Incentives and Standard to Promote Economic and Energy Efficiency

Bruce N. True, California Energy Commission

This paper examines some important advantages of incentives for energy efficiency even in a competitive utility environment. I find that an important role for incentives is to provide important information about a measure before it is incorporated into standards by revealing its unobserved costs to customers. I look at how incentives are especially useful for realizing efficiency while not requiring all customers to choose the same level of efficiency. We also find that both standards and incentive programs impose revenue losses which will tend to increase rates.

Introduction

Energy efficiency has been promoted through a variety of public policy channels. These have included appliance and building standards and utility efficiency incentive programs. The prospect of competition has led to concern that utility incentives may have no role in the promotion of energy efficiency in the future.

I explore some of the relative advantages of efficiency incentives to find what their role will be given increasing competition. I particularly focus on how utility incentives can still support efficiency standards, which may be the principal vehicle for energy efficiency with increased competition. I find that:

- An important use of incentives is to establish the cost to program participants beyond just the incremental measure costs. In particular, it will be shown that encouraging the installation of efficiency measures will reveal the unobserved costs associated with measures and act as a guide for building standards. This information can be an important guide in implementing future standards.

- Utility programs will be a superior alternative to standards when the usage of the equipment varies a great deal across customers.

- The rate impact of incentives is not necessarily a good reason to support standards rather than incentives. The rate impacts of both standards and incentive programs are explored. The impacts of both are significant because both policies impose revenue losses.

We attempt next to analyze when incentives are a method to prepare for standards. Then we examine when information issues create a role for incentive programs. Finally, we examine the rate implication of standards and incentive programs for energy efficiency.

What Are the Strengths of Incentives in a Competitive Utility Environment?

Incentives are a means to facilitate future building standards. They do this by demonstration of new technologies and by forcing technologies. Most of the ways which incentive programs can pave the way for future standards amount to revealing information important to determine for which measure to impose by standards. Below, we explore another type of information that incentives can reveal that will aid the implementation of standards .

Revealing Costs of Measures That Are Unknown to Regulators

An appropriate role of incentives is to reveal the subjective cost of new measures and help establish the less costly one to incorporate into new standards. The level of incentives needed to induce adoption of measures can help reveal some of the costs that customers associate with those measures in addition to the traditional incremental measure costs examined in most cost effectiveness analysis.

Some DSM Measure Costs Are Difficult to Measure. Some of the costs of installing energy efficiency measures are difficult to measure. These would include subtle perceived differences in services such as the flicker of a compact fluorescent bulb or the cost of finding a supplier of a non-standard technology. These unobserved costs are subjective costs. Such costs are difficult for energy planners to measure in choosing among numerous measures to promote by standards or incentive and so on. Such costs are the reason that rational energy consumers do not utilize available energy efficient technology without policies to encourage energy savings. Policies that make these costs of energy efficiency more explicit and measurable are desirable.

Standards that mandate installation of a measure simply impose these unobserved costs on those customers of energy services they affect. Incentive programs reimburse participants for these costs. The costs that are reimbursed are not eliminated but transferred from program participants to ratepayers at large.

Incentives Programs Can Reveal Maximum Subjective Costs of Measures. The subjective costs of installing a measure to program participant are no greater than the bill savings and incentive payment less incremental measure costs for any program participants. (Bill savings are in present value terms.) Below this ceiling, the subjective cost of implementing a measure will vary across customers. There are program participants for whom the unobserved costs are less than observed benefits. For these participants the incentive could be significantly reduced, and they would still participate. For other participants the unobserved costs will eliminate all the apparent benefits of participating in the program. These are the marginal participant. By marginal participant, I mean a participant who is just willing to participate, and who would not participate if the incentives were reduced. They have the highest subjective costs of implementing the measure among participants. The subjective costs to these marginal participants are just equal to the bill sayings and incentive payment less incremental measure costs.

In Table 1 below I explore the levels of these costs to marginal participants revealed in the data submitted by a utility for planning purposes.

The levels of these costs are quite significant-larger than the incremental measure costs.

