Meeting GHG Emissions Reductions Goals While Keeping the Lights On: The Role of Energy Efficiency

Ignacio Rodriguez and Matt Dathan, PA Consulting Group
Rafael Friedman, Pacific Gas and Electric Company

ABSTRACT

Society faces an unparalleled environmental challenge that will require major changes both in the supply of and demand for energy services and products. This paper focuses on the demand side of the equation, specifically on energy efficiency initiatives. It uses California to showcase the key issues that need to be resolved to significantly increase the contribution of energy efficiency initiatives to help California achieve the goal of reducing GHG emissions by 80% by the year 2050 as called for in Assembly Bill 32 (AB32).

While most of the reduction in GHG emissions will have to come from introducing cleaner and renewable power generation resources, transportation, and other sources, California can also significantly expand its current energy efficiency initiatives to take advantage of the full potential that exists to reduce energy use. This will require more 'out-of-the-box' thinking to achieve and this paper identifies four key issues that, if effectively addressed, will help move California towards achieving its goals.

This paper will lay out key issues that are being faced by all long-standing energy efficiency portfolio arenas as the traditional incentives for widget-based portfolios are increasingly less cost-effective and are supplanted by a rapidly growing, market-actor led, transition to a "greener" and more energy-efficient economy. The paper will motivate others to begin addressing in earnest the role of public funds and the policy and protocol changes needed to maximize energy efficiency uptake and leverage to the utmost and in the most cost-effective fashion, efforts by market actors. Only by leveraging market actors will places like California be able to achieve the deep and broad changes needed to significantly abate GHG emissions and mitigate climate change impacts.

Introduction

Society faces an unparalleled environmental challenge that will require major changes both in the supply of and demand for energy services and products. These changes will be needed worldwide and should be led by the trend setters, namely those nations which currently have the most energy intensive lifestyles. This paper focuses on the demand side of the equation, specifically on energy efficiency initiatives. It uses California to showcase the key issues that need to be resolved to significantly increase the energy efficiency initiatives impact on greenhouse gas (GHG) emissions. California is part of the world's most energy intensive economy but it has done more than any other US state to mitigate this. As a result, it is now one of the most advanced in terms of proactively supporting energy efficiency initiatives and establishing aggressive targets toward achieving its goal of reducing GHG emissions by 80% by the year 2050 as called for in the recent state Assembly Bill 32 (AB32).

While most of the reduction in GHG emissions will have to come from introducing cleaner and renewable power generation resources, transportation, and other sources, California can also significantly expand its current energy efficiency initiatives to take advantage of the full potential that exists to reduce energy use. However, this will require more 'out-of-the-box' thinking. Simply continuing with the status quo of programs and policies will not deliver the necessary emissions reductions required by AB32 nor fully maximize the gains that can be obtained from the potential of energy efficiency. Crucial issues will need to be dealt with to develop policies and protocols that foster and entice markets to fully implement all energy efficiency options.

Significant investments have been made over the last few decades to improve energy efficiency in California as well as in the rest of the US and the world. However, according to the IEA, unexploited energy efficiency potential still offers the single largest opportunity for GHG emissions reductions. The IEA stated in their 2006 report 'Energy Technology Perspectives' that energy efficiency could account for between 31% and 53% of CO2 emissions reductions by 2050 under their accelerated technology scenario. In California there is a strong public commitment to ramping up energy efficiency efforts more than four-fold, so as to reduce electricity energy growth by half.

The current energy efficiency programs, focusing as they do on counting widgets, are the legacy of the demand-side management (DSM) programs developed in the 1970s through the early 1990s, and the subsequent periods when the price of oil fell to below $20/bbl. Times have changed. We now face a completely different set of circumstances: oil is hovering over $130/bbl, the effort to safeguard access to fossil fuel supplies is having an impact on the economy, and society is recognizing that real action needs to be taken to address the impacts of climate change. We have a unique opportunity to bring energy efficiency initiatives into the 21st century, to expand their contribution beyond the status quo and fully capture their potential to curb electricity demand with its associated cost and environmental impacts. To do this will require thinking 'outside of the box'.

