Exploring the Economic Development Implications of Capacity Building within State and Local Energy Efficiency Programs

Denise Mulholland, John A. "Skip" Laitner, and Nikolaas Dietsch,
U.S. Environmental Protection Agency

ABSTRACT

The deployment of cost-effective energy efficiency technologies can help state and local governments meet economic development and pollution reduction goals. Enhancing the ability of governments, businesses, organizations, and individuals to accelerate market penetration through information-based capacity building programs can therefore lead to added economic and environmental benefits.

We explore this concept in two ways. The first task is to turn to the literature to determine whether state and local capacity-building strategies improve technology deployment. Based on a literature review, we develop a series of program designs that drive three technology diffusion scenarios for the State of Connecticut. These scenarios include: (i) a Reference Case; (ii) a Market Response Case, illustrating the effects of a moderately funded technology diffusion program (e.g., ENERGY STAR) aimed at boosting the supply and adoption of energy efficient building technologies; and (iii) a Capacity Building Case, in which the demand for efficiency is increased through an information-based capacity building program.

The second task is to evaluate the economic impacts of each scenario using the IMPLAN model. IMPLAN is an established regional macroeconomic model that uses a combination of input-output and econometric linkages to explore a wide variety of economic policies. Our goal is to determine whether an expanded capacity building initiative can significantly improve the economic benefits of standard technology deployment programs.

Introduction

Energy usage in US buildings is responsible for 8% of current global emissions. This figure is equivalent to the total emissions from Japan and the United Kingdom combined. In 2001, the cost of energy to end-users in the US buildings sector is estimated to be about $273 billion. Current forecasts indicate that building energy use will rise by more than 40% by 2025 (EIA 2003).

On a national-average basis, state-owned buildings alone account for about 28% of publicly-owned building floorspace and 5% of total non-residential floorspace. As a result, the opportunity for states to save energy in their facilities is considerable. For an average state, reducing facility energy use by 20% would lower overall non-residential building energy use by about 1% and produce 1.15 trillion Btu annually in savings while reducing energy bills by $16 million (Prindle et al 2003). In a recent analysis, the American Council for an Energy Efficient Economy (ACEEE) estimates that most states could reduce annual energy consumption by 20% with technology that is cost-effective and readily available (Prindle et al 2003). In the private sector, ENERGY STAR data likewise suggest that businesses could save 20% to 30% on their annual energy costs through investments in buildings and equipment (CPPD 2003). At the national-level, the opportunity for savings from ENERGY STAR products alone is substantial.

The Lawrence Berkeley National Laboratory estimates present-value energy savings by 2010 of between $40 and $57 billion – a figure that would rise with enhanced promotional efforts (Webber, Brown & Koomey 2000).

One way to leverage these untapped savings is through government-sponsored capacity building programs. The Environmental Protection Agency's State and Local Capacity Building Branch (SLCBB) works directly with states, municipalities, and their partners to promote efficient technologies through policy and program development. These entities have authority over purchasing decisions and are well positioned to act as "lead adopters." This enables energy efficient technologies to gain a foothold in the market and compete on an accelerated schedule (i.e., before the price-lowering effects of widespread penetration can take hold). State and municipal purchasing decisions can therefore establish economic demand for energy-saving products and promote "learning-by-doing." A "virtuous circle" may result, in which increased experience further drives down costs, which in turn opens up larger markets and yields additional investment and greater experience (Farrell, Keith & Corbett 2003). The State of New York – a leader in energy efficiency – is a proponent of the role of capacity building programs in bringing about market transformation. "Government, acting as a facilitator, can bring parties together to provide accurate timely, and objective information" (DeCotis et al. 2000).

Beyond direct government program-investments, state and local outreach and information initiatives leverage additional private sector resources. According to a study conducted for ENERGY STAR, households in areas with "very active" non-federal information programs were more likely than households in lower publicity areas to recognize, understand, and purchase the ENERGY STAR label (Cadmus 2003). By providing information and technical assistance, capacity building initiatives at all levels of government help their partners make informed decisions about efficiency investments.