This use of data on incentive payments to reveal the level of unobserved costs or energy efficiency is a relatively recent application of revealed preference theory. Incentives programs can act as a guide for standards (Nichols 1993; Herman 1991).

Incentive programs for a measure are useful for overall planning because they help reveal the cost to customers of measures beyond just incremental measure costs—the difficult to measure costs such as those based on service quality. We can construct these costs to marginal participants of measures based on incentive program results. These are the unobserved costs of measures to marginal participants only, and they are lower for many participants and even higher for non-participants. But they will still give a relative indication of these types of costs for different measures. This indication of the relative size of subjective costs of measures can help guide the design of standards imposed to replace incentives. This measure of subjective costs could be normalized to a per kWh basis. New measures that penetrate the market with relatively low subjective costs as indicated using this test are good candidates to include in future efficiency standards all other factors equal. Those with relatively high costs should probably also be removed from the pilot incentive program and no longer pursued. Hence, a role for standards is to be used as a testing ground for picking attractive measures to be included in building standards.

Competition may limit the scope of incentive programs. Given the information they can reveal, it may be appropriate to use alternative test levels of incentives for a limited geographic area. This would reveal unobserved cost of the program with different levels of participation. The low incentive test programs with the lowest fraction of customers participating would reveal the maximum unobserved cost of a small number of participating customer. Higher incentive levels would reveal what fraction of the population has unobserved costs of a slightly higher level. Highest incentives would reveal the cost to the potential participants with the highest unobserved cost of installing the incentivized measure.

Increasing Energy Efficiency When the Individual Circumstances of Energy Consumers Differ and Are Unknown to Regulators

The situations where incentives are best used are discussed next. This begins by examining when standards may not be an appropriate vehicle for energy efficiency. We see that incentives may be superior in these cases. If competition limits the potential funding for incentives, it will be especially important to identify the sectors that incentives are best applied to. The section concludes by looking at the cost and benefits of standards and incentives in a hypothetical example.

The imposition of quality standards to alter consumer behavior is appropriate when the agency attempting to alter consumer behavior has better information to

Table 1. Quantification of Unobserved Costs in a California Utility's DSM Plans

	Bill Savings (B)	Incremental Cost $/Unit (C)	Rebate $/Unit (P)	Maximum Value of Unobserved Costs (B)+(P)-(C)	Savings kWh/Unit (K)	Maximum Value of Unobserved Costs Per kWh Savings (B)+(P)-(C)/(K)
Electronic Ballast	1,296.4	442.59	221.29	1,075.1	1,139.23	10.23
Compact Fluorescent	2,692.33	602.14	380.93	2,471.12	13,790	0.33
VSD Centrifugal Chiller	1,056.73	414.7	207.34	849.37	807.57	8.66
Display Case	416.85	126.92	63.46	353.39	614.24	3.95
Customer Real Discount Rate		5.00%				
Utility Real Discount Rate		5.00%				
Electric Rate in 1993		$0.11				
Inflation Rate		3.51%				
Nominal Utility Discount Rate		8.68%				
Nominal Customer Discount Rate		8.68%				

recognize quality and make optimal choices than consumers. Energy efficiency standards are quality standards for the characteristics of energy using equipment such as SEER rating. Regulators usually have more information on appliance efficiency characteristics than do consumers who often find SEER ratings obscure and confusing. (Hayeck, 1945, is a nice discussion of how society is organized to minimize information costs).

Ideally, efficiency standards will tend to move energy consumers toward a uniform level of efficiency set by the standards and judged to be optimal based on the regulator's superior information. Only when the efficiency chosen by many consumers is increased to the minimum standard, will energy efficiency standards increase energy efficiency and save energy. If few or no consumers are moved to the uniform minimum efficiency then few consumers are moved to a higher level of efficiency and the standards are ineffective. Imposing uniform efficiency or quality controls will be appropriate when there is little reason for the optimal efficiency to be different for different consumers. The appropriateness of this use of standards is analogous to the appropriateness of drug regulation. Consumers have little knowledge of pharmaceutical and could only develop it at a prohibitive social cost. They also have fairly uniform desires: good health. Hence prohibition of many drugs from the market is appropriate.

