Time to Sweep the Dust from under the Rug? Moving Beyond "Business-As-Usual" Energy Efficiency

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ABSTRACT

Today's context provides fertile ground to expand the scope of current energy efficiency best practices so that we reach a sustainable energy future. The past two years have seen a rapid evolution in public awareness and pronouncements by policymakers, utilities, and private companies on the need to deal with global warming, reduce dependence on fossil-fuels, and accelerate sustainable energy efforts, especially energy efficiency.

Against this background of increased worldwide concerns and a significant energy-efficiency market infrastructure, this paper argues that the "business-as-usual" model for promoting and implementing energy efficiency is inadequate for the challenge. Much more remains to be done to reduce societal energy use to the levels needed to avoid the socio-political and environmental outcomes of business-as-usual. It is time for the energy-efficiency community to consider expanding the scope of current endeavors to reach a sustainable future.

This paper reviews past progress in California and argues that though impressive, more needs to be done. It goes on to raise three core areas that require new policy formulations and intervention strategies to update energy efficiency efforts to the current context. First, we need to be smarter at using public funds to better leverage maturing markets. Second, we must begin to seriously address lifestyle choices and behavior. Third, we need to integrate demand-side and renewable supply efforts to make these more cost effective and sustainable.

Introduction

Efforts have been underway for more than thirty years in California and elsewhere to get society to use energy more efficiently. These efforts have fostered the creation and maturation of an energy-efficiency market by addressing various perceived market barriers. Efforts have focused on research, development, and demonstration (RD&D), providing information and monetary incentives, and setting minimum energy performance codes and standards.

Ever since President Carter wore a sweater to urge consumers to conserve energy, public conservation efforts have been associated with sacrifice and deemed unpalatable. As a result, the dominant policy paradigm in the energy efficiency community for the past twenty years has focused on technical efficiency improvements, and has avoided calls for lifestyle changes.

As these programmatic efforts have proceeded, the political and social context has been evolving, partly as a result of the success of the programs. The public, businesses, and policymakers are more aware and knowledgeable of the options available and the benefits of using energy more efficiently. There is increasing worldwide concern about escalating fossil fuel prices and dependence on non-renewable energy resources. The unchecked growth in energy consumption is also leading to local and global social, political, and environmental problems that can no longer be ignored and public pronouncements to seek more sustainable development.

1 The opinions expressed here are solely the author's.

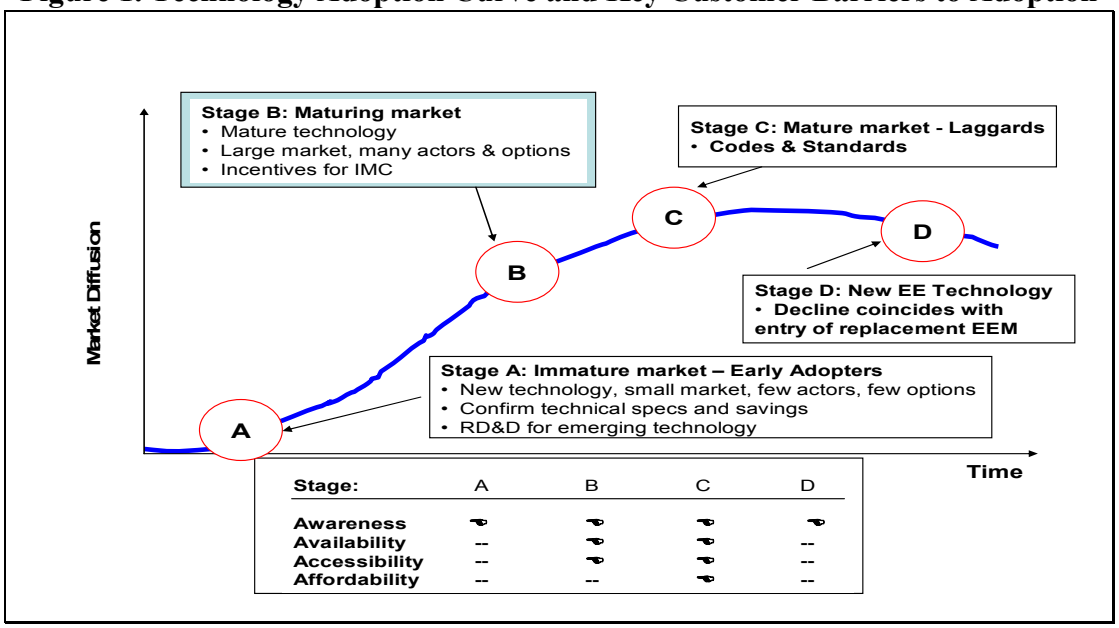
Indeed, the changing context, and the evolving sense that we are approaching socio-political and environmental crises, requires a re-examination of public efforts to promote enhanced energy efficiency. New opportunities exist for broader social action, as awareness among the public, business sector, and policymakers is reaching a "tipping point" of the social and environmental impacts of current and projected energy use (Dickerson 2006). The private sector is increasingly adopting more resource-efficient processes to reduce costs, increase profits, and avoid public relations problems. There is interest among policy makers, entrepreneurs, and some energy efficiency proponents, in seeking out and fostering "destabilizing technologies" in order to change the dominant energy development paradigm for sustainability (Stein 2006).

