Maximizing Societal Uptake of Energy Efficiency in the New Millennium: Time for Net-to-Gross to Get Out of the Way?

Rafael Friedmann, Pacific Gas & Electric Co., San Francisco, CA[1]

ABSTRACT

Humans are running out of time to reduce global warming gas emissions to avoid horrendous socio-political and environmental consequences. Reducing global warming effects may require an 80% decrease in greenhouse-gas emissions by the year 2050. This will require a sharp reduction in the use of fossil-fuels our modern civilization is based on. Widespread uptake of energy efficiency and conservation are the best options available to mitigate global climate change and provide time for developing more sustainable and renewable energy supply sources.

California's thirty-year promotion of energy efficiency provides valuable experience and an institutional and market infrastructure to broaden and deepen customer uptake of energy conservation and efficiency. California policymakers, entrepreneurs, and public show a heightened interest in energy efficiency.

To accelerate uptake of energy efficiency will require California to update evaluation policies and protocols for overseeing the almost one billion dollar per year publicly funded energy efficiency endeavor. Current evaluation is more focused on regulators need of attributing energy savings to specific programs and less so on optimizing interventions. Programs and evaluations are focusing mostly on energy efficient measures (EEMs) that get incentives.

This paper calls both evaluators and policy-makers overseeing energy efficiency portfolios to acknowledge the need for, and move to develop alternate evaluation policies, protocols and methods that will ensure publicly funded energy efficiency efforts are cost-effective, while also being supportive of non-traditional, more economical and deep market transforming interventions. These new evaluation policies and protocols should still ensure continued public oversight. The paper draws upon the California context to show how the Net-to-Gross ratio as currently applied inhibits new, market transforming energy efficiency interventions. Paper ends providing some initial thoughts on how to improve this situation.

Background

Society has long understood the crucial nature of energy to transform the natural world to get goods and services. This initially led to social support for the creation of an increasingly larger and complex energy supply system. With time, this evolution has been accompanied with an understanding that there are social costs that are not fully internalized by private markets and thus, suboptimal investments and developments occur in the energy sector.

This awareness of the suboptimal investment has led to a willingness to collect and use public funds to foster more socially optimal development of the energy sector. Energy efficiency programs funded with public funds is a good example. This public energy efficiency expense comes from a generalized understanding that the free market will not adopt higher efficiency on its own, nor will it

[1] Any opinions expressed explicitly or implicitly are those of the author and do not necessarily represent those of Pacific Gas and Electric Company.

internalize the socio-politic or economic benefits and costs of the variety of energy infrastructure it has developed.

Public good funds for energy efficiency seek to maximize public benefits at minimum cost. Figuring out how to best use these public funds is complicated by a myriad of factors including risks, uncertainty, investment in short versus longer term opportunities, and various intervention strategies that seek to overcome perceived barriers to energy efficiency adoption.

In California and elsewhere (NW, NE and mid-west USA), publicly funded energy efficiency has a long history. In California, it is over 30 years old and has encompassed a variety of intervention strategies and administrative structures. Since 1996, these interventions have been mostly administered and run by the four investor-owned-utilities (IOUs), using public funds collected in rates. Regulatory oversight by the California Public Utilities Commission (CPUC) has sought to ensure IOU expenses optimize the use of these public funds.

As part of the determination of optimal use of these public funds, evaluation protocols have been established and significant evaluation efforts have been done to measure savings from these program interventions (check www.calmac.org for evaluation studies, and TeckMarket Works 2004, 2006). To ensure that funds are used in the best fashion possible, evaluation has focused on determining both gross savings and net savings by energy-efficiency-measures (EEMs) and/or programs. Gross energy savings encompass the totality of energy saved by programs or portfolios. Net savings refer to the energy saved that can be attributed to the programs beyond what would have happened anyways or "baseline". Gross energy savings are adjusted using a "Net-to-Gross" (NTG) ratio which in principle should include both an upwards adjustment for savings obtained beyond the program (spillover) and a downward adjustment for savings which would have happened anyways absent the program (free-riders).

California's four main investor-owned-utilities are currently administering a three-year, 2.1 Billion dollar publicly funded energy efficiency effort, under oversight and policy guidance by the California Public Utilities Commission (CPUC). The goals for this three year effort are to save 5.1 TWh, 2.2 GW and 111 MM Therms of natural gas. These goals are part of a longer-term effort that sought to save during 2004-2012 about 23 TWh, 4.9 GW, and 444 MM Therms.