However, there are circumstances when moving energy consumers to a single level of efficiency is not appropriate. What is best for one consumer may not be for another. In these circumstances, decisions are clearly best made by the consumers who are affected and best know their own tastes and circumstances. For example, the breakfast eater knows best what breakfast cereal to choose to satisfy his own tastes. Some want just the right crunch, others want it to "taste great," and others want "little orange oranges." Often the cost effectiveness of measures will also differ widely across customers based on difficult to measure characteristics that affect the amount of cooling or lighting they use. Regulatory agencies are in a poor position to make decisions that require knowledge of individual characteristics, like thermostat setting behavior. These are different for and usually only known to individual consumers. Hence, we do not regulate cereal for taste. (On the other hand, nutrition is perhaps as confusing as SEER rating to many consumers and the scope for regulation may be much greater in this area.) Standards may well mandate measures that are not cost effective for some customers if the standards are too tight or miss opportunities for cost effective savings if they are too loose.

An appropriate role for incentives is accommodating the difference in customers. To accomplish a number of goals such as reducing energy use to reduce the pollutants associated with energy production there may be policy goals to increase energy efficiency. However, policy makers may not desire to mandate a single level of efficiency that will be non-cost-effective for some energy consumers. In this case, incentives can nudge consumer towards generally greater efficiency but not just a single level, and are the best policy option for energy efficiency for environmental grounds. Hence, given differences in consumer that standards cannot accommodate, incentives are the preferred means of pursuing increase energy efficiency.

This discussion also suggests the start of a criterion for determining when incentives are the best vehicle for realizing increased energy efficiency:

1. when consumer's relevant individual circumstances that affect the amount they use the relevant equipment varies significantly across consumers and;

2. variation in consumers is not easily observable and standards may not be linked to observable characteristics that affect demand.

I explore some cases below where individual variation in circumstances might make incentives a preferable approach to the use of standards.

Incentives for refrigeration would seem to be not meet the first criteria. The degree of difference in consumers in their use of refrigerators is quite small-especially since operating hours are determined to a large degree by a thermostat. Hence standards are probably a more appropriate policy vehicle to promote energy efficiency in refrigerators.

The case for incentives for compact fluorescent lights (CFL) in residences would be clearer. The usage habits of consumer vary a great deal for lighting. As a result, the first condition is not met for mandating compact fluorescent and compact fluorescent are not mandated for residences. A policy of nudging consumer with incentives toward generally higher lighting efficiencies with CFL's is desirable because it allows them to make their own judgments about what applications in their homes if any would allow the most cost effective savings.

Air conditioning may be an intermediate case. Usage can vary a great deal. (Berkeley Solar Group, 1990) Much of the variation in usage will however be due to climate conditions where the dwelling located. Climate conditions are observable to the regulator and standards for minimum efficiency can vary to reflect climate conditions. Standards may still not be appropriate if much variation in air conditioner use is due to tastes not climate. Then some who use very little air conditioning in hot climates may still be required to purchase a level of efficiency that is too high to be cost effective for them. On the other hand many who did not have enough knowledge to discern efficient from inefficient air conditioners may be spared from buying "lemon" air conditioner. Lemons that would have a higher life cycle cost.

The policymaker must make tradeoffs for the air conditioner case in setting standards. The policymaker must decide: how much variation in behavior can be linked to climate; if a level of minimum efficiency will make consumers generally better off; and if so, what minimum level of efficiency. Incentives for higher efficiency models could still realize cost effective savings for homes that are large consumer of space cooling.

Incentives can, but will not necessarily, produces results superior to standards in cases where the characteristics of customers vary. The key advantage of incentives in this case is their potential to be tailored to specific situations. Incentives could produce superior results to standards if they can be designed to induce the greatest increases in efficiency for relatively large energy consumer. This requires that incentives be carefully targeted, emphasizing measures that are focused on large end user where they are more cost effective. Carelessly designed incentives may well induce installation of measures in situations where they are not cost effective to society.

An Example of the Impacts of Standards Versus Incentives

Tables 2, 3 and 4 are an analysis of the specific costs and benefits of applying standards and incentives for high efficiency lights in a hypothetical case.

