

**Final Report To
Consortium for Energy Efficiency (CEE)**

**Regarding:
State and Local Government Purchasing
Initiative - Program Evaluation Scoping Study**

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AND

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1.0 INTRODUCTION

In late October 2000, GDS Associates, in partnership with Patricia Barnes Consulting, was selected by the Consortium for Energy Efficiency (CEE) to conduct a State and Local Government Evaluation Scoping Study. The goal of the Scoping Study is to define appropriate methodologies for evaluating the impact of CEE's State and Local Government Purchasing Initiative.

Key objectives of the Scoping Study, as defined by CEE, are:

- To develop a method for identifying key measurement indicators pertaining to the purchase of energy efficient¹ products.
- To identify a procedure(s) for establishing a baseline of existing energy efficient purchases.
- To identify methodologies for assessing program impact from the perspective of three groups of stakeholders: state and local governments; federal program sponsors and experts on public purchasing of energy efficient products; and program administrators (e.g., utilities, regional organizations and others).

The first step in developing evaluation methodologies was to identify the needs of the three stakeholder groups. To ascertain such stakeholder needs, the GDS Team developed a series of Interview Guides that were used in conducting telephone surveys of a sampling of these stakeholder groups, including three state and local governments; three program administrators; one federal sponsor (the EPA ENERGY STAR® Purchasing program manager); and two (or more) “experts.” The interviews were scheduled and conducted by Patricia Barnes beginning on November 21, 2000. All interviews were completed by December 12th. These interviews assessed the organizations’ current tracking system capabilities, as well as their needs regarding measurement and reporting on the impacts associated with procurement of energy efficient products and services. Identification of key measurement indicators was a primary focus of these Round One interviews.

A First Interim Report, completed in December 2000, documented the GDS Team’s approach to gathering this information, and presented results from the Round One Interview process, including a complete list of measurement indicators that were identified through the interviews. Using secondary research (review of relevant papers, reports, evaluations, etc.), Team members’ expertise, and input from other evaluation experts, the GDS Team developed a number of proposed methodologies for measuring key indicators identified in the First Interim Report and for assessing program impacts. The proposed measurement indicators and methodologies were

¹ For the purpose of this report, “energy efficient” products and equipment are defined as being ENERGY-STAR® qualified or having equivalent efficiency (usually the top 25% efficiency for individual commercially available products.)

tested through a series of second interviews with many of the same participants from the Round One interview process.

A Second Interim Report was delivered to CEE on February 15, 2001. The Second Interim Report included an overview of the methodologies development process; a summary of the GDS Team's second round of interviews; and some state and local government procurement program sample scenarios to help "operationalize" the proposed impact measurement and baseline development methodologies.

This Final Report provides a summary of the information presented in the First and Second Interim Reports, incorporating CEE comments, and further developing the GDS Team's proposed methodologies for assessing key indicators and developing baselines for use in evaluating the impacts from a government energy efficient purchasing initiative. In addition, Section 7 of this report provides a discussion of approaches to facilitate obtaining consensus from key stakeholders to use these tracking methodologies and to encourage participation with CEE in developing formal programs and projects designed to increase the percentage of energy efficient products being purchased by state and local governments.

2.0 BACKGROUND INFORMATION

The Consortium for Energy Efficiency has done substantial research into the purchasing systems and practices of state and local governments. During 1999, CEE conducted pilot project research at 14 state and local governments throughout the country. CEE's research identified many barriers to incorporating energy efficiency as a standard criterion in the purchasing practices of state and local governments. As part of its research in this area, CEE tested the relevance and usefulness of the ENERGY STAR® Tool Kit, developed by EPA and DOE, as a resource to assist purchasing staff to identify, specify, and purchase energy efficient products and equipment. During this time, CEE also developed a number of other resources to educate and assist purchasers to make informed decisions about energy efficient purchasing. In December 1999, CEE's Board of Directors acknowledged the potential Market Transformation opportunity of overcoming the barriers and incorporating energy efficiency into government purchasing, and formally approved the establishment of the Government Procurement Initiative. The ongoing State and Local Government Purchasing Initiative provides resources and technical assistance to CEE members to help them adopt local purchasing initiatives for the benefit of the governments they serve.

The public sector—including federal, state and local governments—purchases at least 10% of all energy-using products in the US. The amount of these purchases by state and local governments alone is estimated to be roughly \$50-70 billion annually.² These are only rough estimates, however. The diverse and highly decentralized nature of government purchasing and acquisition (and the current trend toward electronic or credit card purchasing) makes it difficult to compile information on annual purchasing volume of energy-using products except in very broad, aggregate terms. Also, these totals do not fully include energy-using equipment specified or acquired indirectly, through federal or state design, construction, and maintenance contractors and energy service providers. Products and equipment purchased as part of new construction or major renovation projects are usually specified and purchased by third party contractors.

CEE's research, and similar research done by the Northwest Energy Efficiency Alliance, has shown that governments generally do not have procedures in place to track either individual purchases or categories of purchases of equipment, including energy efficient equipment. In some states, including Massachusetts, individual agencies, although required to purchase from existing state contracts, operate their administrative functions independently. Currently, it is impossible for more than 160 state agencies in Massachusetts to track purchases at the individual user level.³ However, for most government agencies and other stakeholders (e.g., utilities), being

² Each year, the Federal government spends an estimated \$10-\$20 billion to purchase energy-related products. It is this equipment that is responsible for the more than \$7 billion in annual energy bills paid by the government (See www.eren.doe.gov/femp/procurement/challenge.html)

³ Massachusetts has initiated a multi-state collaborative procurement system, Multi-State EMail®, that will eventually be able to provide much more detailed information regarding purchases made from state contracts, and may be able to track purchases of energy efficient equipment.

able to report on the savings achieved from purchases of energy efficient products is crucial to the continued allocation of resources over time. Providing feedback to agency management and individual staff on such savings can serve to further promote the benefits of purchasing energy efficient (EE) products and to increase the number of such products purchased in the future.

Savings, both of energy and cost, associated with the utilization of energy efficient products within state and local government facilities is only one of many potential indicators that may be of importance to key Government Procurement Initiative stakeholders. In the remainder of this report, a number of tracking indicators are identified, along with proposed methodologies for developing baselines and assessing the impacts of improved energy efficiency purchasing practices.

3.0 ROUND ONE INTERVIEWS

The first step in developing potential evaluation methodologies for CEE's State and Local Government Purchasing Initiative was to identify the possible metrics/indicators that might be included, to test their validity and practicality with the various stakeholder groups, and to solicit input on additional indicators that respondents identified as important to their organizations. CEE's Request for Proposals included a list of potential indicators that were included in the study.

With input from CEE, the GDS Team developed a series of three Interview Guides to use in conducting telephone surveys of a sampling of these stakeholder groups, including state and local governments, utilities or other potential program administrators, purchasing experts and the EPA. The Interview Guides that were used for the first interviews are included in this report as Appendix A. A total of 14 interviews were conducted during the Fall of 2000. Round One interviews were conducted with:

- Three state/local governments, representing both purchasing and facility management organizations;
- Four utilities and regional energy efficiency/market transformation organizations;
- Three purchasing "experts"/researchers; and
- EPA's purchasing program managers.

The list of individuals interviewed from these organizations is included as Appendix B.

These interviews assessed the state and local governments' and utilities' current tracking system capabilities as well as the evaluation needs of all groups in assessing impacts associated with the procurement of energy efficient products and services. Identification of key measurement indicators was a primary focus of these interviews. An initial list of potential indicators was included in the Round One Interview Guides and respondents were asked to rate the indicators as to their importance to their organizations' needs, with "1" being most important and "5" being least important. Respondents were also asked to identify additional indicators that were important to their organizations but may not have been included on the initial list, as well as more detail on the specific Market Transformation (MT) indicators that they considered to be most important to track.

The following paragraphs summarize key findings from the GDS Team's Round One interviews in the areas of state and local government tracking systems (Section 3.1), utility tracking system capabilities (Section 3.2), ranking of key measurement indicators (Section 3.3) and input from CEE (Section 3.4).

3.1 Results of Interviews – State and Local Government Tracking Systems

In most states and at least in larger local governments, the responsibility for procuring energy-using products usually resides in two separate organizations. Among other responsibilities, a Central Procurement Unit administers bid processes and purchasing transactions, and develops

standard, or “master” contracts for commodities (e.g., computers, copiers, exit signs). Another organization, usually called Property or Facilities Management, is responsible for facility construction and renovation, which involves purchasing of major energy-using equipment and systems (e.g., HVAC, lighting and motor systems.)

The current systems and procedures in place in most organizations, including those interviewed here, do not allow for tracking of individual purchases or identification of energy efficient purchases. The tracking systems in place at the organizations that participated in the GDS Team's Round One interviews are described below.

3.1A Tracking of Commodity Purchases

- The city of Seattle, WA has been involved in a re-engineering of their purchasing process, the Copernicus project, for the past 18 months. Their new People Soft electronic financial system includes a Purchasing component. While this system has the capability to track individual purchases through a line-item descriptor, the barriers to implementation of this level of tracking are formidable. The directive to implement such an initiative would require a mandate or executive order; revisions to the system; allocation of additional staff resources to implement and maintain; education and training of staff users from 36 city departments on the new process; and the correct use of codes and descriptors. Currently, Seattle tracks 18 commodity areas, (e.g., office equipment, building equipment), not individual products. Tracking is done through purchase orders that are generated by user agencies (for items on standard contracts) or through vendor invoices.
- The city of El Cajon, CA uses a customized Access database for purchasing. They also track categories of equipment, rather than individual purchases. To do so, they would need to establish a new area in the purchasing database, and would have the same requirements for implementation as Seattle (e.g., mandate, additional resources, user training). They have a staff of 2.5 serving 15 city departments. For some contracts (e.g., Exit Signs), they have included an ENERGY STAR® requirement at the bid stage.
- At the Commonwealth of Massachusetts, commodity purchasing “teams” are responsible for purchasing commodities and services. Individual product purchases are not tracked, although each procurement team develops product specifications and standards of evaluation for the contracts that they develop. For example, the copier team included an ENERGY STAR® requirement in the state’s standard contract for copiers. The three to four vendors that were awarded the contract supply only ENERGY STAR®-labeled copiers. The Commonwealth’s commodity teams are beginning to rely on vendors to provide input to purchasing staff on the number of items purchased. Vendors must send a report form back to the Purchasing Department providing information on each site installation, including a verification that a training session on the energy efficient features was given to users.

The GDS Team's Round One interviews with state and local government commodity purchasing stakeholders reinforce the fact that tracking and quantifying the energy efficiency benefits

associated with product and equipment purchases is not a priority. The ideal time to integrate tracking points into a purchasing system is at the time of planning and design of a new system. Many government purchasing organizations have already adopted new electronic purchasing systems, and those that have not yet done so are very likely to switch in the coming years. These organizations will present a unique opportunity to purchasing program administrators to promote, encourage and possibly assist in developing tracking procedures for energy efficient purchases. Adding tracking points after purchasing systems are developed would be extremely difficult and costly, in terms of modifying the system, adopting new procedures and staff/user training. In the absence of existing tracking systems, it may be necessary to develop estimates of energy efficiency purchases of various products.

It seems that, in many state or local governments, individual purchasing staff or purchasing team members are often most knowledgeable about the level of purchasing for individual products or equipment. This information suggests that interviewing purchasers or purchasing team members might be a useful approach in developing baselines and in estimating or calculating the volume of energy efficient purchases.

3.1B Tracking of Purchases for New Construction / Renovation (Capital Projects)

In most states and larger local governments, purchases made as part of new construction and renovation projects for city facilities are done outside of the Purchasing Department, by another agency that is normally responsible for Facilities. In some cases, a portion of the products or equipment purchased for capital projects may be done through existing state, county, or city contracts. In many cases, the Project's General Contractor or individual sub-contractors will purchase equipment and systems, based on specifications provided by the state or local government's project team.

Purchases for these projects can usually be influenced only through bid specifications early in the process, with post-installation verification that the specifications have been met. The difficulty of tracking individual product or equipment purchases was highlighted in our interviews with individuals at the Commonwealth of Massachusetts and the city of El Cajon, CA.

- The Department of Capital Asset Management (DCAM) within the Commonwealth of Massachusetts is responsible for facility renovations and new construction projects. They use Life Cycle Costing (LCC) Analysis for equipment purchases, and include LCC requirements in bid documents. They have an energy database that includes project information and utility rebate information. Project tracking systems include information on equipment specified, but once the project is completed and equipment has been verified, no follow up tracking is done. Equipment purchases are not being tracked to enable a cumulative accounting of what has been installed. DCAM is beginning development of a new DCAM Information System (CAMIS) that will include documentation of systems in place within state buildings, including size, construction cost, and identification of energy using systems and equipment. This system will be able to identify and track what's in place, how it's performing, scheduled maintenance, etc. Assuming that the fully implemented system will enable users to identify energy efficient

equipment, it could provide useful data for developing a baseline of energy efficient equipment and tracking purchases. It could also provide important information on the performance of the energy efficient equipment, a market transformation indicator that was ranked highly by the DCAM manager.

- The Operations Department for the City of El Cajon, CA prepares spreadsheets to track progress for each construction/renovation project that the city initiates. Life Cycle Costing analysis is done occasionally, but the city's overriding philosophy is to award to the lowest bidder. Contractors purchase products according to specification by a design architect hired for the project. The city requests that the most efficient products be specified, but cost is the overriding issue and project costs must be kept within budget. Project spreadsheets include an accounting of costs and equipment installed, and these spreadsheets are given to the Purchasing Department as a basis for paying contractor invoices. The Purchasing department, as explained above, does not track individual purchases of products or equipment. If energy savings are specified by an architect or consultant as part of a project, Operations staff will request copies of the post-installation energy bills to verify savings estimates.

3.2 Results of Interviews - Utility Tracking System Capabilities

Utilities have traditionally collected data on energy efficiency projects and programs they administer through the use of sophisticated tracking systems. This data is used to track progress of individual programs and is reported on a periodic basis to state regulatory agencies. Market transformation programs pose a unique challenge to program planners and evaluators, since the benefits are not as easily quantified and measured.