Given the most recent findings of the Intergovernmental Panel on Climate Change, there is an interest in trying to save even more energy. Indeed, California Assembly Bill 32 calls for California to return to 1990 greenhouse-gas emissions levels by the year 2020 and the Governor issued an executive order that seeks to cut emissions by 80% by 2050.

For California to reach these goals, will require doing more transformative energy efficiency by tapping and engaging markets both broader and deeper than those to date. Broader in the sense that everybody will need to engage in energy efficiency. Deeper in that everyone will need to do more than what they have done. We will need full adoption of energy efficient lighting, premium motors, systems focused energy efficiency rather than individual energy efficiency measures (EEMs), as well as capturing process engineering enhancements, integration with renewable energy technologies, etc.

The current energy efficiency evaluation protocols are too focused on attribution of savings; counting only direct program participants energy saving actions corrected for free ridership. This focus promotes portfolios based on EEMs that are easy to measure and verify; undervaluing resources spent on programs that have longer lead times and/or high spillover effects. Although the current evaluation focus addresses the CPUC's need to minimize crediting of free rider savings, it also affects and impacts addressing other important societal goals, such as maximizing net energy savings and GHG emissions reductions.

The remainder of this paper explores how California's evaluation protocols, especially with regards to NTG may be inadvertently constraining the variety of interventions and resulting in reduced energy savings yields. The paper begins by drawing on the diffusion of innovation concept (Rogers 1995) to describe barriers faced by customers seeking to adopt more energy efficient technology. The discussion focuses on how the NTG can vary at the various stages of technological market adoption. This provides insights that are then exemplified with three possible new interventions that could lead to large energy savings with minimal public goods funding but that are constrained by the current evaluation protocols from happening. The paper ends by discussing how these protocols make broader and deeper efforts riskier given the high savings targets/goals; reducing energy efficiency administrators and implementers shy away from broader and deeper, higher spillover, market transforming interventions.

Current context requires and allows for new, more cost-effective energy-efficiency adoption interventions

At least two major issues with past evolution of the energy sector have recently heightened interest in tapping all cost-effective energy efficiency options first: Global Warming and Resource Adequacy. Global warming requires a significant reduction of Greenhouse Gas (GHG) emissions (some say up to 80% by 2050) to avoid most of the expected socio-politico-environmental impacts identified in the most recent IPCC reports. The frailty of the current energy supply system has become especially obvious in the wake of the California electricity crisis of 2000-2001, the large northeastern blackout of 2005, and Hurricane Katrina. Energy efficiency showed its worth to society during and after the California crisis, saving up to 14% of peak demand and 7% of electricity use in 2001; saving California from experiencing ongoing blackouts that summer. Energy efficiency is also recognized as the most cost-effective option for reducing GHG emissions, with a variety of energy saving measures costing less than 3 ¢/kWh and 1.2 $/MMBtu (Prindle et al. 2007). Energy efficiency and conservation reduces pollution and also gives time to develop better supply alternatives, especially renewable energy technologies and services, where technical breakthroughs and more importantly, market maturity is needed for full cost-effective deployment.

The current context is very receptive to energy-efficiency. There is increased public and private interest in energy efficiency. Corporations are seeking to enhance profits and their image among consumers and shareholders. GE's Ecomagination division had revenues of 17 Billion dollars in 2006; Walmart has established a group focused on sustainability and advertised its intent to sell 100 million compact fluorescent lamps (CFLs) in 2007; Home Depot gave away 1 million of these CFLs this past Earth Day; IBM has announced a 1 Billion dollar program to help its client data centers become more energy efficiency; and among automakers, Toyota and Honda higher energy efficient cars have fueled these two companies profitability and increasing market share over there less energy-efficient-focused competitors. Venture and pension fund capital managers are also increasing its interest and "seeding" new renewable energy and energy efficient technologies. The media is not far behind, with stories about global warming, energy efficiency, and renewable energy technologies showing up regularly in both local and national print and video media, as well as long-term stalwarts of "free markets" like the Economist (Sep 2006). Customer interest in these topics and eagerness to "do what's right" is an at all time high. We've even seen customers banding together to stop TXU's Board's recent interest in building eight new coal-powered power plants.

