How to Catch More Flies with Honey and Vinegar: Integrating Voluntary Programs with Codes and Standards in California

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ABSTRACT

We conduct demand-side management (DSM) based on two distinct and oft-times competing concepts. The first emphasizes obtaining direct energy savings through customer transactions, usually via incentive programs. The second emphasizes market transformation (MT), characterized by interventions to permanently alter market behavior. Although efficiency advocates value both concepts, we generally fail to make linkages between the two.

The result? Significant lost opportunities. Policy makers and regulators overlook the benefits of program integration, instead mandating program mixes and reporting systems which fail to encourage—or capture—enhanced results achievable through an integrated process. This deprives portfolio managers and program designers of clear guidance regarding the value of portfolios designed to both save energy and transform markets. Collectively, California's DSM industry misses the chance to ensure that savings programs amplify results from MT programs, and vice-versa.

This paper applies innovation diffusion (ID) as a framework supporting the concept of program integration: establishing strategically-informed portfolios coordinating energy savings programs with MT programs as a foundation for a new era in DSM. We particularly emphasize the prospective value of stronger linkages between "resource acquisition" incentive programs and energy codes and appliance standards (C&S) enhancement programs, emerging technologies (ET) programs, and research and development (R&D).

Introduction

The central thesis of this paper is that ID theory provides a compelling basis for integration of ET, incentive, information, education, and C&S programs[1]. Program integration provides a fast and cost-effective means to increase energy savings and persistence, and to produce sustained market change. This approach promises to advance the evolution and continued success of the DSM industry.

In the sections below, we first address how C&S ensures MT. Then we examine how MT affects ET programs and voluntary programs[2]—in particular, the impact on these programs when mature technologies are dropped from incentive programs following code adoption.

We next examine some existing program linkages and how ID theory reinforces their importance. We provide two case studies documenting the obstacles that non-integrated programs have encountered, for example, the chasm between early market deployment and

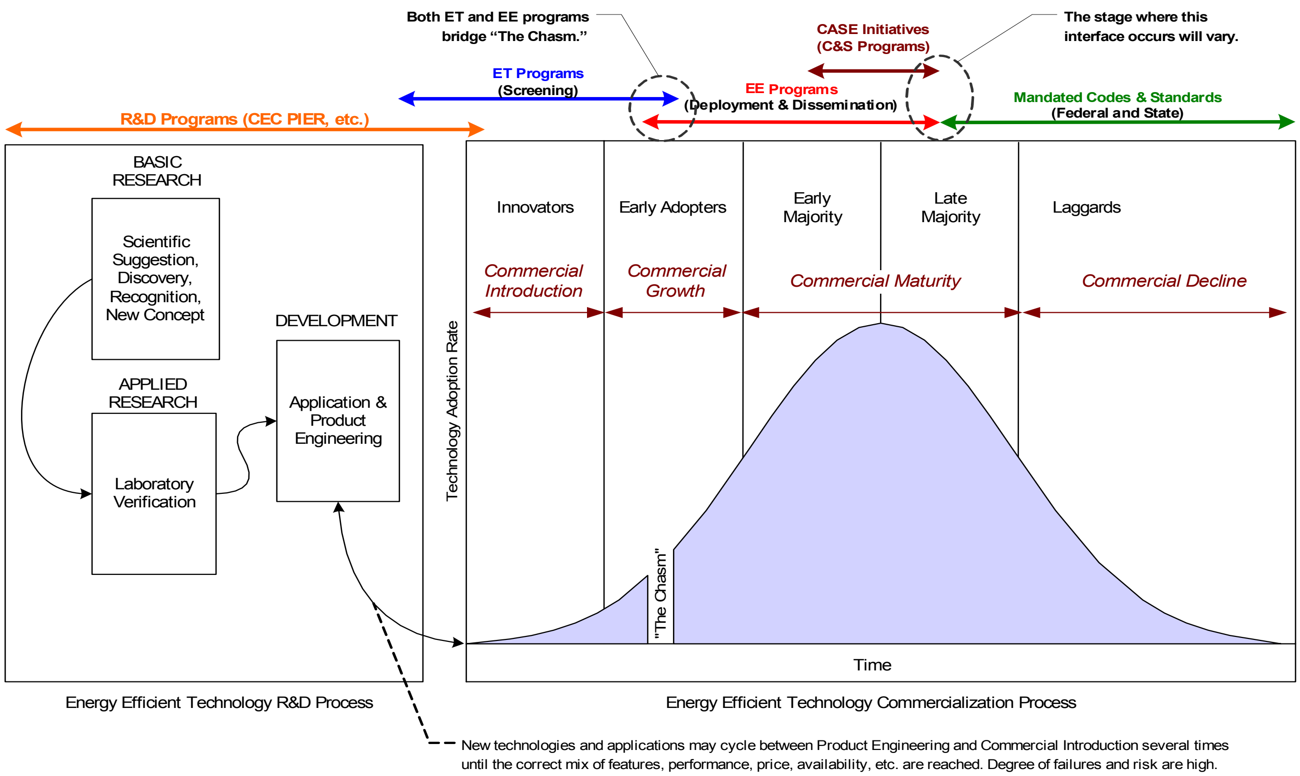
[1] Throughout this paper, we refer to all programs other than C&S as "voluntary programs." This reflects the customer's option to take part in the program or not. C&S is "involuntary" from the customer's perspective.
[2] There is considerable literature on the impact of voluntary programs on MT, and we will not revisit this issue here.