Using California as a case study, the paper describes past accomplishments and current evidence that make the case for seeking more ways for society to use energy more efficiently. The paper highlights three key areas the energy efficiency community could develop further to forestall the impending energy-related socio-political and environmental crises.

California's Past Energy Efficiency Promotion Strategies and Successes

In the past thirty years, California used public funds to promote conservation and more recently, energy-efficiency. Key barriers have been identified that constrain and limit the adoption of economically feasible energy conservation and efficiency measures. These can be characterized as limitations in: 1) awareness; 2) availability; 3) accessibility; and 4) affordability (Friedmann 2005). Publicly funded programs have addressed these barriers by capturing the energy conservation and efficiency opportunities via a mix of programs covering RD&D, information, incentives, and codes & standards. Energy efficiency promoters perceive customers to fall into one of three major areas (A = early adopters, B = mainstream, C = laggards) along the technology adoption curve shown in Figure 1. Public program offerings have sought to alleviate and overcome customer barriers in each of these areas.

Figure 1. Technology Adoption Curve and Key Customer Barriers to Adoption

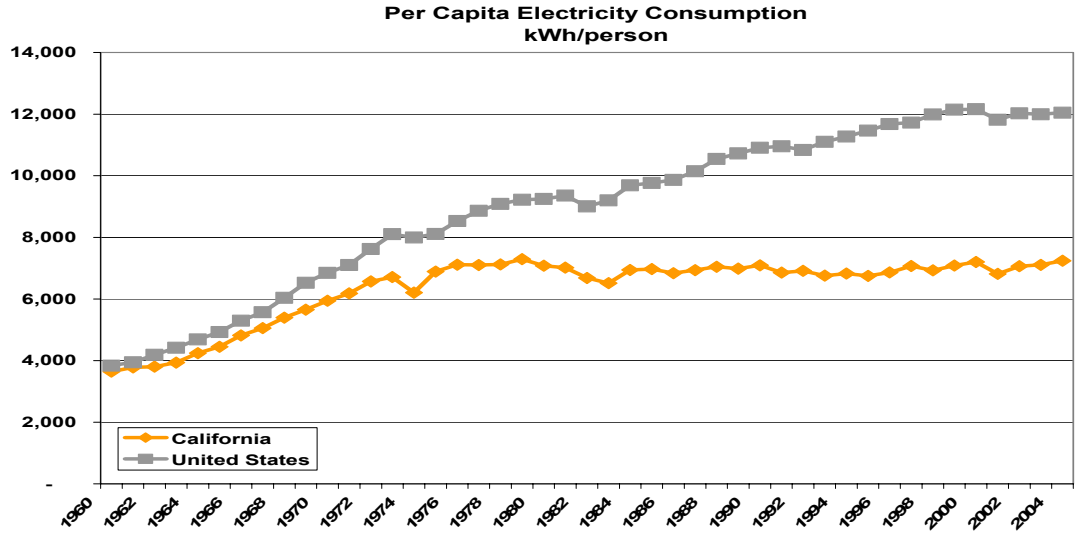


Source: Friedmann 2005

The core of public energy-efficiency efforts has focused on affecting behavior of the "early adopter" and "mainstream" customers (stages A and B in Figure 1). Information and increasingly, incentive programs, are at the core of the portfolio of energy-efficiency programs. Energy-efficiency RD&D and mandatory codes & standards supplement the core programs. This has basically been the *modus operandi* these past 25 years in California, with impressive results.

One indicator of how effective the state's investment in energy efficiency has been is to compare the trend in per-capita electricity use for California, with that of the entire United States, over the past 45 years (see Figure 2). The contrast is remarkable: while the country's per capita electricity consumption has tripled during this period, California's doubled during the first 12 years, and then basically remained constant since 1972, as electric energy efficiency programs began to be implemented. California's public electric efficiency efforts saved more than 10 GW and 35 GWh by 2001 (Reid et al. 2005).

Figure 2. California and USA's Per-Capita Energy Use 1960-2004



Source: Sharp 2006

This investment in an energy-efficiency infrastructure further paid off during California's energy crisis of 2000-2001. California nearly quadrupled its funding and effort on energy-saving programs. Consumers responded to this $1 billion effort and reduced peak demand in the summer of 2001 by about 5 GW or 12% of peak demand, avoiding hundreds of hours of blackouts (CEC 2002). Conservation accounted for about half of the savings. Savings persisted into 2002, with summer peak demand exhibiting about 5% savings (Lutzenhiser et al. 2004).

