APRÈS NOUS, LE DÉLUGE? WHAT WILL HAPPEN TO ENERGY EFFICIENCY MARKETS IN A RESTRUCTURED INDUSTRY?

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As the electric utility industry moves toward competition and restructuring, it is clear that "traditional" DSM programs will disappear. Some advocates argue that energy-efficiency programs are therefore either unnecessary or inappropriate: Either (a) earlier programs have successfully transformed relevant markets, or (b) the unregulated markets will encourage energy saving by providing the necessary price signals to customers and the necessary profit-making opportunities to old and new providers of efficient products and services. However, others argue that the future industry must include, at least initially, follow-on energy-efficiency programs. Moreover, many suggest, those continuing programs should be focused on market transformation efforts.

At this time, several regulatory commissions are in fact requiring that utilities or consortia that include utilities provide energy-efficiency programs oriented toward market transformation. In addition, they are directing that the programs be evaluated, both in terms of specific achievements and as demonstrations of the power and sustainability of market transformation. To provide the necessary feedback to program managers and regulators, evaluators require evidence and analysis keyed to the *specific* markets (e.g., commercial lighting, residential lighting, motors, residential new construction, etc.) that contribute to the demand for and use of electric power. At the same time, program managers and policy makers need tools to provide the basis on which to project what is likely to occur in each market when relevant programs are at some point eliminated.[1]

This paper summarizes secondary analyses conducted for a New England utility that were intended to explore whether selected energy-efficient technologies will develop without intervention by utilities or other extra-market intervention agencies in the future. It also offers an analytic structure for addressing these issues. The discussion assumes that utilities will be operating in a profit-oriented and more competitive arena, but it does not explore those issues or other results of reduced regulatory oversight.

For this paper, we will first discuss the evolution of the market for compact fluorescent lamps (CFLs) in the residential sector. We will then describe our analytic framework and show its applicability to the residential CFL market. We will conclude with a discussion of the implications of this approach for evaluation of other market transformation programs and activities.

The Residential CFL Market

The preponderance of the analyses on which this paper is based rely on secondary data. These data included studies of the technical potential for various lighting technologies, evaluations of pertinent utility resource acquisition programs, and saturation studies. In addition, we interviewed several lighting experts, ESCOs, and code developers.[2]

In this section, we will first provide a brief description of the CFL market before and after heavy involvement by the NEES Companies and other New England utilities. We will then summarize some of the critical barriers to efficiency in that market and review the activities of the utilities in relation to those barriers. Finally, we will summarize some "naturally occurring" trends—some of which suggest optimism about the future course of the market and others of which suggest pessimism.

The Status Quo Ante. The initial problems of CFLs were considerable. First, the product was associated with a plethora of performance uncertainties and failed to meet many lighting-related needs of customers and utilities. Early generations of CFLs were unreliable, slow-starting, and had high failure rates. Units were available in a limited number of wattages and styles, and those that were provided were heavy and often unattractive. In addition, they were not dimmable and did not fit many existing luminaires. Although CFLs provided significant energy savings, they also produced high levels of harmonic distortion. Moreover, their energy-saving potential was exaggerated by overestimates of their lumen equivalence to incandescent lamps.

Second—given the characteristics of the early CFLs noted above—the products did not offer convenience or assist in enhancing the appearance of the home. Moreover, the high initial costs conflicted with customers' budget concerns. Furthermore, although CFLs offered manufacturers a higher per unit margin than incandescent lamps, they also required large investments in product development, channel development, and promotion.

[1] See Prahl & Pigg (Reference 7) for a provocative summary and discussion of some markets where programs have been eliminated and some tracking data are available.

[2] Additional information was made available from a comprehensive study of the commercial lighting market in New England, commissioned by a consortium of public interest groups and New England utilities, including the NEES Companies. A longer report on that project is also being presented at this conference, by Meberg et al. (Reference 6).

Third, neither manufacturers nor other market actors (channel intermediaries) offered strong promotion of CFLs. The selection made available to end-users was limited and the locations and types of distribution outlets were restricted. Generally speaking, neither manufacturers nor intermediaries invested heavily in promotion or other activities associated with effective marketing programs.[3]

In summary, CFLs failed to meet many critical lighting-related needs of residential customers and utilities; they lacked appeal to important customer life-style needs; they offered limited profits to manufacturers. Not only was the product performing poorly in the market, but none of those in the market were addressing and correcting its obvious problems, at least in this region.