This new thinking will require expanding the scope and definition of incremental energy savings from a single action or provider who gets the credit; changing how savings are measured; acknowledging the growing participation in sustainability of commercial and industrial players; anticipating the impact of carbon cap-and-trade programs; encouraging the development and deployment of new technologies; and adjusting policies and protocols to deliver incentives for the desired cost-effective behaviors across all stakeholders to achieve the common goal.

In this paper, four key issues are identified and discussed that, if effectively addressed, will help to move California towards further maximizing the contribution from energy efficiency on the demand side to reach an 80% reduction in GHG emissions by 2050. These are:

- What is the real avoided cost for energy efficiency in a soon to be constrained supply market considering investor-owned-utilities (IOU's) Resource Acquisition Plan and new generation capacity costs, Renewable Portfolio Standards, and transmission bottlenecks?
- What regulatory constraints and incentives need to be addressed to move energy efficiency beyond widgets and current programs to a much broader endeavor that leverages markets?
- Who are the key stakeholders in taking energy efficiency to the next level?
- What are the implications of keeping the status quo?

What is the Avoided Cost for Energy Efficiency?

Energy efficiency options are selected on their cost-effectiveness. This means the cost to implement an energy efficiency measure is compared with the cost avoided by society of providing energy equivalent to that reduction. There is a continual debate over what is the true avoided cost of energy efficiency, to what extent it should include additional environmental or other externalities, whether it is a reliable resource and dispatcheable, and furthermore how it relates to other energy supply options including renewable energy and any associated subsidies.

Avoided costs calculations are complicated. They are not uniform across geographical regions, they vary hourly as well as by planning area, climate zone, season and year. Various factors in addition to the marginal price of energy supply are taken into account to varying degrees including environmental externalities such as CO2 emissions, transmission and distribution (T&D) capacity and line losses, marginal cost of ancillary services and supply market price effects of demand reduction by energy consumers.

The allocation of costs to area and time can have a dramatic effect on the level of avoided costs for efficiency measures that target the peak. Figure 1 below illustrates the variation in electricity avoided T&D capacity costs by utility, planning area and climate zone across California in $/kW-year, as developed for the California Public Utilities Commission (CPUC) in 2003.

Figure 1. California T&D Avoided Costs by Planning Area in 2003

Source: CPUC

Furthermore, for some utilities, different approaches are used if energy efficiency will be considered as part of their Resource Adequacy (RA) requirement. In these cases, energy efficiency capacity value is the cost of RA capacity purchases that are avoided. Another approach is for energy efficiency reductions to be subtracted from load (not as an additional

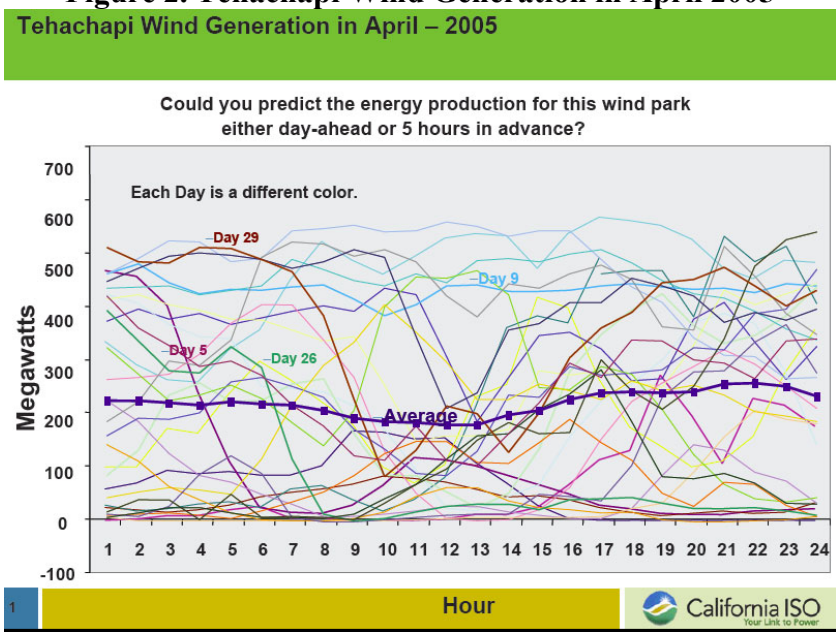
resource). In California the potential emergence of a capacity market also merits a reevaluation of the overall avoided cost methodology.