"The Times They Are A'Changing"

The past two years have seen a rapid increase in public awareness and pronouncements by public and private entities about global warming and non-renewable energy sources, and the need to accelerate sustainable energy solutions, especially energy efficiency.

California Policymakers "See the Light"

As electricity prices in California returned to more normal levels in 2002, the price of natural gas began to increase. This was partly due to the falling production in the USA, and the large increase in natural-gas-fired electric power plants. The increased natural gas price also put pressure on electricity prices. As a result, the attention of California's policymakers on energy efficiency remained high. The aftermath of the California energy crisis affected many, including Governor Gray Davis, who was defeated in a recall election, in which his handling of the energy crisis was a major issue. But most importantly, the impressive demand-side response of Californian customers to the energy crisis of 2000-2001, made policymakers aware that it was possible to quickly mitigate demand growth in a cost-effective manner.

On the basis of a series of energy-efficiency potential studies (Rufo & Coito 2002), and concerns about the costs and reliability of energy supply in the wake of the energy crisis of 2000-2001, California policymakers placed energy efficiency as the first choice for new procurement in the State's Energy Action Plan (EAP), where energy policy for the coming decade was delineated (CPA et al. 2003). The EAP calls for reducing California's electric demand by 6 GW (out of an estimated demand growth of 11 GW) and electricity consumption by 30 TWh by 2012. The CPUC also approved a tripling of funding to almost US$ 2.1 billion and set savings goals of 6.8 TWh, 1.46 GW, and 111 M Therms, for energy-efficiency programs administered by investor-owned-utilities (IOUs) during 2006-2008 (CPUC 2005).

California's Utilities Are Increasing Budgets and Exploring New Strategies

The aggressive energy efficiency goals set by the CPUC, the experience of 2000-2001, the increasing realization of their environmental and public relations benefits, have led California IOUs to see energy efficiency efforts in a new light. The IOUs complemented the Public Goods Charge funding for energy efficiency with Procurement funding; tripling the funding available. The IOUs also reviewed past energy efficiency efforts to develop a portfolio with a growing variety of energy efficiency programmatic approaches. Under IOU administration, programs will be carried out by IOUs, contractors, Third-Party Implementers, and Local Government Partnerships in 2006-2008. Seeking to expand the number of customers participating in its program offerings, and the amount of energy efficiency uptake per customer, Pacific Gas & Electric (PG&E), which administers about 40% of all IOU energy-efficiency programs in California, has shifted its previous, program-focused orientation to a customer-driven implementation effort. PG&E will offer customers tailored packages of energy-efficiency and demand-response products and services.

