Demand-Side Management Programs Under Retail Electricity Competition

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Abstract

Demand-side management programs comprise subsidies from franchised electric utilities for the purchase of high-efficiency appliances, e.g., air conditioners. Competition in power generation threatens the viability of these programs. However, it should also reduce the warrant for them. Under regulation, the justification for such programs depends, somewhat paradoxically, on below marginal-cost pricing. Eliminating regulation should permit pricing flexibility to discourage excessive on-peak energy use. It should also eliminate the assurance of returns that may have encouraged overbuilding of generation capacity. Entrants and incumbent utilities should find it easier to offer "energy services," i.e., to bundle electricity with appliances, if consumers are too myopic to realize the benefits of increasing energy efficiency. Environmental degradation remains a problem, but competition can improve the performance of incentive-based regulations (e.g., permit trades), reducing the value of DSM as a supplemental, second-best alternative.

Key Words: electricity restructuring, energy conservation, regulatory policy

JEL Classification Nos.: L51, L94, Q48

Table of Contents

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Timothy J. Brennan*

INTRODUCTION

Demand-side management (DSM) programs typically cover a variety of policies under which utilities have been directed to subsidize or otherwise encourage the installation of appliances (e.g., air conditioners) that use less electricity to perform their functions (e.g., cooling a house to 70°F in the summer). DSM proponents regard the increased energy efficiency of these appliances primarily as a means for conserving fossil fuels and limiting the environmental effects from their use. The reduced use of energy is believed to also limit the need to build power plants. A further argument supporting DSM is that consumers are too short-sighted to spend more up front on energy efficient appliances, in order to reap greater savings from reduced energy use over time.

As state legislators and regulators, and perhaps the federal government, move to encourage and implement competition among generators for retail sales to households, businesses, and factories, DSM programs as designed will become unsustainable. At least in theory, the incumbent utility will no longer have a protected franchise and captive customers, over whom it has sufficient market power to raise prices enough to generate revenues to cover DSM costs. As competition strips the ability of incumbents to support DSM--a phenomenon some have called "stranded benefits"--new methods, involving more explicit tax or surcharge schemes, will become necessary if DSM is to persist.

While competition reduces the sustainability of DSM, competition also reduces the value of supporting it. To see how much of the DSM problem may have been exacerbated by regulation, we will explore the following points:

- Regulatory inflexibility discourages innovative pricing schemes that could provide incentives to reduce on-peak consumption.
- Cost-of-service regulation may create incentives to build too may generators.

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*Senior Fellow, Resources for the Future, and Professor, Policy Sciences and Economics, University of Maryland-Baltimore County. This paper was presented at the Rutgers University Center for Research in Regulated Industries, 11th Annual Western Conference, Monterey, CA, July 10, 1998, with thanks to Judy Boggess, Michael Crew, Lorna Greening, William Moore, Susan Schneider, and Kathy Treleven. Special thanks go to Karen Palmer for keeping me informed on DSM and helping me to think through its justifications. The model in the third part of this paper is adapted from some joint research we undertook a few years ago. However, neither she nor anyone else bears no responsibility for errors.

- Limits on the ability to bundle electric power with appliances to provide lower cost energy services could combat alleged myopia that leads consumers to underinvest in conservation technologies that would make them better off.
- Regulation could reduce the effectiveness of efficient pollution controls such as marketable emissions permits, creating a need to employ DSM as a supplemental policy for meeting environmental goals.

Examining those arguments suggests that expanding retail competition in electricity should directly promote most of the policy rationales for DSM. This should reduce the need for additional policy initiatives in that area.

The paper begins with a brief review of the intersecting paths of demand-side management programs and retail competition, and why the two on the surface present difficulties in reconciliation. Whether to reconcile them involves understanding why one might have wanted DSM in a regulatory environment. A basic model suggest some insights that might be counter-intuitive to noneconomists, in particular, that when economic conditions warrant price regulation, there is likely to be too little consumption of the regulated service (e.g., electricity). To a first approximation, discouraging consumption is typically a step in the wrong direction, at least from an efficiency perspective.

However, minor modifications to the basic model do suggest the justifications mentioned above. The remainder of the paper sees if they are likely to remain significant in a competitive environment. As they are not likely to remain significant, the remaining justification for DSM policies is likely to be as a substitute for politically unpopular carbon taxes. We conclude by looking at this justification, noting that if the EPA or some other branch of government gets authority to issue stringent carbon use limitations, the demand for DSM and other substitute policy instruments (e.g., renewable fuel use requirements) ought to fall. As always, relevant vested interests are likely to limit the ability to convert a normative recommendation into a positively accurate prediction.

TERMS AND BACKGROUND[1]

What is DSM?