market adoption. We then consider ways to improve integration, proposing a programmatic path from R&D and ET to code adoption

Innovation Diffusion as a Basis for Program Integration

Principles of ID show that within a population or social system, there is a group structure in which some groups adopt innovations more readily than others. This points to the need for involuntary interventions in the face of declining propensity for later groups to adopt an innovation (Rogers, Everett 1995). As an innovation moves from innovators to early adopters, early majority, late majority, and finally to laggards (see Figure 1), the relative propensity to adopt declines, and the cost to influence each group increases.

Figure 1. Energy Efficiency Technology Framework



Source: Campoy 2004

(including incentive programs) also *always declines* over time. Indeed, even wildly-successful incentive programs rarely affect more than 50 percent of the market. To achieve 100 percent adoption of energy efficient technologies[3] and practices—consistent with a theoretical "perfectly rational" society's desire to minimize costs—it is almost always necessary to use involuntary interventions. Viewed as a complement to voluntary efforts, regulation through C&S fulfills the intent to achieve full adoption.

[3] Throughout this paper, we use the term "technologies" generically, to refer to technologies, practices and innovations.

The Role of Codes and Standards in Market Transformation

Under the accepted description of MT for energy efficiency technologies, MT programs are designed to reduce or remove market barriers that inhibit energy efficiency. Program managers aim to do this by conducting interventions that can eventually be discontinued without the market rebounding to its original state.

In the process of creating MT programs, designers encounter thousands of market barriers that emerge from different combinations of market sectors, adopter groups, technologies, and building types. The barriers are generally qualitative and conceptual in nature: phrases such as “split incentives,” “performance uncertainties,” and “organizational practices” describe them. The barriers are real and the results are, too, but MT programs tend to run into trouble when someone asks, “OK, but how much energy did it save?”

Savings programs, on the other hand, hold the advantage of creating and reporting on large numbers of customer transactions through straightforward and time-proven reporting and measurement techniques. These programs create legitimate, measurable, cost-effective savings: however they do little to address underlying market barriers, barriers that persist during and after the program. They don’t answer question such as, “Could we have achieved this result in some other (less expensive) manner?”, or “Has the time come to discontinue incentives for a particular measure?” In other words, they tend not to have built-in MT characteristics and in some cases are driven to preserve—rather than transform—the status quo.

C&S provide the surest means of ensuring market transformation and cost-effective, measurable, sustained savings[4]. As an involuntary form of intervention, C&S are effective to the extent noncompliance carries a credible threat[5].

