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PLANNING FOR EVALUATION OF THE U.S. DEPARTMENT OF ENERGY'S ENERGY PARTNERSHIPS/CLIMATE CHANGE PROGRAMS

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Introduction

This paper describes the planning of a complex evaluation for a large-scale national energy program with international reporting requirements, the U. S. Department of Energy (DOE) responsibilities under the *U. S. Climate Change Action Plan* (DOE, 1993). Referred to as **Energy Partnerships for a Strong Economy**, this program includes 19 DOE Office of Energy Efficiency and Renewable Energy (EE) initiatives and three other DOE projects. The evaluation is complex for three reasons. Methodological issues pose a considerable challenge. It is difficult to quantify and verify the program's impact separate from rival explanations because of the numerous socio-economic factors and natural phenomenon affecting the reduction of greenhouse gas emissions. Double counting among the DOE programs and among DOE and its partners is also a concern, as is accounting for self-selection of program participants. Key aspects in evaluating Demand Side Management (DSM), market transformation, and other energy efficiency programs, such as accounting for spillover and persistence of savings, must be addressed.

Second, like the recent DOE evaluation of its Weatherization Assistance Program (Brown, et.al., 1993), the scope of this evaluation is national, rather than state or local. With the questions being raised by Congress and the public on the proper role of the Federal government, it is particularly important for the evaluation effort to demonstrate the cost-effectiveness and benefits of federal involvement in energy efficiency programs. It is also a coordinated effort among 22 programs, covering a variety of program delivery mechanisms including market transformation, Research & Development (R&D), education and training, technical assistance, financial assistance, regulation and standards, and information dissemination. Third, an additional complexity arises because the plan also responds to the future requirement of the Government Performance and Results Act of 1993 (GPRA, Senate, 1992) that programs demonstrate both short and long term cost-effective outcomes from expenditure of tax dollars and use evaluation results in planning.

The evaluation plan deals with the complexity in the following way. The strategy is to have a six year effort with ongoing performance measurement, market studies and process evaluations as required when deviations from targeted outcomes occur, and a final evaluation report that combines these results with other impact evaluations deemed necessary. There are three key aspects to the approach. First, the evaluation planning and implementation will use a collaborative approach involving program managers and stakeholders, including program partners and customers, to ensure that evaluation results are useful and utilized. Second, performance mapping is used to describe the programs to be evaluated and determine data collection needs and key evaluation questions. Third, the evaluation plan uses multiple evaluation methods, including model and engineering estimates, self-reporting by partners, case studies, surveys, and modified peer/expert review in order to accommodate the scope and diversity of programs and the need to measure progress as well as impact.

Organization of This Paper

First an overview of the DOE programs and their performance goals is presented. Then a brief history of the evaluation planning effort is provided, followed by the evaluation goal, strategy and uses. The collaborative, multiple method approach used for this large-scale evaluation is outlined and then an explanation and examples of corporate performance mapping are provided. Some primary evaluation questions are posed,

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accompanied by a table that shows which methods will be utilized to address each question. The design for three specific data collection efforts is briefly described before conclusions are set out.

An Overview of the DOE Programs and Their Performance Goals

In 1992, world leaders and citizens of more than 200 countries at the Earth Summit in Brazil drafted the Framework Convention on Climate Change (FCCC), an international agreement that formalizes their intent to "achieve...stabilization of greenhouse gas concentrations in the atmosphere...and to enable economic development to proceed in a sustainable manner." *The U.S. Climate Change Action Plan*, released by President Clinton in October 1993, is a compendium of 46 actions that, taken together, aim to reduce U.S. greenhouse gas emissions to 1990 levels by the year 2000. More than half of the U. S. actions are DOE activities, alone or in cooperation with the Environmental Protection Agency (EPA) and the Departments of Agriculture and State. The evaluation effort is managed by the DOE Office of Energy Efficiency and Renewable Energy's Office of Planning and Assessment (EE/OPA). Most of the DOE actions are energy efficiency and renewable energy programs, however, methane recovery programs are included as part of the coordinated evaluation.

The federal mandate for these DOE programs extends beyond the *U. S. Climate Change Action Plan*. Most of the DOE programs are also mandated by the Energy Policy Act of 1992 (EPACT), which expanded the DOE authority and responsibility to actively pursue energy efficiency. The Energy Partnerships for a Strong Economy and other DOE Climate Change programs are listed in Table 1, along with their energy, emissions, and non-federal investment goals for the years from 1994 to 2000. Also included are 1995 targets for new partners and an example of program-specific short term targets for the Climate Challenge program.