Albeit the increased interest in energy efficiency, studies still show that not all cost-effective EE is being adopted by customers, nor is ongoing development of products and services fully obtainable from business-as-usual (D Goldstein 2007; Itron 2006). This is the reasoning behind the ongoing support of energy efficiency promotion with public funds.

The question that arises is whether these funds are being spent in the most cost-effective and energy saving manner. It is also important to examine how current evaluation protocols and policies may be impacting what energy efficiency interventions are undertaken. This paper only examines the impact of NTG's policies, leaving for another discussion other areas that require review and possible revamping.

Let us examine what precludes customers from adopting all cost-effective energy efficiency and how NTG and its determination are not straightforward. Current California protocols regarding application of NTG in essence, by only counting free-riders, ignore non-energy benefits, which typically are the key leverage points to get customers to adopt more efficient services or products. New evaluation protocols with a broader perspective on overall societal benefits could increase research on customers and market actors resource efficiency motivators; providing insights for the development of more cost-effective public interventions.

Barriers to Capturing Energy-Efficiency Opportunities

The objective of a publicly funded energy-efficiency portfolio is to accelerate adoption of efficient energy use practices and technologies across a variety of customers served. Theoretically, successful public interventions spur along the maturation of energy efficiency markets so that these reach a "tipping point" where public interventions are barely needed. To succeed, the portfolio offerings need to take into account this varied mix of customers and their needs, continuously adapting to the changing context in which they are implemented. This requires a thorough understanding of customers needs to enable program offerings to align and produce optimal results. In California, even with over a quarter century of publicly funded energy-efficiency promoting programs, the energy efficiency market is still immature. Yet a new, energy-efficiency enabling context is growing; providing new opportunities for public resources to leverage private efforts to hasten market maturity. The key therefore is to clarify where markets are, what are the key barriers to further development of the market, and how to best tap into public and private resources to hasten tipping points for energy efficiency adoptions when these are possible, while still supporting the needs of less mature market segments.

This section briefly discusses key barriers faced by customers seeking to adopt energy efficiency. It also discusses how the barriers and context customers face change as an innovative product disseminates into the marketplace. This sets the stage for understanding why the CPUC's focus on attribution and rules regarding application of NTG lead to suboptimal results.

Energy-efficiency proponents talk about at least four major barriers that preclude customers (and society) from adopting all the cost-effective energy efficiency options (see Friedmann & James 2005; Friedmann 2006). These barriers are:

- Awareness. Where customers lack information on the options available, and/or their benefits.
- Availability. Manufacturers do not make or market more efficient measures as they do not expect to have a market for these (usually invisible) enhancements to their products.
- Accessibility. Distributors and retailers may not stock or aggressively display the EEMs making it hard for customers to find the more efficient products and services they seek.
- Affordability. Usually, EEMs are more expensive than the widgets they seek to replace, partly because of better quality components, partly because of their less developed and less competitive markets, with higher transaction costs to get these to market.

In order to address the barriers mentioned above, a public energy efficiency portfolio will include research, development and demonstration (RD&D) efforts, information and education components, programs to persuade customers to adopt more energy efficiency widgets and practices, and codes and standards to enhance the efficiency of buildings and equipment. The resources devoted to each of these public interventions will be determined by the market maturity context in which the decisions are made. They will change over time, across customer segments, and draw upon appropriate programmatic and project-level interventions as needed.

The programmatic and project-level interventions used need to address in more efficient and cost appropriate methods the changing needs of the market they seek to influence. Thus, the energy efficiency portfolio will be ever changing, reaching into new areas for further energy-efficiency, and contracting in others, where savings have been tapped out, or where markets have evolved and do not require further public support to continue to evolve.

The evolution of the dissemination of an energy efficient technology can be theorized to follow an S-shaped curve with four major market stages (immature, maturing, mature, and new EE technology markets) as shown in Figure 1 (Rogers 1995). An effective portfolio will optimize the mix of offerings to best address the challenges being faced by each of these four stages of market evolution to align benefits with societal needs. The intent is to match portfolio offerings to market needs, and to do so at crucial leverage points. Some of these efforts will be upstream, midstream or downstream, and/or geographically defined.