Enter the Utilities. To help their customers become more energy efficient and achieve the savings potential offered by CFL technology, the NEES Companies and other New England utilities have conducted a variety of DSM programs, with the active urging and support of regulatory commissions and public interest groups. They communicated information to manufacturers about customer concerns with product design, performance, and reliability. They also communicated their own concerns (e.g., about high levels of harmonic distortion) and set forth useful and attainable standards of performance. Moreover, by using mail order programs in the early stages of market development, utilities lowered the delivered costs of CFLs to program participants. Through these efforts, utilities also assumed some of the risks of product failure and simultaneously helped manufacturers create enough sales to permit economies of scale.

Considerable evidence suggests that the utility program efforts were quite successful in increasing the sales of CFLs in New England. The programs also appear to have induced manufacturers to improve their products, broader product lines, and lower prices. In addition, the programs have created a broader base of dealers who stock the technology.[4] In summary, as the affected markets grew, utility efforts helped stimulate competition, lower prices, and increase distribution.

Barriers and Utility Activities. The mechanism by which utility CFL programs achieved success was by the elimination, reduction, or bypassing of market barriers.

As described earlier, the residential CFL market suffered from many of the barriers to success described by Eto, Prahl, & Schlegel (Reference 1). From the end-user's perspective, these included performance uncertainties, hidden costs, hassle costs, bounded rationality (i.e., contradiction of ordinary rules of thumb—the first-cost orientation), and product unavailability. From the viewpoint of other market actors, moreover, the performance uncertainties limited confidence in the ability of the technology to create sufficient sales to be worthy of the investment in product development and distribution that might be required to achieve profitability without overly cannibalizing the sales of standard units.

What is it that utility programs did? In our view, they provided the feedback to manufacturers that was required to pinpoint the product changes required to meet end-user (and utility) needs. In addition, they promoted the technology and offered the financing that would a) eliminate or reduce end-user concern with first costs and thus b) guarantee a level of sales that, in turn, induced manufacturers and distributors to invest in product improvements. Furthermore, they offered an alternative distribution channel until the volume of sales created sufficient interest among other channels to make it unnecessary.

"Naturally Occurring" Trends. Thus, utility programs accelerated and increased market penetration and saturation for CFLs over what would have occurred naturally—in the absence of their intervention. The critical question, of course, is what is likely to happen in the future, as resource acquisition DSM programs such as that supporting CFLs are eliminated and other changes occur in the utility industry. Are the movement toward an efficient CFL market and the changes that have already occurred sustainable in the absence of continued intervention by utilities or other market transformation agents?

What has already occurred is likely to have some positive feedback effects and some long-lasting consequences. First, as more customers become aware of CFLs and their added benefits, those customers should be more willing to pay some premium for the product. They should also be more likely to stimulate purchases by others through positive word-of-mouth reports. In turn, manufacturers should become even more willing to invest in product development and improvement, promotion, and channel support. As manufacturers change their production lines and make related investments, the market should become less capable of retrogressing toward poor-performing, poorly supported products. Nonetheless, it is difficult to argue that CFLs have already become a commodity product, with few remaining barriers to achieving a broad, sustainable consumer market.

In brief, some events suggest reasons for optimism. Manufacturers have removed many of the product-related barriers to success and they have increased the fit of CFLs with the life-style needs of customers. In addition, manufacturers' investments and growing customer acceptance of CFLs appear to be expanding the opportunities for profit among distributors and retailers. As their needs are more likely to be met, the distributors and retailers can be expected to provide more effective promotion and other marketing activities. As various market barriers are lowered, then, the penetration and saturation of CFLs should increase and their potential energy savings should be more fully realized.

However, to realize their full potential as an energy-efficient technology, CFLs must become commodity prod-

[3] Such activities include efforts to simplify orders, physical procurement, and negotiation and financing, as will be recognized once our analytic framework is described. Another pertinent—but missing—effort is to actively solicit information about product performance as it meets customer needs.

[4] For a comprehensive discussion of proximate indicators of program results, see Rosenberg (Reference 8).

ucts, universally available at a moderate cost and presenting little risk to buyer or seller. In this context, it is important that the technology has moved from a curiosity with appeal limited to a few technology-conscious or environmentally concerned customers to one that is becoming reasonably available in certain types of stores and achieving a foothold among certain knowledgeable customers. But these market developments suggest a boutique item rather than a commodity item. The likelihood of the further transition of the technology into commodity status without additional support is not a given.