History of the Evaluation Effort

DOE began coordinated evaluation planning soon after the *U.S. Climate Change Action Plan* was published in October 1993, as part of the overall EE implementation planning effort. Sandia National Laboratories (Sandia), Energy Policy and Planning Department, is providing expertise to EE/OPA and to the individual programs. During the eleven-month period in which Energy Partnership implementation plans were written, the plans and the evaluation sections in them were discussed with potential partners and stakeholders individually, in five regional roundtable meetings, and at a workshop attended by over 70 representatives of national associations and environmental groups. More than a dozen experts in performance measurement, including Mr. Ronald C. Corbeil of Canada (Corbeil, 1993), assisted in planning and training efforts. This technical assistance was necessary to educate and motivate managers because evaluating programs in this way is new to most of the federal government. A draft coordinated evaluation plan was sent to Congressional staff and other stakeholders in March 1994 along with the draft implementation plans. It was also sent to evaluation experts, DOE, EPA and White House staff before being revised and published with the detailed DOE program implementation plans (DOE, Fall 1994).

In Fall 1994, EE/OPA and Sandia provided assistance to program managers as individual programs set annual performance targets for common and program-specific measures and developed preliminary plans for collecting necessary evaluation data. EE/OPA requested proposals for a coordinated partner survey and coordinated specific evaluation plans for several individual programs, such as a survey of applicants to the National Industrial Competitiveness in Energy, Environment and the Economy (NICE³) grants program for deployment of energy efficiency and pollution prevention technologies. EE/OPA started the development of a data base to track and summarize performance information for DOE reports and for a joint report requested by the White House Office on Environmental Policy. DOE negotiated a progress report format with the EPA that is similar to the information in Table 1 and that will form the basis of the required FCCC U.S. Climate Change Action Plan Report due in October 1995.

Table 1. DOE Energy Partnership/Climate Change Programs and Performance Goals

DOE Energy Partnership and other Climate Change Programs	Fiscal Year 1995			1994 - 2000 cumulative Performance Goals		
	DOE Investment (million \$)	Progress Targets		Non-Federal Investment (million \$)	Primary Energy Savings/Substitution (quad BTU's)	Carbon Emissions Savings (MMTCE)
		New Partners	Program Specific			
Commercial Buildings Programs						
Rebuild America	8.5	20		3,000	0.10	1.600
High-Efficiency Equipment/Appliances	9.0	15		1,250	0.45	9.100
Update Building Codes	6.5	n/a		14,700	0.22	3.320
Housing Programs						
Enhance Residential Appliance Standards	0.0	n/a		n/a	.24	3.800
The Affordable Homes Partnership	3.7	TBD		5,000	0.05	1.900
Cool Communities	1.2	8		TBD	TBD	4.400
Manufacturing Programs						
Climate Wise	2	20			.40	6.400
Motor Challenge	4.5	300		460	2.56Kwh	0.600
Energy Analysis and Diagnostic Centers	1	70		166	TBD	TBD
Expand NICE ³ Grant	3	n/a		160	0.06	9.300
Utility Programs						
Climate Challenge	2	80	5 Work-Shops	TBD	TBD	44.000 (with partners)
			Partner with 53% of electric generation			
Renewable Energy Commercialization						
Photovoltaics	18.0	7		322	0.004	0.070
Biomass Power	20.0	5		248	0.04	0.940
Geothermal Heat Pumps	6.2	70		9,300	0.03	1.270
Geothermal Power	2.8	5		1,300	0.005*	0.120*
Wind	13.5	5		3	3,000MW	1.200
Integrated Resource Planning	1.8	5		TBD	0.27	4.300
Retain/Improve Hydroelectric Generation	2.0	TBD		1,500	0.13	2.000
Efficiency Standards for Electric Transformers	0	4		300	0.15	0.552
Policy and Fossil Energy Programs						
U.S. Initiative on Joint Implementation	3.4	TBD		TBD	TBD	TBD
Methane Recovery Systems - Coal Mining	1.2	2		200	0.21	2.600
Methane Recovery Systems - Landfills	1.5	5		375	0.02	2.280