For forecasting purposes in the determination of customer class contributions to system coincident peak demand, single-hour estimates have been rejected as being too volatile for determining class cost responsibility. As a result, single-hour estimates may also be too uncertain for use in energy efficiency valuation. This problem might subside with the implementation of automatic meter reading where there will eventually be at least 15-minute interval data of all customer consumption patterns.

Adding to the complexity of the determination of the energy efficiency avoided cost is how it can have synergistic interactions or at times compete with other "clean energy" sources. For example, Figure 2 shows wind power as sharing many of the uncertainties of supply reliability that energy efficiency potentially could face. Valuing either of these resources is difficult; making it harder to decide which of the two to pursue. In other instances, there can be synergistic interactions between, for example, energy efficiency and solar PV, where the costs of the solar photovoltaic arrays can be significantly reduced by investing in more energy efficiency first. California already sought to resolve this issue of competing technologies during the period of the "Qualified Facilities" where the issue of to what extent the valuation of energy efficiency was properly reflected when compared to prices with other generation mix.

For now, the future avoided costs are estimated based on the near-term futures market and then extrapolated over the following 20 years. These avoided costs are applied to both supply and demand-side options when doing economic analyses to determine least-cost procurement that meets the electricity demand requirements.

Figure 2. Tehachapi Wind Generation in April 2005



Source: California ISO

Given all of these issues, there is a clear need to re-evaluate the determination of avoided costs when screening energy efficiency measures and programs. It is now more critical than ever

to properly quantify the contribution of energy efficiency to the broader challenge of reducing GHG emissions and the ensuing climate change impacts. At least GHG emissions impact should be better internalized into the avoided costs to more accurately value the benefits in the short and long term of energy efficiency.

What Regulatory Constraints and Incentives Need to be Addressed?

California IOUs are currently implementing a $2.1bn effort from 2006 to 2008 to promote energy efficiency among their customers. This is part of a broader mandate from the CPUC that includes renewable energy, low income energy efficiency programs, demand response and self-generation options to help minimize the costs of providing electricity and help mitigate power sector GHG emissions. This effort is part of the Energy Action Plan developed by the CPUC, the CEC and the now defunct CPA that put energy efficiency first in the loading order for providing society with the services garnered from electricity. To monitor the IOU energy efficiency effort, the CPUC has recently started over $72m of EM&V contracts guided by an evaluation framework and an Evaluation Protocol (TecMarket Works 2005, 2006). Various CPUC decisions have had a strong influence on the IOU energy efficiency offerings as noted next:

