

**Evaluation of the 2003
California Statewide and Local Emerging Technologies Programs**

Study ID: SCE0207

Submitted to

Pacific Gas & Electric Company
San Diego Gas and Electric Company
Southern California Edison Company
Southern California Gas Company

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August 1, 2005

Funded with California Public Goods Charge Energy Efficiency Funds

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1 Executive Summary

1.1 Emerging Technologies Programs

The State of California had two utility programs in place in 2003 that focused on new energy efficient technologies, tools to increase efficiency, and application of existing technologies in different markets to expand the impact of energy efficiency. The larger program was a statewide effort while the second program was implemented within the service territory of Southern California Edison Company.

The Statewide Emerging Technologies Program (ETP) is an information-only program that seeks to accelerate the introduction of energy efficient technologies, applications, and analytical tools that are not widely adopted in California. The program addresses all market segments, and is composed of two parts: Demonstration & Information Transfer, and the Emerging Technologies Coordinating Council (ETCC).

The SCE Local Demonstration and Information Transfer (DIT) program are closely related to the statewide ETP, but is local in scope. That is, the technologies and services selected for investigation by the program are of particular interest to customers located within SCE service territory. The DIT Program focuses on near-commercial and commercial energy efficient applications with low market penetration. The demonstration projects help to measure, verify, analyze, and document the potential energy savings and demand reduction of specific applications in different market segments. Information Transfer efforts disseminate project results, and are usually customized to the targeted markets.

The ETCC is a statewide information exchange and coordination effort between the investor owned utilities and the California Energy Commission's (CEC) Public Interest Energy Research (PIER) program. Program efforts to select technology applications for assessment projects include working with PIER, as well as, but not limited to, members of the research and design communities, manufacturers, energy efficiency advocates, customer groups, universities, professional societies, national laboratories, government agencies, engineering firms, and industry and trade groups. The ETCC met throughout 2003. The statewide ETP efforts form an important link between ongoing energy efficiency Research & Development (R&D) efforts and energy efficient emerging technology applications commercialization.

The four IOUs delivered the ETP and SCE, its DIT program, through technology assessments and customer demonstration projects. Information is disseminated through many different outlets, including SCE's and PG&E's Energy Centers, utility personnel, and community organizations. The information transfer activities were aimed to leverage the utilities' overall energy efficiency communication efforts. The program pursued projects targeting both residential and nonresidential customers segments, including new construction.

1.2 Evaluation Objectives

The initial evaluation of the PY 2003 ETP and SCE's DIT Program had four primary EM&V objectives:

1. Verify that the utilities met the targeted number of technology assessments for both the statewide program ET Program and SCE's local DIT Program.

2. Verify that the utilities updated the ETCC database for both the statewide program ET Program and SCE's local DIT Program
3. Determine the extent to which the recommendations made as part of the evaluation of the PY 2002 ET Program were implemented, and, if not, identify any barriers to their implementation.
4. Conduct an evaluability assessment for the ETP that will involve four steps:
 - a. Clarify the intended program from the perspectives of managers, staff and other key stakeholders (this includes a revision of the current logic model)
 - b. Explore the program reality, including the plausibility and measurability of program goals and objectives. This includes the identification of performance indicators that should and could be collected.
 - c. Recommend an evaluation design.
 - d. Write the proposed research study approach.

A research plan was written in November, 2004. However, the changing design of the ETP, of which little was known into 2005, made the fourth objective impossible to achieve in order to complete the 2003 evaluation in a timely manner. We could not begin to consider the various evaluation design options, logic models and possible indicator data since the design of the ETP had not been finalized and presented in some more or less complete form. Thus, we recommended a change for the 2003 evaluation in March, 2005, such that we complete the first three objectives and transfer the remaining evaluation funds to SCE for use in the evaluation of the PY 2004-05 Statewide ETP. This report presents the results for the first three objectives of the evaluation study.