This example is hypothetical and attempts to look at some simple standards and incentives applied to an arbitrary set of circumstances. I assume value is based on the tastes of consumers who are rational and choose among various option for lighting. Our intent is to see if in a simple example incentives will tend to realize most of their savings from large energy consumers producing more cost effective results.

Next, I discuss the various types of customers; the various types of lamps and lamp efficiency available; and the polices being considered. Then I examine how we are measuring the societal gains and losses of the alternatives. Finally I compare the results of applying standards and incentives to this hypothetical world.

Customers. I assume three types of customers: high demand; medium demand; and low demand. The customers in each class all have the same demand for hours of security lighting which is a roughly linear function of the price of each hour of lighting. The quantity demanded is

Table 2. High Demand Customers

Hours of Light	Demand Price (Marginal Value Before Equipment Cost of each Hour of Lighting)	High Efficiency Lamp: Total Value Less Electricity Cost	High Efficiency Lamp: Total Value After Cost of Electricity and Lamps	Medium Efficiency Lamp: Total Value Less Electricity Cost	Medium Efficiency Lamp: Total Value After Cost of Electricity and Lamps	Low Efficiency Lamp: Total Value Less Electricity Cost	Low Efficiency Lamp: Total Value After Cost of Electricity and Lamps
1.00	0.52	0.48	-0.12	0.46	0.06	0.44	0.09
2.00	0.44	0.88	0.28	0.85	0.45	0.80	0.45
3.00	0.36	1.20	0.60	1.15	0.75	1.08	0.73
4.00	0.28	1.44	0.84	1.37	0.97	1.28	0.93
5.00	0.20	1.60	1.00	1.51	1.11	1.40	1.05
6.00	0.12	1.68	1.08	*1.58	1.18	1.44	*1.09
7.00	0.04	*1.68	1.08	1.56	1.16	1.40	1.05
8.00	-0.04	1.60	1.00	1.46	1.06	1.28	0.93
9.00	-0.12	1.44	0.84	1.29	0.89	1.08	0.73
10.0	-0.20	1.20	0.60	1.03	0.63	0.80	0.45
11.0	-0.28	0.88	0.28	0.69	0.29	0.44	0.09
12.0	-0.36	0.48	-0.12	0.27	-0.13	0.00	-0.35

* Optimum hours for this lamp-customer column.

NO POLICY: Optimum which the customer chooses with no incentive or standards is 70 percent efficiency and 6 hours of lighting for 8.6 watthours.

INCENTIVES: Optimum which the customer chooses with .13 incentive for high efficiency lamp is 100 percent efficiency and 7 hours of lighting for 7.0 watthours.

STANDARDS: Optimum which the customer chooses with standard requiring medium efficiency lamp is 70 percent efficiency and 6 hours of lighting for 8.6 watthours.

always less for low demand customers than the other two classes and always the highest for high demand customers at the same price. Alternatively, as comparing the first columns of Tables 2 and 4, the low demand customers always place a lower value on an hour of lighting than those in the other classes.

The first column, the demand price schedule, shows the value of each additional hour of lighting, and that the value of each additional hour declines as more hours are consumed. Value here is a subjective concept. Each additional hour of lighting is worth less and consumers are not willing to pay as much for it, the usually diminishing marginal value assumption from macroeconomics. The value of an additional hour of night lighting is what the customer believes it to be worth and does not vary from one type of lamp to another. This means the quantity and quality of light from all the lamps is identical. The last hour of lighting purchased will be valued equally to the cost of energy used to produce it. Total value minus electricity costs but before lamp costs (in the third, fifth and seventh columns for different efficiencies) is consumer surplus of the chosen hours of lamp operation, and it equals the sum of the marginal values less the electricity costs.