Other Contextual Drivers: Global Warming, Fossil Fuel Prices, and Competitiveness

Further support for energy efficiency efforts comes from the increasing societal concern with global warming and its impacts on California (Carter et al. 2006; Holdren 2006; Raynolds 2004). Although California's greenhouse gas emissions (GHG) of about 12 Metric Tons CO_2 per capita are about half the U.S. average, the state is still the 20th-largest source of net GHG emissions worldwide (Reid et al. 2005). The California Climate Action Team modeled various scenarios which foresee dire consequences for the state without significant reductions in GHG emissions (CAEPA 2006).

California is leading the U.S.A.'s public response to global warming. Key policies focus on enhanced energy efficiency, and renewable and cleaner energy supply (CPA et al. 2003). A voluntary "cap and trade" system for controlling GHG emissions is also being considered (Wood 2006). PG&E has proposed a voluntary climate change tariff, in which customers would pay extra in their bills and the utility would sequester carbon; most likely via reforestation. The Governor has set targets for reductions of GHG emissions to 2000 levels by 2010, 1990 levels by 2020, and 80% below 1990 levels by 2050. The IOU's $ 2.1 billion energy efficiency plan will reduce GHG emissions by about 3.4 M tons CO_2-equivalent by 2008.

In addition to global warming, the increasing dependence on expensive foreign fossil fuels has recently captured the attention of the U.S. government and the public, becoming another driver for energy efficiency. The recently passed Energy Policy Act of 2005 fosters energy efficiency through a variety of measures including tax cuts and credits.

The private sector is also showing increased interest in investing in resource efficiency. Industries are realizing that attention to environmental issues and resource efficiency improves business results. Ongoing fossil fuel price increases and concerns about reliability of supply, and loss of competitiveness, further stress the benefits of resource efficiency. More companies are seeking to profit from the growing market for energy efficiency products and services, and/or implementing these in-house. More industries are trying to implement "Natural Capitalism" in their manufacturing processes by minimizing waste streams and/or turning them into inputs to other processes (Hawken et al. 2005). The building design community increasingly implements the "Cradle-to-Cradle" concept, and shows a willingness to incur the costs and extra efforts of LEED certification (McDonough & Braungart 2002). For example, GE has pledged to spend $1.5 billion over the next decade "greening" itself. British Petroleum added $650 million of value for an investment of $20 million, when it reduced GHG emissions 10% between 1998-2001. Dupont has saved several hundred million dollars in production costs through enhanced resource efficiencies, including reductions of waste streams (Hawken et al. 2005). Even financial giants such as Goldman Sachs have begun to seek "green" investments. In 2005, venture capitalists invested $1.6 billion in low-GHG emission products and services; an increase of 34 percent over 2004 (Wood 2006).

What Other Options Exist?

The new context and related policy drivers – keen interest among policymakers; a massive increase in public funding; and strong interest, backed up with investments in efficiency, by the private sector -- may open the way for an in-depth, action-oriented discussion about whether and how to change social patterns of increasing consumption in order to make the adjustments needed to mitigate global warming. Some core areas to explore beyond current efforts are:

- We need to be smarter at using public funds to leverage trade allies actions in the maturing energy-efficiency markets.
- We must begin to seriously address lifestyles and consumption patterns in pursuit of sustainability. Focusing only on energy efficiency will not suffice.
- We need to figure out effective ways to fully integrate demand-side efforts with renewable energy supply, resource-efficiency, and sustainable consumption.