1.3 Results

The results are summarized below:

- All four utilities either met or exceeded their goals with respect to the number of technology assessments that were to be initiated in 2003.
- The ETCC data was updated to include these technology assessments begun in 2003.
- To date, some of the recommendations from the previous evaluation have been implemented and discussions regarding the others have taken place. Others, such as refinement of the program theory, have not taken place because the ETP managers have indicated that the statewide program is undergoing significant changes in design and delivery.

While this report is abbreviated, it provides the verification that the utilities met their expected objectives during PY 2003. Because of the renewed acknowledgement by the State in 2004 of the high need to prioritize emerging energy efficiency technologies and the expected influx of funding for PY 2006 and beyond for these programs, future evaluations of these two programs will necessarily be expanded. These future evaluations are expected to be multifaceted, possibly using statistical analyses, case studies, surveys, value-cost analyses, and other methodological approaches to measure the effectiveness of the programs.

2 The Emerging Technologies Program

The Statewide Emerging Technologies Program (ETP) is an information-only program that seeks to accelerate the introduction of energy efficient technologies, applications, and analytical tools that are not widely adopted in California. The program addresses all market segments, and is composed of two parts: Demonstration & Information Transfer, and the Emerging Technologies Coordinating Council (ETCC).

The SCE Local Demonstration and Information Transfer (DIT) program is closely related to the statewide ETP, but is local in scope. That is, the technologies and services selected for investigation by the program are of particular interest to customers located within SCE service territory. Getting these technologies or models “out of the lab” means the DIT program serves as an incubator for statewide implementation through such programs as the Express Efficiency program or the statewide Emerging Technologies Program. The DIT Program focuses on near-commercial and commercial energy efficient applications with low market penetration. The demonstration projects help to measure, verify, analyze, and document the potential energy savings and demand reduction of specific applications in different market segments. Information Transfer efforts disseminate project results, and are customized to the targeted markets.

The ETCC is a statewide information exchange and coordination effort between the investor owned utilities and the California Energy Commission’s (CEC) Public Interest Energy Research (PIER) program. Program efforts to select technology applications for assessment projects include working with PIER, as well as, but not limited to, members of the research and design communities, manufacturers, energy efficiency advocates, customer groups, universities, professional societies, national laboratories, government agencies, engineering firms, and industry and trade groups. The ETCC met throughout 2003. The statewide ETP efforts form an important link between ongoing energy efficiency Research & Development (R&D) efforts and energy efficient emerging technology applications commercialization.