As used here, the term "demand-side management" broadly refers to technologies, products, and programs that involve reducing buyer demand for electricity by substituting conservation on-site for fuel use. DSM can take on a number of meanings, based upon specific purpose, funding method, and context.[2] My emphasis here will be on explicit subsidy programs, as opposed to provision of information regarding expected energy savings.

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[1] The background information in this section is drawn from T. Brennan, K. Palmer, et. al., *A Shock to the System* (Washington: Resources for the Future, 1996): 21-35, 122-24; F. P. Sioshansi, "Editor's Introduction: DSM In Transition: From Mandates to Markets," *Energy Policy* 24 (1996): 283-84.

[2] J. H. Chamberlin and P. M. Herman, "How Much DSM is Really There: A Market Perspective," *Energy Policy* 24 (1996): 323-30, esp. 325.

Because my interest is in market failure, I want to focus on the policy context. Sales of Geo Metros may reduce gasoline use, but for purposes here I would not refer to Geo's production and marketing efforts as a DSM program.

A better analogy from the automotive world to DSM would be "corporate average fuel efficiency" (CAFE) standards, that mandate a minimum miles-per-gallon that an auto company's cars have to achieve on average. But there is a second aspect of DSM that merits attention, which is that the programs are funded in part by subsidy obligations placed on the suppliers of the product to be conserved. In the case of electricity, DSM programs are funded by subsidies from utilities, e.g., rebates on purchases of fuel-efficient air conditioners. The automobile analogy would be if U.S. policy to encourage high mileage vehicles had been implemented by forcing oil companies to send checks to purchasers of cars getting over thirty miles a gallon.

The analogy points out a couple of problems with DSM policy. One is that fuel efficiency and fuel conservation are not the same. Increasing the fuel efficiency of an automobile or appliance could increase energy use, depending on how sensitive consumers are to the price they have to pay for the services they use the energy to provide. A couple of "Laffer curve" examples illustrate this. Were home air conditioners so energy-inefficient that they cost $100/hour to operate, they would never be used, thus conserving energy that might have been used for home cooling. An automobile that got only a tenth of mile per gallon would rarely if ever be driven, reducing fuel use.

The crucial factor is the elasticity of demand for energy, derived from the demand for the services energy delivers. If that elasticity exceeds one in absolute value, increasing energy efficiency will increase energy use. The reduced operating costs lead to sufficiently more intensive use of the service itself to counteract the conservation effects.[3] However, in many if not most cases, underlying demands for electricity-using services (refrigeration, laundry, hot water heating) are likely to be sufficiently inelastic to allow us to ignore this effect. In the analysis that follows, I will assume that DSM programs do not have perverse outcomes, although readers should recognize the possibility.

Competition: Threat or Promise?

The second DSM implementation problem, however, ought not be assumed away; it is the subject of this paper. That problem is how to assess energy suppliers with the burden of paying to subsidize energy-conserving equipment. Until now, the markets in which DSM programs are implemented have been regulated monopolies. Hence, the utilities serve as convenient vehicles for raising funds through higher electricity fees and distributing them to

[3] Intuitively, energy efficiency is essentially the inverse of the price of the service provided by an energy-using piece of equipment. An increase in efficiency is equivalent to a reduction in the price of the service. Therefore, energy use is formally akin to the user's expenditure to produce the service, e.g., home cooling or miles driven. A corollary of the standard result that elastic demand increases expenditure when price falls here is that elastic demand increases energy use (expenditure) when efficiency increases (price falls).

consumers who purchase more fuel-efficient appliances.[4] Moving to a more competitive electricity market complicates matters. If incumbent power generators bear the responsibility for covering the cost of DSM programs, they will bear a competitive disadvantage relative to new entrants. Consumers can turn to the entrants rather than cover the cost of DSM programs, reducing the revenues that can be extracted from the incumbents and threatening the sustainability of the programs altogether.

The path to competition is by now familiar. Electricity in the U.S. has by and large been provided by vertically integrated utilities, with regulated monopoly franchises to provide electricity to residential, commercial, and industrial consumers in disjoint geographic areas. While the "wires" components of the industry--local distribution and long distance transmission--possess some natural monopoly characteristics, scale economies in generation have been shrinking for some time.

Moreover, since the Public Utility Regulatory Policy Act mandated power purchases from independent power producers using renewables or cogeneration, the feasibility of producing and delivering electricity without vertical integration became increasingly apparent. By 1992, Congress passed the Energy Policy Act, requiring the Federal Energy Regulatory Commission (FERC) to devise rules for opening the transmission grids to independent power producers selling electricity in the wholesale markets (i.e., to those who distributors to end users) under its jurisdiction. FERC complied with its mandate in issuing its Orders 888 and 889 in 1996.