San Diego Gas & Electric - tracks program activity and prepares monthly internal reports for all programs from their database information. On a monthly basis, they report on expenditures and what percentage of their goals had been reached for each program. Corporate goals are those established at the beginning of the program year by the California Public Utilities Commission (PUC). Quarterly, SDG&E reports to the PUC on the status of individual programs, and includes the following information:

- Units installed;
- Calculated energy savings (Rebate program calculated savings are based on standardized hours of use and wattages for various types of applications and buildings. Performance Contracting program is based on actual savings, [*i.e.*, type of equipment installed, numbers & wattages of new and replaced equipment]);
- Program Cost-Effectiveness; and
- Dollars Spent vs. Authorized.

The two most important tracking indicators identified by SDG&E during Round One interviews were Market Transformation effects and kW/kWh savings.

National Grid - collects data for all transactions between the Company and its customers on its Ingres Data Management System. This system enables the company to meet the reporting requirements of regulators in the 3 states in which they operate. On a monthly basis, an internal program report is prepared for management, including program goals and accomplishments, year-to date expenditures, MW/MWh savings for each program, and annual MW/MWh savings. They file an annual report in Massachusetts with the Department of Telecommunications and Energy (DTE), including the following information for each program and delivered service:

- What the utility paid for;
- Costs for all measures installed;
- Expected savings (both MWh and MW);
- Measure life;
- Total number of customers participating;
- Percent of market participation;
- Percent of savings per participant per kWh; and
- Avoided costs of measures installed.

For market transformation programs, (primarily education-type programs), National Grid collects a combination of data on energy and non-energy benefits, where possible. Benefits are tied to individual program goals (e.g., how many electrical contractors were trained; how many energy managers educated).

The Northwest Energy Efficiency Alliance - tracks activity for each program in their program tracking system. Quarterly reports are prepared for all programs, and include information on units installed, dollars spent, estimated energy savings, and cost share contributed by partners (e.g., window manufacturers). The Alliance also produces Market Progress Evaluation reports every six months for each project, as part of its evaluation process. In addition, there might be market research or assessment reports, and interim process or impact reports. The Alliance does not conduct full impact evaluations, nor does it report directly to regulators. It does provide information to member utilities in four states for their individual state regulatory reports. Two or three large utilities within the Alliance's territory need reporting details on a regular basis. For example, some utilities require, and the Alliance collects information on the number of ENERGY STAR® windows sold in the region. This overall number is broken down into sales in a specific utility's territory. Also, Bonneville Power (BPA) provides funding and claims savings for Alliance projects on behalf of its public power and direct service customers, and BPA is required to report to the Federal government on these projects. In addition to tracking project savings, the Alliance must also track Market Transformation (MT) effects, since MT is their mission. The Alliance's Director often is asked to make presentations to state authorities, including regulators and governors, regarding Alliance projects in their areas. These are regional or state-specific reports, and include data regarding:

- What has been installed, (type and units of energy efficient products);
- Dollars spent;
- Cost share by partners; and
- Savings achieved: Cost and kWh.

3.3 Results of Interviews – Ranking of Key Measurement Indicators

As part of our Round One interviews, participants were asked to rank a number of indicators that could be used to measure success of an energy efficient purchasing project or initiative. They were asked to rank each indicator on a scale of 1 to 5, with 1 representing “Most Important” and 5 representing “Least Important.” Another option was a ranking of 9, which means “Don’t Know”. Initially, not all indicators were included in each of the Interview Guides. A question on Market Transformation indicators was not initially asked of the state and local government participants, because the GDS Team thought that this indicator might not be relevant to government purchasers. This question was added early in the process when some state and local government respondents mentioned one or more market transformation effects as important “additional tracking indicators”. The GDS Team began to include it as a standard question in subsequent interviews.

A summary, by interviewee category, of key indicators and their average rankings are presented in Tables 1 through 3 below. Participants were asked to rank the indicators in order of importance to their organization (where 1 is Most Important and 5 is Least Important). Also, interviewees’ general comments and responses to the question "what other tracking indicators are important to be tracked" are listed at the bottom of each chart.

TABLE 1
STATE AND LOCAL GOVERNMENTS
Responses To Round One Interview Questions
Ranking Important Tracking Indicators for Measuring Success of Purchasing Project

Ranked from 1-5: 1= Most Important 5= Least Important

Indicator	Average Ranking
Market Transformation Effects	1.00
BTU Savings	1.17
Life Cycle Cost Savings due to EE Purchasing	1.25
kW/kWh Savings	1.33
Gas Savings	1.33
Environmental Benefits	1.33
Changes in Volume of EE Purchases - \$ Value as % of Total Purchases	2.17
Changes in Volume of EE Purchases – Number of Products or Categories of Products	2.50

Other Desirable Indicators and General Comments Mentioned by State and Local Government respondents:

- Performance of EE equipment
- Unexpected maintenance requirements of EE equipment
- Employee awareness
- Employee and public comfort
- Lost opportunities from not purchasing energy efficient products
- Development of Massachusetts-based companies (local economic development)
- Ability to benchmark regionally and against other states
- Individual state agency achievements
- Embedded energy costs of making products and cost of using products with harmful pollutants

TABLE 2
UTILITIES AND REGIONAL PROGRAM ADMINISTRATORS
Responses To Round One Interview Questions
Ranking Important Tracking Indicators for Measuring Success of Purchasing Project

Ranked from 1-5: 1= Most Important 5= Least Important

Indicator	Average Ranking
Market Transformation Effects	1.25
kW/kWh Savings	1.25
Environmental Benefits	1.33
Gas Savings	1.50
Changes in Volume of EE Purchases - \$ Value as % of Total Purchases	2.50
Changes in Volume of EE Purchases – Number of Products or Categories of Products	2.50
Life Cycle Cost Savings due to EE Purchases	3.00
BTU Savings	3.50

Other Desirable Indicators and General Comments Mentioned by Utility respondents:

- Numbers of Participants
- Numbers of contractors, energy managers trained
- Changes in equipment purchases over time
- Changes in number of organizations using Life Cycle Costing
- Types of EE products and volume of each; change in number of units purchased
- Elasticity – do they institutionalize what they’ve learned?

- Demographics of participants
- Number of mandates or policies to purchase EE products
- Awareness (Implementer level) of the value and benefits of EE purchasing.
- Awareness of available tools and resources
- Awareness of lost opportunities of not purchasing EE
- Also need to track and measure: Implementation of EE purchasing policies
 - Are rules in place?
 - Training of staff
 - Are tools available and used (LCC Calculator, Tool Kit, information from Internet)
- Appearance of articles in Association Journals and presentations at S/L conferences.

TABLE 3
PURCHASING EXPERTS AND EPA
Responses To Round One Interview Questions
Ranking Important Tracking Indicators for Measuring Success of Purchasing Project

Ranked from 1-5: 1= Most Important 5= Least Important

Indicator	Average Rating	
	Experts	EPA
Changes in Volume of EE Purchases – Number of Products or Categories of Products	1.83	1.00
Market Transformation Effects	2.00	1.00
Life Cycle Cost Savings due to EE Purchases	2.00	2.00
Changes in Volume of EE Purchases - \$ Value as % of Total Purchases	2.33	5.00
kW/kWh Savings	2.67	1.00
Gas Savings	3.00	3.50
Environmental Benefits	3.00	1.00
BTU Savings	3.33	N/A

Other Desirable Indicators and General Comments Mentioned by Experts/EPA Respondents:

- Are there policy changes in local government to support energy efficient purchasing (political support)?
- Number of participating organizations
- What is being purchased?
- Is the organization devoting enough resources to support energy efficient purchasing?
- Are tools and resources to support energy efficient purchasing being developed and incorporated into purchasing systems?
- Is energy efficiency being incorporated into tools and resources purchasers use?
- Are S/L governments adopting procedures to make it easier to purchase EE products?

- Is Life Cycle Costing becoming a “best practice” in the industry?
- Is EE purchasing being linked successfully to trends such as Electronic purchasing, “Green” purchasing and “Best Value” purchasing?
- Is EE/Environmental purchasing becoming something that is considered “normal”?
- Are we seeing exemplary programs emerging?
- Sustainability, indoor air quality, efficiency of lights, daylighting⁴
- Presentations at peer conferences
- Pay attention to the costs of obtaining data (consultant and staff time)
- Consider what it costs in good will to get the data, and try to make data gathering as easy as possible
- Explore options for E-Purchasing
- Consider to what extent indicators actually need to be tracked. Consider whether the data can be collected at a later date through sampling processes within agencies⁵
- Use vendors to get data where possible. Vendors can be allies and a good source of information
- Make sure to establish a baseline.

3.4 Results of Interviews - Input from CEE

Results from the Round One interviews were presented in a First Interim Report to CEE on December 22, 2000. In commenting on the First Interim Report, CEE staff noted that likely program participants must have the capability to track indicators with relatively little effort. They suggested that the GDS Team avoid indicators that are too theoretical and too difficult to track, and choose indicators that are the highest ranked and the easiest to implement based upon field study.

⁴ Daylighting is the use of natural light as a primary source of illumination for perimeter spaces.

⁵ Jeff Harris of LBNL suggested that a sampling approach might be used to get data as opposed to collecting information via a census approach (a census approach can be more time consuming and expensive). Dr. Harris also noted that the GDS Team should review the Office of Management and Budget (OMB) rules for Federal Purchasing.

4.0 DEVELOPMENT OF METHODOLOGIES

Based on results from the Round One interviews, and input from CEE and purchasing experts summarized in Section 3 above, key tracking indicators were organized and prioritized. The next step was development of proposed assessment and baselining methodologies.

This section of the report presents the three major categories into which the key tracking indicators were grouped. In addition, the GDS Team's proposed methodologies for assessing progress and developing baselines for these indicators are presented. Appendices C-1 through C-3, identify potential tracking methodologies for all indicators, with indicators ranked as to ease of measurement. Appendix C-4 presents summary information on methodologies for developing baselines. Appendix D provides more information on various baselining approaches.

4.1 Organization of Indicators

The Key Tracking Indicator responses from our Round One interviews (Tables 1 through 3, Section 3) were organized and grouped into three categories to enable further development of evaluation methodologies.

Table 4 provides a summary of key measurement indicators identified and itemized above in Tables 1 through 3. This summary groups indicators into three major categories: (1) those requiring direct data tracking and collection activities before quantification and tabulation can be made (*e.g.*, changes in volume of EE purchases - number of products or categories of products); (2) those that are derivable through calculation based on data collected (*e.g.*, kW/kWh savings); and (3) those addressing market transformation issues (*e.g.*, increased levels of awareness). Section 4.2 presents more discussion of these three categories and identifies potential assessment methodologies for each group.

TABLE 4
Responses from First Round Interviews
Key Tracking Indicators

CATEGORY/MEASUREMENT INDICATOR
(1) Directly Trackable Data Collection Indicator
- Changes in Volume of EE Purchases – Number of Products or Categories of Products
- Changes in Volume of EE Purchases - \$ Value as % of Total Purchases
- Number of Participants
- Number of Contractors, Energy Managers Trained
- Number of Mandates or Policies to Purchase EE Products
- Number of Participating Organizations/Adopting EE Purchasing Policies
(2) Derivable Indicators Through Calculation Based on Data Collected in (1) Above
- Life Cycle Cost Savings due to EE Purchasing
- BTU Savings

- kWh/kW Savings
- Gas Savings
- Environmental Benefits (including Carbon reductions)
- Individual State Agency Achievements
- Demographics of Participants
(3) Market Transformation Measurement Indicators
- Employee Awareness & Awareness (Implementer Level) of the Value and Benefits of EE Purchasing
- Awareness of Available Tools and Resources
- Employee and Public Comfort, Improved Indoor Air Quality
- Lost Opportunities From Not Purchasing Energy Efficient Products and Awareness of Opportunities
- Performance of EE Equipment (including efficiency of lights, day lighting)
- Unexpected Maintenance Requirements of EE Equipment
- Development of In State-Based Energy Services Companies (Local Economic Development)
- Ability to Benchmark Regionally and Against Other States
- Changes in Equipment Purchased Over Time
- Emergence of Exemplary Programs
- Linking of Energy Efficient Purchasing to Trends such as Electronic Purchasing, "Green" Purchasing and "Best Value" Purchasing
- Elasticity (Do they institutionalize what they've learned? Is EE purchasing becoming normal?)
- Appearance of Articles in Association Journals & Presentations at Peer Conferences
- Policy Changes in Local Government to Support EE Purchasing (Political Support)
- Existence of Implementation Policy, Are Rules in Place?
- Adoption of Procedures by S/L Governments Adopting Procedures to Make it Easier to Purchase EE Products
- Training of Staff, Availability and Use of Tools (LCC Calculator, Tool Kit, Web Info)
- Organizational Commitment of Resources to Support EE Purchasing
- Changes in Number of Organizations Using Life Cycle Costing (<i>i.e.</i> , Is LCC becoming "Best Practice" in the Industry?)

4.2 Development of Evaluation Methodologies

Based on input received during Round One interviews, and from CEE input and other sources (e.g., secondary research), the GDS Team developed proposed methodologies for measuring key indicators and assessing program impacts. Using the categories in Table 4 above, these indicators and proposed methodologies were assembled in a series of three charts that were the focus of a second round of interviews. A fourth chart describes several approaches to developing baselines. These charts are described below and included as Appendix C. Please refer to Section 5 of this report for a summary of the second round of interviews, which were conducted to solicit input and test the validity of these GDS Team proposed indicator tracking and baseline development approaches.

- Chart 1 – Methodologies List for Directly Trackable Data Collection Indicators. Those requiring direct data tracking and collection activities before quantification and tabulation can be made (e.g. Changes in Volume of Energy Efficient Purchases – Number of Products or Categories of Products);

- Chart 2 – Methodologies List for Derivable Indicators Through Calculation. Those that are derivable through calculation based on data collected (e.g., kW/kWh savings); and
- Chart 3 – Methodologies List for Measuring Market Transformation Indicators. Those addressing market transformational issues (e.g., Increased Levels of Awareness By State and Local Governments of the Benefits of Energy Efficient Purchasing)
- Chart 4 - Alternative Methodologies for Forecasting Baseline Levels of Energy Efficiency. Provides an overview of four traditional approaches to developing baseline levels of energy efficient purchasing.