Background

EPA's State and Local Capacity Building Branch

SLCBB assists partners with voluntary efforts to promote efficiency and reduce energy intensity. Similar state and local programs have the added social benefit of reducing air pollution, lowering greenhouse gas intensity, and enhancing energy security. They typically contribute a small but positive increase in Gross Domestic Product, or GDP (Hanson, Laitner & Mortenson 2003).

SLCBB supports a broad range of clean energy options, including green power purchasing, renewable energy generation, heat island reduction strategies, and energy efficiency. Specific program activities include targeted awareness and information campaigns designed to share experience and lessons-learned among government officials; modest financial support for demonstration projects; customized analyses of the economic and public health implications of state policies; and the development of software tools that quickly assess baseline conditions and the effects of proposed measures. These activities are designed to give state and local officials the assistance they need to optimize their policy and technology decisions. They are also intended to help this constituency develop their own initiatives.

Capacity building programs at the state and local levels provide similar services to their client base. For example, the New York Energy $mart Program – a partnership between the New York State Energy Research and Development Authority (NYSERDA) and the Public Service

Commission (PSC) provides technical and financial assistance to promote energy efficiency in the state of New York. In addition to financial incentives for energy efficiency, the program generates information to help New Yorkers learn about the benefits of energy efficiency, locate ENERGY STAR® appliances and products, conduct energy audits, build more efficient buildings, and find qualified contractors and builders (New York, 2004). The Flex Your Power Program in California is another state-level capacity building program. It provides energy saving tips, incentives, and information on best practices to help Californians save energy and save money" (State of California, 2004).

These programs may result in improved energy efficiency, reduced energy costs, and lower levels of air pollution and greenhouse gas emissions. This analysis focuses on the theoretical impact that government-sponsored capacity building efforts have on programs to transform the market for energy efficiency within a state and enhance economic development.

Capacity Building Defined

Capacity building refers here to the provision by government programs of accurate, timely, and objective information and technical support to increase the penetration of energy efficiency through better-informed decision making. This implies that knowledge can reduce barriers and change consumer behavior so that the penetration of energy efficiency increases towards "achievable potential," or what can be attained through targeted policies and market intervention strategies. In contrast to "market transformation" initiatives, which target both the supply- and demand-sides of the market, capacity building efforts are limited in scope to the latter. And unlike "demand-side management" (DSM) programs, capacity building emphasizes information rather than financial incentives to increase the penetration of energy efficient products and services (Horowitz 2001).

This broad definition is consistent with theories of technology adoption in which success in the marketplace results from linkages to external networks that facilitate collaboration and the exchange of information. Related "network theories" emphasize that the continuous expansion of the quantity of technical knowledge over time increases the demand for analytic tools and other capacity building functions. (Landry, Amara & Lamari 2002)

To evaluate the potential for capacity building efforts to drive change and promote economic development, we turn to the expanding literature on how program-based information programs are quickening the pace of market movement.

Challenges of Evaluating the Effectiveness of Capacity Building Programs

The literature demonstrates that information-based capacity building programs can accelerate the penetration of energy efficiency in buildings relative to a standard technology diffusion scenario, but that this effect is difficult to measure. Retrospective determinations about program effectiveness involve ascertaining whether a change in the market has occurred and whether that change is the result of program intervention. Unlike the evaluation of DSM programs, in which the purchase of energy efficient goods and services is readily tracked through rebate documentation, measuring the impact of information programs requires a framework for assessing the awareness, perceptions, and purchasing decisions of market actors. Consequently, much of the data employed for this purpose come from surveys and interviews (Schweitzer&

Brown 2001), and its interpretation is not typically amenable to straightforward analysis of program impact (Horowitz 2001).

Efforts at program-tracking are complicated by the time horizon required for the market effects of capacity building to take hold, which can be considerably longer than traditional resource acquisition interventions. Another difficulty with the evaluation of information-based programs is that energy-consuming behavior is complex and there is no single behavior that programs are trying to change (Green & Skumatz 2000). Isolating the impact of targeted energy efficiency programs is further complicated by the presence of synergistic relationships with overlapping information-based campaigns (Global Energy Partners, LLC 2003). Nevertheless, the recent proliferation of market transformation programs dictates that methods used for evaluation continue to evolve and mature as data become available.