The real threat to DSM, however, is through the opening of retail electricity markets to retail competition. With competition only at wholesale, distribution companies will still retain a monopoly over the marketing of power and, probably to a large extent, to the generation of power delivered to those in their service areas. Accordingly, they will be able to pass along costs of DSM programs to their captive customers. With retail competition, however, electricity users could purchase power from new entrants that are not saddled with the burden of providing rebates for purchase of high efficiency appliances and other conservation programs.

Whether and how to implement retail competition is largely under the control of state legislatures and regulators. Many states, particular those in which retail electricity rates are relatively high, have undertaken policies to open their retail markets.[5] At the federal level, numerous proposed bills, which mostly would force states to adopt retail competition, have been introduced. After about a year and half of internal review and deliberation, the Clinton Administration recently issued a "Comprehensive Electricity Competition Plan" (CECP). The CECP recommends a federal mandate of retail competition, but allowing states to "opt out" if

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[4] The classic statement of this phenomenon remains R. Posner, "Taxation by Regulation," *Bell Journal of Economics and Management Science* 2 (1971): 22-50. The benefits of the goods purchased with the tax revenues may exceed the costs from higher prices.

[5] For a recent analysis in detail of state implementation of retail competition and an empirical assessment of its determinants, see A. Ando and K. Palmer, "Getting on the Map: The Political Economy of State-Level Electricity Restructuring," Resources for the Future Discussion Paper 98-19, March 1998.

they decide, "on the basis of a public proceeding," that they would rather do retail competition differently or not at all.[6]

Some attention has been given to how DSM funding should be maintained if retail competition becomes widespread. One would need to restructure the funding away from the incumbent generators to the market at large. The CECP envisions supporting state-funded "public benefits" programs, including energy-efficiency programs with a 1 mill per kilowatt-hour "fee" (i.e., tax) on the generation or transmission of electricity.[7] A fee assessed on local distribution would also mitigate the retail market distortions that the current funding mechanisms would create.[8]

But while retail competition threatens DSM, it may eliminate the value in perpetuating those programs as well. If so, attention to coming up with funding mechanisms may be misdirected. To understand whether retail competition might eliminate the disease along with its cure, we might begin by identifying some factors in current regulated markets that could justify policies to tax electricity in order to subsidize conservation programs.

REGULATORY JUSTIFICATIONS

DSM Under Regulation: The Wrong Direction?

Demand-side management policies originated while electricity was (and by and large still is) provided by regulated monopolies with exclusive franchises. Consequently, looking at a model of DSM subsidies under electricity regulation seems a good place to begin looking for rationales.

Define the following variables:

- e = quantity of electricity produced.
- t = quantity of a DSM-type technology available in the market.
- $b(e, t)$ = consumer welfare. Make the standard assumptions that b_e and b_t are positive, b_{ee} and b_{tt} are negative. Assuming that purchasers of electricity are price takers, b_e equals p_e, the price of electricity, and b_t equals p_t, the price of DSM technology.
- $c(e)$ = the cost of producing electricity. Assume $c' > 0$. Because electricity may be produced under natural monopoly conditions, we leave the sign of c'' open.

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[6] The CECP is available electronically from the Department of Energy at http://www.hr.doe.gov/electric/cecp.htm, March 25, 1998. The plan has since been put forth in the form of proposed legislation, introduced by Sen. Murkowski on July 10, 1998. For an assessment of the CECP, see T. Brennan, "Transforming Power Markets," Resources for the Future, http://www.rff.org/misc_docs/brennan_oped.htm, May 16, 1998.

[7] http://www.hr.doe.gov/electric/benefit.htm.

[8] Washington State reportedly has approved a plan along these lines. E. Hirst, R. Cavanaugh, and P. Miller, "The Future of DSM in a Restructured US Electricity Industry," *Energy Policy* 24 (1996): 303-15, esp. 311.

$h(t)$ = the cost of producing DSM-type technology. Assume $h' > 0$, $h'' \geq 0$, i.e., that the technology (e.g., energy efficient air conditioners) is not subject to scale economies that would prevent effective competition.

Without adding anything else to the model, maximizing social welfare W becomes the relatively trivial exercise of choosing e and t to maximize

$$W(e, t) = b(e, t) - c(e) - h(t),$$

with the obvious results that one supplies electricity and DSM technology up to the points where price equals marginal cost.[9]

However, suppose that we are in a regulated environment, where the price of electricity need not equal marginal cost. For simplicity in exposition, suppose that the price of electricity is set equal to p^*. Then, the constrained social welfare maximum is the solution of:

$$L(e, t) = b(e, t) - c(e) - h(t) - \lambda[b_e - p^*].$$

The first-order conditions are

$$b_e - c' = \lambda b_{ee}$$
$$b_t - h' = \lambda b_{et}$$

Define the function $sgn(z)$ as the sign of z, i.e., positive, negative, or zero. Since $b_{ee} < 0$ (demand curves slope downward), and because $b_e = p^*$,

$$sgn(b_t - h') = -[sgn(p^* - c')][sgn(b_{et})]. \quad (1)$$

Justification for a DSM subsidy would be indicated by the optimal price being less to consumers than the marginal cost of production, i.e., $sgn(b_t - h')$ being negative. According to equation (1), this will hold when $p^* - c'$ and b_{et} each have the same sign, i.e., are both positive or both negative. In the standard "natural monopoly" context, where marginal cost pricing is insufficient to cover costs, we would expect that $p^* > c'$. This implies that a DSM subsidy is warranted if $b_{et} > 0$--that is, increased use of the technology increases the marginal value of electricity to consumers, hence increases how much energy they would demand at the prevailing price.