We Need to Be Smarter at Using Public Funds to Leverage the Maturing Market

Past efforts have led to an increasingly mature market of energy efficiency products and services. This market has a wide variety of market actors; "providers" that may be willing to take a larger role with customers in the future, to capture market share in a no longer "niche" market. Also, customer interest in efficiency can be expected to grow as energy prices go up; as evidenced in the recent success of hybrid vehicles. Given the recent run-up in natural gas prices, as well as electricity prices (since about one-quarter of the USA's capacity is natural gas fired), we can expect increased customer interest in energy efficiency.

Given the relative maturity of the energy efficiency products and services market, can we expand the traditional program framework? For example, can public endeavors shift to focus more on fostering and leveraging private efforts? Can resources be shifted to engage venture capital, and draw manufacturers and wholesalers, as well as retailers to market energy-efficient products and services? Could some public funds go to get the private sector to increase their efforts with the early adopter and mainstream customers? Besides leveraging private actions, public funds could be refocused on simplifying/clarifying the myriad regulations and fiscal incentives to establish a truly "level playing field" for energy conservation and efficiency investments and development, and focus on upstream (RD&D and information) and downstream (codes & standards) as well fiscal and legislative interventions.

Lifestyles – Can We At Least Open a Debate to Consider Addressing Them?

The California experience promoting energy efficiency has been quite successful. Yet, all the efficiency in the world will not suffice to deal with global warming nor our dependence on non-renewable resources, as long as our society continues to believe in the mantra of "bigger and more is better". Given the new context, it may be instructive for resource efficiency proponents to review and use previous research that highlights the importance of understanding and influencing lifestyles (Kunkle et al. 2004; Lebot et al. 2004; Lutzenhiser 2000; Moezzi 1998; Rudin 2000; Wilhite et al 2000).

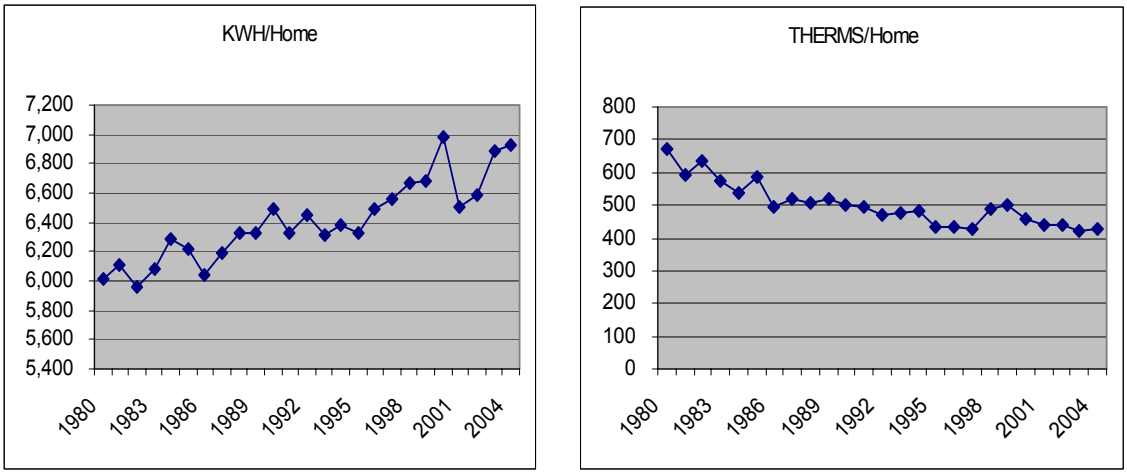
As shown in Figure 3 below, the overall electric energy use per home in California has increased by about one-sixth (17%) while natural gas use has declined by about one-third between 1980 and 2004. This trend is partly due to the increased amount of all-electric homes, as well as to the increase in larger, centrally air conditioned, single-family homes, being built by affluent families in the warmer areas of California. The efficiency gains on the electric side have not been able to offset the large increase in size and number of the electric appliances in the homes. Similar patterns of increased size of homes and appliance use have been observed for the U.S.A. as well (Diamond & Moezzi 2004; Laurence 2004; Lutz 2004).

