvenience and no cost to the customer.

Orders have been facilitated with electronic ordering. Suppliers are required to provide PNNL a toll-free telephone number and a toll-free fax number, which PNNL will make available to the buyers. Suppliers are encouraged, but not required, to provide PNNL an Internet link and product information sufficient for a web site presentation. PNNL will maintain a web site with a description of the CFL volume purchase program, a description of the products available through the volume purchase (including prices), and the toll-free telephone and fax numbers of the suppliers. If a supplier provides an Internet link for direct Internet ordering, PNNL will include that link and related information in the CFL volume purchase web site. Although deliveries must be made within 30 days of order, some of the suppliers were willing to provide delivery within a week.

Making the Deal - Here, too, the Devil is in the Details

The CFL agreement is similar to that for the clothes washers. Consummating this deal showed up the following different types of problems.

1. We would have preferred to have lamps carry the Underwriters Laboratory designation to provide a well-known neutral source of safety information for buyers unfamiliar with the CFL technology. However, not all of the manufacturers had chosen to use Underwriters, so we settled for an equivalent safety requirement:

   > Lamps must be tested, listed, and labeled by an organization accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) or the American Association for Laboratory Accreditation (A2LA) as having the capability for testing, listing, and labeling CFLs. These organizations include Underwriters Laboratories (UL), Intertek Testing Services Performance Division (formerly ETL Testing Laboratories), Factory Mutual, and others. Listing and labeling are as defined in the National Electrical Code®.

2. There were technical issues involving appropriate performance and

application of the lamps. One was the minimum starting temperature. Because our primary buyers group wanted a lamp suitable for outdoor uses anywhere in the country, we carefully specified a minimum starting temperature of minus 20°F, based partly on input from manufacturers on what could be done at what cost. This actually led us to reject some manufacturers, who could only certify lamps down to 0°F. Another issue was that, unlike incandescent lamps, some small-dimension screw-base CFLs cannot be used with timers or dimmers. Because this was an unanticipated technical restriction not covered by the request for proposal, it was necessary to advise restricted use for some of the lamps that otherwise met all of our qualifying criteria:

> Customers are advised to exercise caution and diligence when selecting timers and five photocells for use with CFLs. CFLs may not operate effectively with certain electronic, timers and certain photocells. Furthermore, the use of certain timers and photocells may shorten the life of CFLs and may, potentially, void the warranty. Customers should use only timers and photocells rated for use with CFLs.

The lesson learned from these two examples is that the more that the volume purchase manager understands the potential uses of the technology, the better will be the neutral product information provided by the procurement and the less backfilling that otherwise may be required later on.

CONCLUSION: WHAT HAVE WE LEARNED?

Market transformation has the objective of permanently removing the market barriers impeding the adoption of energy-efficient technologies and practices, thus improving the fundamental structure and functioning of energy efficiency markets. Our experience to date has suggested that it is possible to use the services of government to identify market needs and potential suppliers, negotiate the development of technologies, and provide credible neutral product and market information through open competition.

Government can structure purchase agreements that offer substantial benefits of volume sales to suppliers and lower prices to consumers, even without the necessity of guaranteeing a minimum purchase volume, and thus accelerate the market introduction and adoption of new technology. Experience also has shown that *government need not directly intervene with subsidies or rebates. Market forces, informed by government information-gathering and, the judicious use of government sponsorship, are effective.*

The process of market transformation will be successful as long as Foley's four criteria are addressed: 1) the potential for manufacturing better equipment at acceptable costs; 2) informed buyers and sellers; 3) appropriate catalyst(s) to spur market forces; and 4) financing. The two volume purchase programs discussed in this article have addressed the first three criteria since (lack of) financing apparently has not been a significant factor in either case. Negotiated volume purchase agreements of the type now being offered provide the opportunity for manufacturing better equipment at acceptable cost.

While they do not guarantee markets, negotiated volume purchase agreements identify markets and their needs with a high degree of credibility. The information gathering process, the neutral information provided by competition, and the experience built up by early introduction improves the knowledge base of both buyers and sellers. The identification of market needs and good products seem to be sufficient incentives for rapidly developing sales.

Finally, the volumes achieved and the low prices extracted through volume purchase competition seem to make financing much easier. All of these features are important, and the first returns are promising.

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Further information on the volume purchase program described in this article may be found at www.energystar.gov/volumepurchase.html

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