4.2A Methodology for Measuring Directly Trackable Indicators

As noted above, "Directly Trackable" indicators are ones that can be readily tracked from information gathered via a purchasing system or a survey. In general, these indicators are tracked through financial accounting or purchasing information systems. CEE identified two of the six "Directly Trackable" indicators identified in Table 4 above, as having the most promise based upon data collected by the GDS Team through round one interviews with key stakeholders. These two indicators are listed in order of importance below (on a scale of 1 to 5, where 1 is most important and 5 is least important):

Directly Trackable Indicators	
Name of Indicator	Rank
• Changes in Volume of EE Purchases - Number of Products or Categories of Products	1.96
• Changes in Volume of EE Purchases - \$ Value as % of Total Purchases	3.00

Proposed tracking methodologies for each of the "Directly Trackable" indicators listed above and in Table 4, are provided in Appendix C-1. The following are examples of measurement methodologies for these two “changes of volume of EE purchases” indicators.

The “Changes in Volume of EE Purchases” – number of products or categories of products” indicator was highly ranked by experts and EPA interviewees. The number of purchases of a particular commodity would need to be tracked from year to year in order to provide a time line, as the number of purchases in one year in isolation is of little value. For example, more of a particular item may be purchased one year than in a previous year, but if overall more purchases of both the inefficient and efficient units are made, the raw number of purchases of the efficient units may represent an actual decrease in the overall percentage of items purchased. It would be necessary to track (or estimate) the total number of units purchased in a given year as well as the number purchased that were energy efficient. Having this data will allow calculation of the penetration rate of efficient equipment. To collect this data, organizations would need to have in

place a data tracking system.⁶ Alternatively, the penetration rate of efficient equipment could be estimated through an annual survey of purchasing managers (where the survey asked for an estimate of the penetration rate of efficient equipment for various types of equipment).

If a survey approach is used, the survey should provide a definition of the threshold to be used for energy efficient equipment and the following types of questions should be included on the survey:

- How many units of _____(equipment category, for example: HVAC or lighting systems) were purchased in year _____?
- How many of the units (specified above) purchased in year _____ were energy efficient?

Problems associated with using a survey approach to collect this data include: the difficulty of identifying appropriate survey respondents within an organization; the lack of purchasing tracking, which increases the burden on respondents and makes their answers questionable; and the relatively few sample points that will be available for any one organization or government agency, rendering it very difficult to conduct statistical analyses, such as regression or modeling.

The “Changes in Dollar (\$) Volume of EE Purchases” indicator was not as highly ranked as the number of EE units purchased. The tracking procedure for this indicator is straightforward. For a particular piece of equipment, it would be necessary to track in any particular year the dollar volume of units purchased as well as the dollar volume purchased that is energy efficient. An organization would need to have in place a data tracking system in order to collect this data. Alternatively, for organizations that do not have a tracking system, the dollar volume of energy efficient equipment could be estimated through an annual survey of purchasing managers (where the survey asked for an estimate of the dollar value of efficient equipment as a percent of total purchases for various types of equipment). If a survey approach is used, the survey should provide a definition of the threshold to be used for energy efficient equipment and the following types of questions should be included on the survey:

- What was the dollar volume in year _____ for total purchases of this equipment (regardless of its level of efficiency)?
- What percent of the dollar volume of purchases of this equipment was for energy efficient equipment?

There are problems associated with tracking the total dollar volume as a percentage of the total dollars spent on a commodity. In addition to the problems raised in the discussion of the indicator above, an average price of a particular unit must be established. For example, if an efficient Widget costs \$X in year 1, and that year \$X⁸ is spent on all widgets, next year's price of the Widget could be doubled and percentages would be of little value without average

⁶ The GDS Team notes that many government and business organizations do not have suitable information systems to allow a census to be done of efficient purchases. See details of tracking systems in Section 3.1 above.

purchasing price information for each year. This problem may be avoided if one could track the percentage of transactions (purchasing transactions of energy consuming products in a specific category) that are of energy efficient products. For example: this year, 200 exit lights were purchased, with 20 percent of these transactions for LED products. Last year only 10 percent of such lighting purchases were for LED lights.

While there are four other possible indicators in the “Directly Trackable” category (see Table 4 above), the GDS Team does not propose that all of these other four indicators be used to measure program impacts. GDS has, however, provided measurement methodologies for all six indicators in this category in Appendix C-1, at the end of this report.⁷

4.2B Methodology for Measuring Derivable Indicators

"Derivable Indicators" are ones that can be derived or calculated from other data that has been collected or is available from prior research projects. Of the eight indicators in this category listed in Table 4 above, CEE identified five as having the most promise, based upon data collected by the GDS Team through round one interviews with key stakeholders. These five indicators are listed in order of importance below:

Derivable Indicators Through Calculation Based on Data Already Collected	
Name of Indicator	Rank
• kW/kWh Savings	1.56
• Environmental Benefits (including Carbon reductions)	1.67
• BTU Savings	2.00
• Life Cycle Cost Savings due to EE Purchasing	2.06
• Gas Savings	2.33

Proposed tracking methodologies for each of the "Derivable" indicators listed above and in Table 4, are provided in Appendix C-2. The following are examples of measurement methodologies for “kW and kWh savings” and “environmental benefits”, the highest ranked indicators.

The “kW/kWh savings” indicator was highly ranked by utility and EPA interviewees. The derivation for this indicator is straightforward. For a particular piece of equipment, such as a personal computer, it would be necessary to track in any particular year the total number of energy efficient units purchased. For this indicator to be of use, an organization would need to have in place a data tracking system to collect data on the number of units that qualify. Then it would be necessary to obtain annual per unit savings for the energy efficient unit compared to a

⁷ Please note that tracking the number of participating organizations adopting EE purchasing policies could be particularly useful for CEE as these states or agencies are potentially ripe for assistance and for the involvement of utility and other member program administrators. The GDS Team notes that this indicator is viewed as a market transformational indicator in Appendix C-3 of this report.

baseline unit. Per unit savings information can be obtained from organizations such as the EPA, CEE or ACEEE.⁸ To calculate total savings in a particular year, simply multiply the number of energy efficient units times the annual per unit savings (kWh or kW).

In general, "Environmental Benefits" can be derived by multiplying specific factors for SO_x, NO_x, CO₂ and particulates times the annual energy savings (kWh or therms). Such factors can be obtained from work published by organizations such as the Lawrence Berkeley Laboratory or the US Department of Energy (DOE). DOE has standard assumptions for translating energy savings into savings of carbon dioxide, sulfur dioxide, nitrous oxide and particulates.⁹

4.2C Measurement of Market Transformation (MT) Indicators and Baseline Development

The purpose of collecting data on indicators of market transformation is to provide information on whether program strategies are effective in reducing or removing barriers to adoption of energy efficient practices and equipment. Based on the indicators identified and prioritized through our round one interviews (see Table 4 above), MT indicators have been classified into five general categories as follows:

- Awareness - S/L government agency employee and equipment supplier/vendor awareness of the value and benefits of energy efficient purchasing (including awareness of the different categories of items for which energy efficient purchasing is available)
- Promotion - Degree of promotion of energy efficient equipment by suppliers to organizations participating in CEE Purchasing Program;
- Performance - Perceived performance of energy efficient equipment;
- Availability - Availability of energy efficient equipment (both on the market and in the purchasing program in question); and
- Penetration - Penetration of energy efficient equipment at participating organizations.

To assess progress on indicators in these categories, comparison against baseline information is required. The GDS Team recommends that the research approach for developing baselines and

⁸ Examples of energy savings per unit data for several categories of equipment used by government agencies are available in the cost effectiveness section of each FEMP purchasing recommendation. These data can be found on-line at www.eren.doe.gov/femp/procurement. Additional information on energy savings for equipment is available from the Lawrence Berkeley Laboratory (LBL).

⁹ For information on how to quantify emissions reductions related to energy efficiency programs, see LBL web site entitled Global and National Energy and Greenhouse Gas Emission Analysis, (<http://www.eetd.lbl.gov/ea/GNEGGEA/GNEGGEA.html>), another reference site for emissions data is the EPA's Emissions and Generation Resources Integrated Database, <http://www.epa.gov/airmarkets/egrid>.

collecting information on indicators in these categories be designed so that it is as simple and cost effective as possible. Key MT indicator measurement data can be collected through surveys, focus groups, content analyses or secondary research, and baselines can be developed through historical information, statistical approaches or through expert opinion and "delphi" techniques.

General information on the steps involved in each of the MT indicator measurement methodologies (*i.e.*, surveys, focus groups, content analysis) is presented below. Please refer to Appendix C-3 for more information on the GDS Team's proposed methodologies for specific indicators. Details on baseline development techniques are included in Appendix D at the end of this report.

Surveys/Focus Groups: - To assess current status of and collect information from key stakeholders on important program success indicators, various survey techniques can be applied (*e.g.*, telephone and mail/e-mail surveys, depth interviews or focus groups). In each of these cases, participants to be targeted for interviews and a list of researchable questions must be clearly identified prior to ultimate development of appropriate survey instruments or interview guides. Depending on the needs for statistical significance, a sampling plan must also be developed and the interviews can commence. For CEE's State and Local Government Purchasing Initiative, to minimize recruiting difficulties, increase responsiveness and otherwise limit interference with interviewee's busy schedules, the GDS Team recommends utilization of telephone and/or mail surveys of 15 to 20 minutes duration at most when dealing directly with government agencies, purchasing staff and vendors/equipment suppliers. In depth interviews (of 45 minutes to 1 hour duration) can be a useful data collection tool when targeting utilities and other program administrators. Focus groups can also be conducted in situations (*e.g.*, regional/national conferences) where it might be easy to recruit key stakeholders into a targeted breakout session to solicit opinions on key indicators or specific program approaches.

Content Analysis/Secondary Research: - Useful information can also be gathered through review of reports and studies that have already been conducted (secondary research) or through assessment of print ads, news articles and specialty conferences/seminars relating to or promoting energy efficient equipment and procurement practices (content analysis). Assessment of promotion-related indicators can often be achieved without inconveniencing government agencies, purchasing staff or equipment vendors through utilization of content analysis techniques. By targeting key publications, a baseline of energy efficiency-related print space could be determined and then regularly reassessed to measure changes. Also, it is important, before embarking on a more costly and complicated primary data collection/survey effort, to step back and review/assess the relevance of existing studies, reports, or papers that may already have been conducted/written for local, regional or national purposes. Research on state and local government purchasing practices has been conducted by CEE and the Northwest Alliance, and numerous studies have and are being performed on energy efficiency awareness, promotion, performance, availability and penetration throughout the country that may be of use when assessing key MT indicators for CEE's Government Procurement Initiative.

Baseline Development: - As noted above, the GDS Team has identified three generic approaches to developing baselines:

- Historical: Project current or recent trends or replicate previously observed models
- Statistical: Apply mathematical models or similar formal decision tools
- Expert opinion: Develop estimates based on the aggregated forecasts of market actors or others familiar with the particular market of interest

These approaches are summarized briefly in Appendix C-4 and discussed in more detail in Appendix D at the end of this report.

As determined during our second round of interviews (and summarized in Section 5 below), development of meaningful market transformation assessment methodologies is quite difficult without a clear definition of the energy efficiency program and participants to be evaluated. In Section 6 of this report, three state and local government energy efficiency product procurement program scenarios are presented, within which key success indicators, baselines and tracking methodologies can be more readily explained.

5.0 SECOND ROUND INTERVIEWS

To solicit input and test the validity of the GDS Team's proposed indicator tracking and baseline development approaches, a second series of interviews was conducted during February 2001 with 11 of the respondents from the first Interview process. Second round interview respondents included:

- Program managers from two utilities and one regional energy efficiency/market transformation organization;
- Purchasing and facility management staff from one state and two local government organizations;
- Two purchasing experts/researchers; and
- An EPA ENERGY STAR® Program evaluator.

(Please refer to Appendix B for a list of individuals interviewed)

A preliminary version of the four Methodology and Baseline tables described above and included as Appendix C-1 through C-4 was sent to all participants in advance of the interviews. Participants were asked to comment on the reasonableness of the proposed methodologies, and to provide additional comments, enhancements, suggested approaches, or concerns with each. They were asked to review each table in advance of the interviews, and to write down any comments to prepare for discussion during the interviews. The main focus for each interview was to solicit feedback on the methodologies proposed to track the indicators that participants had identified during the first round as being most important to their organizations. In addition, participants were given the opportunity to provide comments about any of the indicators listed, or to suggest alternative tracking approaches.

Respondents were asked to comment on the reasonableness of the proposed tracking methodologies, and the likelihood of being able to track the necessary data regarding equipment and product purchases. This basic information was considered to be necessary for calculating baselines of energy efficient product purchases, as well as measuring the impacts of a program intervention. Respondents indicated that the methodologies seemed appropriate, but several cautioned against including indicators that could not realistically be implemented. Several respondents suggested reorganizing and ranking the indicators to prioritize those that are most feasible and likely to be practically implemented.

5.1 Results of Interviews

Complete summaries of all second round interviews were included in the GDS Team's Second Interim Report. Some key comments and suggestions for alternative approaches to data collection are highlighted below.

- Individual S/L government participants (in a purchasing project) would need to decide what information they wanted to track up front.
- Consider using vendors as a source of information on what has been purchased.
- It would be useful to have a comprehensive listing of all energy efficiency products, to help develop tracking systems, baselines and methodologies for purchasing projects.
- In the absence of S/L government tracking systems for individual purchases, purchasing commodity team members are often the best source of information on the types and volume of equipment purchased.
- Square feet of buildings might be a more useful indicator than “number of agencies or organizations.”
- Program administrators or S/L governments might consider starting a program with just a few selected products, and develop tracking procedures for these. Start small, then expand over time.
- Properly structured surveys should be an effective way to measure many market transformation effects.
- Possibly use credit card billing and/or UPC bar code tracking to identify purchases from a S/L government purchaser (where credit card purchasing is used).
- Collect data by creating a “bounty” for ENERGY STAR® labels.
- Build tracking systems into electronic (ECommerce) purchasing systems.
- Percent is key indicator in understanding saturation. Symbolic nature – 100% of all purchases are ENERGY STAR® qualified – may be enough.
- It is easier to specify energy efficiency during the bid process, and to develop savings estimates for organization-wide (standard) contracts, than for purchases made outside of these contracts.
- Are there proxy indicators that can be developed to represent how many energy efficient products are being purchased?