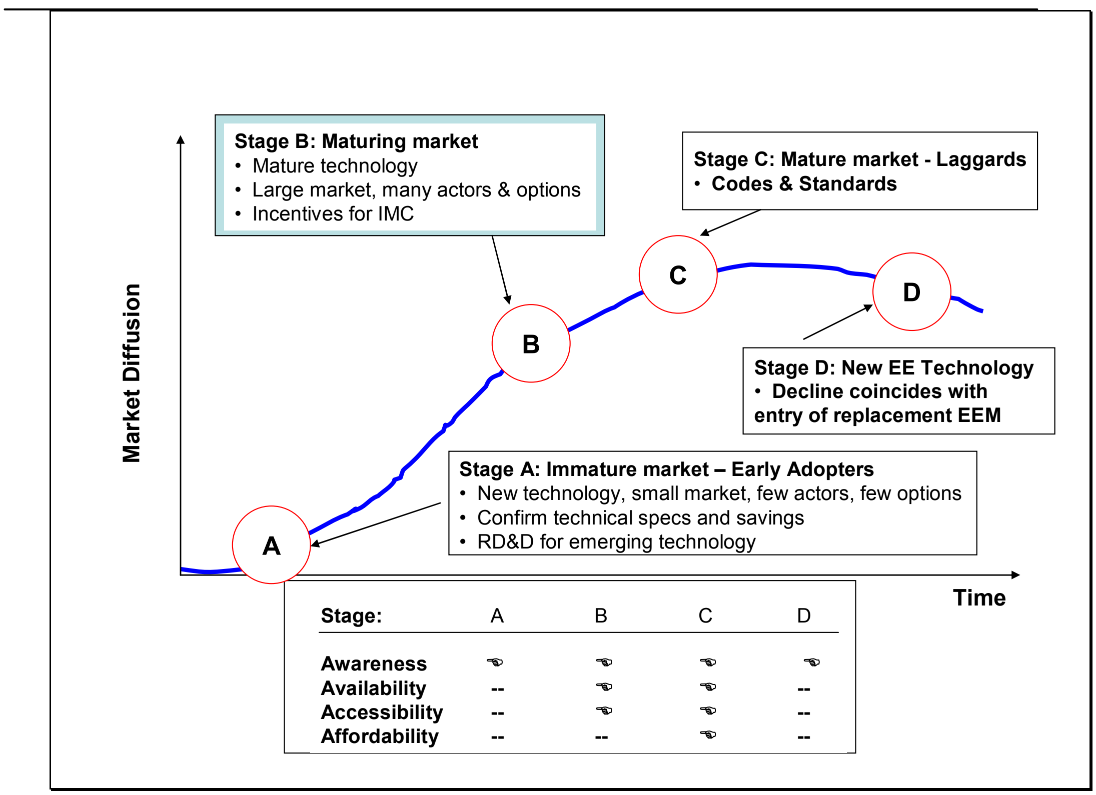

Figure 1. Market Evolution Curve for an EEM or EE Practice and Barriers Faced at Each Stage

There are important linkages among these four stages of market evolution. Stage A describes the early stages of a new technology or practice. Typical interventions for this stage focus on research, development and demonstration (RD&D). Decisions on what technologies or practices to include in the portfolio in Stage A depend on the remaining significant opportunities for energy savings. These depend in part on the previous maturation of other energy-efficiency measures addressing the more important customer energy end-uses. Indeed, Stage A and Stage D are interlinked, as the new technologies or practices being developed in Stage A begin to reduce the saturation in the market of the technology or practice that was previously being promoted by market interventions in Stages B, C and D. In Stage B, a technology or practice has become better known, is more available, accessible, yet still most likely, significantly more expensive than the less efficient technology or practice it seeks to supplant. Stage B is where most portfolio resources are typically spent currently, in the form of audits and incentive programs to help reduce the incremental costs of efficient measure's adoption. In Stage C, most of the customers have adopted the more efficient technology or practice, but some significant portion of the customers is unlikely to ever adopt it. In Stage C standards and codes are typically the intervention of choice to ensure that all customers adopt the more efficient technology given its significant societal benefits. By Stage C, the efficiency interventions administrator needs to be identifying and beginning to develop the next generation of technologies and/or practices to introduce (and start their own Stage A). This is reflected in Stage D, where the saturation of the current efficient technology is being impacted by the growing market presence of the next generation, even more efficient technology already in its own Stage A or perhaps even Stage B.