- **Aggressive efficiency goals** - the CPUC set aggressive energy efficiency goals both for the 2006-08 period as well as for 2004-2013 which seek to cut in half the growth in electricity demand. These goals were based on a series of energy efficiency potential studies carried out under IOU oversight in 2001-2002. The goals seek to garner the "achievable potential" estimated in those studies. However, subsequent studies (Itron 2006, 2008) show a significant reduction in the available "achievable potential". Setting the goals so high has led the IOUs to focus on as many energy efficiency measures (EEMs) as possible. To keep the portfolio of offerings cost-effective, over half of the savings have come from the very cost-effective CFL and T8 lightbulbs.
- **Confusion in the market** - the CPUC required the IOU portfolios to include at least 20% of the budget by Third Party Implementers (TPIs) and a further percent for Local Government Partnerships (LGPs). Most of the TPIs and LGPs were new or had not been carefully evaluated before having their earlier 2004-05 contracts extended. Although having multiple implementers can increase the reach of the offerings to more markets, it can also confuse these markets with a multitude of offerings.
- **Under-counting and timeliness of savings achieved** - the CPUC decided that they would only count towards the IOU goals the savings achieved by those projects that were implemented and had their incentives paid by December 31, 2008. It also decided that projects that were in the pipeline in 2005 would not count towards these goals if they were implemented in the 2006-08 period. This reduced the contribution of longer lead time, more complex, yet higher savings per site opportunities to the overall portfolio savings. It also may have limited engagement in longer lead time partnerships that could leverage eventually these market allies energy efficiency actions
- **Net versus Gross savings** - the CPUC decided that the goal would be based on "net", not 'gross" savings. Net savings would be determined by adjusting gross savings estimates by a multitude of correction factors. The most controversial of these is the "Net-to-Gross"

(NTG) factor. The CPUC decided to apply only the "net-of-free-riders" (NTFR) aspect of NTG; leaving out spillover. Evaluators were allowed to attempt to quantify "participant spillover" if it was expected to be large and quantifiable and not detract resources from the impact evaluation effort. Spillover of any kind would not be counted towards meeting the 2006 to 2008 goals. Using NTFR instead of NTG to attribute savings to IOUs makes programs that seek to leverage market actors' efforts unpalatable to IOUs, as it is likely that these efforts savings would be highly discounted since such "spillover" would not be counted.

- **Incentive mechanism** - in late 2007 the CPUC decided that the mechanism which would govern any incentives/penalties the IOUs would accrue in the 2006-08 period (CPUC 2007). This means that IOUs face penalties if their performance for all 3 years or any given year is less than 65% of the goal, and will get a portion of the net benefits to society if they exceeded 85% of the goal.

These decisions have resulted in some IOUs seeking to achieve their 2006-07 goals via a strong push of "deemed" EEMs (mostly CFL and T8 bulbs). This would deliver target savings in the 2006-07, buying time for the longer lead-time projects, typical of large commercial or industrial facilities, to be implemented in time to deliver savings efficiencies in the 2008 period. These decisions also created the incentive to make the entire portfolio focus on widgets, as there is less controversy and risk about measuring the savings per widget than behavioral or energy efficiency market maturation. This incentive structure also mitigated against the IOUs engaging with the new actors in the commercial sector who were promoting energy efficient widgets such as Wal-Mart with its goal of selling 100 million CFL light bulbs nationwide in 2007. Given the current rules, the CPUC would probably consider such partnership energy savings as likely to have happened anyway and therefore would not attribute any energy efficiency savings to the IOU portfolio effort.

Although this current scheme is producing enormous savings (in the region of 2.5 TWh/year and 600 MW), it will not be enough if it is to make a significant contribution to the goals of AB32 - it is reducing demand growth, but is still not reducing absolute energy use.

The situation from the perspective of the IOUs will only worsen given the current accounting rules for savings. The IOUs will be hard pressed to continue to earn credit for savings at the levels achieved in 2006-07. For example, CFL bulbs have accounted for about half of the entire portfolio savings in those two years. But CFLs are becoming more ubiquitous both because of these programs but also because of new initiatives by commercial players like Wal-Mart who are pushing CFLs into the market as part of their sustainability strategies. Although about one third of California homes have yet to purchase one CFL, there are more than 17% with 15 or more. The marginal returns are eroding rapidly and will only improve if programs somehow manage to get the one third of homes that have yet to install any CFLs to do so, and to stop the rebates for the other two thirds who do have them. This would require a very targeted program design, one which would be expensive to administer. An alternative is to couple the current programs that provide upstream incentives to manufacturers and vendors to make CFLs available, affordable, and accessible, with media campaigns to enhance awareness about how modern CFLs are significantly better than those in the past.