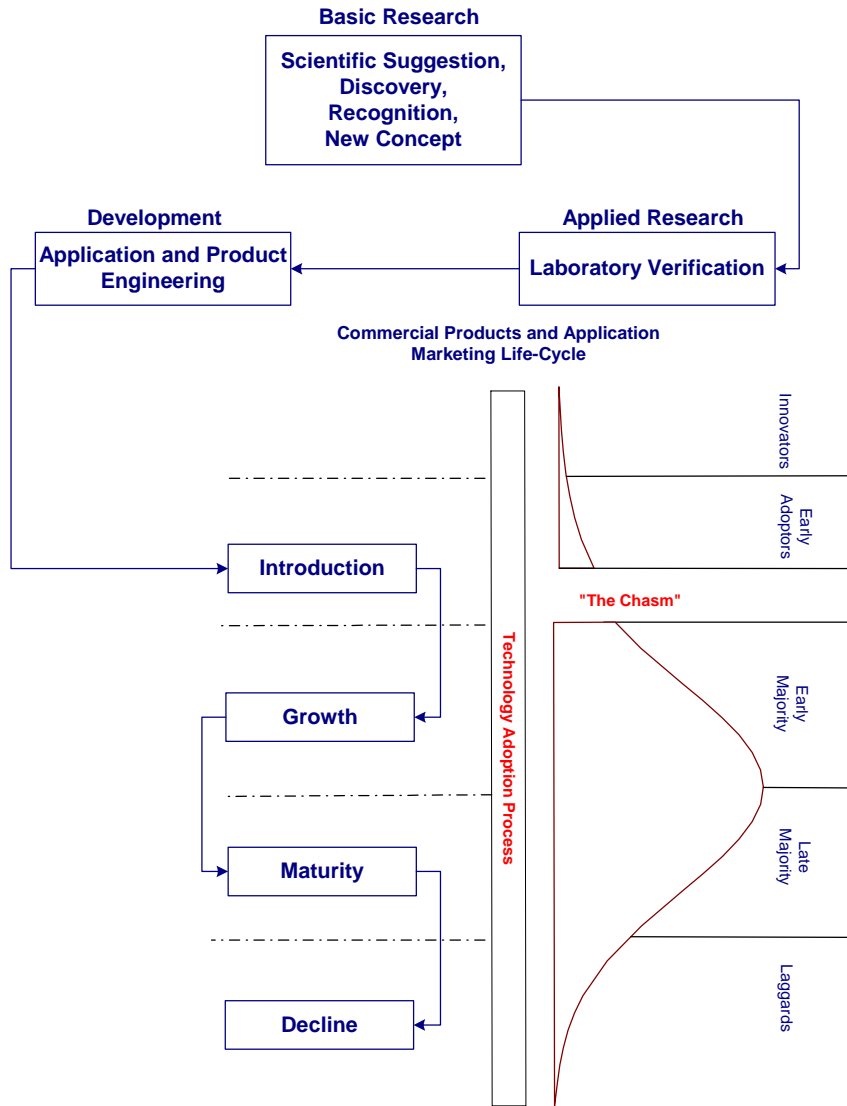
The Program uses a targeted approach, working with “innovators”. The utilities will deliver the program through demonstration projects, and through coordinated efforts similar to the ETP database. Information will be disseminated through many different outlets, including the Energy Centers, utility personnel and professional and community organizations.

According to the program implementation plans filed by the utilities, neither the ETP nor the DIT changed significantly from 2002.

2.1 Diffusion Theory

Those who designed and are implementing the ETP and DIT have placed these programs firmly in the *diffusion of innovation* theory. As shown in Figure 2-1, the program efforts form an important link in the commercialization of energy efficient emerging technologies and applications.

Figure 2-1
Typical Product Development and Commercialization Cycle



The four IOUs delivered the ETP and, SCE, its DIT Program, through technology assessments and customer demonstration projects. Information transfer was stated to have been accomplished through many different channels, including SCE's and PG&E's Energy Centers, utility personnel, and community organizations. The information transfer activities were aimed to leverage the utilities' overall energy efficiency communication efforts. Through the demonstration projects, comprehensive design methods and tools may be developed and disseminated, along with the performance information of the energy efficient emerging technology measures. The programs pursued projects targeting both residential and nonresidential customers segments, including new construction.

2.2 Market Barriers

The ETP and DIT activities are expected to produce both near- and intermediate-term market effects, leading to long-term transformation of the marketplace for energy efficient technologies and design approaches that are new or at least new to a given market segment. To meet these objectives, the programs address five known market barriers that are discussed next.

2.2.1 Performance Uncertainty

Many designers, architects, engineers, contractors, and owners are skeptical about new energy efficient products and designs. These market actors do not readily accept unproven technologies and concepts, especially if the first costs are significantly higher than existing, proven equipment and methods. Further, these market actors are not sure if these emerging technologies and innovative designs will either work or perform as claimed. Through demonstrations and technology assessments, emerging energy efficient technologies and designs may prove their value to the various market actors, and the performance of the efficiency options under actual field conditions.

2.2.2 Information/Search Costs

One major barrier is the cost of identifying energy efficient products. Disseminating information about the technology showcases and assessments through a variety of ways, including fact sheets, web sites, and journal articles, can significantly reduce this barrier.