Literature Review: The Impacts of Capacity Building Programs on Market Penetration

The growing literature on the effectiveness of information programs sheds light onto the central question driving this inquiry: what is the increment to building-sector energy efficiency penetration that can reasonably be ascribed to government-sponsored capacity building efforts relative to a "market response" scenario? The assertion that government-sector programs impact the demand-side of the market is supported by both qualitative and quantitative analysis, and is borne out by the existence of numerous of government-sector programs that use information as a tool to affect market decisions. (If capacity building efforts were not effective, we would expect a scarcity of such initiatives. It is quite possible, however, that difficulties in evaluating information programs will lead to sub-optimal investment in capacity building (Green & Skumatz 2000)). Our goal here is not to identify a specific percentage-change associated with government program efforts, but to suggest a plausible capacity building scenario for a state.

In an evaluation of the economic and environmental benefits of Department of Energy (DOE) State Energy Program (SEP), Schweitzer et al characterize the mechanism by which SEP funds support the implementation of the ENERGY STAR label. The authors estimate each dollar of federal spending drives $3.54 of non-federal investment (i.e., matching state spending plus private sector investment (Horowitz 2004b). The study estimates that 10% of total energy savings from SEP and leveraged non-SEP spending on rating and labeling programs comes from state capacity building activities.

Likewise, in a study of ENERGY STAR awareness and program effects, Feldman and Tannenbaum find that in states with capacity building programs, the penetration rate of high-efficiency clothes washers is at least 10% higher than in non-program areas. A recent study by Green and Skumatz looks at informational programs targeting a range of market actors (including customers, installers, and manufacturers) and concludes that "education only" initiatives have a 10-12% energy savings effect. A similar analysis of Swedish information programs aimed at the building sector corroborates Green and Skumatz's conclusion, finding that 12% savings is achievable under well-designed programs.

Building on methodologies used to evaluate market and public program outcomes, Horowitz uses a fixed effects panel model to analyze electricity intensity across US states from 1989-2001. Market transformation impacts result in a 5.8% reduction in intensity over the study period. The study accounts for the effects of market factors such as energy prices and technological trends, and allows for comparison with demand-side management, or "resource acquisition," programs. Because capacity building is confined in the present context to program-activities on the demand side, Horowitz's broader "market transformation" assessment is not directly comparable (i.e., it captures the impact of both supply- and demand-side initiatives). This study does, however, underscore a key impetus for SLCBB-type capacity building efforts: "It appears that the stated priority of improving the future energy intensity of the US economy may not be able to be met without the help of energy efficiency programs" (Horowitz, 2004a).

Market Response and Capacity Building Scenarios

We can explore the potential for capacity building programs by examining business-as-usual energy projections within a given state and adjusting the baseline to capture the effects of market transformation initiatives like ENERGY STAR. We can then compare the revised projections to what the literature suggests a capacity building program might additionally achieve. We must also determine the level of investment under each scenario and estimate the projected costs associated with a capacity building program. Once we have this information, we can estimate the macroeconomic effects of the scenarios. We selected the State of Connecticut for this analysis because of ready access to data and the existence of a joint modeling effort between the state and EPA to assess the macroeconomic impacts of energy efficiency investments. Here we look into the potential impact of various scenarios upon commercial sector electricity savings within Connecticut's borders.

Market Response Scenario: Market Penetration and Energy Savings Assumptions

For convenience, we use the electricity projections from the REMI model (REMI Policy Insight 2003) to establish a benchmark projection of commercial sector electricity consumption for Connecticut. This is then adjusted to reflect the full impact of DOE and EPA voluntary programs that we assume were not fully accounted for in the Annual Energy Outlook (EIA 2003) projections. In the case of the AEO 2004 projections, for example, it appears that perhaps only 40% of the program impacts are captured through 2025 (CAMD 2003). Correcting for this lowers the reference case by about 6% in 2025.