This finding is consistent with the general theory of the second best. One should subsidize complements and tax substitutes to counteract the demand-decreasing effects of a distortion in the economy that increases the price of a product above its marginal cost.

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[9] The first-order conditions are b_e [$= p_e$] $= c'$ and b_t [$= p_t$] $= h'$.

Regulation (or unregulated monopoly) that results in electricity pricing above marginal cost will do just that. Therefore, one would want to subsidize technologies that increase the demand for electricity, and tax those that decrease it. But DSM policy takes the opposite tack.

Regulatory Pricing Below Marginal Cost

This basic model suggests that DSM policy could be justified if the regulated price of electricity is below its marginal cost of production. Two factors may cause bring about this somewhat counterintuitive result:

- In setting prices based on average electricity costs over time (the day, month, or year), rates may be below marginal cost during peak demand periods. DSM technologies that depress demand could counteract the excessive on-peak consumption that results from time-averaged prices.
- The components of electricity service that have natural monopoly characteristics are the wire networks that deliver electricity from generators to final consumers. One may need to regulated electricity rates to prevent exploitation of the market power such wire networks may possess. However, natural monopoly in wires may be consistent with increasing marginal costs of generation. Regulation that sets electricity rates on the basis of average cost over a vertically integrated firm could lead to rates below marginal cost, even without the above peak-load effects.[10]

Moreover, DSM programs can have a somewhat unexpected benefit if regulatory prices are tied explicitly to a utility's cost of service. A subsidy program will increase a utility's cost, leading the regulator to raise rates. This increase in rates will mitigate the distortion from prices below marginal cost, regardless of the effect of the subsidized technology on the demand for electricity. Subsidizing a product with no detectable association with electricity use, or using the revenue to pay for government expenses, will have the same benefit. The flip side of this coin, however, is that when price is above marginal cost, the fact that DSM subsidy programs further increase electricity rates can exacerbate rather than eliminate economic losses from too little electricity use.

The marginal cost of electricity may not include external environmental costs associated with electricity generation. DSM technologies that substitute for electricity use can counteract this demand. This latter effect, of course, would hold under competition as well, absent environmental policy interventions. We return to this topic below.

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[10] One qualification is that these average power costs will include costs for the wires themselves. Since most of the costs of local distribution and perhaps for long-distance transmission are insensitive to the volume of power consumed (as opposed to the number of consumers), pricing these fixed costs on a per kilowatt-hour basis will tend to lead to prices above marginal cost. This would reinforce the conclusion that policies to subsidize substitutes for electricity, such as DSM-related technologies, exacerbate rather than mitigate the inefficiencies from pricing above marginal cost.

Overbuilding Generators

DSM programs may reduce the economic effects of another, familiar inefficiency associated with cost-of service regulation. If that cost of service included a rate of return on capital that exceeds the cost of raising capital, a utility will have an incentive to construct too much plant that would be included as part of the regulatory rate base on which returns to investors are calculated.[11] Policies to decrease demand for electricity could reduce this incentive to overbuild plant. However, a model similar to that constructed above shows that this "capital limiting" effect does not outweigh the inefficiency of DSM when energy prices exceed marginal cost. Prevention of overbuilding thus may depend on how well the regulatory process for approving plant construction reflects at the margin the mitigation of demand that DSM would bring.[12]

COMPETITION'S EFFECTS

The economics of regulation suggests that DSM is economically counterproductive under the usual natural monopoly scenario. If average costs fall with output, marginal cost must be below average costs. Hence, prices must exceed marginal cost to ensure that the firm covers its expenses. We should discourage, not encourage, technologies that further depress output below the already-low levels created by prices above marginal cost. But, as noted above, regulation itself, even if justified by natural monopoly conditions, may set prices below marginal cost. Prices may be too low because of prices being set to average cost over generators and across time periods. Moreover, regulated utilities might have inappropriately large incentives to construct generators, in order to expand the rate base over which they earn returns exceeding capital cost.[13]

Demand-side management programs can improve efficiency when the latter circumstances hold. But, as earlier noted, moving to competition in electricity threatens the funding mechanisms employed to pay for those programs. Essentially, entry will predictably decrease demand for the incumbent's electricity. In so doing, opening markets reduces the ability of incumbent utilities to cover both their costs of generating power and the subsidy programs. Selective responsibility for funding DSM programs will also create a situation in which entrants supply up to the point where their marginal cost equals the market price for electricity, while incumbents will supply up to the point where their marginal cost equals the

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[11] H. Averch and L. Johnson, "Behavior of the Firm Under Regulatory Constraint," *American Economic Review* 52 (1962): 1052-69. For a review of this effect, its empirical significance, and its theoretical qualification, see S. Berg and J. Tschirhart, *Natural Monopoly Regulation* (Cambridge: Cambridge Univ. Press, 1988): 324-65.