*Includes funding only for U.S. Climate Change Action Plan. Total program funding for programs in existence prior to 1994 may be higher.
^aby 1997

EE did not fund a performance measures data base until April 1995 and funds for the Partner Survey are not expected before May 1995. Similarly, a coordinating evaluation team will not be in place before May. Furthermore, EE total resources have decreased and resources have been allocated to priorities other than evaluation. An EE senior management review of individual programs' progress on milestones and performance targets, and on 1995 evaluation plans, is scheduled for May 1995. EE will integrate the energy and emissions estimates generated for the October 1993 Plan and the EE Quality Metrics effort, both described in more detail below. An external independent review of estimates and the assumptions leading to them will occur in Summer 1995.

The Evaluation Goal, Strategy, and Uses

Evaluation goals and strategy were determined in consultation with program managers and stakeholders. The goals of the Energy Partnerships program evaluation are to assess progress in energy savings and other performance goals, improve programs, and report results through ongoing performance monitoring and

evaluation. The evaluation strategy addresses these three goals through regular performance monitoring, ad hoc evaluation as the programs unfold over the next five years, and a summary evaluation.

Performance monitoring reports will provide Congress and the White House with an overview of the intermediate progress that the DOE program is making in meeting its goals, especially energy savings. Progress and performance will be measured by impact evaluations in terms of indicators, such as number of audits resulting in action and number of buildings retrofitted, compared to targets. Feedback to program managers from the more detailed information underlying the performance monitoring reports will alert them to any deviations from target, so they may improve individual and overall programming. If deviations from targeted outcomes cannot easily be remedied, ad hoc market studies and process evaluations will be mounted to identify and remove barriers to performance. The final evaluation report will summarize and document performance on program goals for partners, funding agencies and the international community as part of the FCCC requirements. It will build on the regular performance monitoring, the ad hoc evaluations, and results of individual program evaluation studies, supplementing information with other evaluations where necessary.

Evaluation Approach

Collaborative Evaluation

As in some DSM evaluations, the collaboration in this evaluation planning extends beyond the programs' management to program stakeholders (Kushler, 1993), including partners who co-deliver or fund a project, and customers who receive a product or service, as well as others who have an interest in the effects or outcomes of the program. A team approach to developing and implementing plans is necessary given the voluntary nature of most of the programs. It helps ensure that all parties find evaluation results useful and credible, and responds to recent federal initiatives which call for increased customer focus and stakeholder input. The annual partner survey discussed below is an example of the collaborative approach.

Multiple Methods

The methodological challenges, the scope and diversity of programs to be evaluated, and the intention to measure progress as well as impact, led to an early decision to have a coordinated evaluation effort employing multiple methods. It is necessary but not sufficient to evaluate each of DOE Energy Partnerships programs individually. In some areas, there must be a coordinated effort to avoid costly duplication of effort and minimize double counting of program results. The competition among alternative fuels and energy efficiency programs, and actual energy savings and substitution of alternative fuels, must be measured in order to estimate the emission reductions more accurately. Quantifying the contributions of DOE programs will also be done in multiple ways to enable attribution of results to DOE programs separate from the influence of partners, related programs, and external events. Table 2 shows detail on methods and evaluation questions.

Separating the influence of DOE from that of partners includes identification of instances where participants have self-selected, that is, would have adopted energy efficiency or renewable energy technologies without the DOE program. Without investigation and verification of partners' voluntary reports of emission reductions we may not be able to identify the separate DOE contribution. Where the partner receives funds or services, such as the NICE³ grants program, DOE may require verified energy savings and permission to evaluate the portion of those savings attributable to the DOE program. For many programs, however, such as Climate Wise, industry is reluctant to have formal verification of their reports because of the expense and the proprietary nature of energy use data. The voluntary reporting system established under EPACT is discussed in the section on data collection plans.

Actual energy savings and fossil fuels displaced, not just estimated and predicted energy savings and substitution, will be measured using methods such as case studies and metering of individual projects. The type of fuel displaced and regional weather conditions, among other factors, must be tracked in order to estimate the emission reductions. The modeling method for baseline estimates and forecast outcomes is discussed

below. External events to be accounted for include the price of oil, energy and environmental regulation at the state and local levels, technology advances, and stakeholders' perception of the urgency of global environmental problems. Lessons learned in DSM evaluation and work in the area of market transformation (Feldman, 1994) may be helpful.