Although the customer base for CFLs has grown considerably, both in size and in acceptance of the technology, users still comprise a definite minority of the population. Neither manufacturers nor dealers have signaled a willingness to engage in heavy competition for market share through major promotions, lowering prices to customer-defined price points, writing off stocks of older, less sophisticated models,[5] or broadening the current target markets. Moreover, the dealer base itself remains relatively narrow, confined in large part to specialty stores with no interest in broadening the appeal of the technology in such a way as to allow discounters and mass merchandisers to undercut their profits.[6]

In summary, the residential lighting DSM programs conducted by the NEES Companies and other New England utilities (as well as similar programs conducted elsewhere in the country) have helped to stimulate manufacturers to improve CFLs both technically and in response to consumer life-style needs. As the market has begun to develop, manufacturers have also reduced some CFL prices and invested more heavily in promotional efforts and the distribution network. Together with utility support for dealers, these changes have also helped to make CFLs more readily available to customers than before. But it is difficult to predict with confidence whether current trends should engender a high degree of optimism regarding the achievement of market transformation in the absence of a continued presence by utilities or other agents promoting energy efficiency.

Barriers and Exchange Functions: The Analytic Framework

What is lacking in the discussion of the CFL market to this point is a framework for evaluating the need for involvement of utilities, their reasons for involvement, and the prospects of continuing involvement in the emerging utility industry environment. The approach presented in this paper attempts to marry the analysis of market barriers with the concept of exchange functions. We begin by describing the underlying logic of this approach; in doing so, we proceed from a reintroduction of the importance of market barriers themselves to a discussion of the market functions whose health they signal and the roles of market actors.

Markets and Market Barriers. As discussed elsewhere (see Feldman, Reference 2), a market is a system for the voluntary exchange of goods or services among particular groups or individuals. Market barriers exist to the degree that such exchanges remain inefficient *over time*[7]—that they are not conducted reliably, effectively, and at low cost.

In an efficient market, for example, consumers must be aware of the options available to them and aware of the benefits and costs of each option. Moreover, the product should be available in a variety of locations convenient to customers. It should also be available in various styles and quantities, corresponding to customer needs and preferences.

Often, however, barriers impede the smooth operation of the market assumed by theory. For example, customers may be unaware of their options or unaware of the associated costs and benefits, so that their behavior does not reflect choices made with full information. Similarly, consumer transactions may be burdened with the additional hassle costs imposed by the difficulty of securing their preferred options, rather than the pure costs of the products or services alone. And, in the last example, the consumer may be forced to accept the additional costs of unwanted options or larger sizes—or to reject the otherwise preferred option.

Market Functions. In the normal course of market development, designers, manufacturers, or channel intermediaries recognize these barriers to market efficiency (and to the sales of their product or service) through market research or various less formal feedback mechanisms. In a well-functioning market, they then address these problems through changes in the product, promotion, pricing, or placement. For example, they may actively promote their product and its benefits, rather than simply responding to customer inquiries and search efforts. They may aggressively seek out dealers who are convenient to customers, increase the number of styles and sizes in which a product is offered, or unbundle product or service features.

The activities of the market actors can be summarized as a list of marketing flows, or channel functions, shown in Figure 1. However, it should be noted that these functions are not normally the province of any one market actor. Moreover, not all are prominent in every market.

[5] For example, motor manufacturers allowed distributors to return standard efficiency units they had in stock when it became clear that the market in British Columbia had been transformed (personal communication, D. Nelson).

[6] For additional exposition and discussion of the qualitative data underlying these assertions, see Feldman (Reference 3).

[7] As will be seen in the following discussion, the time dimension is critical. It is likely that the markets for almost all new products and services will be inefficient at least initially. But the profit motive is likely to induce some market actor to reduce or remove the source of inefficiency in the hope of gain as the product moves through its life cycle. It is the unusual case—unfortunately all too common in the realm of energy-efficient technologies—where market barriers persist over time.