[12] And if the regulatory process works perfectly well, there is no padding of the rate base that DSM could serve to limit.

[13] Utilities might also overbuild plant if they believe that regulators will guarantee cost recovery beyond what would be prudent or efficient. See T. Brennan and J. Boyd, "Stranded Costs, Takings and the Law and Economics of Implicit Contracts," *Journal of Regulatory Economics* 11 (1997): 41-54.

market price less the implicit DSM-related tax. This will make the supply of electricity inefficient; the incumbents will do too little, while entrants will do too much.[14]

The onset of competition may make it more costly to continue DSM programs because new, competitively neutral and politically acceptable means for funding them would need to be devised. As mentioned above, the Clinton Administration's plan calls for a one mill per kilowatt hour "public benefits charge," to provide matching support to state efforts for energy efficiency and other social goals, such as universal service support or renewable fuel research.[15] To be competitively neutral, any support should come from all sources of electricity, equally at the margin. Despite the best efforts of proponents to promote euphemisms, this is, of course, is a tax.[16]

However, the good news is that the costs need not be incurred, because the benefits of DSM programs also fall as we introduce competition into electricity generation. Regulation of electricity generation can cause two market distortions that warrant subsidizing technologies that reduce demand for electricity. The first of these are regulatory rules that led prices to be below the marginal cost of electricity. While pricing above marginal cost is the norm in regulated industries, prices may be below marginal cost because of rules limiting the ability of sellers to set rates equal to marginal cost. Two examples came quickly to mind. The first was average cost pricing over all generation to redistribute rents from low cost generators to consumers. Second were rules limiting the flexibility of utilities to adjust rates as power surges based on times of the day, temperature, or the seasons require them to bring higher marginal cost power on-line.

With open competition in electricity, both of these phenomena are likely to be less prevalent. In competitive markets, firms that cannot sell output at marginal cost are generally speaking not going to make their power available. Economic principles predicts that prices should reflect the marginal cost of generation as states move to open retail markets. This should not simply be true overall, but also tend to be true with prices more free to adjust to induce supply to meet demand surges when, say, high temperatures lead to greater use of air conditioners.[17]

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[14] This does not imply that entrants will be DSM advocates. The competitive advantage created by preserving the current system would have to be weighed against the losses due to the DSM-led reductions demand for electricity.

[15] See citations at n. 6 *supra*.

[16] We should remember that a "competitively neutral" tax on electricity creates a competitive disadvantage for electricity *vis a vis* other fuels.

[17] Competitive markets do not necessarily provide complete price flexibility. Firms may be reluctant to vary from posted prices for a variety of reasons. They may want to commit not to vary prices, to strengthen bargaining positions against those who might be in a position to seek low rates. They may want to promise risk-averse buyers that prices will remain within a certain range. Finally, there may be mundane "menu costs" in changing price, e.g., in preparing and distributing new "menus" on a daily or even minute-by-minute basis. In such cases, technologies that produce the electricity consumption patterns we would observe "as if" prices were flexible, without actually varying prices themselves, would lead to more efficient outcomes and could merit subsidization. However, the power producers themselves may be able to capture those gains themselves by subsidizing purchase of DSM technologies by their electricity customers. Policy intervention to impose subsidies on the industry may not be necessary. See the discussion *infra* on the "myopia" rationale for DSM policy.

The second market distortion induced by regulation is that regulated firms may have an incentive to overbuild plant if the allowed rate of return exceeds the cost of capital and regulators are committed to ensure full recovery of investment. But, again, absent cost-of-service regulation, profit-maximizing power producers will build plant only to the point where doing so allows them to produce power in the least costly manner.[18] As a general matter, one should not then need to subsidize DSM technologies to discourage firms from building inefficient generation, when they would already be losing money to do so.[19]

CONSUMER "MYOPIA"

We have not yet touched on one of the most influential justifications for DSM subsidies. Numerous studies suggest that consumers fail to make investments now in more expensive fuel-efficient appliances that would lead to relatively huge future returns in reduced energy expenses. Some estimates of the economic returns to investing in high-efficiency air conditioners or refrigerators are on the order of ninety percent, particularly for poorer customers.[20] That consumers fail to avail themselves of these apparent huge returns, when they simultaneously put money in other investments promising lower rates of return, indicates to some that there is some kind of market or cognitive failure. To correct that failure, the government should at least encourage consumers to purchase the energy-saving equipment that they would purchase absent this failure.