We call this adjustment in our commercial electricity projection for Connecticut the Market Response Scenario. The point is not to suggest a precise impact on Connecticut's commercial building sector, but to be consistent with EPA adjustments and to provide the basis for our second scenario. For example, the Reference Case projection assumes that Connecticut's economy, as measured by its Gross State Product, will grow in real terms by 2.4 percent annual over the period 2004 through 2020. Commercial electricity consumption will increase by 2.0 percent annually over that same period. Under the Market Response Scenario in Connecticut, commercial electricity consumption will grow at the slightly slower rate of 1.8 percent per year. This adjustment produces savings of 647 million kWh, or about 3.7% from the 2020 reference case.

Capacity Building Scenario: Market Penetration and Energy Savings Assumptions

To define the Capacity Building Scenario, we need to develop a case that accounts for the increase in market penetration that can be achieved through information-based capacity building programs. The literature presented earlier suggests that capacity building, as defined in this paper, may catalyze an additional impact of 3% to 12% beyond normal market penetration. We conservatively chose to double the low-end of the range for our comparative scenario. This increases savings from 647 million kWh in the Market Response Scenario to 1,074 million kWh in the Capacity Building Scenario for a savings of about 6.1 percent of the 2020 Reference Case. Whereas the Market Response Scenario put commercial electricity consumption growth at 1.8 percent per year, our Capacity Building Scenario slows the growth rate to about 1.6 percent annually.

Energy Efficiency Technology Investment Costs

One critical piece of information needed to evaluate the impact of these scenarios is the cost of investment in energy efficiency technologies. To derive this information we adapt the structure of the LIEF model (Cleetus et al. 2003). The key relationship in this model is the gap between average and best energy-efficiency technology or practice.

The assumption in the LIEF model is that as a sector moves closer and closer to best practice or best technology, the cost of efficiency investment per kWh saved increases. The rate of that increase depends on the electricity prices, the elasticity of the efficiency supply curve, and the discount rate. As used in this exercise, the investment cost is shown as:

Investment per Annual kWh Savings = $\left[\frac{1-G_0}{1-S}\right]^{(1/A)} * \left[\frac{P}{C}\right]$, where:

- P = Price of electricity in the given year.
- C = Capital recovery factor (CRF) or discount rate for the given year.
- A = an elasticity that reflects the magnitude of the investment response to changes in price levels or the capital recovery factor.
- S = percent of savings in current year compared to base year consumption.
- G_0 = the energy intensity gap, or the difference between best and average practice. In many ways this can be thought of as the energy savings that would be economically viable in the base year, but have not been realized.[1]

For this exercise, we adopt an efficiency gap of 30% based on ENERGY STAR program information (EPA 2003), an efficiency elasticity of 0.4, and a discount rate of 15%. With commercial building electricity prices of about 8.7 cents per kWh in 2004, these assumptions suggest a typical payback of about 2.7 years in 2005, rising to about 3.3 years in 2020 for the Market Response Scenario. For the Capacity Building Scenario, the greater level of electricity savings pushes the payback up to about 3.7 years. These results are broadly consistent with commercial sector costs and paybacks found in Hanson et al (2004). By way of comparison, had the market signals and capacity building program efforts reduced electricity consumption by 30% (in other words, fully closing the gap between average and best practice but without assuming any further technology advances) the payback would have increased to about to about 7 years on average.

---

[1] This adaptation of the LIEF equation ignores the autonomous time trend component. In other words, the assumption of an efficiency gap remains static and there is only movement toward best practice or best technology rather than improvement in the base year representation of best practice or best technology. Hence, there is a tendency to slightly overstate the cost of new savings.