Second Round Interviewee's Comments on Proposed Baseline Development Approaches

- Possibly develop default values for per unit savings for various products. Potential sources for these default per unit savings values include: web-based listings (for ENERGY STAR®-labeled products); DOE-published directory for white goods; Gamma; the California Energy Commission web site; and the FEMP book.
- A sampling across organizations of what is being purchased would be helpful. Baseline could be sales weighted average.
- Could develop default baseline levels for whole markets, e.g., State of MA could apply overall market penetration.
- Ranges might be useful, e.g., range of 20-30% might be good enough.
- For certain product categories (e.g., computers, copiers), estimates of market penetration could be developed. Adjust values to reflect that governments are late adopters.
- If you've captured data on market share (e.g., baseline information on key "volume" indicators), you've come a long way towards estimating numbers for purchases of various types of equipment.

As a result of input received during the second round interview process, the preliminary version of the GDS Team's proposed methodology tables were reorganized and a "Feasibility Ranking" column was added. Indicators in each of the three tables were ranked according to the feasibility of collecting and tracking necessary data. The indicators were ranked as described below:

FEASIBILITY RANKING

1. Most likely to be able to be tracked by state/local governments or program administrator with some modification to current practices.
2. Tracking not as readily implemented, but could work under certain circumstances.
3. Not generally recommended due to difficulty in tracking and obtaining data.

The revised Methodology Tables, incorporating a Feasibility Ranking, are included as Appendices C-1 through C-3. These tables include proposed methodologies for collecting data and evaluating the impacts for each indicator that has a Feasibility Ranking of 1 or 2.

During the GDS Team's round two interviews, it became obvious to the GDS Team that respondents were having difficulty assessing the reasonableness of proposed evaluation methodologies given the lack of a targeted participant group or actual program context from which to provide their comments. As a result, CEE and the GDS Team agreed that the development of specific state and local government energy efficiency purchasing program scenarios would help key stakeholders envision how the proposed indicators could be operationalized. Section 6 of this Report identifies key tracking indicators, and proposed baseline development and measurement methodologies all within a context of three different sample program scenarios.

6.0 STATE AND LOCAL GOVERNMENT PROCUREMENT PROGRAM SAMPLE SCENARIOS

Due to the variety of tracking indicators and possible approaches to developing baselines and measuring success of state and local government procurement programs, CEE and the GDS Team found it necessary and very helpful to provide some basic program frameworks and assumptions as a context for considering how to measure impacts. Three sample delivery approaches are presented below and include, for each approach, a discussion of key program indicators, proposed measurement assessment methodologies, and potential baseline development recommendations.¹⁰

6.1 Purchasing Department – Pilot Project Scenario (for Commodity Purchases)

Scenario Description: Program Administrator (e.g., utility or regional energy consortia) offers services to a state or local government purchasing department to help it to incorporate energy efficiency requirements into the bidding process. The resulting contracts for ENERGY STAR®-labeled equipment ensure that future purchases made through standard contracts are energy efficient. (The Commonwealth of Massachusetts used this approach for copiers purchased through standard State contracts.)

Process: Build ENERGY STAR® requirements into standard purchase contracts for a few selected products (e.g., copiers, exit signs). Eventually, this process could be expanded to include more ENERGY STAR®-labeled products.

Participant: State or local government purchasing department.

First Year Goal: With few exceptions, the State or Local government purchases only ENERGY STAR®-labeled models of the selected products.

Long Term Goal: In all bids for standard purchasing contracts that call for energy consuming commodities, there will be specifications requiring that such commodities be ENERGY STAR®-labeled or meet the energy efficiency standards of DOE's FEMP criteria for the particular product category.

Assumptions:

- Assumes that purchasing management understands benefits and issues associated with changing purchasing practices to incorporate energy efficiency, is supportive of the process, and is willing to include ENERGY STAR® as a requirement in bids.

¹⁰ These sample delivery approaches (potential program scenarios), are hypothetical examples of the types of targeted efforts that CEE may wish to consider for more detailed program development. They are provided only to set a framework from within which specific indicators, baseline development and tracking methodologies can be more easily viewed. No attempt has been made to research or design actual programs for implementation, or to verify legitimacy of the goals, barriers and designs of these sample scenarios.

- Starts with a few commonly purchased products, and then expands to more. Eventually could include energy efficiency requirements in all standard contracts for purchases of energy consuming equipment.
- Program Administrator can assist participants in defining average energy use for standard efficiency and energy efficient models, and can help to calculate average savings estimates. Program Administrator can also provide various tools available from ENERGY STAR® website and/or CEE to assist throughout the process (e.g., ENERGY STAR® Tool Kit and its Life Cycle Costing Analysis diskette, and/or its bid specification language).

Potential Barriers and Proposed Interventions:

Potential Barrier	Possible Intervention	By Whom
Purchasers' lack of information about EE products & technologies	- Provide Tool Kit and other information about products selected for pilot, and for future consideration.	Program Administrator
Purchasers don't have time to research new products; develop specifications	- Provide bid language from Tool Kit or provide specifications from other sources.	Program Administrator
First cost may conflict with organization's "least cost" purchasing policy	- Promote the use of Life Cycle Costing (present as Best Value Purchasing) to make Purchase decisions & secure management agreement to use LCC. -Train purchasers on the use of the LCC diskette included with Tool Kit.	Program Administrator

Development of Baseline: For selected products, estimate of baseline purchases could be made by the members of the commodity team responsible for developing standard purchase contracts. Baselines would be based on "what was purchased previously." Any available historical purchase information could be used ("Historical Data" approach), or this information could be enhanced by the commodity team members' knowledge and understanding of the level of purchasing activity for various products included in the pilot (Expert Opinion/"Delphi Technique"). This information might also be gathered from current vendors who are selling the products under state contract.

Tracking of Purchases: Can be done through vendor reports of what was purchased and installed during the previous period. Vendor reporting requirements could be included in the contracts. Contracts and Vendor reports could also include verification that user training on energy

efficient features was conducted at the time of installation. In Massachusetts, when a copier is purchased from the state contracts, the vendor is required to send a report to the Purchasing department each time a new machine is installed, including verification that user training on the energy efficiency features was provided.

Electronic Purchasing Systems (E-Purchasing): Electronic purchasing systems offer unique opportunities to incorporate detailed tracking of products purchased, including the identification of energy efficient products. These tracking methods should be built into a new system during the planning and development stages, as it is much more difficult to add tracking points after implementation.

Tracking Indicators to Assess Success of Individual Project:

From Perspective of Participating Organizations:

- *Energy cost savings or Life Cycle Cost (LCC) savings* ("Derivable" indicators) achieved by purchase of efficient models since new contracts were put into place. Energy cost savings could be calculated by multiplying the number of vendor-reported purchases by the average savings estimates developed at the beginning of the project and comparing this to the baseline. LCC savings can be calculated using the LCC diskette included with the ENERGY STAR® Tool Kit.
- *Environmental benefits due to purchases* ("Derivable" indicator). LCC diskette included with the ENERGY STAR® Tool Kit can calculate environmental savings. Other calculation tools and methodologies might be available from program administrator that is providing project assistance (e.g., National Grid has savings calculations that they use to determine CO₂, NO_x and SO_x savings from energy efficiency projects, LBL, EPA web sites, etc.).

From Perspective of Program Administrator:

- *kW/kWh Savings* ("Derivable" indicator). This could be calculated from information provided by participating organizations based on the number of energy efficient products purchased during a previous period multiplied by a predetermined amount of energy and demand savings per unit of each product installed.
- *Number of Standard contracts that include ENERGY STAR® or energy efficiency requirement* ("Market Transformation" indicator). This information could be tracked by the participating organization with minimal effort and provided to the Program Administrator periodically.

6.2 Construction/Renovation Scenario (Equipment and Systems Purchased as Part of New Construction or Major Renovation Projects)

Scenario Description: Program Administrator works with department or agency within a state or local government that has responsibility for new construction/renovation of buildings to incorporate requirements and procedures to purchase the most cost-effective energy efficient products and systems as standard practice for capital projects.

Process: Assist the agency to develop guidelines and establish tools and procedures to incorporate Life Cycle Costing (LCC) and energy efficiency requirements into project specifications for energy consuming equipment and systems purchased for new construction and renovation projects.

Participant: Agency or department within state or local government that has responsibility for building construction/renovation projects, including developing bid specifications and hiring project contractors.

First Year Goal: To develop and begin to use practical tools that will enable project planners and contractors to use Life Cycle Costing Analysis (LCC) in decisions to specify and install the most energy efficient systems and equipment. Also, to test these new tools in several new projects through bid specifications requiring that LCC Analysis be conducted by bidders.

Long Term Goal: LCC is required in bids and conducted as a matter of course for systems/equipment used in facility new construction and renovation projects. Also, the local or regional design/build community understands and responds to the organization's commitment to energy efficiency in its buildings and operations, and bidders include efficient systems and equipment (and LCC analysis) as standard practice.

Assumptions:

- Assumes high-level management commitment to achieving energy efficiency in new buildings and through renovations of existing buildings.
- Bid contracts include energy efficiency requirements for systems and equipment that must be followed by the contractor.
- Program Administrator can provide education and training to staff on benefits of purchasing energy efficient products, Life Cycle Costing Analysis, Commissioning, use of the ENERGY STAR® Tool Kit, LCC diskette, and other resources. A training seminar might also be developed for the local or regional Architect and Engineering design and build community.
- Program Administrator can also provide technical assistance in identifying energy efficient products and models, and can assist in developing specifications if necessary.

Potential Barriers and Proposed Intervention:

Potential Barrier	Possible Intervention	By Whom
Energy Efficiency not generally a criteria for building operators or facility mgrs. When specifying equipment for purchase.	-Promote benefits of EE to the organization; “good government” practices, “best value” criteria - Secure mgmt. commitment to energy efficiency in building operations. - Communicate the EE benefits that are most important to this audience: quality, reliability, less maintenance, longer life.	Program Administrator
A/E design/construction community does not use LCC.	- Require use of LCC in bids for energy consuming equipment. - Provide training to A/E community on LCC	S/L government S/L government, or Program Administrator
Purchasers for this equipment are often third party contractors. Lack of information about EE products & technologies and budget constraints often result in less efficient equipment being installed.	- Include in bid specifications a requirement to conduct LCC analysis, and to purchase and install energy efficient equipment. - Authorize a “premium” to be paid for energy efficient equipment, or some incentive for purchaser. (University of CA gives bonus to General Contractor upon verification of target BTU per square foot.)	S/L government
First cost may conflict with organization’s “least cost” purchasing policy	-Promote the use of Life Cycle Cost Analysis (can be presented as “Best Value”) -Authorization by management to pay higher price when savings in operating and maintenance cost justify higher first cost.	State/Local Government (Mandate to authorize “Best Value”, LCC or higher first cost might require legislative changes).

	-Train purchasers on the use of the LCC diskette included with the ENERGY STAR® Tool Kit.	Program Administrator

Development of Baseline: For a renovation project, the baseline could be based on the equipment being replaced ("Historical Data"). For a new building, the baseline could be developed through a modeling approach, using inputs for "standard" efficiency equipment ("Statistical" Approach). The Commonwealth of Massachusetts is beginning development of a building information system (CAMIS) that will provide information on state buildings, including the size of the building, construction cost (if known), identification of key energy consuming systems and equipment, maintenance schedules, etc. Such information might be used to develop baselines of energy consumption.

Tracking of Purchases – Some agencies already have a project tracking system or a building database in place. The Commonwealth of MA Department of Capital Asset Management (DCAM) currently uses a spreadsheet to track the progress of each project. This spreadsheet typically includes a description of systems and equipment that have been specified by the contractor. If the spreadsheet is updated to include the actual equipment installed, this could provide a means of tracking purchases. The information on this spreadsheet could be incorporated into the new CAMIS building information system. The cost of equipment and expected energy use would also be useful information to include in a project tracking system. Project commissioning would ensure that equipment is operating at maximum efficiency, and energy costs could be tracked for some period after project completion, to compare to projections.

Tracking Indicators to Assess Success of Individual Pilot

From Perspective of Participating Organizations:

- *Number of bids requiring energy efficient equipment/LCC Analysis* ("Directly Trackable" indicator). This would seem to be relatively easy to track, especially if LCC was a standard requirement for equipment or systems purchased as part of a renovation or new construction project.
- *Number of contractors responding to bids with energy efficient equipment recommendations* ("Directly Trackable" indicator, also is an indicator of "Market Transformation"). This could be rated and tracked during the bid review process.
- *Changes in equipment purchased over time* ("Market Transformation" indicator). This could be assessed through surveys of project managers from the agency that oversees construction/renovation projects in facilities, (e.g., DCAM in Massachusetts.)
- *BTU Savings, kW/kWh savings* ("Derivable" indicators). This could be tracked by comparing building's energy use before and after implementation; or by comparing the building's energy consumption after project completion to the building's baseline use

before starting the project. This could be difficult to track for buildings, and might require the use of advanced modeling techniques, including pre- and post-installation building modeling simulations, with adjustments for weather, type of use, number of occupants, etc. The ENERGY STAR® Buildings Program or HERS ratings could provide more information on building energy use factors.

- *Energy Cost Savings* ("Directly Trackable" indicator). Assuming that kW/kWh savings could be estimated or tracked, energy cost savings could be calculated by multiplying the reduction in demand/energy savings by the cost.
- *Environmental Benefits* ("Derivable" indicator) - could be derived from kW/kWh savings, using conversion factors from EPA's ENERGY STAR® Tool Kit or from Program Administrator.