These arguments tend not to sit very well with the rational choice principles taken by neoclassical economics. If choices are intended to reveal preferences, it must make a consumer worse off by his or her own lights with the more expensive energy-saving appliance, despite the large economic returns. One justification, then, for DSM policies on

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[18] "Price cap" regulation where prices are divorced from actual costs, should bring about these benefits as well. Regulators would then not allow prices to rise by more than costs, e.g., by allowing a rate of return on capital in excess of the payments necessary to solicit investment in the regulated firm. Unfortunately, regulators may find it difficult or impossible to make credible the commitments necessary to assure regulated firms that prices will not follow cost. T. Brennan, "Regulating by 'Capping' Prices," *Journal of Regulatory Economics* 1 (1989): 133-47.

[19] There may be a peculiar failure in the separation of ownership from control, where managers derive utility (so to speak) from owning more and bigger generators than would be profitable, and the stockholders cannot control such wasteful expenditure. One would expect that competition among power suppliers would make such inefficient conduct more difficult. (For a general review of the effects of competition on productive efficiency by reducing the severity of agency problems, see S. Nickell, "Competition and Corporate Performance," *Journal of Political Economy* 104 (1996): 724-63.) But suppose one could show that managers of electric power producers were insufficiently constrained by the interests of their stockholders in just this way. One would still need to show that subsidizing DSM and reducing demand for electricity would provide the necessary incentives to improve performance sufficiently to be worth the cost. Moreover, general DSM subsidies would encourage conservation among all consumers, not just those who purchase power from suppliers unduly obsessed with generator construction.

[20] J. Hausman, "Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables," *Bell Journal of Economics* 10 (1979): 33-54. For an argument that cost-benefit tests of DSM technologies may be overstated, see P. Joskow and D. Marron, "What Does a Negawatt Really Cost? Evidence From Utility Conservation Programs," *Energy Journal* 13, no. 4 (1992): 41-74.

these ground is that consumers cannot tell how much they would save with more fuel-efficient appliances, and thus cannot evaluate the returns.[21] A second, related problem is that there is an agency problem of sorts related to these information costs.[22] Tenants allegedly are unwilling to pay higher rents to landlords who install high-efficiency appliances, in exchange for lower utility bills. Homeowners or builders may believe that potential home buyers are unwilling to pay higher prices for a house with such appliances.[23]

These arguments have not silenced DSM criticism. That the returns from DSM technology are harder to evaluate than the expected income stream obtainable from, say, owning a share of IBM, is not obvious. A remedy that has been employed in securities law is disclosure requirements. In the conservation context, this would involve certification and labeling programs to inform consumers of the value of energy savings, a less intrusive and more targeted intervention in appliance market than explicit subsidy programs. Moreover, some observers claim that consumer reluctance to invest in DSM on their own represents is reasonable in light of the risk associated with investing in fuel efficiency.[24] If energy prices fall, the economic rewards for buying appliances that conserve also fall. If one takes the risk associated with energy price variability over time into account as well as the returns, an investment in a high-efficiency air conditioner may look undesirable, despite having a high expected return.

Even if the "myopia" case for DSM programs remains persuasive, replacing regulation of competition in retail power markets may mitigate the need for their continuation. Opening power markets to new entry invites firms to come up with a variety of ways to market and price electricity to make money. If the proponents of DSM are right, a power producer could make money by offering to provide not just basic electricity to consumers, but "energy services" such as heating and cooling where power and equipment are bundled together. If the risk-adjusted discounted present value of energy savings from DSM-type equipment exceeds any added costs, there is a profit opportunity that some non-myopic electricity market

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[21] Even there, one might note that in the securities context, many consumers defer to intermediate experts to evaluate the information and make choices for them, e.g., mutual fund managers.

[22] A. Jaffe and R. Stavins, "Energy-Efficiency Investments and Public Policy," *Energy Journal* 15, no. 2 (1994): 43-65, esp. 49.

[23] William Moore suggested to me that energy appliance regulations may be analogous to other quality criteria mandated in building codes and regulations. One might defend such regulations on the grounds that consumers lack the information or skill to assess certain features of a home, or that it is less costly for the government than for consumers one-by-one to mandate and enforce generally accepted standards. Of course, not everything meets such criteria, either because consumers can make determinations for themselves and have differing preferences regarding certain features, hence not every home feature can be presumed in need of government mandate. Whether energy efficiency is more akin to, say, the load-bearing capacity of a floor (regulated by code) or the number of bedrooms and bathrooms (selected by the consumer) is the question the DSM advocate would have to address.