The consumer surplus for a given number of hours of lighting net of operating costs is different for different efficiencies of lamp. This difference is because differing amounts of electricity are used causing differing bills paid to produce the same quality and quantity of light. A customer will purchase a light that maximizes the value of the lighting less the operating and lamp cost. They operate the purchased lamp according to the demand schedule for their class: high, medium, or low, as long as the maximized value is greater than zero. By choosing their hours of operation according to this schedule they maximize the value of lamp operation after purchase. The low demand customers who have little value for security lights are the least likely to purchase security lights. This is because they find the cost of the lamp plus the cost of the energy

Table 3. Medium Demand Customers

Hours of Light	Demand Price (Marginal Value Before Equipment Cost of Each Hour of Lighting)	High Efficiency Lamp: Total Value Less Electricity Cost	High Efficiency Lamp: Total Value After Cost of Electricity and Lamps	Medium Efficiency Lamp: Total Value Less Electricity Cost	Medium Efficiency Lamp: Total Value After Cost of Electricity and Lamps	Low Efficiency Lamp: Total Value Less Electricity Cost	Low Efficiency Lamp: Total Value After Cost of Electricity and Lamps
1.00	0.35	0.31	-0.29	0.29	-0.11	0.27	-0.08
2.00	0.25	0.52	-0.08	0.49	0.09	0.44	0.09
3.00	0.15	0.63	0.03	*0.58	0.18	0.51	*0.16
4.00	0.05	*0.64	0.04	0.57	0.17	0.48	0.13
5.00	-0.05	0.55	-0.05	0.46	0.06	0.35	0.00
6.00	-0.15	0.36	-0.24	0.26	-0.14	0.12	-0.23
7.00	-0.25	0.07	-0.53	-0.05	-0.45	-0.21	-0.56
8.00	-0.35	-0.32	-0.92	-0.46	-0.86	-0.64	-0.99
9.00	-0.45	-0.81	-1.41	-0.96	-1.36	-1.17	-1.52
10.0	-0.55	-1.40	-2.00	-1.57	-1.97	-1.80	-2.15
11.0	-0.65	-2.09	-2.69	-2.28	-2.68	-2.53	-2.88
12.0	-0.75	-2.88	-3.48	-3.09	-3.49	-3.36	-3.71

* Optimum hours for this lamp-customer column

NO POLICY: Optimum which the customer chooses with no incentive or standards is 70 percent efficiency and 6 hours of lighting for 8.6 watthours.

INCENTIVES: Optimum which the customer chooses with .13 incentive for high efficiency lamp is 100 percent efficiency and 7 hours of lighting for 7.0 watthours.

STANDARDS: Optimum which the customer chooses with standard requiring medium efficiency lamp is 70 percent efficiency and 6 hours of lighting for 8.6 watthours.

the lights use exceed the value to the customer of any level of security lighting.

In fact, from the table, we see that the column for value less lamp and electric cost is always negative for efficiency greater than the minimum of .5 for low demand customers. This is consistent with the usually expectation that efficient equipment is more appealing to those who demand more of the service the equipment produces.

Lights. I assume three types of lights: high efficiency (which is the unit other efficiencies are defined relative to); medium efficiency (which produces 30 percent less light for the same energy), and low efficiency lights (which produce 50 percent less light for the same energy). The less efficient light uses more energy for the same light but its initial costs is less (see Table 5).

Polices. There are two policies to encourage energy efficiency. The first is a standard that eliminates the low efficiency lamps. The second policy is an incentives of 13 cents for the high efficiency lamp.

Objectives. I do not assume that the net value to customers is the only measure of the appropriateness of policies. Net value to consumers does not take into account the value of energy efficiency to all of society. Since energy efficiency is often justified on the basis that it mitigates air pollution and other social bads; energy efficiency policies do not have to increase private net value or net consumer surplus. The main subject of our attention is whether standards or incentives do a better job of capturing energy savings from large energy consumers and thus are more cost effective.

Results. In this case the incentive realizes all of its savings from high demand energy consumers. The standard realizes all of its savings from low demand energy consumers. Thus the incentive seems to realize one of its more desirable results.