From perspective of Program Administrator:

- *Number of mandates to specify/purchase energy efficient equipment for renovation or new construction projects* ("Directly Trackable"/"Market Transformation" indicator). This could be tracked by the project administrator, along with the dates of implementation.
- *Number of agencies requiring use of Life Cycle Cost Analysis for products/equipment purchased as part of new construction/renovation projects* ("Directly Trackable"/"Market Transformation" indicator). This could be tracked on a spreadsheet by the project administrator.
- *Number of Contractors, Design Firms trained* ("Directly Trackable" indicator). This could be tracked by program administrator as part of his/her normal tracking of programs and services provided to customers.
- *Changes in equipment purchased over time* ("Market Transformation" indicator). This could be determined through surveys of project managers from the state or local government agency that oversees construction/renovation projects in its facilities.
- *kWh/kW savings* ("Derivable" indicator) – could be estimated by comparing baseline to expected energy use of equipment. For existing buildings, baseline could be the equipment that is being replaced, and estimates of energy use of new equipment could be used to calculate savings. For new buildings, building simulation modeling could be used to derive demand and energy savings. Or could compare actual energy use of new equipment or building after project implementation to a predetermined baseline.

6.3 Environmentally Preferred Purchasing Systems Scenario

Scenario Description: Environmentally Preferable Purchasing (EPP) is the purchase of "products and services [that] have a lesser or reduced effect on human health and the

environment when compared to other products and services that serve the same purpose.” (Executive Order 13101, *Greening the Government Through Waste Prevention, Recycling and Federal Acquisition*, September 1998). By definition, EPP includes energy efficient products that consume less energy and have reduced environmental impacts. In many EPP programs, the connection between energy efficiency and environmental benefit is not clearly understood or promoted. Many programs initially focus on the benefits of recycled-content products and/or toxic waste reduction, and over time, energy efficient products are included.

This discussion proposes a methodology for tracking and evaluating the energy efficient products, focusing on ENERGY STAR®-labeled products included in an EPP program.

Process: Program Administrator assists Purchasing/EPP staff with specifications and product identification to incorporate ENERGY STAR® requirements into new standard contracts and to track these purchases.

Participant: State or local government EPP staff.

Goal: Build awareness of benefits of purchasing energy efficient products as a means of meeting goals of EPP program. Assist Purchasing/EPP staff to incorporate ENERGY STAR® requirements into new standard contracts for purchase of ENERGY STAR®-labeled office equipment.

Assumptions:

- Build ENERGY STAR® requirements into bid solicitations for products purchased through state contracts. Begin with office equipment (copiers, computers and peripherals, multi-function devices, etc.) and expand to appliances and other energy consuming equipment. As existing contracts for these products expire, ENERGY STAR® requirements are included in the new solicitations.
- Program Administrator provides energy efficiency/Tool Kit/ LCC training to staff, with a focus on the environmental benefits of energy efficiency.
- Identification of ENERGY STAR® - qualified models, and energy use of various products, is available through the ENERGY STAR® website. Additional assistance is provided by vendors, or Program Administrator.

Potential Barriers and Proposed Intervention:

Potential Barrier	Possible Intervention	By Whom
Purchasers' lack of understanding of environmental benefits of EE purchasing	- Provide training on EE purchasing/ Tool Kit/LCC training, highlighting environmental benefits	Program Administrator
Purchasers don't have time to research new products, develop baselines, and develop specifications	- Help to develop baselines & specifications. - Provide bid language from tool kit or provide specifications from other sources.	Program Administrator

Development of Baselines: For products to be included, need to estimate the baseline for categories of purchases made in the past year. Participating organizations can use estimates of historical purchases from purchasing staff or teams, through direct inquiry or surveys ("Historical Data"). The ENERGY STAR® website also has information on energy use for "standard efficiency" equipment. The support of purchasers or purchasing teams can also be enlisted to develop baseline estimates (Expert Opinion/"Delphi Technique") for:

- Number of categories of energy efficient products purchased; and
- Dollars spent on energy efficient products as a proportion of total purchasing budget.

Tracking of Purchases: Can be done through vendor reports of what was purchased and installed during the previous period. Vendor reporting requirements could be included in the contracts. Contracts and Vendor reports can also include verification that user training on energy efficient features was done at the time of installation. For purchases of copiers by state agencies in Massachusetts using state contracts vendors are required to send a report to the Purchasing department each time a new machine is installed, including verification that user training on the energy efficiency features was provided.

Tracking Indicators to Assess Success of Individual Pilot:

From Perspective of Participant Organizations

- *Changes in volume of energy efficiency purchases – number of products or categories of products* ("Directly Trackable" indicator). This could be tracked by comparing the number of categories or products in the baseline with the number of categories or products purchased six months or one year after incorporation of energy efficiency as a factor in purchasing under an EPP program. Information on new purchases could be tracked from vendor reports and/or contracts.
- *Environmental benefits* ("Derivable" indicator). This information can be calculated on an individual product basis from information included in the ENERGY STAR® Tool Kit/Life Cycle Costing diskette or from Program Administrator.
- *Number of standard contracts that include ENERGY STAR® or energy efficiency requirement* ("Directly Trackable"/"Market Transformation" indicator). This information could be tracked by the Purchasing Department.

From Perspective of Program Administrator

- *Number of Participants* ("Directly Trackable"/"Market Transformation" indicator). The number of organizations that are actually making purchase decisions relying on considerations of energy efficiency as part of their EPP programs ("Directly Trackable"); and number of EPP programs in Program Administrator's service territory that contain energy efficiency as a factor to be considered in purchasing decisions ("Market Transformation" indicator).
- (Per Participating Organization): *Number of Standard Contracts that include ENERGY STAR® or energy efficiency requirement* ("Directly Trackable"/"Market Transformation" indicator). This information could be tracked by the Purchasing Department and provided to the Program Administrator.
- *Environmental Benefits* ("Derivable" indicator). This information can be calculated on an individual product basis from information included in the ENERGY STAR® Tool Kit/Life Cycle Costing diskette or from Program Administrator.

7.0 SUMMARY AND CONSENSUS BUILDING RECOMMENDATIONS

The objectives of CEE's Government Purchasing Initiative are to encourage and assist state and local governments to understand the benefits of purchasing energy efficient products and equipment, and to identify and develop tools and resources to assist this effort. The ultimate goal is to incorporate energy efficiency as a standard consideration in state and local government purchasing practices.

Results from CEE's research of purchasing practices at 14 state and local governments and a Market Segmentation Study, combined with earlier government purchasing research conducted by the Energy Efficiency Purchasing Collaborative, Lawrence Berkeley Laboratories and the Northwest Alliance, provided an important body of knowledge concerning purchasing practices and challenges to "standardizing" energy efficiency considerations. This research confirms not only the challenges, but also the opportunities in this area. State and local government purchasing represents a massive untapped market for advancing energy efficiency awareness, practice and implementation, and ultimately, market transformation. Due to the sheer size of this market, a transformation towards the purchase of energy efficient products and systems could have a major market pull effect resulting in an increased demand for all energy efficient products and equipment purchased for use in this sector.

As a result of past research, CEE has identified and assembled a number of tools and resources to assist their members in providing pilot project or program services to their state and local government customers. Several CEE members have expressed interest in developing government purchasing pilot projects or programs, and have stressed the difficulty and importance of understanding how to measure the impacts from such a program.

This Evaluation Scoping Study was commissioned by CEE to identify the reporting needs of stakeholders, including state and local governments, CEE members and federal funding agencies, and to develop proposed evaluation methodologies that can best address these diverse needs. The intent of this Scoping Study, as defined in CEE's RFP, was to develop a consistent approach to credible evaluation methodologies that can be adopted nationally by implementers to measure success of CEE's Government Purchasing program efforts and meet stakeholder reporting requirements.

Building consensus among key stakeholders to utilize the baseline development and indicator tracking methodologies proposed in this report, and more importantly, encouraging program administrators and state/local government purchasing entities to improve the efficiency of their energy using equipment purchases requires significant effort. Numerous barriers exist and must be overcome before wide-spread improvements in state/local government procurement practices can be achieved (refer to the "Potential Barriers and Proposed Interventions" tables in Section 6 above for a listing of some of the more significant obstacles and approaches to overcome them). The following issues were a recurring theme in these barrier tables and were identified throughout the GDS Team's first and second round interviews conducted during development of this report:

- Lack of state and local government employee and equipment supplier awareness of the value and benefits of energy efficient purchasing (including awareness of the different categories of items for which energy efficient purchasing is available);
- Minimal promotion of energy efficient equipment by vendors/suppliers to organizations participating in CEE's State/Local Government Purchasing Program;
- Questionable, or limited information regarding performance of energy efficient equipment; and
- High first cost and limited availability of energy efficient equipment.

Overcoming these four barriers will increase the penetration of energy efficient equipment at participating organizations.

To determine the tracking and reporting needs of stakeholders and to test several proposed evaluation methodologies, the GDS Team conducted a total of 25 interviews during November 2000 and February 2001. The methodologies and interview results have been previously discussed in this report. Utilizing the baseline development and indicator tracking methodologies outlined in this report will help program administrators to assess progress and measure the degree of success of their targeted intervention strategies in overcoming these four important barriers.

As a result of CEE's past and current efforts, awareness of the value and benefits associated with implementation of State/Local Government Purchasing Programs is already improving among key stakeholders. To facilitate additional increases in awareness and to encourage key stakeholders to begin or expand efforts to improve the efficiency of state and local government energy-consuming purchase practices, the GDS Team recommends that the scenarios outlined in Section 6 of this report be presented to CEE members as opportunities for pilot projects with their state/local government customers. These program concepts could be developed and customized for individual implementation by key stakeholders, with CEE providing tools and assistance. By developing consensus among members to focus on these three project approaches, the approaches can be further developed, tested and refined, and the results can be documented (as case studies) and shared with other similar organizations.

In summary, these recommended approaches are:

- **Purchasing Department Pilot Project Scenario (for Commodity Purchases)**
In this approach, a program administrator (e.g., utility or regional energy consortia) offers services to a state or local government purchasing department to help it to incorporate energy efficiency requirements into the bidding process for standard contracts for commodities. The GDS Team recommends starting with products that have the ENERGY STAR® label. Resulting contracts for ENERGY STAR®-labeled equipment ensure that future purchases made through standard contracts are energy efficient.

➤ **Construction/Renovation Scenario (Equipment and Systems Purchased as Part of New Construction or Major Renovation Projects)**

For this approach, a program administrator works with the department or agency within a state or local government that has responsibility for new construction/renovation of buildings to incorporate requirements and procedures to purchase the most cost-effective energy efficient products and systems as standard practice for capital projects. The administrator assists the agency in developing guidelines and establishing tools and procedures to incorporate Life Cycle Costing (LCC) and energy efficiency requirements into project specifications for energy consuming equipment and systems purchased for new construction and renovation projects. Encouraging third party contractors to specify that energy consuming products and systems purchased for installation in new construction and retrofit projects be energy efficient is a good start.

➤ **Environmentally Preferable Purchasing Systems Scenario**

A growing number of state/local governments throughout the country have implemented environmentally preferable purchasing (EPP) programs, which encourage purchasing by state and local government agencies of “green products” (“those products that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose.”¹¹ These EPP programs have extended beyond “buy-recycled” to encompass any number of environmental factors, including water efficiency, waste prevention, toxic material content, and packaging.

EPP programs may also include consideration of energy efficiency in purchasing decisions. Purchasing research conducted by CEE and the Northwest Alliance found that these programs often do not specifically promote energy efficiency as an integral component of their EPP programs. In this scenario, a program administrator assists Purchasing/EPP staff with specifications and product identification to incorporate ENERGY STAR® requirements into new standard contracts and to track these purchases. This is similar to the Commodity Pilot Project scenario described above, but its focus is on incorporating energy efficiency into existing EPP initiatives. The target audience for this approach would be one of the many city, county or state governments that have initiated EPP programs.

Each of these three scenarios (described in more detail in Section 6 of this report) assumes that a program administrator (CEE member utility or regional administrator) would provide assistance to the state/local government in developing a pilot project that would result in the purchase and installation of greater numbers of energy efficient products and systems. Early successes could lead to expansion of the project to include a broader product focus.

¹¹ Federal Executive Order 13101, *Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition*, September 14, 1998.

The GDS Team appreciates the opportunity to help identify key indicators, and baseline development and tracking methodologies to measure success of current and future Government Purchasing program efforts that CEE has provided us through this project,. We would be pleased to provide continued assistance to CEE or its members in developing and expanding these sample scenario approaches, identifying actual pilot participants, and applying these methodologies for developing baselines and tracking key indicators specific to the needs of individual state and local governments.

APPENDIX A-1

Final - November 16, 2000

Telephone Survey/Interview Guide for State and Local Government Purchasers

for CEE State and Local Government Purchasing Initiative
Program Evaluation Scoping Study

TELEPHONE SURVEY PROCESS

Members of the GDS Team will be calling one to three individuals within each of three state and local government organizations (a state-wide government purchasing agency, a large municipal government organization, and a smaller town government entity), including staff with responsibility for some or all of the following functions:

- Purchasing energy-consuming commodity products (*i.e.*, computers, copiers, appliances);
- Commodity product specifiers (if different from purchasers)
- Purchasing for (or development/oversight of) construction/renovation capital projects;
- Design/Construction staff responsible for new buildings and major renovations;
- Energy Office (if there is one) staff;
- Facilities Management staff, if responsible for purchase or specification of energy consuming products or systems;
- Accounting or Budget staff overseeing and tracking purchasing budgets;
- City Manager or other administrator responsible for setting and overseeing implementation of purchasing policies (if no formal policy setting purchasing agency exists); and
- Other relevant, important contacts as identified by others within the organization.

It is anticipated that respondents might make referrals to other contacts within the organization that can better answer specific questions. Assistance from CEE will be provided to help identify individuals to be interviewed. The GDS Team will compile listings of all contacts made within each organization.

INTERVIEW RECRUITING AND GENERAL IDENTIFICATION DATA

Hello, my name is _____ and I am working as a consultant to the Consortium for Energy Efficiency on a State and Local Government Purchasing Project. The focus of this overall project is to understand state and local government purchasing practices and to promote the purchase of Energy Star® and other high efficiency products, equipment, and services. I understand that you are knowledgeable about the policies and procedures for purchasing and tracking of energy consuming products and services, equipment and new building construction or capital improvements in your organization.

I am calling today with some brief questions to understand, from your perspective, what measurement criteria are most important to your organization when making purchasing decisions and tracking the installation, construction and ultimate usage of energy consuming products and services, and what tracking and reporting of purchases currently exists.

Some measurement criteria that may be necessary in order for your organization to track the purchase and use of energy efficient products may include: savings on energy bills, reduction in energy consumption (kWh or kW), and volume of purchases (in terms of number of products and dollar amounts spent) on energy consuming products. There may be other criteria you believe are important in the tracking and measurement process.