Appliance standards, which mandate minimum performance or prescriptive requirements for individual or groups of products, generally limit the sale of covered products within state or federal jurisdictions. Such regulations send strong signals to manufacturers and distributors and are generally considered to be very effective in assuring widespread compliance.

Building energy codes are less prescriptive in nature, in that they drive alternative construction options rather than specific approaches. Like appliance standards, they produce a high level compliance (RLW Analytics 1999, RER 2001) when designers, builders, and code officials understand them. This is reinforced by building owners’ expectations of lower energy bills for complying buildings.

The California investor-owned utilities’ (IOUs’) C&S programs enhance the effectiveness of the California Energy Commission’s (CEC) code update process. IOUs bring credibility and institutional weight to the issues that other players cannot.

Opposition to C&S proposals to increase energy efficiency usually comes from the manufacturing and construction community and is based on economic arguments countering the benefits of C&S proposals. These parties argue that the proposals may save energy but are very expensive, place undue burdens on them, limit legitimate product choices for customers—and should therefore not be adopted.

[4] In the Northwest, pure market transformation strategies without C&S follow-up have been used with success but the jury is still out on whether “snapback” will occur when local interventions are withdrawn.

[5] We recognize that regulating some technologies and practices (e.g. industrial process) in not practical.

As major market players themselves, the IOUs are well-positioned to balance the economic arguments of manufacturers and builders with their own economic arguments related to the compelling benefits of proposed C&S: life-cycle cost-effectiveness, energy supply requirements and grid stability. Other parties cannot do so with the same degree of credibility.

Recent history in California suggests that the IOU C&S programs are highly effective and that C&S enhancements are repeatable on a periodic basis. The IOU C&S programs supported numerous upgrades to building and appliance energy standards that were adopted for the 2001 and 2005 code revision cycles. Recent C&S program successes in California include new regulations for LED traffic lights, compact fluorescent lamps, electronic ballasts, cool roofs, and residential high-performance windows. C&S program managers have already begun preparing for the 2008 code cycle. Moreover, there is a direct cause-and-effect relationship between program interventions that drove adoption and the adoption as a form of market conversion, so all interested parties can rely on C&S as a clear means to transform markets.

DSM professionals debate the issue of the optimum market share percentage at which adopting new energy C&S requirements is likely to be successful. Historically, C&S advocates have considered a 60 percent market share desirable, to reduce the risk of backlash from builders, manufacturers, and others, after adoption.

Recent experience, however, shows that market share is not a strong determinant of success. C&S adoption can occur over a wide range of market shares (from 3 to 85 percent) and a wide range of benefit/cost ratios (from 1+ to 10), determined by more fundamental attributes such as cost effectiveness, availability of technologies, and the magnitude of change from accepted practices necessary to meet the new code (New Buildings Institute, 2000a, New Buildings Institute, 2000b).

How Codes & Standards Adoption Drives Program Transformation

Once technologies are adopted into C&S, incentive programs can and do drop them. In 2003, for example, energy efficiency programs in California discontinued incentives for LED traffic signals after new appliance standards requiring them became effective. In 2001, enhancements to residential building standards, such as those requiring verification of tight ducts, shifted program baselines and caused program redesign. Likewise, advancements in nonresidential building standards have had similar impacts on nonresidential programs

After dropping technologies from a program following their adoption into C&S, an incentive program manager has to identify new technologies, redesign the program, and train program staff. These program redesign and training efforts increase administrative cost and can reduce program cost effectiveness.

The search for a repeatable, cost-effective way to identify replacement technologies for incentive program measures leads the program managers to ET. The statewide ET program in California supports the transition from research to commercialization. It seeks to accelerate the introduction of energy efficient technologies, applications, and analytical tools that are not widely adopted in California.

The ET program managers look to research and development efforts such as the California Public Interest Energy Research (PIER) program and to existing, underutilized technologies for the ET project portfolios. To assure an adequate supply of potential new measures for incentive programs, IOU ET program managers begin a new round of demonstration projects and related activities annually.