2.2.3 Asymmetric Information

When shopping for new equipment, customers find it difficult to evaluate the veracity, reliability, and applicability of claims made by sales personnel. Sellers of energy efficient products typically have more and better information about their offering than do consumers and sellers can have an incentive to provide misleading information. By providing information on technology demonstrations to customers, the customers are at less of a disadvantage when interacting with sales personnel.

2.2.4 Organizational Practices

Within organizations, certain kinds of behavior or systems of practices discourage or inhibit cost-effective energy efficiency decisions. Through technology demonstrations and assessments, market actors can be convinced that the new technologies and designs perform well, are reliable over the long-term, and are cost effective. As a result, they may modify their standard practices and incorporate the new technologies and designs into future projects.

2.2.5 Split Incentives

In some cases, the incentives of an agent charged with purchasing energy efficient equipment are not aligned with those of the persons who would benefit from the purchase. For example, a contractor working for a school district, by focusing on first costs, may not purchase the somewhat more expensive, more energy efficient equipment for a given building. However, such a decision will result in a school district paying more in energy costs over the long term. The ETP's focus on the creation and performance of an optimal energy efficient design requires

teamwork between designers, architects, engineers, contractors, and building owners to create, operate, and maintain an optimized system that accounts for the interactions between its components and the building. Making sure that all those involved understand the long-term costs and benefits of equipment and building decisions can reduce this barrier.

2.3 Evaluation Objectives

The initial evaluation of the PY 2003 ETP and SCE's Local Demonstration & Information Transfer (DIT) Program had four primary EM&V objectives:

1. Verify that the utilities met the targeted number of technology assessments for both the statewide program ET Program and SCE's local DIT Program.¹ Table 2-1 presents the number of assessments for each utility that were slated to occur in 2003.

Table 2-1
Technology Assessment Objectives, by Utility

| Utility | Technology Assessments |
|----------------------|------------------------|
| <i>PG&E</i> | 8 |
| <i>SCE</i> | 6 |
| <i>SDG&E</i> | 2 |
| <i>SoCalGas</i> | 6 |
| <i>SCE Local DIT</i> | 3 |

2. Verify that the utilities updated the ETCC database for both the statewide ETP and SCE's Local DIT Program
3. Determine the extent to which the recommendations made as part of the evaluation of the PY 2002 ETP² were implemented, and, if not, identify any barriers to their implementation.
4. Conduct an evaluability assessment for the ETP that will involve four steps:
 - a. Clarify the intended program from the perspectives of managers, staff and other key stakeholders (this includes a revision of the current logic model)
 - b. Explore the program reality, including the plausibility and measurability of program goals and objectives. This includes the identification of performance indicators that should and could be collected.
 - c. Recommend an evaluation design.
 - d. Write the proposed research study approach.

¹ Technology assessments involve either an on-site *or* a laboratory demonstration of a particular technology.

² Ridge & Associates and Equipoise Consulting Inc. (2003). "Evaluation of the 2002 California Statewide Emerging Technologies Program." Prepared for PG&E, SCE, SDG&E, and SoCalGas.

A research plan was written in November, 2004. However, the changing design of the ETP, of which little was known into 2005, made the fourth objective impossible to achieve in order to complete the 2003 evaluation in a timely manner. We could not begin to consider the various evaluation design options, logic models and possible indicator data since the design of the ETP had not been finalized and presented in some more or less complete form. Thus, we recommended a change for the 2003 evaluation in March, 2005, such that we complete the first three objectives and transfer the remaining funds to SCE for use in the evaluation of the PY 2004-05 ETP. This report presents the findings of the first three objectives of the evaluation study.

This study was conducted at the request of the California Public Utilities Commission. The study was managed by SCE. It was funded through the public goods charge (PGC) for energy efficiency and is available for download at www.calmac.org.