This survey will take around 15 minutes of your time.

Verification of Name, Title and Organization of Respondent

Date: _____ (include start and finish time) Interviewer initials: _____

Name of Interviewee: _____

Title: _____

Organization: _____

Telephone Number: _____

Major Responsibilities: _____

Number of Years with Purchasing Responsibilities: _____

INTRODUCTION

The focus of this overall project is to understand state and local government purchasing practices and to promote the purchase of Energy Star® and other high efficiency products, equipment, and services. In an earlier phase of this project, purchasing systems at 14 state and local government organizations across the country were studied. This interview process is a follow-up to the earlier research phase.

CEE members are beginning to develop programs to help their state and local government customers to identify, develop and implement energy efficiency purchasing strategies.

The goal of this follow-up work is to develop recommendations on how best to *track the benefits* of a purchasing project, so that the various stakeholders (state and local governments, their energy utility providers, federal program sponsors, etc.) can calculate the impacts, satisfy their individual reporting needs, promote their successes, and reinforce their commitments to continued energy efficient purchases.

I. COMMODITY AND "STANDARD" PURCHASES

The following questions pertain to commodity or "standard" purchases of energy consuming products (those purchases that are expensable items, requiring lesser levels of prior authorizations or approvals).

1. Are you the correct individual to speak with on these topics? _____ (Yes/No)

If YES - continue with Question 2.

If NO - request name, phone number, and title of appropriate person:

Name: _____ Phone Number: _____

Title: _____

2. Briefly describe your responsibilities: _____

3. Does your organization have a centralized or decentralized purchasing function?

Centralized

Decentralized

4. Is reporting done on an individual agency/department basis or organization wide?

Individual Agency/Department

Organization Wide

5. Does your organization purchase energy efficient products? _____ (Yes/No)

If YES - please provide a few examples: _____

6. When making purchasing decisions (for commodity/expensable products and services) do you use life-cycle costing analysis? _____ (Yes/No)

7. Please describe how purchases are tracked. What categories are your organization's purchases group into (*i.e.*, office equipment, appliances, etc.)?

How Tracked: _____

Key Categories: _____

8. Using a specific product as an example, please explain your purchase, tracking and reporting process. *[interviewer might recommend a product, e.g., copiers]*

9. If you do purchase energy efficient products (YES to Question 5), do you track these purchases? _____ (Yes/No)

If YES - please describe how you track them. _____

At what level within the organization are they tracked (*i.e.*, agency/department, organization wide, etc.)? _____

10. If you were to implement a focused energy efficiency purchasing project in your organization, what would be the most important information for you to track? Please rank the following on a scale of 1 to 5, with 1 being Most Important and 5 being Least Important.

	Most Important			Least Important Know		
	1	2	3	4	5	9
Changes in volume of overall energy efficiency purchases - number of products or number of categories of products	1	2	3	4	5	9
Changes in volume of energy efficient products - dollar value of products purchased	1	2	3	4	5	9
Life cycle cost savings due to purchase of energy efficient products and services	1	2	3	4	5	9
Fuel (BTU) savings from energy efficient purchases	1	2	3	4	5	9
Electric energy (kWh/kW) savings from purchasing and installing energy efficient products and services	1	2	3	4	5	9
Environmental (<i>i.e.</i> , pollution reduction) benefits from purchasing energy efficient products and services	1	2	3	4	5	9
Other - are there other items that you track? _____	1	2	3	4	5	9
How Important are they?						

II. PRODUCTS/SYSTEMS PURCHASED FOR CAPITAL PROJECTS (New Construction/Renovation Projects, Major Capital Purchases)

This group of questions addresses your Capital Projects purchasing policies and tracking practices (*i.e.*, new construction/renovation projects and major capital purchases).

11. Are you the correct individual to speak with on these topics? _____ (Yes/No)
If YES - continue with Question 12.
If NO - request name, phone number, and title of appropriate person:
Name: _____ Phone Number: _____
Title: _____

12. Briefly describe your responsibilities: _____

13. Please describe the process for construction or major renovation projects. Are these projects done in-house or by contractors? Who specifies energy consuming equipment? Who purchases this equipment? _____

14. When making purchasing decisions (for new construction/renovation and major capital items) do you use life-cycle costing analysis? _____ (Yes/No)

15. Are energy efficiency considerations incorporated into your decision making process? _____ (Yes/No)

16. Please describe how the project expenditures are tracked and on what level they are tracked (*i.e.*, agency/department level, organization wide). How does this information get reported as part of agency tracking and reporting? _____

17. If you do consider energy efficiency in these major project decisions (YES to Question 15), do you keep track of the impacts from these particular purchase decisions? _____ (Yes/No)
If YES, and different from the tracking methods discussed in Question 16 above, - please describe how you track them and at what level within the organization they are tracked (*i.e.*, agency/department level, organization wide,).

18. Using a specific project as an example, please explain your purchase, tracking and

reporting process. [interviewer might recommend a project, e.g., school expansion, new firehouse, etc.] _____

19. If you were to implement a focused energy efficiency purchasing project for major capital expenditures in your organization, what would be the most important information for you to track? Please rank the following on a scale of 1 to 5, with 1 being Most Important and 5 being Least Important.

	Most Important			Least Important			Don't Know
	1	2	3	4	5	9	
Changes in volume of overall energy efficiency purchases - number of products or number of categories of products	1	2	3	4	5	9	
Changes in volume of energy efficient products - dollar value of products purchased	1	2	3	4	5	9	
Life cycle cost savings due to purchase of energy efficient products and services	1	2	3	4	5	9	
Fuel (BTU) savings from energy efficient purchases	1	2	3	4	5	9	
Electric energy (kWh/kW) savings from purchasing and installing energy efficient products and services	1	2	3	4	5	9	
Environmental (<i>i.e.</i> , pollution reduction) benefits from purchasing energy efficient products and services	1	2	3	4	5	9	
Other - are there other items that you track? _____	1	2	3	4	5	9	
How Important are they?							

III. CONCLUSION

20. Is there anything else you'd like to mention with regard to energy efficiency purchasing or tracking benefits? _____

21. After we come up with an ultimate list of measures for assessing impacts of energy efficiency purchasing programs, we will be developing some methods for tracking these items. Would you be willing to participate in a short follow-up interview to review and offer opinions on these tracking methods? _____ (Yes/No)
22. Are there others within your organization who might be able to provide us with additional information regarding these issues? _____

We have completed the survey, and I appreciate your taking the time to answer our questions. Thank you for your participation.

APPENDIX A-2

Final – November 21, 2000

Telephone Survey/Interview Guide for Utilities and Other Energy Program Developers/Implementers

for CEE State and Local Government Purchasing Initiative
Program Evaluation Scoping Study

TELEPHONE SURVEY PROCESS

Members of the GDS Team will be calling one or two utility company energy efficiency program development/implementation/evaluation staff as part of this scoping study to determine their needs with regard to measurement criteria and methodology for determining savings from an initiative to help their state and local government customers identify, specify and purchase energy efficient products and systems.

We anticipate interviewing one or two utility/program developer staff with functional responsibility in one or more of the following areas:

- Program planning and/or development;
- Program implementation;
- Program Monitoring and/or Evaluation;
- Government customer service or account representative; or
- Other relevant, important contacts as identified by others within the organization.

It is anticipated that respondents might make referrals to other contacts within the organization that can provide important information. Assistance from CEE will be provided to help identify and schedule interviews with the proper individuals. The GDS Team will compile listings of all contacts made within each organization.

INTERVIEW RECRUITING AND GENERAL IDENTIFICATION DATA

Hello, my name is _____ and I am working as a consultant to the Consortium for Energy Efficiency on a State and Local Government Purchasing Project. The focus of this overall project is to understand state and local government purchasing practices and to promote the purchase of ENERGY STAR® and other high efficiency products, equipment, and services. In this phase of the project, we are trying to understand how to track and measure the impacts resulting from an energy efficient purchasing project or program.

I understand that you are the [title] for [name of utility] that provides services to [State and Local government customer being interviewed].

I am calling today with some brief questions to identify, from your perspective, what measurement criteria are most important to your organization when sponsoring or assisting with this type of project. This survey will take around 15 minutes of your time. May I proceed with the survey questions now or is there a more convenient time you would like us to schedule to conduct this brief survey?

[SCHEDULED, IF NECESSARY, FOR: _____]

Verification of Name, Title and Organization of Respondent.

Date: _____ Time Start: _____ Time End: _____ Interviewer Initials: _____

Name of Interviewee: _____

Title: _____

Organization: _____

Telephone Number: _____

Major Responsibilities: _____

Number of Years with [Program Development, Implementation, Evaluation or Specify other function (i.e., Government Customer Service Account Representative)] Responsibilities:

INTRODUCTION - before proceeding with survey, the following background should be presented:

The focus of this overall project is to understand state and local government purchasing practices and to promote the purchase of ENERGY STAR® and other high efficiency products,

equipment, and services. In an earlier phase of this project, purchasing systems at 14 state and local government organizations across the country were studied. This interview process is a follow-up to the earlier research phase.

CEE members are beginning to develop programs to help their state and local government customers to identify, develop and implement energy efficiency purchasing strategies.

The goal of this follow-up work is to develop recommendations on how best to *track the benefits* of a purchasing project, so that the various stakeholders (state and local governments, their energy utility providers, federal program sponsors, etc.) can calculate the impacts, satisfy their individual reporting needs, promote their successes, and reinforce their commitments to continued energy efficient purchases.

I. MONITORING AND EVALUATION FUNCTION

First, I'd like ask a few questions about your organization's Program Evaluation function.

1. Are you the correct individual to speak with on these topics? _____ (Yes/No)

If YES - continue with Question 2.

If NO - request name, phone number, and title of appropriate person:

Name: _____ Phone Number: _____

Title: _____

2. Briefly describe your responsibilities: _____

3. Please describe how it is that you presently track and report on energy efficiency to meet regulatory reporting requirements (i.e., to whom do you report, how frequently, when are reports generated, what information is typically required to be reported, and how is information collected?) _____

4. If different from the process explained in question 4 above, please describe how it is that you presently track and report on energy efficiency to meet corporate reporting

requirements (i.e., to whom do you report, how frequently, when are reports generated, what information is typically required to be reported, and how is information collected?) _____

5. Are you aware of any other state or local government, or federal government (i.e., EPA, DOE, FERC, etc.) reporting requirements regarding energy efficiency that your organization must comply with? _____ (YES/NO) If YES, please explain:

6. If you were to implement a program to assist government purchasers to identify, specify and purchase energy efficiency products and equipment, what would be the most important information for you to track? Please rank the following on a scale of 1 to 5, with 1 being Most Important and 5 being Least Important.

	Most Important			Least Don't Important Know		
	1	2	3	4	5	9
Electric energy (kWh/kW) savings from purchasing and installing energy efficient products and systems	1	2	3	4	5	9
Natural Gas (mcf/dth) Savings from purchasing and installing energy efficient products and systems.	1	2	3	4	5	9
BTU Savings from purchasing and installing energy efficient products and systems.	1	2	3	4	5	9
Market Transformation Effects due to program or project (e.g., increased levels of awareness within state and local government purchasing staff of the benefits and value of energy efficient procurement practices, changes in purchasing policies to promote ee procurement)	1	2	3	4	5	9
Life Cycle Cost Savings due to purchase of energy efficient products and systems.	1	2	3	4	5	9

Changes in volume of overall energy efficiency purchases - number of products or number of categories of products	1	2	3	4	5	9
Changes in volume of energy efficient products - dollar value of products purchased	1	2	3	4	5	9
Environmental (<i>i.e.</i> , pollution reduction) benefits from purchasing energy efficient products and services	1	2	3	4	5	9
Other - are there other items that you track? _____	1	2	3	4	5	9
How Important are they?						

7. Do you have any ideas you could share with me regarding how to best measure the items you identified as being key, in Question 4 above? _____

8. What would you consider to be important Market Transformation indicators for a government purchasing program (e.g., awareness by purchasers of benefits; product availability through state contracts; management commitment or mandate to purchase energy efficient products, etc.)? If not already addressed above, what methods would you suggest be used for measuring/tracking these key MT indicators? _____

II. CONCLUSION

9. Is there anything else you'd like to mention with regard to a program targeting state and local government energy efficiency purchasing practices or tracking the benefits

of such a program? _____

10. After we come up with an ultimate list of measures for assessing impacts of energy efficiency purchasing programs, we will be developing some methods for tracking these items. Would you be willing to participate in a short follow-up interview to review and offer opinions on these tracking methods? _____ (Yes/No)

11. Are there others within your organization that might be able to provide us with additional information regarding these issues? _____

We have completed the survey, and I appreciate your taking the time to answer our questions. Thank you for your participation.

APPENDIX A-3

Final – November 29, 2000

Telephone Survey/Interview Guide for Purchasing Experts and EPA Sponsors

for CEE State and Local Government Purchasing Initiative
Program Evaluation Scoping Study

TELEPHONE SURVEY PROCESS

Members of the GDS Team are planning to interview three individuals selected for their expertise in government purchasing, and one or two EPA staff persons as part of this scoping study to solicit their input regarding the measurement criteria and methodology for determining savings from a state and local government purchasing project.

We will request interviews with the following experts who have been involved in government purchasing research or implementation of energy efficient purchasing programs

- Jeff Harris, Lawrence Berkeley National Laboratories;
- Rick Kunkle, Washington State University; and
- Gary Matteson, University of CA

We will also interview either one or two staff contacts from US EPA's ENERGY STAR® program, including possibly:

- Jennifer Dolin, former ENERGY STAR® Purchasing Program Manager; and/or
- Kate Lewis, whose duties now include the Purchasing Program.

The GDS Team will arrange all interviews and compile listings of all contacts made.

INTERVIEW RECRUITING AND GENERAL IDENTIFICATION DATA

Hello, my name is _____ and I am working as a consultant to the Consortium for Energy Efficiency on a State and Local Government Purchasing Project. The focus of this overall project is to understand state and local government purchasing practices and to promote the purchase of ENERGY STAR®-labeled and other high efficiency products, equipment, and services. In this phase of the project, we are trying to understand how to track and measure the impacts resulting from an energy efficient purchasing project or program.