Innovation Diffusion Supports Stronger Program Linkages

As we have shown, discontinuing incentives for technologies or raising technology performance baselines following C&S adoption precipitates a series of events that eventually impact R&D. Periodic code cycles that advance efficiency regulations thus stimulate a continuous improvement process which may include identifying new technologies or raising the incentive baseline or performance threshold for an existing technology.

Sustaining such a continuous improvement calls for enhanced program portfolio management, from R&D through C&S adoption. For example, as mentioned above, when C&S adoption causes incentive program managers to drop existing energy-saving measures, the program managers call on ET program managers for new ideas. Since ET success depends on R&D productivity, this reinforces the need for enhanced coordination between the PIER R&D organization and statewide ET program managers, who operate collectively as the Emerging Technologies Coordinating Council.

This process will break down if there are delays in moving technologies from one step to the next in the development, demonstration, and commercialization process. Program portfolio integration that keeps the entire process in view can prevent the formation of technology chasms that otherwise may disrupt ID. Successful integration requires understanding the distinct roles of programs as part of the portfolio, without which, the risk of program and portfolio failure increases. We demonstrate this in the case studies and analysis sections below.

A primary role for emerging technologies programs is to prepare technologies for incentive programs, with an emphasis on risk reduction related to technology performance or failure. This preparation requires ensuring technical, economic, and design performance, verifying customer acceptance, establishing availability of products from multiple vendors, and establishing the minimal industry infrastructure required to support incentive programs. These needs dictate education program activities to expand market infrastructure and disseminate information.

As with the transition from voluntary programs to C&S adoption, DSM professionals debate the optimum point at which to transfer technologies from ET programs to incentive programs. Once again, there is no clear-cut answer, but diffusion-of-innovations principles provide useful indicators.

Innovators are the first choice for ET demonstrations early in the life cycle of a technology when risk is highest. Since innovators are not considered dependable sources of information for other adopter groups, the risk of technology failure causing for one user causing others to reject it is less.

ID theory describes early adopters as methodical decision makers with enough financial strength to accept limited risk. Their opinions are so influential on the early majority that any ET demonstrations that they participate in should involve technologies that have been well vetted to weed out potential performance issues in advance. Since early and late majority make adoption decisions based on the experience of early adopters, early adopters determine the fate of newly commercializes technologies. So if technology performance risks are significant (or even moderate), incentive program managers should ensure that ET programs have adequately documented customer acceptance with early adopters, not just with highly motivated innovators, before they begin marketing the technologies broadly.

Thus, when incentive program managers incorporate a new measure into a program, they are banking on the early adopters' positive response to the measure and to the incentive program. To ensure success, program managers address early adopters' attributes with a blend of offerings that include technical information and incentives to offset risk. The combination of information and incentives increase demand and volume, driving down the cost of products and services. Although the scope of incentive program activities is narrow, their linkage with other interventions is central to increasing cost effectiveness. This, in turn, is fundamental to successful commercialization. Ultimately, transformation occurs through code adoption.

C&S programs show up later in the market cycle to compel the use of market-ready technologies by the early and late majority and by laggards who do not (or can not) respond to voluntary program efforts.[6] ID theory demonstrates that the early majority make their decisions, in large part, based on their trust in early adopters to make good decisions.

Although incentives can and are employed to accelerate adoption among early adopters, some degree of free ridership should be assumed. This comes about when program managers raise or maintain incentive levels in the face of falling incremental measure cost to increase non-participants to adopt the technology. At this point, some early adopters and early majority are already persuaded of the financial benefits of adoption, and merely take the incentive as free money rather than as a reason to adopt.

By definition, the late majority has a proportionately lower propensity to adopt. So the cost effectiveness of voluntary programs will decrease with increased outreach efforts needed to influence this group. Whereas an early adopter requires only a fraction of incremental cost to influence the adoption of an energy efficiency substitution, member of the late majority or laggard group likely require that the entire incremental cost be offset, in addition to program administrative costs.