What California needs to significantly increase the depth and breadth of energy efficiency uptake is a paradigm shift in how savings are attributed to IOU-led initiatives to enable a new set

of programs to emerge that can complement the most cost-effective current ones. This would grant savings credits to IOUs that partner with market players, government agencies and other bodies with an interest in achieving environmental sustainability. Indeed, to this end, the CPUC leadership has already proposed the "Big-Bold Energy Efficiency Strategies" (BBEES) for residential, commercial buildings and HVAC. Another example can be found in the high-tech market segment, where PG&E's successful efforts to promote virtualization technology adoption in datacenters is now being "sold" to other IOUs around the country by Vmware, to rapidly expand adoption of this energy efficiency technology nationwide. That a market ally would tout a California IOU program elsewhere for replication can only help address the global climate change problem! Yet to implement these types of efforts with support from the IOU community will require significant changes to the rules on how savings are attributed to the energy efficiency efforts. Ideally, the IOUs should become the "grease" in the "machinery", rather than continue to try to be the "machinery" that drives increased energy efficiency uptake by consumers. The policies and protocols around how energy efficiency savings are measured and attributed need to change to a new paradigm that is aligned with portfolios that seek to leverage the actions of all market actors.

As an example of what we mean, let us consider the concept of sustainable communities. By this we mean a community that seeks to be resource efficient in the broadest sense - one that doesn't just focus on end-use electricity or gas efficiency. Therefore, it would not suffice to simply have zero-net-energy homes (ZEH), which is the current focus of the residential BBEES of the CPUC. Such a policy would seek to have mixed-use communities, with homes and commercial establishments interspersed, so as to minimize the need for vehicular transport. The communities would be more compact (possibly multi-story mixed commercial-residential) to make it easier for residents to walk everywhere and the homes would be smaller – maybe in the region of 300 square feet per person rather than the almost 900 square feet per person we are seeing in new homes. This would not only reduce the amount of resources for construction materials, but by having smaller homes, would make home ownership more affordable, which would contribute to residents being more likely to remain within the community and would make it easier for an aging population (another growing trend) to continue to live there and walk rather than being dependent on others for transportation. Yet the current BBEES focuses on offering incentives to install solar panels on roof-tops and encouraging more energy-efficient building materials and appliances to minimize the demand for electricity. While this is what works best with the current IOU program offerings it does not provide for the level of GHG emission reductions needed to meet AB32 targets. The current rules make it a real challenge for the IOUs to engage with land-use planners, cities, counties, developers, builders and government development stakeholders to build more truly sustainable communities.

So, how would the IOU long-term efforts and long time-lag savings be attributed to current goals? The experience with Codes and Standards advocacy by the IOUs can provide some lessons on how to proceed. Indeed, the CPUC acknowledged the IOU contribution to the development of new and upgraded codes and standards by attributing half of the total savings to them. Nonetheless, the CPUC still needs to develop a new evaluation scheme that not only allows, but encourages, the IOU-led portfolio to pursue the broader and much more sustainable options for society. To this end, it would be hugely beneficial if it acknowledged and gave savings attribution for other longer-term and long-lag savings efforts such as the deployment of emerging technologies and roll-out of training, education and awareness programs.

Who are the Key Stakeholders in Taking Energy Efficiency to the Next Level?

With the absence of well defined national policies that address climate change issues, innovative businesses around the world are now taking a more proactive position on corporate environmental sustainability (CES) and are looking into the future with longer time horizons than governments. They are also reacting to the growing pressure in many countries to enact some form of carbon emission control legislation. This can be seen as simply good business risk management, however some businesses are going beyond what this alone would require. In the US, although currently not participating in the Kyoto protocol, CES is a trend for competitive businesses who are seeking to move beyond the status quo toward developing and implementing strategies for reducing their overall environmental impact and GHG emissions footprint. These 'early movers' see this as a new market opportunity instead of a threat and policymakers should be seeking to engage them as additional stakeholders in moving energy efficiency to the next level, not only in making themselves more energy efficient, but also in helping to drive energy efficiency out into the broader consumer market.