Table 1 compares the energy use and saturation of various types of equipment and energy-efficiency measures in "newer" and "older" California homes. Newer homes use 20% more electricity than pre-1996 homes. This is partly due to their larger size (42% larger); the higher ratio of single family homes (28% higher); their location in warmer climates (2/3 of the newer homes were built in the hotter climate zones); and the owners' higher income levels (49% higher). All of this translates into higher saturation rates for central ACs (93% higher),[2] pools

2 This astounding increase in central air conditioners demonstrates the impact of new home construction in the warmer areas of California. Evaporative coolers—a much more efficient and viable technical cooling option for these hot, dry climates, is typically not even considered for these homes due to lifestyle norms.

(59% higher) and personal computers (30% higher). The increase in unit household consumption occurs mostly among single family homes. Indeed, unit household consumption is generally lower in newer multi-family homes (KEMA et al. 2004). The energy guzzling features (larger homes, and more appliances) of newer homes are not offset by the higher saturation of energy-efficient features (higher wall and attic insulation, double pane windows, low flow showerheads, CFLs/home or horizontal axis clothes washers). Indeed, without the higher saturation of energy efficient features, electricity use of the newer homes would be significantly higher!

Figure 3. Electric and Natural Gas Energy Use Per Home in California, 1980-2004



Source: Glen Sharp 2006

Of particular concern to energy policymakers in California is that these larger homes located farther away from the cities, makes it harder to attain future energy reductions. As more Californians move to the hotter inland areas seeking larger homes perceived as the "American Dream", their needs for air conditioning increase. This worsens the load factor of the entire electric grid, leading to less cost-effective energy supply investments and increased pollution. These larger homes that are farther from work places also contribute to urban sprawl, increasing the amount of energy used for transportation, and lengthening the evening peak load period.

Our community of energy efficiency policymakers and practitioners has provided society with reliable information on how to enhance efficiency. Yet they are reluctant to mention the need to alter lifestyles in order to reduce overall energy use. In one telling example, only one of 18 world renowned speakers during a Climate Change event to honor Commissioner Arthur Rosenfeld mentioned lifestyle as a critical issue that needs to be addressed. (Peevey 2006).

Publicly-funded energy efficiency programs do not inform customers of the implications of "needing" larger homes. Can we continue to focus on promoting more efficient widgets, while the increased widget size and usage results in an increase in overall energy use? Will monetizing the real costs of energy by fully internalizing all externalities be possible, and if so, will it lead to socially optimal individual behavior? Could public funds be used to inform customers of the "energy footprint" impacts of their current lifestyles and expectations, in an effort to seek to change their behavior – i.e. to "conserve" resources and reduce overall resource use?

Table 1. Comparison of Newer and Older California Homes Energy Use and Efficiency Measures Saturation

Item	Newer Homes (post 1996)	Older Homes	Percent Higher for New Homes vs. Older Homes
Annual Electric Household Use (kWh)	7,159	5,960	+20%
Annual Gas Household Use (Therms)	468	459	+2%
Dwelling Size (ft2)	2,039	1,434	+42%
Number of Residents	3.14	2.93	+7%
Average Yearly Income ($)	86,276	58,082	+49%
Percent Single Family	74%	58%	+28%
Owners	83%	62%	+35%
Saturation of Central AC (%)	78%	41%	+93%
Cooling Degree Days	962	900	+7%
Cooling Degree Days (for CAC homes)	1,119	1,279	-13%
Programmable Cooling Thermostat (%)	85%	47%	+83%
Pool Saturation (%)	13%	8%	+59%
Average Computers per Home	1.21	0.93	+30%
Gas Primary Heating	86%	83%	+5%
Heating Degree Days	2,050	2,023	+1%
Exterior Wall Insulation Throughout	91%	51%	+77%
Attic Insulation	91%	66%	+38%
Double Pane Windows Throughout	79%	31%	+157%
Low Flow Showerheads Throughout	71%	54%	+32%
Average CFLs/Home	2.29	1.74	+32%
Horizontal Axis Washers	13%	9%	+43%