[24] S. Awerbuch and W. Deehan, "Do Consumers Discount the Future Correctly? A Market-Based Valuation of Residential Fuel Switching," *Energy Policy* 23 (1995): 57-69. They apply the capital asset pricing model of the effect of returns on risk to analyze specifically consumer resistance to switch from electric heat to gas heat.

competitor could capture. With more than one such competitor, the benefits of DSM technology would be passed along to the consumers.[25]

Not only does moving to competition facilitate inventive marketing that would capture the benefits of DSM, but getting rid of regulation eliminates much of the economic problems that could arise from integrating power with equipment. A regulated firm (e.g., an electric utility) typically is having its price held below the level that would maximize its profits. Entering unregulated markets (e.g., for air conditioners) could be a means for evading that regulation. One technique, at least in theory, might be to design air conditioners, using proprietary information about the grid, to put competing air conditioner suppliers at a competitive disadvantage. In the limit, which may or may not be achievable, a utility could use this proprietary information to create a monopoly for itself in air conditioners, capturing the profits that electricity price regulation would otherwise deny. A second technique would be for the utility to put up capital, allocate labor, or purchase equipment on behalf of its appliance subsidiary. Where regulators base rates on reported costs, this cost-shifting can be used to increase the regulated rates closer to the monopoly level and perhaps fund otherwise unprofitable predatory pricing schemes in the unregulated market.

These concerns have long been part of electricity policy. They were part of the rationale for the 1935 Public Utility Holding Company Act, passed in part to limit inappropriate self-dealing by multi-state utility companies.[26] In 1976, the Supreme Court found that Detroit Edison's plan to give away light bulbs constituted effective monopolization of the light bulb market.[27] In the current debates over electricity restructuring, these concerns rationalize separating regulated transmission and distribution systems from to-be-competitive generation, either through some sort of functional separation, e.g., instituting "independent system operation," if not outright divestiture of generation by transmission and distribution utilities.[28] The most dramatic policy response to these concerns was the federal antitrust case against AT&T, which led in 1982 to the divestiture of its regulated local telephone monopolies, and a court decree keeping the divested companies (the Regional Bell Holding Companies, or RBOCs) from entering some competitive markets, such as long distance service.[29]

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[25] A. Lovins, "Negawatts: Twelve Transitions, Eight Improvements, and One Distraction," *Energy Policy* 24 (1996): 331-43, esp. 340.

[26] Brennan and Palmer, *et. al.*, *A Shock to the System*, n. 1 *supra*.

[27] *Cantor v. Detroit Edison*, 428 U.S. 579 (1976). The focus of *Cantor* in antitrust law is not so much on vertical integration by monopolists, regulated or not. Rather, it established the principle that simply being regulated by the state is insufficient to immunize a firm from federal antitrust liability. T. Brennan, "Local Government Action and Antitrust Policy: An Economic Analysis," *Fordham Urban Law Journal* 12 (1984): 405-36, esp. 424-25.

[28] Brennan, "Transforming Power Markets," n. 6 *supra*.

[29] T. Brennan, "Why Regulated Firms Should Be Kept Out Of Unregulated Markets: Understanding the Divestiture in *U.S. v. AT&T*," *Antitrust Bulletin* 32 (1987): 741-93. The court decree keeping the RBOCs out of long distance was formally rescinded by the Telecommunications Act of 1996, which gave the Federal Communications Commission authority to approve an RBOC's entry into long distance if it satisfies a fourteen point checklist. So far, no RBOC has met the checklist in the FCC's estimation.

ENVIRONMENTAL PROTECTION

A final argument in favor of DSM, alluded to above, begins with the idea that electricity prices may below their marginal cost. But instead of their being too much regulation, which preempts the market forces that would equate prices to marginal cost, the contention is that there is insufficient regulation to get electricity produces to internalize the full costs of their production. While foreign policy considerations, e.g., "energy independence," play some role in this argument, the main uninternalized cost would be the damages from environmental degradation associated with electricity generation. DSM subsidies could mitigate this market failure by encouraging consumers to choose the degree of fuel-efficiency in their appliance that they would have chosen had they faced prices for electricity that reflected social and not just private production cost.

Unlike the other DSM justifications--pricing inflexibility, incentives to overbuild, inability to bundle appliances with power--pricing below marginal cost due to environmental externalities would not disappear with competition. Continued regulatory and policy responses will remain necessary to lead power producer to internalize the costs these externalities create. However, opening retail electricity markets to competition may even produce some benefits here that might make it less necessary to try to deal with environmental problems through DSM subsidies.