Case Studies Illustrating Integration Issues

In this section, we highlight key integration issues through two case studies: T8 lamps and electronic ballasts, and cool roofs.

T8 Lamps and Electronic Ballasts Case Study

Lamp manufacturers introduced a reduced wattage T12 fluorescent lamp in the mid 1970s in response to escalating electricity prices after the OPEC oil embargo. The General Electric brand, "Watt Miser," became a generic name for this 34-watt lamp. It produced savings of 15 percent relative to a standard F40 T12 lamp powered by a magnetic ballast available at that time.

California utilities responded by developing the first energy saving equipment incentive program, "California Savers," to accelerate market adoption of this new technology. However, users were unsatisfied with this lamp. Concerns included poor color rendition, poor lamp-ballast performance causing decreased lamp life, and lower lumens per watt than the standard F40 lamp.

Lamp manufacturers addressed these concerns by introducing a T8 lamp they had developed for the European market, where energy prices were higher, into the U.S. This is a tri-

[6] Non-adopters in the groups may be hard to reach for a number of reasons, including competitive strategy, economic hardship, limited market size, etc.

phosphor lamp that uses a new phosphor type developed for color televisions. This is the first fluorescent with high efficacy, great color rendition and long life. This lamp draws 32 watts and is 20% more efficient than the F40. But it did not run well with the standard magnetic ballasts common at that time.

Concurrently, researchers at Lawrence Berkeley Laboratory were perfecting an electronic ballast that increases efficacy and removes "flicker" and noise from the lamp. A successful field demonstration of two early near-commercial electronic ballasts sponsored by the Department of Energy took place at the main office building of Pacific Gas and Electric Company in San Francisco in 1978. When combined with the tri-phosphor T8 lamp, the electronic ballast proved capable of saving almost 30% over the standard magnetically ballasted T12 lamp system.

Utilities offered their customers incentives on T8s and electronic ballasts and supported the effort with a variety of education and information, demonstration, design assistance programs. However, a first generation of electronic ballasts introduced in the early 1980's proved too expensive and prone to failure for wide market acceptance.

Successive improvements in the mid-to-late 1980's in response to customer complaints and utility requirements for performance and power quality resulted in a successful market reintroduction of electronic ballasts. Utility energy efficiency programs increased lighting manufacturers', lighting vendors' and customers' awareness of T8s and electronic ballasts and their reliability and value.

In 1998, a dozen years after the successful reintroduction of the electronic ballast, the CEC locked T8s and electronic ballasts into practice with revisions to the commercial Title 24 energy codes requiring lighting power density of 1.1 watts per square foot. Generally, businesses need to use T8s and electronic ballasts in order to achieve this level of performance.

The use of T8s and electronic ballasts as an underlying technology marks the point in time when the CEC determined that this technology was economically viable to use as a basis for energy code compliance. The entrance of the T8 and electronic ballast into this realm is primarily a result of utility energy efficiency programs, which increased demand and drove the cost down. Expenditure to date on utility programs has totaled about $600 million.

The widespread adoption of the T8 and electronic ballast technology in California spread to the rest of the country. Lamp manufacturers now produce relatively small quantities of T12 lamps (Komonosky 2004).

Cool Roofs Case Study

In November, 2003, the CEC adopted the 2005 update to Title 24, a regulation which includes California's energy efficiency code for buildings. In the 2005 update, cool roofs become a requirement for most low-slope nonresidential buildings. This measure will save some 35 MW per year by reducing cooling loads in the range of 10-20% in typical nonresidential buildings.

In 1983, PG&E offered commercial customers incentives for cool roofing by way of "Direct Rebates," a predecessor program to the current "Express Efficiency." If a technology works, is cost-effective, and does not create significant marketplace disruption, does it really take 20 years to move from incentive programs to building codes? It can if a "false start" penalty forces a punt.