Eventually, as the private energy efficiency market grows and matures, one would hope that public support would center on Stages A and C, leaving private market actors to address most of Stage B. In this ideal theoretical construct, public funds would be used where most effective (namely where the private sector would not invest adequately due to the public good nature of that market), and be supplemented largely by private market actors positioning themselves to serve the maturing market customer in Stage B. Indeed, public resources would be used to guide and also provide credibility to private actors' best energy efficiency offerings in Stage B. This public-private market segmentation has only begun to occur in a few select situations, for example, with CFLs in homes and T-8 fluorescent bulbs in businesses. Even in these two cases, private market actors still look for various types of support from publicly funded programs. These public programs also are involved in coming up with the next generation of lighting products: LED and T-5 fluorescent lighting.

NTG and Maturing Markets for Energy Efficiency

Drawing from the diffusion of innovation for energy efficiency products and services curve, and the barriers inherent to each stage of market evolution, we examine here what factors affect the Net-to-Gross (NTG) ratio for any public interventions and the likely resulting value for NTG (see Table 1).

NTG at each stage of dissemination of innovation is different, as the key four barriers impact varies. NTG may be high in early adopter—because there is very low availability, accessibility for EEMs in Stage A. Although affordability and awareness also very low among the general population, they are actually high among the early adopter crowd. Thus, what the overall NTG—when defined as "what would have done without the program" depends on whether early adopters would have indeed been aware of the technology and been willing to spend more and seek it out to overcome the availability and accessibility barriers. Worse, should someone just focus on the early adopter participant customer's NTG it is likely the NTG would be quite low, and possibly lead to a decision to discontinue supporting the evolution of its' market. In this situation, spillover happens over time. Although the early adopters' NTG is low, through their actions and public support of market actors becoming engaged in the EEM, you are moving this technology to Stage B. Thus, just focusing on the early NTG, could lead to a decision to stop public support of the incipient EEM market, long before it is ready for uptake by the majority of customers and at least delaying capturing this technology's savings.

Table 1. NTG for Evolving Markets of EE Technologies

Market Stage	Participant Characteristics	Net-to-Gross Issues Of Participants
A. Immature	Early adopters. Embrace new technologies quickly	Awareness, affordability, accessibility, availability all low—imply high NTG; yet propensity to adopt is high among early adopters, possibly resulting in low NTG
B. Maturing	Majority of market. Require information, incentives, and other support to adopt efficient products	Relatively high NTG as these customers not "primed" to adopt new technologies and require information to be made aware, market support via upstream/midstream programs to enhance availability and accessibility, and incentives to improve affordability
C. Mature	Reticent/laggards. Lag at adopting new technologies or practices	Very high NTG as these customers very reticent to adopt EEMs. Indeed, C&S are used to force adoption, and even then, compliance with them can be very spotty
D. Decline	Back to early-adopters.	NTG indeterminate, depending on market barrier being faced for new, replacement EEM

In Stage B, all four barriers of awareness, availability, accessibility and affordability are being lowered. At this stage, the NTG for early adopters is low given the very high free-ridership; but for the mainstream customer, NTG is probably quite high initially and then, starts to decline as the market for the technology continues to mature.

In Stage C, all four barriers have been mostly overcome. The NTG is very low for both early adopters and mainstream customers, but very high for the late/never adopter. Adoption by the late adopters is obtained through mandatory energy efficient Codes and Standards. Yet compliance with the Codes or Standards remains a problem. NTG for these laggard customers is very high, but very low for all other customers.

We have seen that NTG is very dependent on the stage of market development for the energy efficient product being considered. Also, the rules on how NTG is applied can heavily influence the portfolio of energy saving strategies pursued. The market context within which we are seeking to enhance customer adoption of a particular energy efficiency product is also important. After 30 years of efforts and with the increased public and private interest in GHG, fossil fuel availability and socio-political implications of our dependence on them, it is becoming very hard to accurately estimate a NTG for a specific program intervention or EEM. Given the current context and energy savings goals under which California's energy efficiency programs are operating, it seems that a revision of the policies and their focus on NTG is needed. How these two aspects come together is discussed next.