One alleged benefit of competition is that it opens up markets to power producers who can advertise and market so-called "green power" or "environmentally-friendly" options to consumers. The Clinton Administration's electricity competition proposals include recommendations for clear and accurate disclosure of a producer's generation mix, to facilitate power purchases by customers inclined to take environmental effects into account, and thus to encourage power producers to meet that demand.[30] However, while there is evidence that some consumers are interested in paying extra for green power, more would not take environmental considerations into account in purchasing electricity.[31] In addition, even if some people are willing to take environmental costs into account, the external costs at the margin remain, leading to an open question (beyond the scope of this paper) as to whether "good" preferences are appropriate substitutes for explicit prices as means for internalizing environmental externalities.[32]

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[30] CECP, n. 6 *supra*.

[31] Data from a pilot retail competition program in New Hampshire indicate that "[t]wenty percent said that their decision was strongly influenced by the environmental message or image of the power supplier. But notice that most respondents (54%) said that this factor had no influence on their decision." UNH Survey Center Retail Electric Competition Pilot Program Survey Report, New Hampshire Public Utility Commission (Feb. 14, 1997), http://www.puc.state.nh.us/survey/exesumm.html.

[32] A second concern, also beyond the scope of this paper, arises because increased competition in electricity markets should reduce prices, increasing the overproduction of output relative to the optimal level because of the pollution externality that goes along with it, and thus increasing the need for environmental policy. (I leave aside here the possibility that entrants will tend on average to use "cleaner" generators than incumbents employing older plants, and thus that opening markets could reduce pollution.) However, to the extent that prices are falling in power markets because costs are falling, the difference between social cost--production costs plus the externality--and benefit (measured by electricity demand) also falls. This tends to reduce the size of the economic loss associated with the pollution externality. This "difference reduction" effect can outweigh the "output overproduction" effect, so that a fall in the costs of producing an environmentally dirty product can reduce the welfare loss associated with the negative externalities.

A more important environmental consequence of opening retail electricity markets to competition is that it should make environmental policies more effective. Under regulation, particularly cost-of-service regulation, utilities typically do not keep the profits they get form cutting costs. These include the costs that would be cut from not having to pay taxes for using polluting fuels--were such taxes in place.

More pertinently, deregulating electricity generation gives power producers an incentive to cut costs and increase profits by economizing on the use of tradable pollution permits, e.g., as under the sulfur dioxide trading program instituted by the Environmental Protection Agency in 1995 under amendments to the Clean Air Act.[33] Under regulation, utilities might only lack an incentive to cut costs by buying fewer permits than they might need in excess of their initial allocation, but an expectation that regulators will confiscate profits from permit sales will discourage them from abating pollution in order to be able to sell permits.[34] Increasing competition in the generation sector would eliminate these barriers to efficient trading and thus enhance the ability of these market-based policies to achieve environmental goals.

Absent policies to lead power producers, and thus consumers, to take into account costs of pollution and emissions, DSM subsidies may continue to play a justifiable policy role. But it is important to keep in mind that DSM is an inferior "second-best" tool, in economic terms, to emissions taxes or permit trading policies that would increase bring electricity prices closer to marginal cost. As a rule, if X creates an externality and Y is an externality-free substitute, then subsidizing Y will lead to an economically better mix between X and Y. But this step in the right direction is not as large as it should be. Subsidizing Y rather than taxing X will lead the prices of both X and Y to be below social marginal cost. We might improve the mix between X and Y, e.g., between high-efficiency air conditioners and using electricity, but the price of what X and Y delivers, e.g., cool air, will be below marginal cost and, thus, consumed excessively relative to the efficient amount.

CONCLUSION

Opening generation markets to competition threatens to make utility-funded DSM programs more costly if not unsustainable. But before instituting policies to reform DSM programs to be more compatible with open power markets, one should consider whether competition might remedy the problem itself. Substituting retail competition for regulation of electricity rates should give power producers the flexibility to set rates based on marginal cost during peak periods, thus discouraging the excess power consumption that DSM technologies can mitigate. In addition, under competition, utilities will no longer be guaranteed returns on

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[33] Council of Economic Advisers, *Economic Report of the President* (Washington: Government Printing Office, 1997): 208-210.

[34] For a comprehensive review of regulatory distortions in permit trading markets, perhaps leading to too much trading as well as too little, see D. Bohi and D. Burtraw, "Utility Investment Behavior in the Emission Trading Market," *Resources and Energy* 14 (1992): 129-156.

investment that could lead them to build too much generation capacity. We also have seen that entrepreneurs in an open electricity market may be able to combine high-efficiency appliances with power to profit from making investments in energy conservation that consumers are allegedly either too myopic or ill-informed to undertake.

Competition cannot eliminate pollution externalities that could lead to excessive energy consumption. But it can make more effective policies, such as permit trading programs, better tailored to meet environmental objectives. As the case for those policies becomes even stronger, DSM as a public policy tool--as opposed to a power marketing technique or an independent consumer response to efficient electricity prices--should become increasingly less valuable.