The Performance Mapping Approach for Planning Coordinated Evaluation

Coordination in the evaluation was achieved by drawing together the diverse actions in the program through their common programming and performance elements. The unifying force came from constructing what we call a *Corporate Performance Map* (Figure 1), which shows how the 22 programs' various actions work together to achieve the program objectives. The performance map is also referred to in the literature as "Logic Model" or "Logic Chart". The notion was introduced in the late 1970's by Joseph S. Wholey, and he describes use of the technique to define and test a program design during an evaluability assessment in a recent evaluation handbook (Wholey, et.al., 1994). Canadian evaluators have extended that use to the planning of evaluation during more than a decade of mandated evaluation of Canadian federal programs (Rush, 1991).

The performance map process uses a graphic to complete the first step in successful performance measurement and evaluation, that is, defining the system or program to be evaluated. Its simple appearance is deceptive. Developing a performance map is a process, not an event. The development is most successful if it takes place in an iterative manner with collaboration of all major stakeholders. In that way, those who will be using the results of the evaluation and those who are being evaluated can come to agreement on expected results and how those results will be measured. The process defines a Total Quality Management "plan, do, check, act" cycle, and in the process, stimulates communication among all levels of management and between management and stakeholders. We also found that pushing program managers to clarify the path from activities to outcomes resulted in improved program design.

The Energy Partnerships Evaluation Plan

The Energy Partnerships Performance Map

EE/OPA and Sandia developed a draft corporate performance map and worked with program staff to develop several related program performance maps, adjusting these maps as more information and points of view were gathered. We began by identifying primary EPACT and *Climate Change Action Plan* objectives as the key outcomes. Then we identified common program delivery mechanisms into key activity groups. For measurement purposes, we then identified the most basic outputs of each major program delivery mechanism, such as "New Technology Developed or Adopted" derived from "Research and Development" and "Change in Shelf Stocks or Sales" derived from "Market Transformation". We also identified common short term progress outcomes. "Program or Market Penetration", will be program specific. For example, the Climate Challenge initiative will monitor percent of electricity generation represented by their partners, while Rebuild America will monitor the square feet of buildings under renovation. Clearly the map does not indicate all the relationships between activity groups and key outputs. Also, most program outputs contribute in some way to more than one progress and performance outcome, thus no specific linkages are shown between these levels. The individual program performance maps, such as that shown in Figure 2, reflect the Corporate Map with an increased level of detail, and some, but not all, of the corporate activities, outputs and outcomes.

Figure 1. Corporate Performance Map
Energy Partnerships for a Strong Economy
 (Climate Change Actions) *Final Draft 10/94*