- Physical possession
- Ownership
- Promotion
- Negotiation
- Financing
- Risking
- Ordering
- Payment
- Market information

Source: Vaile, Grether, and Cox (Reference 9)

Figure 1. Exchange Functions

For example, lighting dealers generally transfer *physical possession* and *ownership* of products from manufacturers or distributors to customers; they also commonly handle *ordering* and *payment*. However, *promotion* is most commonly the province of the lighting manufacturer, as is any *negotiation* that occurs. It should also be noted that, in the lighting market, "*risking*"—the assumption of risk for product reliability, is most often left to the consumer, and that little attention is normally paid to collecting *market information*.[8]

Benefiting Through the Provision or Improvement of Market Functions. As noted, market actors normally perform the functions described. They do so either because that will increase sales and associated profits or commissions, or because they can realize a profit directly on the function itself. To illustrate the latter possibility: A lender offers *financing* based on the spread between the interest paid and the interest received; a credit card company exacts a fee from the seller for facilitating and processing *payments*; etc.

Accordingly, in most contexts, the fact that the market for a desirable product or service is not operating as efficiently as it might is seen as an opportunity for someone to provide or improve the missing or inefficient function, and reap the associated profits.[9] If no one does so or no one does so successfully, market barriers persist and intervention by an outside actor may be required.

In considering the issue of who will provide or improve market functions, we can distinguish three cases: (a) At the one extreme, the problem is structural and cannot be overcome within the market system itself. For example, in a pure monopolistic system, the power of the supplier can only be limited by the collective action of the customers or their representatives (e.g., government). (b) The inefficiency can be and is remedied by an entity that is normally a part of the market, such as a manufacturer or distributor, or by another agent who enters the market with the intention of obtaining a profit, such as a service company. We might label these Intra-Market Providers, or IMPs. (c) Although the inefficiency could be remedied by IMPs, it is not. Instead, it is addressed by an actor, such as a utility or a nonprofit organization that is not normally a part of the affected market and does not stand to profit directly from that market. To contrast with IMPs, we might label these Extra-Market Providers, or EMPs. The distinctions are illustrated in Figure 2.

A further issue to be considered is whether the intervention by an external provider can resolve the problems of the market in a sustainable manner. Consider the following polar examples: If a market for some technology were weak because of some technological fault in the product and an EMP solved that problem (e.g., a government laboratory offered a technological fix that overcame the reliability problems of the product for all competing manufacturers), no further, continuing intervention would seem required. If, however, a market were weak because no IMP was willing to provide the needed access to financing, a one-time EMP intervention might not be sufficient. It is not predictable a priori whether providing temporary access to financing would lead to a long-term change in lending practices.

Rather, as suggested in Figure 2, the analysis that might be of value would be to determine whether the intervention seems likely to change the anticipated profitability of providing the missing function or the long-term risk-reward ratios in the relevant market for various IMPs.

The restructuring of the utility industry and the emerging competitiveness of the markets for energy and energy services further complicate the appropriate analysis. It is no longer sufficient to assess the likelihood that an intervention is sufficient to create a lasting reduction of a market barrier in an otherwise stable market. Rather, it is now necessary to ascertain the likelihood that increases in market efficiency will be supported by the motivations and mechanisms of a rapidly changing industry.

Applying the Framework

In this section, we illustrate the value of our framework for the consideration of market transformation programs by applying it to the case of residential CFLs.

The Past. As described earlier, IMPs failed to provide several functions for the CFL market, or to do so in such a way as to expand that market rapidly. We believe that much of their reticence to do so derived from concern over the investments required to improve the product and obtain adequate distribution, coupled with uncertainty regarding the likelihood of customer interest. (See also, Haddad, Reference 4.) In essence, for IMPs, the risk-reward ratio appeared high; consequent profitability, low.

[8] In contrast, some markets normally include standard or optional warranties on the products or services offered. Others feature prominent efforts to collect and disseminate information about the state of the market (cf., for example, the Neilsen rating service in the television industry).

[9] Because of the problems's complexity and its policy implications, we defer to another venue the discussion as to why this does not seem the case for products and services that increase energy efficiency.