(FOR EXPERTS): I am calling today with some brief questions to identify, from your perspective, what measurement criteria are most important to address in developing an evaluation methodology, and to discuss your ideas about how to best approach the task of evaluating impacts from a purchasing initiative.

As you know, the measurement criteria for different stakeholders vary according to their informational and reporting needs. For example, utilities have traditionally been interested in measuring energy (kWh) and demand (kW) savings. Utilities, as well as CEE and other program developers might also want to know the Market Transformation effects of their program efforts. The federal sponsor, EPA, is interested in measuring the CO savings and possibly the change in volume of energy efficiency purchases over time. State and local government organizations may also want to know the change in volume of energy efficiency purchases, or possibly the short and long-term cost and savings from purchasing and using more energy efficient products. Our challenge is to identify the most important measurement indicators, and to develop a method or methods to measure their effects.

(For EPA): I am calling today with some brief questions to identify, from your perspective, what measurement criteria are most important to your organization in sponsoring purchasing initiatives. As you know, the measurement criteria for different stakeholders vary according to their informational and reporting needs. For example, utilities have traditionally been interested in measuring energy (kWh) and demand (kW) savings. Utilities, as well as CEE and other program developers might also want to know the Market Transformation effects of their program efforts. The EPA has been interested in measuring the CO savings and possibly the change in volume of energy efficiency purchases over time. State and local government organizations may also want to know the change in volume of energy efficiency purchases, or possibly the short and long-term cost and savings from purchasing and using more energy efficient products. Our challenge is to identify the most important measurement indicators, and to develop a method or methods to measure their effects.

This survey will take around 15 minutes of your time. May I proceed with the survey

questions now or is there a more convenient time you would like us to schedule to conduct this brief survey?

[SCHEDULED, IF NECESSARY, FOR: _____]

Verification of Name, Title and Organization of Respondent.

Date: _____ (include start and finish time) Interviewer initials: _____

Name of Interviewee: _____

Title: _____

Organization: _____

Telephone Number: _____

Major Responsibilities: _____

Number of Years of Involvement/Familiarity with These Matters: _____

INTRODUCTION - *before proceeding with survey, the following background should be presented:*

The focus of this overall project is to understand state and local government purchasing practices and to promote the purchase of ENERGY STAR® and other high efficiency products, equipment, and services. In an earlier phase of this project, purchasing systems at 14 state and local government organizations across the country were studied. This interview process is a follow-up to the earlier research phase.

CEE members are beginning to develop programs to help their state and local government customers to identify, develop and implement energy efficiency purchasing strategies.

The goal of this follow-up work is to develop recommendations on how best to *track the benefits* of a purchasing project, so that the various stakeholders (state and local governments, their energy utility providers, federal program sponsors, etc.) can calculate the impacts, satisfy their individual reporting needs, promote their successes, and reinforce their commitments to continued energy efficient purchases.

I. MEASUREMENT CRITERIA & EVALUATION METHODOLOGY

(FOR EPA):

1. Please specify whether the following indicators are important to be tracked for your reporting needs, or for other purposes within your organization. Rank the following on a scale of 1 to 5, with 1 being Most Important and 5 being Least Important.

	Most Important			Least Don't Important Know		
	1	2	3	4	5	9
Electric energy (kWh/kW) savings from purchasing and installing energy efficient products and systems	1	2	3	4	5	9
Natural Gas (mcf/dth) Savings from purchasing and installing energy efficient products and systems.	1	2	3	4	5	9
BTU Savings from purchasing and installing energy efficient products and systems.	1	2	3	4	5	9
Market Transformation Effects due to program or project (<i>i.e.</i> , increased levels of awareness within state and local government purchasing staff of the benefits and value of energy efficient procurement practices, changes in purchasing policies to promote ee procurement)	1	2	3	4	5	9
Life Cycle Cost Savings due to purchase of energy efficient products and systems.	1	2	3	4	5	9
Changes in volume of overall energy efficiency purchases - number of products or number of categories of products	1	2	3	4	5	9
Changes in volume of energy efficient products - dollar value of products purchased	1	2	3	4	5	9
Environmental (<i>i.e.</i> , pollution reduction) benefits from purchasing energy efficient products and services	1	2	3	4	5	9

Other - are there other items that you track? _____	1	2	3	4	5	9
How Important are they?						

(FOR EPA):

2. What are the specific types of pollution reductions that your agency is interested in achieving through the promotion of energy efficient programs? (e.g., carbon, carbon dioxide) _____

3. (FOR EPA): What are the methods and/or procedures you would use to measure the items identified in Questions 1 and 2 above? _____

(FOR EXPERTS):

4. Our previous interviews with State and Local government staff and utilities indicated that they are most interested in tracking the following indicators:

For State & Local Governments: (insert most important measurement criteria)

For Utilities: (insert most important measurement criteria)

For EPA: (insert most important measurement criteria) - *assuming you complete EPA interviews before interviewing the experts.*

How important do you feel that each of these pieces of information is to track (rate on a scale of 1 to 5, where 1 is most important and 5 is least important)?

	Most Important		Least Important			Don't Know
	1	2	3	4	5	9
Electric energy (kWh/kW) savings from purchasing and installing energy efficient products and systems						

Natural Gas (mcf/dth) Savings from purchasing and installing energy efficient products and systems.	1	2	3	4	5	9
BTU Savings from purchasing and installing energy efficient products and systems.	1	2	3	4	5	9
Market Transformation Effects due to program or project (e.g., increased levels of awareness within state and local government purchasing staff of the benefits and value of energy efficient procurement practices, changes in purchasing policies to promote ee procurement)	1	2	3	4	5	9
Life Cycle Cost Savings due to purchase of energy efficient products and systems.	1	2	3	4	5	9
Changes in volume of overall energy efficiency purchases - number of products or number of categories of products	1	2	3	4	5	9
Changes in volume of energy efficient products - dollar value of products purchased	1	2	3	4	5	9
Environmental (<i>i.e.</i> , pollution reduction) benefits from purchasing energy efficient products and services	1	2	3	4	5	9
Other - are there other items that you track? _____	1	2	3	4	5	9
How Important are they?						

Are you aware of any other important criteria that should be tracked? _____

(FOR EXPERTS):

- From your perspective, what are the most important issues that need to be considered in developing an evaluation methodology to track key indicators and

success of a state and local government purchasing program? _____

(FOR EXPERTS):

6. What suggestions do you have regarding how best to measure the Market Transformation effects of a purchasing program? What would you consider to be important Market Transformation indicators for a government purchasing program (*e.g.*, awareness by purchasers of benefits; product availability through state contracts; management commitment or mandate to purchase energy efficient products?) If not already addressed above, what methods would you suggest be used for measuring/tracking these key MT indicators? _____

II. CONCLUSION

(FOR EPA AND EXPERTS)

7. Is there anything else you'd like to mention with regard to a program targeting state and local government energy efficiency purchasing practices or tracking the benefits of such a program? _____

(FOR EPA AND EXPERTS)

8. After we come up with an ultimate list of measures for assessing impacts of energy efficiency purchasing programs, we will be developing some methods for tracking these items. Would you be willing to participate in a short follow-up interview to review and offer opinions on these tracking methods? _____
(Yes/No)

(FOR EPA AND EXPERTS)

9. Are there other individuals that you would strongly recommend that we speak with regarding these issues? _____

We have completed the survey, and I appreciate your taking the time to answer our questions. Thank you for your participation.

APPENDIX B

CEE State and Local Government Scoping Study

INTERVIEWEE LIST

Type	Name	Title	Organization	First Interview	Second Interview
State/Local Government	De De Porter	Senior Buyer	City of El Cajon, CA	✓	✓
	John Owings	Operations Manager	City of El Cajon, CA	✓	
	John DiModica	Energy Efficiency & Sustainable Design Planner	Div. of Capital Asset Management, Commonwealth of MA	✓	✓
	Hope Davis	Program Manager	Div. of Capital Asset Management, Commonwealth of MA	✓	
	Jonathan Goldberg	Director, Infrastructure & Support	Operational Services Division, Commonwealth of MA	✓	
	Melody Mociulski	Purchasing Manager	City of Seattle, WA	✓	✓
Utility	Jeff Alexander	Program Manager Consumer Programs & Services	San Diego Gas & Electric	✓	
	Bill Daiber	Senior Program Manager	San Diego Gas & Electric	✓	✓
	John Jennings	Senior Project Coordinator	Northwest Energy Efficiency Alliance	✓	✓
	Michael McAteer	Manager, C&I Programs	National Grid	✓	✓
Experts	Rick Kunkle	Research Engineer	Washington State University (WSU)	✓	✓
	Gary Matteson	Director, Facilities Mgmt, Energy & Utilities Planning	University of California	✓	✓
	Jeff Harris	Project Leader, DC Office	Lawrence Berkeley National Laboratory	✓	✓
EPA	Kate Lewis	Sales & Marketing Manager, ENERGY STAR Programs	EPA	✓	
	Jennifer Dolin	Program Manager Transportation & Air Quality		✓	
	Maureen McNamara	ENERGY STAR® Program Evaluator			✓
CEE	Jody Lehrer	Government Program Manager	CEE		✓
	Monica Nevius	Manager of Evaluation and Research			✓

APPENDIX C-1

METHODOLOGIES LIST FOR DIRECTLY TRACKABLE DATA COLLECTION INDICATORS
Ranked By Feasibility of Data Collection

FEASIBILITY RANKING

1 - Most likely to be able to be tracked by S/L government or program administrator with some modification to current practices.

2 - Tracking not as readily implemented, but could work under certain circumstances.

3 - Not generally recommended due to difficulty in tracking and obtaining data.

Indicator	Feasibility	Ranking (Where Available)					Average Rank across categories	Proposed Tracking Methodology for Assessing Program Impact
		State and Local Government	Utilities	Experts	EPA			
Number of Mandates or Policies to Purchase EE Products	1	NA	NA	NA	NA	NA	This indicator would collect data on the number of participating organizations that have policies or procedures in place that require energy efficiency to be a major consideration during the purchasing process. This data would ideally be collected at a national level by CEE or a national government or purchasing organization (e.g., NASPO, NIGP, PTI) through a survey of purchasing managers.	
Number of participants (program administrators)	1	NA	NA	NA	NA	NA	This indicator mainly applies to utilities and other program administrators that are operating energy efficiency or public benefits programs. The methodology for collecting this data is to collect and store in a program database the number of participants in a particular program. This information should be readily available through the Administrator's database. This item would likely not apply for purchases used internally by utilities or the government	
Number of Contractors, Energy Managers Trained	1	NA	NA	NA	NA	NA	This indicator is very common for public benefits programs. The methodology is to count the number of persons trained at particular training events. This counting process is routinely done by the specific organization that is conducting the training. The training counts are then stored in a data base.	
Changes in Volume of EE Purchases - Number of Products or Categories of Products	2	2.50	2.50	1.83	1.00	1.96	This indicator was highly ranked by experts and EPA. This would involve tracking the number of new standard contracts that were developed in a particular year for energy consuming products or equipment that include ENERGY STAR requirements. This information would then be compared to a baseline of previous contracts with ENERGY STAR requirements. This could be done by the S/L government through a review of historical data or by surveying purchasing staff.	
Changes in Volume of EE Purchases - \$ Value as % of Total Purchases	3	2.17	2.50	2.33	5.00	3.00	This indicator is not as highly ranked as the number of EE units purchased. The tracking procedure for this indicator is straightforward, but could be difficult to implement. For a particular piece of equipment, it would be necessary to track in any particular year the dollar volume of units purchased as well as the dollar volume purchased that is energy efficient. CEE will need to establish the threshold to be considered energy efficient. For purposes of this study GDS recommends that the threshold be any equipment with an ENERGY STAR label or equivalent efficiency. This information would need to be supplied by the S/L government and would require a data tracking system.	

Changes in % of EE Purchases by Product	3	NA	NA	NA	NA	NA	<p>This indicator was not included in the surveys, but was recommended as an important indicator by several respondents. The tracking procedure for this indicator could be difficult to implement. For a particular piece of equipment, such as a personal computer, it would be necessary to track in any particular year the total number of units purchased as well as the number purchased that were energy efficient. For purposes of this study GDS recommends that the threshold be any equipment with an ENERGY STAR label or equivalent efficiency. An organization will need to have in place a data tracking system in order to collect this data. GDS recommends beginning with a few commonly purchased products, (e.g., computers, copiers, Exit signs), and expanding over time.</p>
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Note: NA means 'not available'.

APPENDIX D

Measuring and Forecasting Baselines

The analysis of program effects entails estimates of the level of savings or reductions in market barriers that would have occurred in the absence of a market transformation program. This section explains the importance of determining baseline levels of energy efficiency adoption in the absence of energy efficiency initiatives and identifies some potential approaches for establishing a baseline for CEE's State and Local Government Purchasing Initiative.

Challenges of Measuring Baselines

In the resource acquisition paradigm, the estimation of changes in energy use or demand that occur independently from the effects of the program under evaluation was somewhat easier than it is in the market transformation paradigm. At the aggregate level, it was possible, at least for utility sponsored programs, to identify other service territories with key characteristics similar to the territory under study, but without the relevant energy-efficiency programs, to use as control groups. Direct comparisons between the program group and control groups could be used to help estimate program effects. Similarly, at the individual level, program participants could be matched with non-participants on critical demographic or firmographic variables and the effects of program participation could be estimated.¹

In the market transformation paradigm, the opportunity to use control groups to make comparisons is extremely limited. As has been pointed out by many evaluators, comparisons of individuals are inappropriate under this paradigm because it is not possible to identify program participants and non-participants in a region for most market transformation programs. Moreover, the ability to make aggregate-level comparisons is compromised by the spillover effects of intervention programs. Markets tend to change on a regional basis rather than a local basis. Moreover, these changes tend to have ramifications on other regions and, at times, nationally. For example, the United States Government is the largest buyer in the world for many products. Actions by the Federal government to institute routine procedures and practices that require the purchase of energy efficient equipment can stimulate market transformation throughout the economy.²

¹ In practice, of course, the problem was far more complicated. Among the relevant problems were the fact that program participants tended to be self-selected; in addition, some program participants appeared to be “free riders”—customers who would have undertaken the energy-efficient purchases or behaviors in the absence of the program. However, over the years, evaluators have been able to develop data collection instruments and statistical correction procedures that led to consensus estimates of the baselines involved.