One principle for choosing standards versus incentives becomes evident here. Incentives will tend to make having some kind of light more attractive relative to having no light. Incentives may increase the saturation of an end use

Table 4. Low Demand Customers

Hours of Light	Demand Price (Marginal Value Before Equipment Cost of each Hour of Lighting)	High Efficiency Lamp		Medium Efficiency Lamp		Low Efficiency Lamp	
		Total Value Less Electricity Cost	Total Value After Cost of Electricity and Lamps	Total Value Less Electricity Cost	Total Value After Cost of Electricity and Lamps	Total Value Less Electricity Cost	Total Value After Cost of Electricity and Lamps
1.00	0.32	0.28	-0.32	0.26	-0.14	0.24	-0.11
2.00	0.19	0.43	-0.17	0.40	-0.00	0.35	*0.00
3.00	0.06	0.45	-0.15	0.40	-0.00	0.33	-0.02
4.00	-0.07	0.34	-0.26	0.27	-0.13	0.18	-0.17
5.00	-0.20	0.10	-0.50	0.01	-0.39	-0.10	-0.45
6.00	-0.33	-0.27	-0.87	-0.37	-0.77	-0.51	-0.86
7.00	-0.46	-0.77	-1.37	-0.89	-1.29	-1.05	-1.40
8.00	-0.59	-1.40	-2.00	-1.54	-1.94	-1.72	-2.07
9.00	-0.72	-2.16	-2.76	-2.31	-2.71	-2.52	-2.87
10.0	-0.85	-3.05	-3.65	-3.22	-3.62	-3.45	-3.80
11.0	-0.98	-4.07	-4.67	-4.26	-4.66	-4.51	-4.86
12.0	-1.11	-5.22	-5.82	-5.43	-5.83	-5.70	-6.05

* Optimum hours for this lamp-customer column (no lamp is preferable to the higher efficiency lamps for these customers.)

NO POLICY: Optimum which the customer chooses with no incentive or standards is 70 percent efficiency and 6 hours of lighting for 8.6 watthours.

INCENTIVES: Optimum which the customer chooses with .13 incentive for high efficiency lamp is 100 percent efficiency and 7 hours of lighting for 7.0 watthours.

STANDARDS: Optimum which the customer chooses with standard requiring medium efficiency lamp is 70 percent efficiency and 6 hours of lighting for 8.6 watthours.

Table 5. Lamp Costs and Efficiencies

	High Efficiency Lamp	Medium Efficiency Lamp	Low Efficiency Lamp
Lamp Efficiency	1	0.7	0.5
Lamp Capital Cost	0.6	0.4	0.35

and actually increase energy consumption, even as efficiency is increased. Incentives are more appropriate for an end use with a very high saturation. Standards in contrast may well reduce the saturation of an end use. In this case the low demanders choose to have no night light with the standards in place.

Another observation that comes from this example is that standards should be paid for the highest efficiencies. This type of equipment will appeal more to high energy demand consumers for whom it is already more cost effective. As a result, incentives for the highest efficiency will capture more application for large energy users and be more cost effective. In addition, the incentives program increases efficiency, but allows for some variation in levels of efficiency for different customer classes.

How Large a Problem Are the Rate Impacts of Incentive Programs

Concerns about their effects on rates have motivated much concern about efficiency incentive programs, and competition has if anything increased these concerns. Building standards, however, as well as utility programs will cause revenue loss that will tend to increase utility rates at the same time as they reduce energy use. Thus, it is inappropriate to assume that the rate impacts of standards will always be much greater than incentive programs.

Energy efficiency program of all kinds will tend to increase utility rates when avoided costs are below average rates for program participants. Under these conditions the lost revenues from reduced energy sales will be larger than the reduction in production costs, and these conditions generally describe the resource situation in California and elsewhere. The regulator may not choose to give the utility full rate relief for the lost revenue, but in California at least the Electric Rate Adjustment Mechanism (ERAM) implies at least in the short-run this is the correct assumption.

We examine the rate increase potential of standards and incentive programs. This analysis is limited to examining the potential to raise rates of the installation of a single energy saving measures under standards versus a utility incentive program. Determining the effect on rates of standards versus incentive programs would require much more knowledge including penetrations of measures under both scenarios. In addition, one would need to examine carefully the cost savings caused by each measure installation. Cost savings are ignored here on the assumption that the savings from the installation of each measure will be the same regardless of whether its installation was induced by standards or incentives.