NTG and Big, Bold Efficiency Interventions

In the search for new options to continue to garner energy savings and their accompanying socio-economic-environmental benefits to society, the question of how NTG (among other evaluation protocols) affects the possibility of carrying out effective new big and bold ventures comes up. We briefly describe three possible interventions being considered for the PG&E service territory and explore how current rules regarding NTG increase the risk of meeting savings goals making these interventions less interesting for the utility to pursue.

CFLs – Getting deeper and broader adoption by customers

About 31% of California homes have yet to install a single CFL. Of the remaining 69% of homes who have installed CFLs, only about 17% have installed 15 or more CFLs and can be assumed to have fully saturated their home lighting with CFLs (RLW 2005). Therefore, probably about half or more of the residential lighting is still using inefficient incandescent lights. According to the latest energy efficiency potential study (Itron et al. 2006), full saturation of CFLs would imply slightly over 100 million installed CFLs in PG&E serviced homes. The same study estimated at 53 million CFLs the maximum achievable saturation between 2004-2016. PG&E is seeking to accelerate adoption of CFLs via an upstream/midstream market program that offers about $2/CFL to manufacturers and distributors and retailers. This allows retailers to sell the CFLs for $1 each. Sales volumes have been increasing rapidly with up to 25 million expected in 2007, up from almost 7 million in 2006 and 4 million in 2005. Should this growth continue, PG&E homes will be close to CFL saturation in 2 to 3 years. The program has very low administrative costs by offering the incentives to manufacturers, distributors and retailers instead of customers. Yet this makes determining NTG very difficult, as participant contact information is unavailable. Instead success could be measured in terms of product availability, accessibility, affordability, and awareness. A survey of households (given that about 69% have CFLs) would still be hard pressed to get a reliable value for free-ridership given the multitude of energy efficiency messaging and promotions going on in the marketplace and that PG&E's incentive is almost invisible to the customer. Current evaluation protocols do not allow credit for any spillover, further reducing the per-protocols, official cost-effectiveness of the CFL upstream program. The program strategy is successful but can easily result in mistakenly high free ridership estimates. If the free ridership estimates come out too high, PG&E may decide to end this program (which also helps promote higher quality CFLs that have more of the characteristics customers want and that usually have led to rejection of CFLs in the past), before the CFL market is fully tapped out, leaving significant energy savings untapped.

Large Commercial Office Buildings

PG&E is currently offering a variety of products and services to large commercial office buildings. These include audits, retro-commissioning and commissioning, design-assistance, incentives for more efficient equipment, training on both, opportunities and enhanced operations and maintenance, etc. Customer outreach is mostly via PG&E Assigned Service Representatives (ASRs). The idea is that large office building managers can avail themselves of a variety of energy efficiency services to meet their needs through just one point-of-contact. Research is being conducted to allow for an even better focused program to meet this market segment needs. The idea is to characterize the large office buildings in PG&E territory by ownership and management set-up. PG&E will then reach out to these building owners and operators at the most appropriate levels of decision-making on energy-related investments, with appropriate messaging and utilizing the most appropriate PG&E staff level. This will imply establishing long-term relationships at various levels of both PG&E and the large office building manager or owner that will enhance uptake by the customers. Rather than focusing most of the effort on incentives, it is quite likely that efforts will be required at non-rebated aspects of the business decision. Tracking and determining the ultimate influence on energy savings of this variety of interventions among a variety of decision-makers (e.g., across the engineering or capital investments leadership within these organizations) over a long period of time, will be very difficult, and figuring out a free-ridership ratio even more difficult. How would one apportion such a free-ridership if say 8 of 9 decision makers were totally keen on adopting the technology (i.e., free riders) yet the 9^{th} and final decision maker (or even the first one on the decision-tree) only agreed to the enhancement thanks to the intervention of PG&E? How will a NTG based only on participant free-ridership underestimate the energy savings from spillover, within the organization and variety of decision-makers involved and their impact on their peer groups and over time? How interested will PG&E be in pursuing this business model if there is a high level of risk on what savings will be ultimately apportioned to its efforts, partly because of current protocols governing NTG and the difficulty of estimating it?