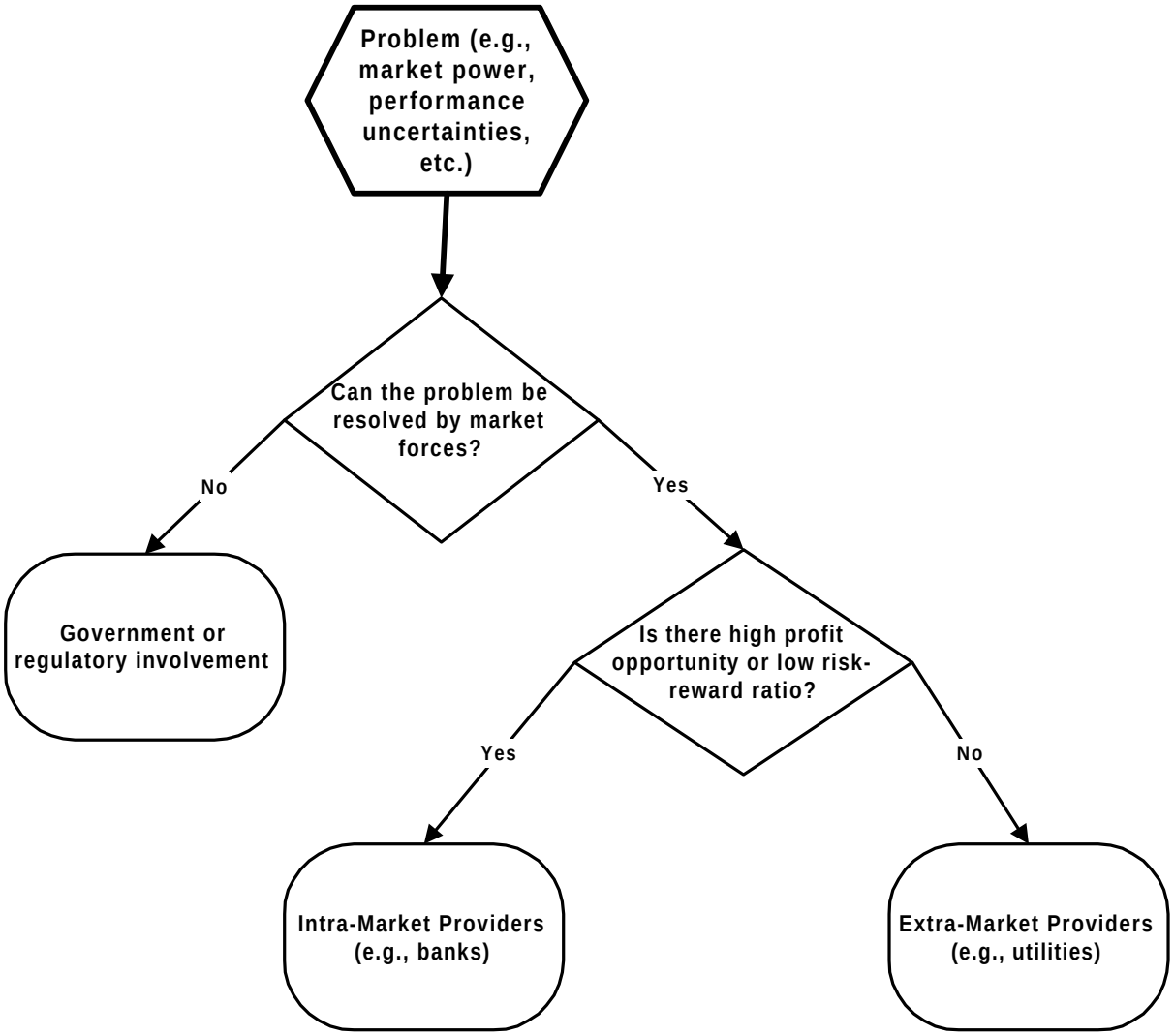

Figure 2. Who Offers Market Functions?

Utilities were able to carry out the missing functions because the risk-reward ratio was, for them, quite low. Because of DSM policies and procedures, utilities would be compensated for relevant investments by their regulatory commissions. Moreover, to the degree that the programs could be shown to help reduce energy use and demand, the utilities would realize both some level of direct reward from their regulators and some load relief and lessened pressure on their resources. The major risk was associated with embracing a poorly performing technology—a concern the utilities strove mightily to eliminate. An added reward was the opportunity to demonstrate their commitment to energy-saving and the environment.

The Present. The questions that arise in the emerging environment are these: Is it likely that the CFL market has been permanently transformed, such that those who are normally in the market will carry on effectively, without further intervention by EMPs such as utilities? If not, does this market offer the opportunities for profit that will draw in other IMPs, such as ESCOs or lighting management companies? Unfortunately, we cannot be optimistic about the transformation of the residential CFL market on either of these counts.

The evidence does not appear to show that utility programs altered the *long-run* risk-reward ratios for any of the IMPs. Manufacturers must still bear the burden and risk of investing in CFL technology without a demonstrably sustainable demand (e.g., through successful development and

marketing of dedicated fixtures).[10] Utility programs greatly increased awareness, sales, and trial purchases. But evidence of continuing demand in the absence of large rebates or demand arising beyond relatively limited population segments is lacking.