Incentives put more upward pressure on rates per installation than standards designed to induce the same installation because they require rate increases to recover incentives as well as revenue lost from reduced sales. To determine how much more pressure per installation incentives put on rates than incentive program, we now examine how large are costs of incentives versus lost revenue for selected measures in a proposed utility incentive program. If incentives for a measure installation are a small share of lost revenues due to that installation, then other things the same incentive program may raise rates little more than standards. The upward pressure on rates from each measure installation under either policy will differ more if the costs that ratepayer must cover for a measure in an incentive program are largely its incentive costs.

I have examined the revenue and incentive costs of measures a California utility plans to include in future DSM. My intent was to determine the size of lost revenue versus the cost of incentives for each measure installation. Table 6 contains this information. The table contains the relative size of the revenue requirement to recover lost revenues and pay for incentives to program participants for each measure installation.

Lump sum costs in the year of installation are adjusted so they can be compared to the stream of costs in lost revenue over the life of the measures. This is done by levelizing lump sum cost.

Table 6 consists of 6 columns. The first two present the measure type and lifetime used to levelize lump sum values over. Column 3 is annual lost revenue, computed by multiplying annual energy savings for the measure times the electric rat. Column 4 the rebate cost per unit levelized to an annual value for each year of the life of the measures. Column 5 contains the rebate cost and revenue loss cost of each measure to non-participants. Column 6 is the ratio of the levelized stream of incentive payments and lost revenues at constant cents per kWh (the cost of incentives to made up rates) in to lost revenues alone (the cost of standards to be made up in rates).

The upward pressure per measure installation with standards is lower than for the incentive program. The revenue loss per installation with standards is 85 percent of revenue loss and payment with incentive programs levelized over the life of the measures for most measures in the table. The pressure on rates from standards would similar to that from this incentive program for these measures.

Table 6. Cost Per Installation to Non-Participants for Selected Measures Proposed by a California Utility

(1)	(2) Measure Life	(3) Cost to Non-Participants of *Standards* Revenue Loss (@.11 per kWh)	(4) Levelized Rebate $/Unit/Year (5% Real)	(5) Cost to Non-Participants of *Incentives* Revenue Loss (@.11 per kWh) + Rebate (3)+(4)	(6) Cost of *Standards* Cost of Incentives (3)/(3)+(4)
Electronic Ballasts	16	119.62	20.42	140.04	85.4%
Compact Fluorescent	2	1,447.95	204.87	1,652.82	87.6%
VSD Centrifugal Chiller	20	84.79	16.64	101.43	83.6%
Refrigerator Display Case	8	64.5	9.82	74.31	86.8%

Conclusion

There are important advantages to incentive programs that should be taken advantage of even as utility competition increases. First, the level of incentive payment can help reveal the subjective costs of implementing new measures if they are included in incentive programs. Revealing this subjective information can help provide guidance on which measures to include in standards. Those with the lowest subjective costs are desirable candidates other things equal. Second, incentives are desirable to realize energy efficiency when it is not desirable to push all customers to the same level of efficiency. Last, all efficiency program will increase utility rates if marginal costs are below rates. The rate increase associated with utility incentives programs may not be that much larger than for efficiency standards .

References

Berkeley Solar Group, 1990 *Occupancy Patterns & Energy Consumption in New California Houses (1984-1988),* California Energy Commission.

Hayeck, Fredrich. 1945. “The Use of Knowledge in Society.” *American Economic Review.* 57 (5) PP. 519-*530.*

Herman, Patricia. 1991. *Comments of Barakat & Chamberlain, Inc. On the Proposed modifications and Clarification to the Standard Practice Manual,* Barakat & Chamberlain.

Nichols, Albert L. 1994. *Revealed Preference and the Net Benefits of Electricity Demand-Side Management,* Prepared for the Western Economics Association.

Sutherland, Ronald. 1992. *Analytical Foundation of Conservation Policy.* Argonne National Laboratory.

Southern California Edison. 1994. *Uncommitted DSM Forms.*