For cool roofs, the gaping hole in 1983 was the complete lack of consensus performance standards and definitions around this technology. Under the program at that time, any white or light colored material qualified for a incentive as “reflective roof coating.” There were, literally, no further specifications in the program. Predictably, this led to a lot of inferior, inappropriate product—in many cases, product that was never intended to serve as roofing material—going on a lot of commercial roofs. Although the fundamental science regarding radiative properties of materials had been understood for a long time, this science had not been translated across into roofing products and into common understanding about roof performance. In many cases, inferior product installed under the program washed away. Customers did not benefit and we were embarrassed.

As implementers, we caught on to these problems quickly and ended the program as quickly as we could, but a lot of damage was done. Backlash against cool roofing persists to this day based (at least in part) on that experience from more than 20 years ago. The backlash persists even though all of the issues around performance standards and definitions were resolved years ago. It persists despite numerous studies demonstrating the efficacy of legitimate cool roofs from the 1990s. The net effect of rushing this technology into incentive programs 20 years ago slowed it down by a number of years by giving it a black eye and making many people treat it with real suspicion (not just healthy skepticism).

Lessons Learned

Examining the preceding case studies, we can identify opportunities for enhanced program integration.

The first case study gives two examples of products that consumers found unsatisfactory based on field performance—the F34 T12 lamp and the first-generation electronic ballast. The second case study illustrates the impact of unsatisfactory performance of early cool roofing materials. In all cases, the technologies received support from voluntary IOU programs without adequate performance validation.

In an integrated program environment, the technologies would have received appropriate ET demonstrations and performance verification efforts independent from manufacturers and research advocates. Also, ET projects could have provided recommended performance metrics for the technologies to assure customer and IOU usability. This would have given incentive program managers important information that could have led to delaying full-scale product introduction or at least delayed IOU program support until the products better met customer needs and IOU requirements.

The lesson is that ET plays an crucial role in program integration much like M&E for research results.

Both case studies also illustrate what happens if a technology fails to cross the market adoption chasm due to performance issues for customers and/or installation contractors on initial introduction. Upon reintroduction, the technology requires increased time to gain market acceptance and increased incentive program expenditures to overcome the negative market perception that it’s a risky investment.

The lesson is that market failures for energy efficient technologies are costly, and that program integration can reduce or eliminate these costs.

We believe that even if the F34 lamp hadn’t created negative contractor and customer perceptions of energy-saving fluorescents, the T8 would still have required a relatively large retrofit program incentive budget and more years of promotion and subsidy compared to other measures. This is because there are significant lighting design issues involved in switching to T8 lamps. T12 to T8 conversion is a relatively complex measure since it isn't just a plug and play replacement for the standard, less efficient T12 lamps[7].

In a case like this, an integrated program portfolio would provide coordination between ET, information, education, incentive, and C&S programs to minimize total cost and time to successful C&S adoption.

Both case studies also illustrate what happens if a technology is introduced through an incentive program without any strategic frame of reference for further market transformation. In both cases, there was no general plan for how the technologies might move into the building standards arena and what types of definitions and performance standards might ultimately make sense—even though a full standards program is not necessarily needed to operate a incentive program.

In the case of T8 lamps and electronic ballasts, the result was a kind of market "addiction" to incentives as the measures remained in voluntary programs for a long time with no off ramps to drive them further along the ID curve. With cool roofs, the lack of a reasonable long-term strategy based on ID principles was a root cause of problems that delayed cool roof market adoption for years.

In both case studies, the IOUs used education and information programs to pave the way for measure reintroduction. For electronic ballasts, this happened in the 1980's when there was little integration between programs. For cool roofing materials, this happened during the MT era at the end of the 1990's when integration was beginning to take hold. In both cases, an integrated program portfolio approach could have produced better results more quickly at a lower cost.

Steps to Successful Program Integration

The last six years have seen introduction and growth of numerous program innovations in California that can contribute to an integrated program portfolio. These include third party programs, local government partnerships, ET programs, and C&S programs.

Successful program integration will require relatively small changes in this program portfolio. However, achieving success will require thoughtful development and prudent implementation of a well-articulated general portfolio plan reflecting a strong understanding of customer needs, market segmentation, technology commercialization, and marketing strategies.