These 'early movers' are also reaping the rewards of thinking holistically about their impact on the planet. They have re-examined their strategy and operations from a broader perspective and, while it may still be too early to demonstrate a direct statistical correlation between these measures and improved financial performance, there is strong evidence to suggest that organizations that embrace sustainability can achieve world-beating returns to shareholders.

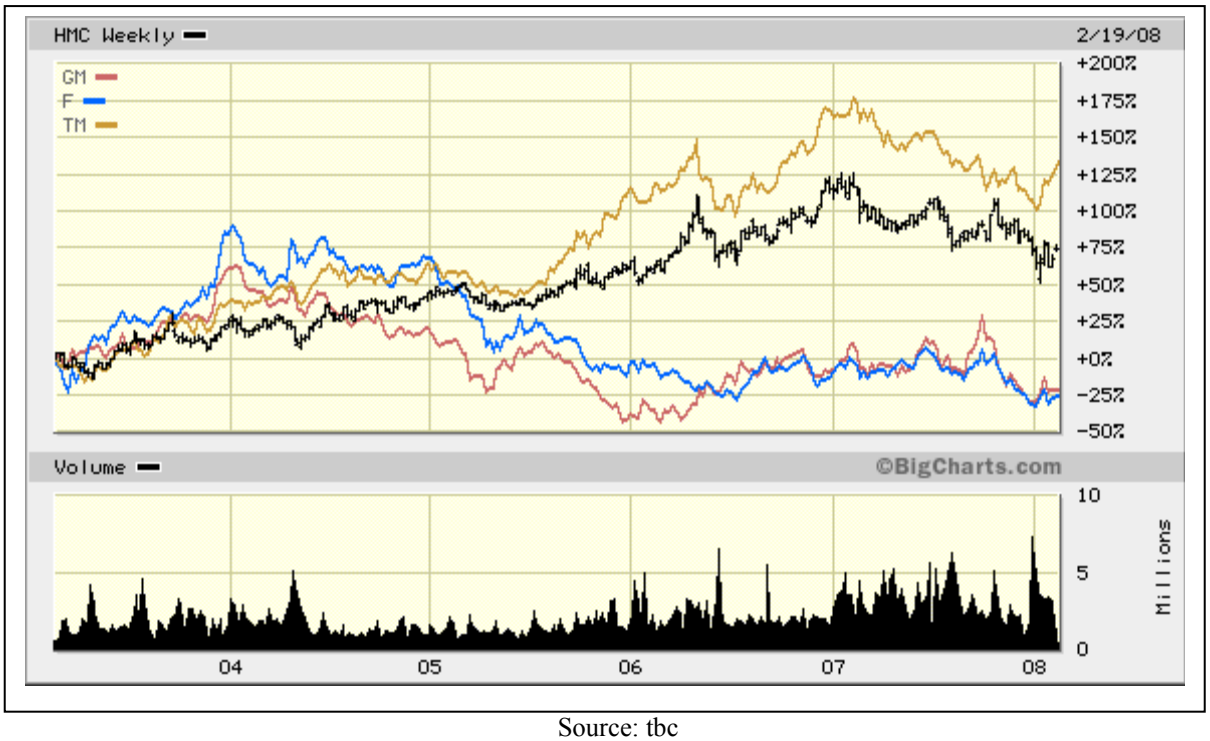
Sustainable Asset Management (SAM) Group, a Zurich-based asset management firm that was founded in 1995 to specialize in sustainability investments, states in their 2008 Sustainability Yearbook that, "the research strongly suggests that there is a positive, statistically significant correlation between corporate sustainability and financial performance... in future the true winners will be those who think outside the box about the business models required to develop new products and services for society's evolving needs." Whatever the opinion on the actual evidence, one thing is clear: Boardrooms have moved beyond asking whether they should become sustainable; now most are asking how to achieve it.