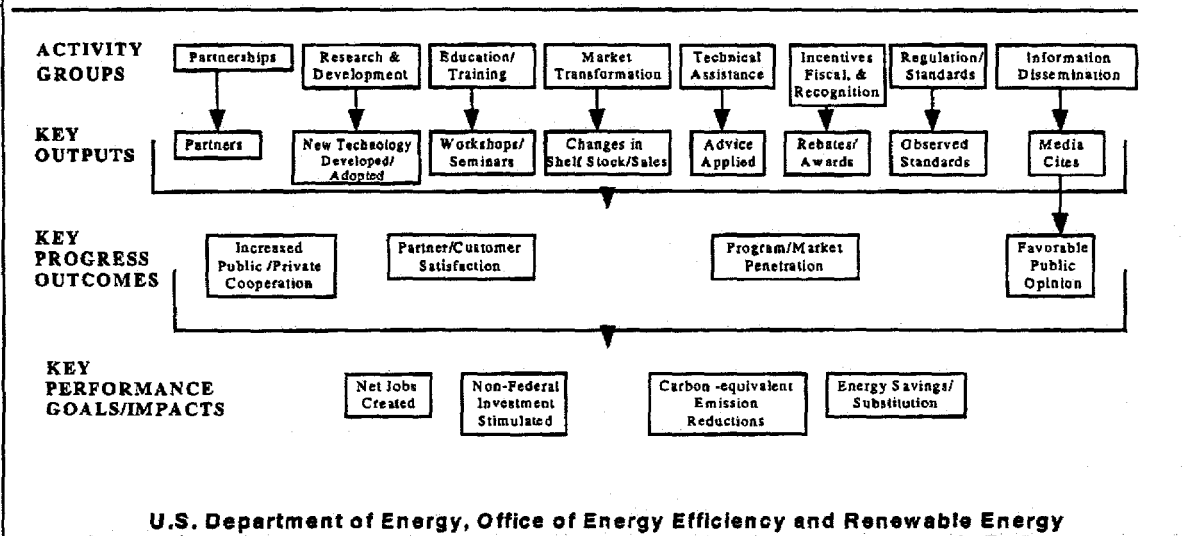
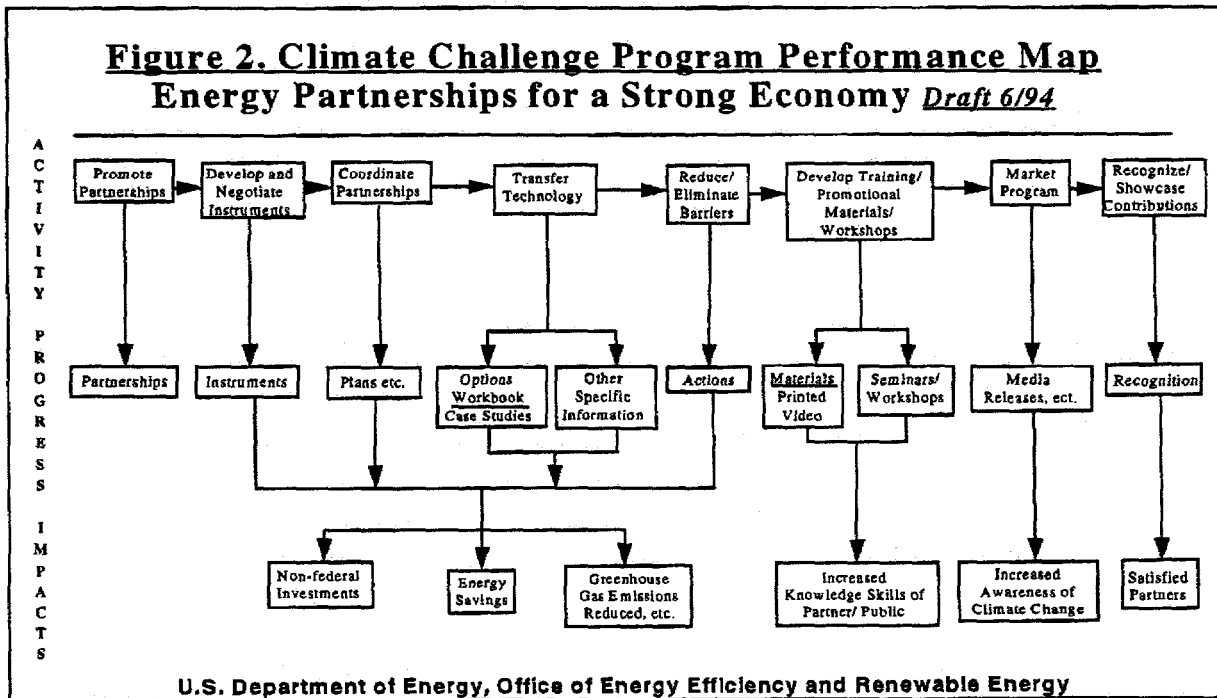


Figure 2. Climate Challenge Program Performance Map
Energy Partnerships for a Strong Economy *Draft 6/94*



Evaluation Questions and Methods Used to Address Them

The questions to be answered by evaluations and ongoing performance monitoring reflect the corporate and individual program performance maps. In Table 1, notice that the performance targets and goals are tied to boxes in the outcomes levels of the performance maps in Figures 1 and 2. And notice that the evaluation questions discussed below address the "cause and effect" flowing along vertical linkages, such as between outputs and progress, or progress and performance outcomes or impacts.

Impact evaluations will demonstrate **program performance on goals**. DOE program managers will consider their programs successful if they meet the overall targets for energy savings/substitution and emissions reductions. Factors leading to that success are efficient and effective expenditure of anticipated federal funds, leveraging of non-federal investment, and achievement of specific technical and program goals, including estimated penetration of the program "market" they have defined. Another impact evaluation question is the extent of the economic benefits enjoyed due to the DOE program, since economic benefits such as reduced energy bills, higher productivity, and jobs created follow from energy savings both directly and indirectly. As evaluators we hypothesize no program effect on these outcomes and collect data to test these hypotheses. Macro and micro models will be utilized to estimate impacts, with information also collected from partner reports, case studies, and more rigorous analysis of some individual projects.