Following is a summary of existing and proposed program elements with our recommendations on how each can be tuned for integration with the others to produce maximum sustainable customer energy savings as quickly and cheaply as possible.

[7] We have also observed the converse – lower incentive costs and more rapid transition to C&S adoption for drop-in replacement technologies that have significant non-energy benefits to customers and/or installation contractors.

Research and Development

The PIER R&D project portfolio serves as a valuable source for new program measures and energy-saving practices. Even at the R&D stage, integration with marketing research and voluntary programs is essential. R&D must be informed by a general understanding of customer markets and by targeted marketing research to define customer needs in the targeted market segment and for the intended technology application.

Rarely do researchers or research project managers possess the customer knowledge or market awareness to provide these customer preference insights. Instead, the general portfolio plan should include time, money, and human resources for independent, best-in-class expertise to guide research programs. Managers of voluntary programs have a strong understanding of energy efficiency markets and should be consulted periodically by research project managers.

Emerging Technologies Programs

ET programs fill the essential role of separating validation of innovative technologies and practices from their development. This is important because the R&D community's strength is in its focus on and advocacy for developing new technologies and practices—but that focus also makes it impossible for researchers to function as independent validators of their creations. The preceding case studies illustrate this point.

ET programs provide highly credible, unbiased demonstration projects that add value by verifying energy savings and other performance claims, as well as creating performance metrics and confirming installation contractor and customer satisfaction with the technology in a real-world setting. ET project managers operate in a disinterested role that is separate from the source of the technology or practices. The IOUs and CEC established the ETCC specifically to manage integration of R&D project results with ET activities.

ET projects have the potential to provide new measures for incentive programs if results confirm that measure energy savings and incremental costs meet program cost effectiveness tests and if the measures meet other program management and portfolio criteria. For ET projects that fail to meet program cost effectiveness tests but confirm other measure benefits for customers, information and education programs offers alternate channels for market introduction. Once introduced this way, some measures will achieve initial market acceptance which can drive down costs enough to meet cost effectiveness thresholds. This can open the way to subsequent incentives to further drive ID.

Pilot Programs

These are small-scale programs that deploy new technologies at multiple sites to flush out any potential implementation or performance shortfalls not identified during ET demonstrations.

Pilot programs currently have no explicit regulatory standing in California. In addition, regulators have overlooked the powerful synergy of pilots with pre-implementation marketing research and post-implementation M&V. This is unfortunate because without the ability to pilot test and verify a new program or measure, IOU utility administrators lack opportunities to deploy innovative concepts in a low-risk setting.

By default, third-party programs have become the nexus for program pilots in California. But since 2002, the California Public Utilities Commission has used an open solicitation process backed up by limited understanding of customer markets and no specific marketing research on customer needs in targeted market segments or for the intended technology applications. In addition, the timeliness and quality of M&V for third party programs is highly variable because it is managed by program staff rather than by specialists such as those found in utility company M&V groups.

IOU administrators need a combination of marketing research and pilots to prove the effectiveness of innovative technologies, program designs, marketing strategies, and/or targeted market segments before initiating full-scale production programs. Thus, pilots present significant opportunities for regulators to support integration with modest amounts of incremental funding. As a first step, future third party solicitations should be tailored to address specific technology, market, or segment opportunities in response to marketing research findings.

Ultimately, pilots sponsored by utilities, third parties, or utility / non-utility alliances, evaluated in a consistent manner and building on marketing research performed in the context of a general portfolio plan, can provide a valuable platform for market testing and initial market introduction. This can improve the likelihood of success for new measures and new production programs.

Production Programs

These are the rebate-based incentive programs that continue to provide a highly reliable source of large demand and energy savings for IOUs' energy efficiency portfolios[8]. Production programs offset the need for new generation, transmission, and distribution infrastructure and reduce global warming. In addition to the currently deployed range of production programs, there is an unrealized opportunity for new, hybrid programs that combine incentives for energy and demand savings with the innovative approaches of pilots, education and information programs, and with some emerging technology project approaches.