Table 1. Scenario Cost Assumptions

	2005	2010	2015	2020
Market Response Scenario				
Incremental Savings (Million kWh)	31	37	44	52
Total Savings (Million kWh)	31	202	406	647
Savings from Reference Case (%)	0.2%	1.4%	2.5%	3.7%
Investment Cost per kWh	$0.26	$0.26	$0.28	$0.29
Annual Program Spending ($MM)	0.0	0.0	0.0	0.0
Annual Investment ($MM)	7.8	9.7	12.0	14.9
Amortized Investment ($MM)	2.0	11.2	13.8	17.1
Bill Savings ($MM)	2.9	18.8	37.8	60.2
Net Annual Savings ($MM)	0.9	7.6	23.9	43.1
Implied Simple Payback (Yrs)	2.7	3.1	3.3	3.3
Capacity Building Scenario				
Incremental Savings (Million kWh)	31	67	80	93
Total Savings (Million kWh)	31	262	635	1074
Savings from Reference Case (%)	0.2%	1.8%	4.0%	6.1%
Investment Cost per kWh	$0.26	$0.27	$0.29	$0.31
Annual Program Spending ($MM)	0.2	1.6	3.8	6.4
Annual Investment ($MM)	7.8	18.0	22.9	29.4
Amortized Investment ($MM)	2.0	15.2	26.1	33.4
Bill Savings ($MM)	2.9	24.4	59.1	99.9
Net Annual Savings ($MM)	0.7	7.6	29.2	60.1
Implied Simple Payback (Yrs)	2.7	3.1	3.4	3.7

Capacity Building Program Costs Assumptions

Another key piece of information is the level of program costs in the Capacity Building Scenario. The assumption in the Market Response Scenario is that current programs and price signals are already in place to drive the results described in Table 1. However, the Capacity Building Scenario requires additional program efforts to encourage further investment in commercial building energy efficiency absent no additional price signals.

To estimate the associated cost we adopt the value documented in the DOE Study, *Scenarios for a Clean Energy Future* (Interlaboratory Working Group 2000). Based on primary energy savings, the DOE study suggests program spending of about 60 cents per million Btu of savings. We translate this value into an estimated program cost of 0.6 cents per kWh of total savings for a given year. Thus, under the Capacity Building Scenario in 2020, total savings rise to 1074 million kWh and annual program expenditures are estimated at $6.4 million. We assume that the commercial sector investments occur through energy service companies or are financed through loans or other market instruments. On average, payments are made for investments at an interest rate of 8% over five years. By 2020, total electricity savings rise to $99.9 million. Amortized payments and program spending reduces the net savings to $60.1 million.

Economic Impacts

The macroeconomic impacts of the investments and spending that underpin the Market Response and Capacity Building Scenarios were analyzed using an annual economic impacts model based on IMPLAN ("IMpact analysis for PLANing"), an established input-output model that represents interactions among all sectors within a given regional economy (Minnesota IMPLAN Group 1997). The latest databases provide a detailed accounting for each of the 50 states for the year 2001. The analytical approach uses a matrix operation to multiply the vector of annual spending changes in each scenario with the appropriate input-output relationships summarized by the economic coefficients in Table 2. In the case of the job impacts, the employment projections were adjusted for anticipated changes in sector productivity, also shown in Table 2. This analytical assessment is similar to that used by Geller et al. (1992), and more recently Laitner et al (1998) and Bailie et al. (2001). These reports can be referenced for additional discussion and insights on the critical methodological issues.

Table 2. Coefficients for Key Economic Sectors in Connecticut

Sector	Jobs	Income	Value-Added	Annual Productivity
Construction	14.0	0.70	0.79	1.6%
Commercial Services	12.6	0.58	0.89	2.3%
Electric Utilities	3.9	0.33	0.79	2.3%
Finance	6.8	0.57	0.84	2.6%
With the exception of the productivity values taken from the REMI model (2003), the economic coefficients shown above were estimated from the 2001 IMPLAN database for Connecticut. The employment coefficients represent the direct and indirect jobs supported for each million dollars spent for the goods or services purchased from a given sector. The income and value-added coefficients represent direct and indirect impacts of one dollar spent for goods or services from a given economic sector. Finally, annual productivity represents the annual reduction in the labor required to produce goods or services within a given sector.				