² Harris, Jeffrey, Francis Johnson, *Potential Energy, Cost and CO₂ Savings from Energy Efficient Government Purchasing*, paper presented at 2000 ACEEE Summer Study on Building Energy Efficiency, August 2000. An example of a government energy efficiency purchasing policy is the Department of Energy Federal Energy Management Program (FEMP). FEMP promotes energy efficient purchasing by

Given these obstacles to the use of cross-sectional comparisons, evaluators must develop other approaches for comparing the penetration of energy efficient products or market barrier status observed under program conditions to those anticipated under naturally occurring conditions.

Common Approaches to Market Penetration Forecasting

Fortunately, the problem of estimating technology penetration in the absence of a market intervention program is not new or unusual. This is not to say that the problem has been solved; it is, rather, to note that several reasonable approaches have been developed and applied over the years. Evaluators can familiarize themselves with approaches from market research and market management professionals and apply those that appear most likely to be pertinent to the specific energy-efficient technology or service involved.

In brief, there appear to be three generic approaches to sales forecasting.

- Historical: Project current or recent trends or replicate previously observed models
- Statistical: Apply mathematical models or similar formal decision tools
- Expert opinion: Develop estimates based on the aggregated forecasts of market actors or others familiar with the particular market of interest

Each of these will be discussed in turn.

Historical

It is often extremely tempting to project current or recent market penetration or rates of growth, at least as an initial estimate of future sales. The drawback of this approach is that however simple the development of such projections may be, they offer little guarantee of success.

Suppose that compact fluorescent lamps command a market share of 5% and that share has grown by about one share point each year over the past two years. It may seem reasonable to project that same level of growth into the next 2-3 years. Accordingly, if the share observed after a program has been instituted were to reach 15% at the end of three years, it might be argued that the program doubled expected sales. Of course, the estimation of growth in this example ignores the very real possibilities of faster growth in a naturally occurring market, as the result of such factors as increased word-of-mouth among consumers, increased promotion by retailers as they observe repeat buying among the early adopters of the technology, or increased production and distribution by manufacturers as they receive positive feedback from dealers and customers.

helping Federal agencies comply with requirements of the 1992 Energy Policy Act and a 1999 Executive Order.

Conversely, it is tempting to assume that good initial acceptance of a technology or rapid growth in its sales will perpetuate itself. To the dismay of many investors and the companies they support, it is not only pet rocks that suffer precipitous declines in sales after early successes. Consumers may find that a product is unreliable, that it fails to have the expected longevity or fails to deliver the level of benefits anticipated. In some cases, the product may become outmoded rapidly by even newer products or changes in customer needs. Or the product may become the victim of strong counter-selling by the technology or models it was intended to supplant.

Another historical approach is to search the record for the sales curve of highly similar products. Thus, for example, a manufacturer of DVD players might forecast the growth of sales for the technology on the basis of the observed growth of CD players, assuming that the same factors that powered or inhibited the market growth of the earlier technology will determine the market growth of the newer one. The problems with this approach are twofold. First and foremost, no clear rubric exists for determining what products are highly similar to one another. Thus, the claim that the adoption curve for one technology or product should parallel that of another is more a matter of art than of science. Second, even if the products are themselves similar, it does not follow that the adoption curves will be similar—no guarantee is available that external conditions such as the economic environment or the competitive arena are the same for the new technology as they were for the old.

Statistical

Several statistical models have been brought forward to explain and forecast baseline market penetration of specific products and technologies. The input data to these models can be either aggregate data (e.g., size of the target population, product prices, advertising budget) or individual data (e.g., customer preferences, willingness to pay, family income).

The most generic approach to statistical modeling of market penetration at the aggregate level is the use of multiple regression models. In these models, baseline levels of sales (or other variables of interest that appear to be correlated (such as customer awareness, product price, advertising expenditures in normally occurring markets for the product of interest, and disposable personal income), are examined and their relationship is described as a function. An important addition to this approach is the use of multiple scenarios, or "scenario analysis". Here, a range of forecasts is developed through changing the input levels of different predictors of baseline penetration (e.g., product price). By systematically varying those inputs, evaluators are able to estimate the relative importance of different variables as precursors of increased penetration/sales—an important planning tool—and to assess the *range* of sales that may be expected under different conditions.³ The GDS Team strongly recommends the use of scenario analysis in the development of market penetration estimates regarding the energy efficient purchasing practices of State and Local governments.

³ As an evaluation tool, this approach has the virtue of setting up more realistic expectations than traditional point estimates. However, it does then require that market effects also be expressed as a range rather than a point estimate.

Perhaps the best-known statistical model in the energy-efficiency field is the family of S-shaped curves most commonly associated with the diffusion of innovation literature (e.g., the key works of Bass and of Rogers). In the typical S-curve model, there is relatively slow growth in awareness or adoption over time, followed by a rapid rise, and in turn by a slowing of growth as the innovation reaches a saturation point. The early phase is generally associated with actions taken by innovators and then by early adopters. The rapid run-up is associated with sales to majority members (particularly the early majority) and the last phase, with late adopters or laggards. This model is not only useful as a descriptive tool; it also offers an explanatory component. In particular, it attempts to relate changes in product penetration levels and the recruitment of different types of buyers on the basis of mass media impressions and the growth of interpersonal communication regarding the technology or the product.

Modeling at the individual level is most commonly based on expressed or revealed preference data. The most common example of expressed preferences is the collection of survey data regarding the preferences or intentions of potential buyers. In those surveys, members of the target population are asked directly such questions as whether they are interested in the product, whether they believe it offers them specific benefits, whether they would prefer it to a competing product, and whether they intend to buy it.

In studies of revealed preferences, customers are not asked their intentions regarding the purchase of a specific product in so direct a manner. In conjoint studies, for example, they are presented with a series of choices among products that vary systematically in their attributes and associated benefits and costs. Through careful statistical analysis of the pattern of choices, the importance of and preference for particular attributes is revealed. These preference data can then be used as inputs for predicting the penetration of specific products or services embodying those attributes.

Expert Opinion and the Delphi Technique

One straightforward method of obtaining baseline penetration projections is simply to ask those who are most familiar with a market to provide their expert opinions as to what will occur in that market in the absence of intervention. Indeed, many companies simply ask members of their sales force what they believe customers will do in the coming quarter or coming year. Similarly, many manufacturers rely on feedback from their distributors and dealers when developing their production schedules.

A more systematic and somewhat more complex method of gathering expert opinion is the Delphi technique. This technique is intended to develop consensus estimates from a panel of experts, through an iterative process. First, the members of the panel are polled for independent estimates of critical quantitative data. In different variants of the technique, they are also asked to specify a reasonable range around their estimate and/or the factors that would cause their estimates to rise or fall. A summary of the panel's initial responses is then communicated to the members and they are asked to provide new estimates that take into account the feedback received as well as their initial thinking. In almost all cases, some convergence of ranges and of the central tendency is achieved.

Again, depending on the variant, the process may be repeated one or more times until no further changes are evident or some broad consensus is attained. (A recent application of the technique in the energy services industry—with very different objectives—is described by Mortensen *et al.* in the Proceedings of the 1997 National Energy Program Evaluation Conference.) As can be seen, this method improves on the direct questioning method through the use of systematic discussion among the experts. It also has the virtue of highlighting critical assumptions and identifying the most important inputs to sales through the discussion process.

GDS used the Delphi approach in a study done for Boston Edison during the summer of 1999.⁴ This study produced estimates of market penetration for two energy-efficient technologies (residential clothes washers and integral T-frame motors of less than 100 hp) under each of two conditions (no program—“naturally-occurring”—and planned Boston Edison program).

Two pieces of critical quantitative information were obtained in each instance. The first of these was, for each calendar year from 1998 through 2005, the expected penetration of the efficient technology (i.e., the market share for current sales, relative to directly competitive products). The range of years allows the Delphi process to provide information for projecting the magnitude of market effects both before and after the termination of Boston Edison’s programs. The second was, for each year, the saturation (i.e., cumulative ownership, percent of all competitive installations) of the existing technology. In addition, qualitative information was developed about the critical factors that would be expected to increase or decrease the relevant penetration or saturation of the energy-efficient technology in each year. (This included not only general economic factors and new product introductions, but also program-related activities such as changes in promotional budgets.) Efforts were made to identify the mechanisms through which those factors exert their effects (e.g., customer awareness, availability of the product, product maintenance infrastructure). However, to limit the burden on Delphi-group participants, no effort was made to estimate specific levels of barriers or proximate indicators (e.g., awareness, availability, maintenance structure) for each year. In conducting the Delphi-group surveys, significant attention was paid to clearly defining key terms and scenarios to avoid potential misinterpretations across different participant/organizational perspectives.

A brief discussion of key steps that can be utilized when implementing a Delphi process follows:

Delphi Group (Expert Panel) Selection and Recruiting - The key objectives in developing a Delphi panel are twofold: (1) recruit a diverse group of participants, representing a variety of perspectives, (2) ensure that each participant is a recognized expert in the field. Once potential members of the panel are identified, each of the potential panelists should be called to invite their participation. In this initial contact,

⁴ GDS Associates, Inc, *Markets Effects – Delphi Survey for Resource Efficient Clothes Washers and Premium Efficient Motor Applications, Final Report, July 9, 1999*. Study prepared by GDS Associates for the Boston Edison Company.

project purpose, overall design, and the responsibilities involved should be outlined for the potential participants. To increase the likelihood of participation, we recommend providing a substantial incentive. In the case of the Boston Edison project mentioned above, potential participants were told that compensation would be provided in the form of a \$250 donation to the participant's favorite charity.⁵ For the Boston Edison project, between five and eight experts were selected in each technology (washers and motors). They were recruited from qualified representatives of manufacturers, utility and regional program managers, energy-efficiency analysts, engineering experts, energy efficiency advocates, federal program managers, and market analysts.

Develop Background Description of Markets - A background description of the markets to be considered, including discussion of key baseline issues (e.g., pending code changes, etc.) must be developed and disseminated to members of the expert panel along with instructions specifying the types of estimates and other information requested from each panel participant. All communications can be conducted by electronic means (email or fax) or telephone, to help minimize costs and calendar time requirements.

In the case of the Boston Edison Project, after initial contact and recruiting were completed, materials were faxed or emailed to panelists for their review and completion. These materials included a cover letter thanking them for their participation, reviewing what was expected of them, and soliciting complete contact information. The materials also included detailed instructions and a form for recording and transmitting their initial market projections. The research was designed to gather key types of information from the expert panelists including: likely penetration rate of either resource-efficient clothes washers or premium-efficiency motors in the region, in the absence of any publicly funded market intervention (base case); and any factors that might affect the penetration rate of market interventions that were not publicly funded.

Initial Estimates and Feedback - After the panelists' initial estimates and other information are gathered, results must be summarized and a feedback statement prepared for members of the panel. This statement and a request for new estimates should then be transmitted to panel members and a second round of responses solicited.

Second Round - Application of the Delphi technique requires at least two rounds of estimates on the part of the expert panelists. In the case of the Boston Edison project, a first set of materials was sent to each expert with a request that he or she complete a matrix showing the expected level of market penetration for the technology for each calendar year. The experts were also instructed to list the assumptions they made as they developed their estimates. The panelists returned their estimates and the descriptions of their assumptions to the research team. The team then compiled a summary of the initial estimates by each of the panelists as well as their comments and assumptions regarding the scenarios and the overall market. These summaries were then sent back to each of the

⁵ Using a charitable contribution incentive, instead of a direct cash incentive to the participant, eliminated potential problems associated with policies surrounding certain participant's inability to receive direct cash incentives.

panelists, along with a request that they review the materials and provide a second set of estimates, based on their initial responses and the review.

Results - Results for this technique can yield a reasonable estimate of baseline conditions from a panel of experts, through an iterative process. In addition, the Delphi technique elicits important contextual information regarding the assumptions underlying expert forecasts. Overall, this approach appears to provide extremely valuable information that is applicable to a wide range of forecasting situations and can be gathered in a time efficient and cost-effective manner.

Forecasting the Status of Market Barriers

The discussion in the previous section focuses entirely on estimating baseline penetrations (sales forecasting) largely because that has been the focus of market managers. In most marketing applications, market managers do not address the status of market barriers.⁶ Few market managers have the mandate or the resources (other than advertising budgets or sales force budgets) to address the wide variety of barriers that may be of interest to those attempting to increase the deployment of energy-efficient products and services. For these reasons, there do not seem to be approaches specifically developed for forecasting the status of various market barriers over time.

Nonetheless, it seems reasonable to adapt most of the models described above for use in forecasting barrier levels. Evaluators could project current barrier levels or changes in barrier levels based on analogies with similar products. They could also develop and apply statistical models based on aggregate data. Of most interest in the current context, the use of expert opinion offers a ready approach to estimating future barrier levels.

The Delphi approach used by GDS for Boston Edison required no major additions to the client's existing data collection methods. All that was required was to add questions about specific barriers to a discussion protocol. The experts assembled for the forecasting effort were readily able to estimate current levels of distribution, customer awareness, price levels, availability of financing, and related factors, and were able to forecast future values of those factors.

Concluding Remarks

In brief, no magic solution is available for use in forecasting the naturally occurring adoption of energy-efficient technology or practices as a standard against which to measure the effectiveness of a market transformation program. Each of the approaches described above has some virtues, such as simplicity, theoretical elegance, ease of development, or statistical rigor. But each also suffers from some defects, such as cost of

⁶ Customer awareness is the most notable exception to this point. Several models do address this factor directly, in part because it can be closely tied to advertising expenditures. It should also be noted that awareness data can be a useful input to diffusion models.

data collection, lack of theoretical grounding, or reliance on analogy. In cases where past performance is a good predictor of future events and information is readily available at a reasonable cost, GDS recommends using historical data to identify base lines for key indicators. In other, less mathematically predictable situations, the Delphi approach and use of scenario analysis would be preferable for identifying key barriers and the relative importance of various environmental factors and program inputs when estimating energy efficient technology penetration (with and without a program) for CEE's State and Local Government Purchasing Initiative.