These companies have identified new internal opportunities for innovation, improved productivity and greater market agility. For example, Wal-Mart reached out to environmental and consumer experts for more than a year before launching its new sustainability strategy. Currently Wal-Mart is working closely with major suppliers to achieve the goals set out in their sustainability plan. Shell regularly uses risk scenario planning to predict how different developments in society might impact their markets, offerings and public goodwill. IBM conducts global electronic "jams" on broad trends and business-relevant sociopolitical issues with thousands of people and key stakeholder groups. Every two years, GE convenes "Energy 2015" and "Healthcare 2015" meetings with a cross-functional group of government officials, industry leaders, key suppliers, NGOs and academics that feed back into the company's strategy. GE has sold over $17bn of its 'Ecomagination' products in 2006; about 1/3 of total sales.

Honda and Toyota are renowned for their innovation. They both capitalized on this by introducing the first hybrid cars and this, combined with very successful communication to their market and employees, has allowed them to overtake GM and Ford who are now playing catch-up. To further reinforce the point, it has taken the threat of a costly proxy shareholder suit to force Ford to release its plan to reduce greenhouse gas emissions, the first major automaker to do so. Figure 3 below shows the stock price of these companies over the last five years and clearly

demonstrates that taking onboard the sustainability agenda need not simply add cost and damage shareholder value. PG&E's top leadership has strongly embraced environmental stewardship and sustainability, with CEO Peter Darbee clearly stating the need to address climate change, not only because it is the right thing to do for society, but also because it is the right thing for the business. Energy efficiency is a major part of the company's strategy around global climate change.

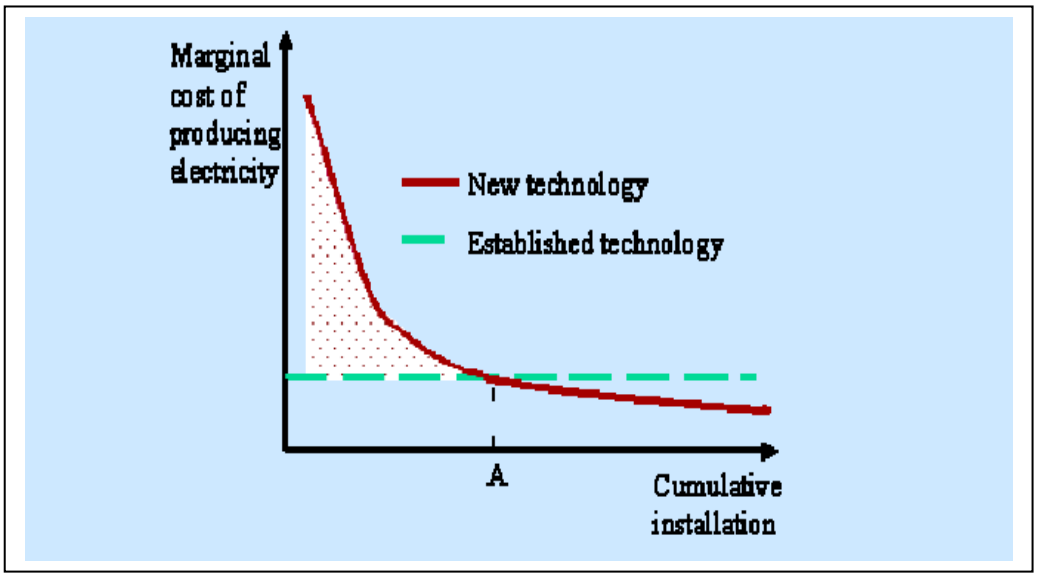
Figure 3. Relative Share Price of Honda and Toyota to General Motors