After entering cost data and running the analysis, the IMPLAN-based model provided estimates of annual economic impacts including net effects on jobs, wage and salary income, and Gross State Product (i.e., value-added improvements) over the period 2005 through 2020. Table 3 shows these modeling scenario results. Employment is expressed in numbers of net jobs created each year. Gross State Product (GSP) and wage and salary income results are expressed in terms of millions of fixed 2001 dollars.

Table 3. IMPLAN Results for Capacity Building Scenario Analysis

Economic Impact	2005	2010	2015	2020
Market Response Scenario				
Employment (Net Jobs)	105	149	260	367
Gross State Product (Million Fixed 2001$)	5	6	11	17
Income (Million Fixed 2001$)	5	2	3	6
Capacity Building Scenario				
Employment (Net Jobs)	105	252	417	622
Gross State Product (Million Fixed 2001$)	5	12	19	30
Income (Million Fixed 2001$)	5	6	5	10

From this information, we can see that all economic indicators are positively impacted over the time horizon. This is the result of new investments in energy efficiency technologies that pay for themselves through lower electric bills in less than four years (even with higher costs associated with borrowing, the internal rate of return ranges from 12-20 percent). Although the electric utilities face a slightly smaller revenue stream, the construction and related industries show increased demand for goods and services. Similarly, the commercial sector electricity bill savings frees up real resources that are spent elsewhere in the economy. Matching each of these annual changes in spending with their appropriate input-output coefficients suggests a small but net positive benefit to the Connecticut economy under both scenarios. If the overall scale of program impacts seem small (less than a 0.02% change from the reference case in all cases), it is because the commercial electricity savings (shown in Table 2) is only 6.1% higher than the reference case. Moreover, the 2020 energy savings of about $100 billion is only 1% of total energy expenditures. Hence, the seemingly small net impact is primarily the result of the small scale of the program described.

Conclusions

For many state and local governments, deploying energy efficiency technologies and services is a critical component of economic development and pollution reduction efforts. Capacity building programs can further accelerate the adoption of cost-effective innovations, and can extend the benefits of technology deployment. This is the role of EPA's State and Local Capacity Building Branch, which assists partners with voluntary efforts to promote efficiency and reduce energy intensity. SLCBB achieves this by providing customized analysis, facilitating information exchange among states, and developing software tools to assess the impacts of policies and measures. These activities – combined with similar state and local efforts – can accelerate the deployment of energy efficiency technology and deliver reductions in air pollution, improvements in greenhouse gas intensity, enhanced energy security, and a small but positive contribution to GDP.

We explore the impact of information-based capacity building activities on commercial sector electricity consumption in the State of Connecticut by examining baseline energy trends within the state, evaluating a Market Response Scenario, and using assumptions from the literature to illustrate the affects of capacity building. The literature suggests that capacity building may catalyze an additional impact of 3% to 12% beyond normal market penetration. We chose 6% for our comparative scenario, which increases total savings from 347 million to 1,074 million kWh, or about 6.1 percent of the 2020 Reference Case. With commercial building electricity prices at 8.7 cents per kWh in 2004 – and program spending under the Capacity Building Scenario rising from $0.2 million to $6.4 million dollars over the period 2005-2020 – the implied simple payback in 2020 is 3.7 years. Total electricity savings rise to $99.9 million, while amortized payments and program spending adjusts net savings to $60.1 million.

Under both the Market Response and the Capacity Building Scenarios, jobs, income, and Gross State Product are positively impacted over the study's time horizon. At the same time, the increased investments catalyzed by a larger commitment to capacity building delivers a combination of slightly higher wages, greater employment, and reduced electricity expenditures compared to standard market forces alone. The preliminary results of this study suggest a minor diminishing return on investment (reflected by both the slightly higher payback periods and increased program spending), but one that continues to show a net benefit to the Connecticut economy.

At some point, the greater costs will clearly exceed the program benefits – especially as the gap between average and best practice narrows over time. Moreover, there are a number of economic interactions not included in this study, including such issues as the rebound effect and the extent which opportunity costs may impact these results. We will explore these issues in future exercises to determine the magnitude of their impact. Notwithstanding these concerns, it appears that a well-designed capacity building initiative can improve the economic performance of state and local programs.