Monitoring, market and process evaluations must demonstrate **program progress and shorter term outcomes**, in particular, the success of the voluntary approach. Program managers will consider the voluntary approach successful if the targets set by programs for number and type of partnerships are met, many stakeholders participate, partners and participants are satisfied with the way DOE ran the program, and DOE overcomes any identified barriers to voluntary participation. We will have ongoing monitoring of how many partnerships/joint ventures were formed and how significant they were in terms of the potential market for the DOE program. We will monitor participation in the various DOE activities. We will annually measure the degree to which participants and partners are satisfied with the way the DOE program ran, ascertaining what was important to them and how delivery rated in comparison to similar services received from other organizations. Surveys of participants and case studies will ascertain actual effects and whether the DOE program influenced the adoption, scale, or timing of adoption of energy efficiency or renewable energy technologies. Surveys and case studies will also investigate incentives and barriers influencing participation and how the program changed in response to this information. Independent, modified peer (or expert) review will assess progress toward technical and programmatic goals.

In both process and impact evaluations there are **questions of relative cost-effectiveness**. Program managers will consider the program as a whole is most cost effective if individual programs are cost effective, if DOE is aware of the effectiveness of the various sectors and delivery mechanisms, and if programming adjustments are made to fund those most likely to result in the largest carbon emissions reduction per tax dollar spent. Thus an important evaluation question is how much the various sectors (e.g., commercial buildings, residential buildings, etc.) and individual programs contribute to meeting targets for energy savings/substitution and emissions reduction. Standard definitions of measures for representative outputs of the various program delivery activities such as financial incentives and training will aid in comparing how each activity type contributed to meeting targeted outcomes, as will the Partner Survey and evaluations of individual programs.

Table 2 summarizes the key issues of the coordinated evaluation and the multiple methods that will be used to address them. Utilization of multiple methods increases the confidence with which program success or cost effectiveness are demonstrated.

Table 2. Multiple Methods Used to Address Evaluation Questions

Evaluation Methods	Program Progress/Shorter Term Outcomes					Program Performance on Goals			
	Partnerships			Program-Specific		Non-Federal Investment	Energy Savings/Substitution	Carbon Equiv. Emission Savings	Jobs Created
	Number, type	Cost-share	Satisfaction	Milestones/Targets Met	Technical Goals Met				
Macro Model Estimates (IDEAS model)				X		X	X	X	
Micro Model Estimates (AMIGA, REACT)								X	X
Self-reporting by Partners (1605(b), etc.)	X	X	X			X	X	X	X (indirect)
Audits, Engineering Estimates, billing data, metering		X		X			X		
Case Studies				X	X	X	X		X (direct)
Surveys	X		X						X
Ongoing Review/Monitoring by Manager/Partner	X	X	X	X	X	X			
Independent or Expert Review				X	X		X		
Official Statistics (e.g. units sold)				X					

Data Collection Plans

Source for Baseline Estimates and Projected Outcomes

The assumptions and calculation of the 1990 baseline and projected reductions in total greenhouse gas (carbon equivalent) emissions by the year 2000, with the accompanying non-federal investment and energy savings for the Energy Partnerships programs are described in the *Climate Change Action Plan: Technical Supplement* (DOE, March 1994). The *Technical Supplement* explains the modeling scenarios, the Integrated Dynamic Energy Analysis Simulation (IDEAS) model, and the Energy Information Administration's (EIA's) *Annual Energy Outlook 1993 (AEO 1993)* Reference Case.

An EE management initiative begun in Fall 1993 provides another method for estimating energy savings, production, and emissions reductions. The goal of this "Quality Metrics" effort is to provide a framework for estimating the current and future benefits of all EE programs that is consistent across the EE sector offices (DOE, October 1994). The benefits are assessed at an aggregated "planning unit" level for energy savings, emission reductions, and jobs created. Non-federal investment, market penetration, and other assumptions of program achievements are inputs to the model estimates.