Similarly, some members of the distribution chain have profited from the sales generated by utility programs. But as with the manufacturers, they must still bear the burden and the risk of ordering, stocking, and promoting the technology at this time, with little evidence of widespread and sustainable demand. Moreover, as described earlier, significant growth in demand is likely to be to the disadvantage of those distributors and dealers who have profited thus far. Ideally, for example, discounters would offer well-made, long-lasting units at a low margin. Needless to say, this is not a formula for significant profits. [11]

To reiterate, prior utility programs do not appear to have lowered risks associated with manufacturing and marketing CFLs or improved their likely profitability to the degree that IMPs will invest heavily in the promotion, financing, and risking necessary to expand that market. We cannot readily identify any market actors who appear willing to finance major new product developments (such as a broad line of dedicated fixtures that will require CFLs and reduce the possibility of snapback) or product promotions. Neither do we envision current market actors extending their efforts in this direction.

The Deregulated and Competitive Future. To return to the initial concern of this research: Will the restructuring of the utility industry create the conditions whereby intervention by EMPs such as utilities is no longer required in such markets as that for residential CFLs?

To answer this question, we must examine the possibilities that the future shape of the utility industry will reduce the risk-reward ratio or the perceived profitability of CFL programs for IMPs, for EMPs other than utilities, or for utilities themselves.

In brief, the answer appears to be in the negative for each of the entities suggested: As already noted, the removal of rebates as a support for CFL sales reintroduces levels of risk that manufacturers and distributors had found unacceptable in the past. Moreover, they are likely to evidence even greater concern about their ability to sell a technology that is promoted to a large degree on its energy-saving features in an era of steady or falling energy prices.[12]

Would the removal of regulatory pressures on utilities to provide energy-efficiency programs open the door to ESCOs or others not now in the market to develop and implement programs to increase the penetration and saturation of CFLs? It is certainly possible that some energy-efficiency programs could be profitably offered by IMPs or by EMPs other than utilities. For example, a strong case could be made that commissioning programs that include energy efficiency or large-scale commercial lighting renovations can be highly profitable to providers, given the sizes of projects involved, the resources of potential customers, and the benefits to those customers. It is difficult to envision a similar case being made for promoting CFLs.

Would competitive utilities anticipate either increased profits from offering CFL programs or increased customer satisfaction that would generate greater loyalty and thus greater profits? If there were significant profits to be made, we believe that the IMPs or potential market entrants would be better positioned to gather them. As for increased customer satisfaction—the price elasticity of most customers is probably too great for savings on CFLs to be of great importance to them; moreover, the benefits that do accrue are likely to be diffuse and to become apparent only over considerable time.[13]

This analysis suggests that CFLs may remain a successful niche product in the absence of continued support from government (e.g., through codes), or from utilities or other EMPs in a deregulated and competitive world. However, it seems unlikely that CFLs will become a commodity. To achieve anything resembling their technical potential, additional support appears required, whether from nonbypassable wires charges administered by utilities or through some other appropriate extra-market intervention.

Implications

We believe the type of analysis offered here is of considerable value for both program planning and future evaluation of market transformation programs. Program planners can use this framework to help identify those areas where additional programs—particularly market transformation programs—are most likely to be desirable. It should suggest those markets that may be less in need of further program support and those that continue to require such support, thus helping to reduce and focus future expenditures. Furthermore, by emphasizing specific barriers and channel functions, it offers direction as to what aspects of high potential markets should be targeted by future programs.

The associated possibility that utilities may begin to identify opportunities for profit as a result of providing certain market functions—that they may evolve from EMPs to IMPs—should also be explored: If market transformation

[10] Unfortunately, such an evolution is problematic in its own terms.

[11] In a provocative discussion of the structure of the "industrial organization" supporting lighting sales, Haddad (Reference 4) provides additional reasons for concern regarding the ways in which competition among IMPs affects the likelihood that they will promote energy-efficient CFLs.

[12] The issue is not whether residential electricity prices will fall or whether CFLs are nonetheless beneficial. It is, rather, that the *risk* of lower prices reducing sales and profits will impede manufacturer and distributor enthusiasm.

[13] It should also be noted that customer satisfaction does not necessarily translate into customer loyalty (cf. Lineweber, Reference 5).

programs are to continue for long in the restructured and more competitive era, it is likely that such intrinsic motivations will be required.

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