Acknowledgements

Neither the findings nor any of the conclusions contained herein necessarily represent the views of either the U.S. Environmental Protection Agency or the U.S. Government.

References

Alliance to Save Energy, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, Tellus Institute, and Union of Concerned Scientists. 1997. *Energy Innovations, A Prosperous Path to a Clean Environment*. Washington, D.C.: American Council for an Energy-Efficient Economy.

Bailie, Alison, Stephen Bernow, William Dougherty, Michael Lazarus, and Sivan Kartha. 2001. "The American Way to the Kyoto Protocol: An Economic Analysis to Reduce Carbon Pollution," Boston, MA: Tellus Institute Stockholm Environment Institute.

Elliott, R. Neal, Skip Laitner, and Miriam Pye. 1997. "Considerations in the Estimation of Costs and Benefits of Industrial Energy Efficiency Projects*."* In *Proceedings of the Thirty-Second Intersociety Energy Conversion Engineering Conference.* New York, N.Y.: American Institute of Chemical Engineers.

[CAMD] Clean Air Markets Division. 2003. "Attachment B: Electricity Demand Growth in V.2.1.6," *Documentation Supplement for EPA Modeling Applications (v.2.1.6) Using the Integrated Planning Model*, EPA 430/R-03-007, U.S. Environmental Protection Agency, Washington, DC.

Cleetus, Rachel, Stephen Bernow, Neal Elliott, Anna Shipley and Elizabeth Brown. 2003. "Explorations with the LIEF 2002 Model." In *Proceedings of the 2003 ACEEE Summer Study on Energy Efficiency in Industry*, Washington, D.C.: American Council for an Energy-Efficient Economy.

[CPPD] Climate Protection Partnerhips Division. 2003. *Change for the Better: ENERGY STAR® and Other Voluntary Programs 2002 Annual Report*, EPA 430-R-03-009, U.S. Environmental Protection Agency, Washington, DC.

DeCotis, P., J. Ellefsen, H. Kim, M. C. Coleman. 2000. “Determining the Success of Market Development Programs and the Continuing Role of Government.” In *Proceedings of the 2000 ACEEE Summer Study on Energy Efficiency in Buildings,* Washington, D.C.: American Council for an Energy-Efficient Economy.

[EIA] Energy Information Administration, *Annual Energy Outlook 2004*, U.S. Department of Energy, Washington, DC, December 2003.

Farrell, A. E., D. W. Keith, J. J.Corbett. 2003. “A Strategy for Introducing Hydrogen into Transportation.” *Energy Policy* 31: 1357–1367.

Feldman, S. and B. Tannenbaum. 2000. “Swoosh!? Awareness and Effects *of* the ENERGY STAR Brand in Wisconsin Appliance Efficiency Programs.” In *Proceedings of the 2000 ACEEE Summer Study on Energy Efficiency in Buildings*, 6.107-119. Washington, D.C.: American Council for an Energy-Efficient Economy.

Geller, Howard, John DeCicco, and Skip Laitner. 1992**.** “Energy Efficiency and Job Creation: The Employment and Income Benefits from Investing in Energy Conserving Technologies,” Washington, DC: The American Council for an Energy-Efficient Economy.

Global Energy Partners, LLC. 2003. *California Summary Study of 2001 Energy Efficiency Programs Final Report (Submitted to Southern California Edison & The California Measurement Advisory Council).* Report ID# 02-1099. Lafayette, Calif.: Global Energy Partners, LLC.

Green, John, Lisa A. Skumatz. 2000. “The Impacts of Education/Outreach Programs: Lessons on Impacts, Methods, and Optimal Education.” In *Proceedings of the 2000 ACEEE Summer Study on Energy Efficiency in Buildings*, 6:107-119. Washington, D.C.: American Council for an Energy-Efficient Economy.