Data Centers—Brave New World

PG&E estimates data center load growth at between 400 and 500 MW. A variety of hardware and software options are now available that can cost-effectively reduce the energy used by these data centers by one-half or more. This requires implementation of a variety of measures in a synergistic fashion, including the promotion of standards and metrics for data center equipment, and promotion of improved data center designs and operation schemes. Outreach and promotion from a credible source such as PG&E (who does not sell the equipment) is crucial. As PG&E only sells energy to these data centers, its efforts to promote a variety of products and services being offered by a variety of firms (including IBM, HP, Sun, Intel, VMWare, etc.) are providing critical credence to the claims of these various vendors as well as optimal integration of the services and products offered by them. PG&E also sponsored a data center design charrette in 2005 that helped develop ideas on how to improve energy efficiency in these facilities. Yet, how will the savings from these efforts be apportioned among the entities involved? Given that affordability is not a key issue for this market, whereas awareness and credibility are, how will free-ridership be measured? Given the quick uptake and high turnover of personnel typical of this marketplace, with the expectation that about half of it will have adopted for example virtualization (whereby they can get rid of about 70-80% of the servers and cooling needs of a data center by increasing the load from 10% to 70% in each server), will evaluations be able to gather reliable free ridership (or spillover) data before the market is basically transformed? Given the large savings being obtained with minimal public resources, this effort appears to be very cost-effective and something to try to emulate in other markets. Under current policies it is unclear what savings will be attributed to PG&E's efforts.

These three examples show issues around using NTG (especially based solely on free-ridership), and how focusing on attribution of savings is not only near impossible for these big and bold strategies, but worse, makes these very risky endeavors for PG&E to pursue.

California Needs New Evaluation Protocols for Energy Savings Attribution

Given the rapidly changing, increasingly embracing energy efficiency context we live in California, it is imperative to develop new evaluation methods, policies and protocols that will help guide and ensure optimal use of public energy efficiency resources. These new policies and protocols should foster leveraging much larger private resources with carefully crafted public interventions.

Current California protocols and CPUC rulings need to be updated to increase the focus on maximizing social benefits accruing from public resources, to balance these goals with the current one that focuses on attempting to attribute savings to specific public efforts; and take advantage of a societal context where there is a large opportunity for saving energy by leveraging market actors resources. There is an increasing level of activity from private market actors that is tapping into energy efficiency regardless of the presence of publicly funded, utility administered efforts. Customers are more interested in adopting energy efficiency than ever before as they try to do their part to solve a variety of issues they care about (Climate Change, USA's "addiction to oil", Iraq war, etc).

Utilities need to meet goals that are set at levels that are hard to achieve under current rules governing what counts or does not if they are to get shareholder incentives for their energy efficiency efforts. The CPUC requires evaluations to estimate NTG, but only considering free riders, with no credit for spillover savings. Given current market conditions, it is impossible to estimate a reliable free-rider-based NTG and/or spillover. Furthermore, the reticence to accept spillover leads to increased resources being assigned to programs where the savings not only are "counted" but also, "attributable" and help programs meet their large energy savings goals. Current policies lead implementers to avoid programs that may have large spillover effects; in essence spending the resources in less cost-effective efforts. And to add insult to injury, yesterday's spillover (that you never accounted) turns into today's baseline. In the long run this leads to underestimation of energy savings and cost-effectiveness.

The inordinate focus on attribution also takes away resources that could be used to better understand the markets we are trying to influence, thus detracting from the quality and depth of the information we use in designing and running publicly funded energy saving interventions. Evaluation activities are thus done in an institutional framework that determines the scope of the activities and analyses undertaken. The majority of energy efficiency programs are done with public monies overseen by a public entity. This institutional framework leads to evaluations that cater to the needs of ensuring public oversight, but not necessarily clearly identifying the needs of customers, or the programs that attempt to get customers to adopt energy efficiency. As these are the major evaluative efforts, they also affect the evaluation community framing the scope of enquiry and methods. In my view, the current framework may be giving us a distorted view-as it does not encompass other issues that may be crucial at really finding out what works, as efficiency markets evolve.

As the CPUC gets ready to define energy efficiency goals for 2009-2011, there is an increased awareness of the changing context, the increased difficulty for determining NTG, and the need to review the rules and evaluation protocols under which the IOUs administer the energy efficiency public endeavors.