Source: tbc

In order to take energy efficiency beyond the status quo, innovation and new technologies are required. The private sector is the major driver but governments can do much to help in overcoming barriers for new technology development and introduction. Studies by the International Energy Agency (IEA) quoted in the UK Government's Stern Review indicate that by 2050 energy efficiency has the potential to be the biggest single source of emission savings in the energy sector. However, lack of reliable information, high transaction costs, behavioral and organizational inertia are all barriers preventing action. These are areas where governments and policymakers can intervene to facilitate the market mechanisms. For example, the introduction of carbon pricing would provide a far clearer incentive to invest in new technologies to reduce carbon than rhetoric alone. Another measure that policymakers can take to speed up the process of new technology introduction is to ease the cost burden of introducing new energy efficiency technologies by speeding its introduction into the mass markets. As figure 4 below demonstrates new technology is typically more expensive in the initial stages of use, but as this increases costs quickly fall.

Figure 4. Cost of Technology vs. Marginal Cost of Electricity Over Time



Source: IEA/Stern Review

In the US, some progress is being made to enact policies supportive of environmental sustainability. AB32 has fixed a timeframe for California, requiring all stakeholders to respond. But there is plenty that California's policymakers can do to turn the ambition into action that starts to have a significant effect on GHG emission reductions. Engaging all stakeholder groups and harnessing them to delivering the potential of energy efficiency will serve to speed this process.

What are the Implications of Keeping the Status Quo?

Doing nothing and maintaining the energy efficiency status quo will simply deliver ever-diminishing returns to society. There is a limit to what can achieved by just continuing to provide customers in California with more CFL and T8 light bulbs, even with the recently approved US Energy Policy which requires a ban on incandescent light bulbs by 2014. The contribution of energy efficiency in reducing electricity energy use and demand may be marginalized if new approaches and more widespread and long lasting initiatives are not considered. Increasingly, it is becoming impractical to attribute energy efficiency savings to a single action by a single agent which has implications for a system that has been established with incentives or mechanisms designed for this. It isolates the benefits that could be obtained by a broader approach with a consequent loss of benefit to society.

With oil prices now topping $130/bbl and high electricity rates, society is now searching for innovative approaches and technologies to reduce costs, yet keep businesses competitive. Doing nothing is simply not an option. The status quo means no end in sight of increasing energy bills to customers and loss of economic productivity, not to mention the costs of environmental degradation and climate change.

The question still lies in how much can we get from energy efficiency in the short, medium, and long term. To what extent is there an incentive for implementing today a policy

with the necessary incentives that will transform the market in 20 years? The status quo can take us in a direction where energy efficiency has been before, not achieving the potential it can reach as we know well from the different scenarios in the technical, economic, and achievable market potential studies.

Conclusion

A new approach is needed if energy efficiency is to deliver the levels of GHG emission reductions that will be needed to mitigate the potential impacts of climate change. As the pressure is growing in the US for national legislation to address this threat and as consumers are demonstrating ever-greater interest in sustainable products and services now is a unique opportunity to act. Public funds for energy efficiency can now be used to "oil" the "machinery" rather than seek to be the "machinery" that matures the energy efficiency marketplace.

This new approach will require a similar adjustment of the regulatory rules and procedures that govern the utility-led energy-efficiency promoting portfolios. Key will be changing how gross savings are attributed to the portfolio effort. Indeed, society would be better served by focusing on gross savings to assess the success of the portfolio (as is done in other jurisdictions such as the NW), and use more in-depth studies to help program implementers enhance their successes.

Energy efficiency is recognized as a key contributor to achieving absolute reductions of GHG emissions. To garner all cost-effective energy savings we need to deliver an innovative and market-led transformation. This can be achieved through a strategy that integrates policy with market trends and the general willingness to make a difference. Not only can this achieve reductions in energy consumption and greater environmental responsibility but it can also lead to sustained economic growth.

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