Hanson, Donald A., John A. “Skip” Laitner, John C. Mortenson. 2003. “Modeling Energy Efficiency Program Effort and Administrative Expenditures.” In *Proceedings of the 2003 ACEEE Summer Study on Energy Efficiency in Industry*, Washington, D.C.: American Council for an Energy-Efficient Economy.

Hanson, Donald A., Irving Mintzer, John A. “Skip” Laitner and Amber J. Leonard, "Engines of Growth: Energy Challenges, Opportunities, and Uncertainties in the 21st Century," Argonne, IL: Argonne National Laboratory, 2003.

Henryson, J., T. Hakkansson, J. Pyrko. 2000. “Energy Efficiency in Buildings Through Information – Swedish Perspective.” *Energy Policy* 28: 169-180.

Horowitz, Marvin J. 2001. “Economic Indicators of Market Transformation: Energy Efficient Lighting and EPA’s Green Lights.” *The Energy Journal* 22 (4): 95-122.

Horowitz, Marvin J. 2004a. “Electricity Intensity in the Commercial Sector: Market and Public Program Effects (forthcoming).” *The Energy Journal*, 25 (2): 1-23.

Horowitz, Marvin J. (*Demand Research*). 2004b. Personal Communication. March 5.

Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies [CEF]. *Scenarios for a Clean Energy Future*, prepared for Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, November (URL address: http://www.ornl.gov/ORNL/Energy_Eff/CEF.htm), 2000.

Kushler, M., J. Schlegel, R. Prahl. “A Tale of Two States: A Case Study Analysis of the Effects of Market Transformation.” In *Proceedings of the 2000 ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, D.C.: American Council for an Energy-Efficient Economy.

Laitner, Skip, Stephen Bernow, and John DeCicco. 1998. “Employment and Other Macroeconomic Benefits of an Innovation-Led Climate Strategy for the United States.” *Energy Policy*, 1998, *26*(5), pp. 425-433.

Landry, R., N. Amara, M. Lamari. 2002. “Does social capital determine innovation? To what extent?” *Technological Forecasting & Social Change* 69: 681–701.

Minnesota IMPLAN Group, Inc. 1997. *IMPLAN Professional: User’s Guide, Analysis Guide, Data Guide.* Stillwater, MN: Minnesota IMPLAN Group, Inc.

New York Public Service Commission, New York State Energy Research and Development Authority. 2004. *New York Energy $mart*SM Portal. http://www.getenergysmart.org/GES.portal

Prindle, W., N. Dietsch, R. Neal Elliott, M. Kushler, T. Langer, and S. Nadel. 2003. *Energy Efficiency’s Next Generation: Innovation at the State Level*, Report Number E031. Washington, D.C.: American Council for an Energy-Efficient Economy.

REMI Policy Insight, Regional Economic Models, Inc, 2001. http://www.remi.com/. Last accessed December 2003.

Schweitzer, M., and M. Brown. 2001. “Improving the Methods Used to Evaluate Voluntary Energy-Efficiency Programs.” In *Proceedings of the 2001 ACEEE Summer Study on Energy Efficiency in Industry*, Washington, D.C.: American Council for an Energy-Efficient Economy.

Schweitzer, M., L. G. Berry, D. W. Jones, and B. E. Tonn. 2003. *Estimating Energy and Cost Savings and Emissions Reductions for the State Energy Program Based on Enumeration Indicators Data.* Oak Ridge National Laboratory: Oak Ridge TN.

Shipley, A. M., J. A. "Skip" Laitner, R. Neal Elliott. 2000. "Market Diffusion Theory and the Penetration of Combined Heat and Power." In *Proceedings of the 2000 ACEEE Summer Study on Energy Efficiency in Buildings*. Washington, D.C.: American Council for an Energy-Efficient Economy.

State of California. 2004. *Flex Your Power* homepage. http://www.flexyourpower.ca.gov/state/fyp/fyp_homepage.jsp

Webber, C.A., R.E. Brown, and J.G. Koomey. 2000. "Savings Estimates for the ENERGY STAR Voluntary Labeling Program." *Energy Policy* 28: 1137-1149.