Of late, there is a growing concern among evaluation practitioners about the capability of estimating accurately NTG and attribution of savings to specific programs given the current context, and/or using these to design program offerings (see recent conference proceedings of AESP 2007, IEPEC 2006, and Barnes 2007; Chappell et al. 2005; R Friedmann 2005, 2006; Saxonis 2007). Market effects indicators appear to be the preferred choice at this juncture (Chappell et al. 2005). Much more work is needed here to develop new indicators and then protocols aligned with them to foster the ongoing evolution of energy efficiency markets and energy savings by customers.

Conclusions

Paper has shown that the current context in California allows for new energy efficiency intervention strategies. Given the private market's interest in selling or adopting energy efficiency to increase profits and show good corporate citizenship and customer's increased interest to "do what's right", publicly funded efforts can change their "mainstream" efforts to interventions that optimize leveraging of private market actor efforts. Publicly funded efforts will still need to deal with creating new options for early adopters as well as addressing "laggard" customers via Codes and Standards. It is with the mainstream customer that publicly funded efforts can now let the relatively mature California energy efficiency market take a bigger role and even the lead, and intervene with public funds to "oil" this private markets' machinery.

Current evaluation policies and protocols make difficult such a change in public energy-efficiency interventions. They insist on calculating free-ridership and not allowing for savings from non-incented energy efficiency improvements. Changing current policies to allow for counting spillover from participants and non-participants needs to be addressed.

But both spillover and free-ridership are becoming much harder to determine as the context becomes one that embraces energy efficiency (for a variety of reasons that have little to do with saving energy). Therefore, new evaluation metrics, methods, policies and protocols need to be developed to better understand customer adoption decision-making, identification of key leverage points in the markets for energy efficient products and services, so that publicly funded interventions can continue to focus their efforts in the most cost-effective and socially beneficial manners.

References

H. Barnes. 2007. "Market-Effects Momentum: Are We Giving Market Effects Their Full Due?" *In Proceedings of the 2007 IEPEC,* Oregon, WI: International Energy Program Evaluation Conference. Forthcoming.

California Public Utility Commission. 2004. "Energy Saving Goals for Program Year 2006 and Beyond." Decision 04-09-060. San Francisco, Calif.: Public Utilities Commission of the State of California.

Chappell, C., D. Mahone, L. Megdal, and K. Keating. 2005. "White Paper on Methods for Estimating Net-to-Gross Ratio for Non-Residential New Construction." Southern California Edison.

Friedmann, R., and K. James. 2005. "Optimal Design, Implementation, and Evaluation of an Energy Eficiency Portfolio." *In Proceedings of the IEPEC 2005 Conference,* 911-919. Madison, WI.: International Energy Program Evaluation Conference.

Friedmann, R. 2006. "Time to Sweep the Dust From Under the Rug?" *In Proceedings of the 2006 ACEEE Summer Study.* 8:76-87. Washington D.C.: American Council for an Energy-Efficient Economy.

Goldstein, D. 2007. *Saving Energy, Saving Jobs.* San Francisco, CA.: Bay Tree Publishing.

Itron, Kema, RLW Analytics, and AEC. 2006. *California Energy Efficiency Potential Study.* Sam Francisco, CA.: Pacific Gas and Electric Company.

Prindle, B. M. Eldridge, M. Eckhardt, and A. Frederick. 2007. *The Twin Pillars of Sustainable Energy: Synergies Between Energy Efficiency and Renewable Energy Technology and Policy.* Washington D.C.: American Council for an Energy-Efficient Economy.

RLW Analytics. 2005. *California Statewide Residential Lighting and Appliance Efficiency Saturation Study.* San Diego, CA: San Diego Gas & Electric Company.

Rogers, Everett (1995). *Diffusion of Innovations.* New York: The Free Press.

W. Saxonis. 2007. "Free Ridership and Spillover: A Regulatory Dilemma." *In Proceedings of the 2007 IEPEC,* Oregon, WI: International Energy Program Evaluation Conference. Forthcoming.

TecMarket Works. 2004. *The California Evaluation Framework.* Prepared for Southern California Edison Company. Oregon, WI: TecMarket Works.

TecMarket Works. 2006. California Energy Efficiency Evaluation Protocols: *Technical, Methodological, and Reporting Requirements for Evaluation professionals*. Oregon, WI: TecMarket Works.