For integration to succeed in harvesting maximum savings in an increasingly complex and dynamic California customer market, we anticipate a blend of current incentive programs and hybrid programs. In addition, we expect that M&V comparing initial projections with actual market penetration and incremental cost improvements over time will have an increasingly important role in the decision to transition from voluntary programs to C&S.

Production program measures may encounter obstacles blocking this transition. We mentioned several of these in the Lessons Learned section above.

To make integration work, thus overcoming the chasm between production programs and C&S, production programs should do the following:

- rely on ET and pilots to minimize the risk of performance issues before broad market introduction
- rely on information and education programs to prepare the market for reintroduction of any measure that was previously withdrawn due to performance issues. Marketing

[8] Among the most successful statewide production programs in California are the IOUs' Express Efficiency, Energy Star New Homes, Savings By Design, and Standard Performance Contracting programs.

research is also crucial to validate market readiness and potential customer issues related to reintroduction

- identify off-ramps or triggers for code or standard adoption, usually in terms of increasing market share and decreasing incremental cost
- provide enhanced installation contractor and customer education for any measure that is not a simple drop-in replacement for the standard alternative.

Education and Information Programs

Along with marketing research and M&V, education and information (E&I) programs provide a "secret sauce" for program integration. E&I programs can and should support other programs in many ways, including the following:

- aid in preparing markets to accept pilot programs
- encourage innovators and some early adopters to consider measures that are not yet cost-effective enough for implementation in pilots or production programs
- introduce new practices with no associated incentives into the market
- identify potential customers for pilots and production programs
- inform building officials, installation contractors, and customers of forthcoming C&S requirements
- provide support for newly adopted C&S and for code enforcement after adoption.

Codes & Standards Programs

Well before C&S adoption, the California C&S development process allows for compliance options – state-approved optional measures that designers can use to meet code requirements for building energy budgets. Compliance options lend preliminary government support to energy savings estimates for measures with low market penetration while simultaneously paving the way for future consideration of a new measure for C&S adoption. It gives innovators and some early adopters, particularly those in the building design and construction industry, a reason to try out a measure, with or without incentive support.

Compliance options work best when they build on ET results that have confirmed measure performance. They effectively "validate the validation," lending state support and credibility to the already independent ET project finding. They also presume that manufacturers have the infrastructure in place to produce the necessary technology, so there will be no market disruption when installation contractors attempt to use it.

As we have discussed in the earlier sections of this paper, C&S adoption serves to cement the market transformation brought about by voluntary programs. It is crucial that portfolio planners and C&S program managers coordinate this activity closely with voluntary program managers.

If C&S adoption comes too soon, disruptive responses may appear such as regulatory or legislative backlash by disgruntled market actors. Another form of indirect resistance occurs when market actors form common cause with local building officials to put an unofficial moratorium on code enforcement. This can drive up the cost of statewide code enforcement, transferring the burden and cost of market transformation from the integrated program portfolio to the budgets of code officials. Given their other priorities, the code officials are unlikely to hold the line on energy efficiency in the face of significant market resistance.

Conclusions

We have shown that ID theory provides a substantial basis for enhanced integration of ET, incentive, information, education, and C&S programs. We have demonstrated the important role of C&S in ensuring sustained market transformation, and how the C&S adoption requires the identification and implementation of new program measures. We have identified some current program linkages and shown how ID theory provides a model for strengthening these linkages.

Based on two case studies, we have highlighted opportunities to move from weakly linked program elements to a more integrated program structure in California. We believe that most of the elements to achieve integration are already in place – what's needed is regulatory guidance that allows IOU administrators to produce and implement a general portfolio plan. Additionally, regulators should allow funding for marketing research and planned program pilots due to their crucial roles in developing an integrated program portfolio.

Program integration can provide a fast and cost-effective means to increase energy savings and persistence, and to produce sustained market change in California. Enhanced program integration shows strong promise of advancing the evolution and continued success of the DSM industry.

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