Source: KEMA et al. 2005

Integration—The Quest for Synergisms for Sustainability

Finally, energy efficiency does not occur in a vacuum. It is, and should be seen as part of a larger set of options to provide customers with the energy services they seek. Customers want comfort, transportation, illumination, etc., not the energy per se. Most energy professionals understand this, but few have integrated energy efficiency fully with supply options. To attain sustainable energy use, our society needs to find ways of living off resource flows instead of energy stocks. Energy efficiency enables and facilitates a move to increased dependence on renewable energy for meeting our needs.

Unfortunately, the early promise of integrated resource planning has faded, and there are few examples where efficiency and renewables are truly integrated. Instead, they are nearly always considered separately on both a policy and implementation level. The result is, for example, that large solar panels are placed on houses which have been neither designed, nor retrofitted for energy efficiency. In this sense, integration needs to occur at the program levels, so that investments on renewable energy projects are contingent upon the end users first having an energy audit and reducing energy waste. Although this is a simple, least-cost economic approach, the institutional walls of the sustainable energy profession have somehow made it difficult to achieve this simple goal in practice.

Indeed, integration may be the most effective way to further accelerate the full maturity of renewable energy supply and energy saving services and products. Symbiotic packages of efficiency and renewables can be combined so that the lower-cost efficiency measures pay for the higher-cost renewables, and the total costs is still below the avoided supply option.

Integrated packages and markets can serve not only the USA, but more importantly, rapidly growing fossil-fuel using countries, such as China, India, Brazil, etc., helping ameliorate significantly global warming. Indeed, developing country markets are often more open to new approaches and can offer more fertile ground for renewable technologies; allowing these to rapidly reach their full potential as "destabilizing technologies" (Stein 2006).

Integration also means developing linkages and breaking through institutional and programmatic barriers. The energy-efficiency community needs to get better at tapping into and leveraging a range of efforts that simultaneously seek to create market changes. These efforts include federal and state tax incentives for efficiency; trading markets and schemes for sale and trading of emissions from GHGs and other pollutants; venture and capital investment markets; and cross pollination of efforts across regions, countries, and disciplines by setting up information clearinghouses and collaboration ventures; especially via the Internet.

Conclusions

The energy-efficiency community has grown up, and it is time to think about new ways to confront the immense challenges to achieving energy sustainability. Past efforts that were mostly geared at addressing barriers that were prototypical of immature markets, need to evolve and take advantage of the current context and help further shape its ongoing evolution. The social and political drivers for energy efficiency are aligned in a way that they have not been for a quarter century. Gone are the days where renewable and/or efficiency efforts were the "icing on the cake". Renewable and efficiency resources now need to become the core components of future energy sector development, and there is an emerging political and entrepreneurial will to make this happen.

Markets for energy-efficiency products and services are larger and more mature; and the old ways of stimulating market shifts although still useful, are not sufficient. The efficiency community needs to engage in a debate about how to effect quantum, rather than incremental shifts. The case of California demonstrates that two key elements are in place to make this happen: the *technical and human infrastructure* for energy efficiency; and *grassroots and political will* to highlight this issue; allocate significant budgetary and financial resources; and follow this with effective implementation, promotion, and monitoring.

This paper has highlighted three key areas that need to be addressed in the near term if we are to begin shifting toward a truly sustainable energy system.

1. Redefine the role of public funds to better leverage private resources for optimizing societal uptake of energy conservation and efficiency. Creative thinking is needed on how private resources can be used to leverage a quantum increase in the move toward energy-efficient markets, and even lifestyles.
2. Squarely address human lifestyles as a topic that is "fair game" for energy saving efforts. The case needs to be made that excessive consumption is an unacceptable lifestyle if we are to live in harmony with our planet. The energy efficiency community must provide leadership on this issue.
3. Force systematic integration of energy conservation and efficiency with renewable supply resources, during both design and implementation of policies and programs, to make these become the core of future energy sector development.

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