Voluntary Reporting by Partners under EPACT 1605(b)

In Section 1605(b) of EPACT, Congress authorized a voluntary program for the public to report achievements in reducing or sequestering greenhouse gases. DOE, in consultation with EPA, prepared reporting guidelines (DOE, October 31, 1994). Two reporting forms will be available in June 1995, including a one page short form. Voluntary reports must establish a reference case to use as a basis of comparison, the project's effects, and estimates of emissions for the reference case and the project case. The reporting entity must indicate whether emissions are direct (on site) or indirect (generated elsewhere, such as reduced electricity use lowering emissions at a utility).

To date, even where reporting is part of a signed partnership agreement, there are no agreed-upon consequences for failing to report accurately. There has been discussion, particularly where recognition awards are to be given, about verification of partner impacts. Currently, DOE plans to verify partner reports only on a sample basis. Discussions with partners will determine how a sample will be drawn.

The DOE Partner Survey

If a broad range of people, businesses and organizations do not participate, the Energy Partnership program can not achieve its objectives. Their satisfaction with the product the program offers them, and with their interaction with the program, in terms of timeliness, responsiveness, reliability and accessibility, becomes, therefore, a critical element in measuring the program's performance. Determining the barriers to voluntary participation, and removing those barriers, is synonymous with improving customer satisfaction in this case. Finding out what attracts customers to alternatives and adapting the program accordingly (benchmarking customer satisfaction) has even been suggested as a DSM strategy by evaluators (Hirshberg, 1993).

The EE/OPA, with the assistance of the research firm Macro, International, will complete an evaluation study to establish baseline estimates of partner satisfaction for the Energy Partnership programs. The study will also gather feedback from partners and participants that will enable program managers to improve programs and report results, clarify the expectations of partners and participants, and create a method for evaluating partner and participant satisfaction over time.

The proposed methodology will involve program managers extensively in the process of designing an effective survey and in utilizing the results. In this first survey we must invest time in characterizing partners, building the list and a data base, and educating program managers in setting service standards and using the results of the survey. The 14 steps in the proposed partner survey are listed in Table 3.

Table 3 - Steps in Development, Implementation, and Use of the Partner Survey

1. Meet with project managers to determine evaluation goals, definition of customer.
2. Develop data base of customers and a process for collecting information.
3. Hold staff focus groups to define attributes customers assign to service quality.
4. Expand on attributes through personal interviews.
5. Construct the survey instrument. Focus on most important service attributes.
6. Develop the sample plan.
7. Field test the survey instrument.
8. Analyze data. Finalize survey instrument.
9. Administer the survey.

10. Analyze data using multivariate statistical techniques.
 11. Develop briefing materials on survey results.
 12. Hold workshop with managers.
 13. Form Action Teams to implement specific recommendations.
 14. Refine the process.
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Conclusions

The strategy and approach DOE has chosen for the six-year evaluation of this national Energy Partnerships program -- monitoring progress and evaluating deviations from targeted outcomes, using a collaborative, multiple-method approach and performance mapping -- appears to be sufficient to meet the goals set out for the evaluation.

The collaborative approach, particularly during the performance mapping process, has resulted in monitoring and evaluation that is useful to program managers and stakeholders, and has begun to prepare EE programs to meet future GPRA requirements. The targeted outcomes set as part of this evaluation plan have been used to satisfy several related departmental requirements. Measures and targets appear in the DOE Secretary's Performance Agreement with the President, the EE GPRA pilot, budget documents, Congressional testimony, and management reviews. The use of multiple methods has alleviated some stakeholder concerns about methodological issues, but more detail on application of the methods is needed.

There has been a delay in establishing an Energy Partnerships evaluation team and in funding initial evaluation studies such as the partner satisfaction baseline survey. This could partially be explained by the usual tendency to cut evaluation expenditures along with other overhead, given that program resources have decreased. It may also be because the approach represents a change from the normal way of doing business. There is limited in-house expertise in program evaluation and performance measurement, limited existing performance data, and general distrust of evaluation. Evaluation seminars, workshops, and consultation with individual programs have helped educate and motivate managers, lowering these barriers to implementation.

Evaluation implementation continues, but at a slower pace than originally expected. Individual managers have been very positive about the usefulness of performance mapping and the evaluation effort. Management has recently restated the importance of maintaining resources set aside for evaluation. There has been progress in funding evaluation studies and establishing the evaluation team to address methodological issues in the collaborative setting necessary to maximize use of these resources. As implementation continues in collaboration with program managers and stakeholders, we are encouraged that the evaluation strategy and approach will lead to cost-effective evaluation findings that are both credible and useful.

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