3 Results

3.1 Verification of Assessments and Updating of Database

In the PY2002 evaluation report, it was noted that “There was some confusion about the definition of a technology assessment”³, but that the definition used in that evaluation effort was “Technology assessments involve either an on-site *or* a laboratory demonstration of a particular technology”.⁴ For the purposes of this evaluation, a project record within the ETCC database was considered an assessment.

We used information from the PY2003 Program Implementation Plans, 2003 Quarterly reports, and the ETCC database as of 12/31/03 to determine what projects had been started in 2003. Additionally, the ETCC Website was reviewed to determine some information about certain projects. The projects shown in Table 3-2 are those that were stated to have been initiated in PY2003 from the quarterly reports or were input in 2003 within the ETCC database. Some projects had data within the ETCC database that indicated that they began in 2003. Others listed here did not have such documentation within the database, but either were listed in the 2003 quarterly reports or had a project ID that was higher than the project IDs from the PY2002 evaluation of the database. (i.e., Projects input into the ETCC database have sequential numbering. The evaluation of the PY2002 database indicated the highest project ID to be 266. All projects from PY2003 had project IDs greater than 270.) There were ongoing projects in 2003 that are not included in this table. No analysis was done to determine exactly what those ongoing projects were as it was outside the scope of this verification.

Projects such as these do not always have work products (such as fact sheets) that are available to use as part of the verification process. Part of this is because the project may not be ready to produce such a document at the time of the verification. As another source of verification that the project was underway, we reviewed the documents output by the ETCC database as of 12/31/04 to see if the projects were continuing to be tracked. Three out of the four utilities had updated their projects by the end of 2004, with a few projects now showing information in the results section of the documents. For the most definitive verification of each project, we reviewed hard copy of the contracts, field demonstration agreements, or other relevant information on each of the projects. The hard copies were checked for signature date and description of the project involved to be sure that the project was begun in 2003 and that the hard copy was on the expected project.

Table 3-1 shows the original technology assessment objectives and the technology assessments actually begun in 2003. As one can see all four utilities either met or exceeded their goals. In addition, the ETCC data was updated to include these technology assessments begun in 2003.

³ Ibid, p. 5-2.

⁴ Ibid, p. 2-13.

Table 3-1
Technology Assessment Objectives and Accomplishments, by Utility

| Utility | Technology Assessment Objectives | Verified Technology Assessments Begun in 2003 |
|------------------|---|--|
| <i>PG&E</i> | 8 | 8 |
| <i>SCE</i> | 6 | 7 |
| <i>SDG&E</i> | 2 | 2 |
| <i>SoCalGas</i> | 6 | 8 |
| <i>SCE Local</i> | 3 | 6 |

The projects begun in 2003 are shown below in Table 3-2. Each of these projects was updated in 2003 and is considered verified by the evaluation team. Table 3-3 provides a short description of each project taken from the ETCC database.

**Table 3-2
PY2003 Projects**

| Utility | Budget / PY2003 Expenditures * | Objective Measures Planned | Objectives Measures Verified | Projects Begun (Project ID in ETCC database) |
|--------------------|---|---------------------------------------|--|---|
| PG&E | \$ 943,000 / \$ 943,000 | 8 Assessments / Update Database | 8 Assessments Database Updated | <ol style="list-style-type: none"> 1. Tankless Residential Water Heaters Study of Technical Opportunities and Barriers (278) 2. Verified HVAC Refrigerant Charge and Airflow Technical and Market Study (276) 3. Commercial Kitchen Ventilation Optimization (275) 4. High Color Temperature Lighting Demonstration at Customer Site (279) 5. Data Center Energy Efficiency Demonstration Scoping Study (282) 6. Diagnostics and Commissioning (280) 7. Advanced Evaporative Cooler vs. Baseline Testing (281) 8. Relocatable Classroom Daylight Dimming Demonstration and Simulation (274) |
| SCE (Statewide) | \$ 850,000 / \$ 842,925 | 6 Assessments / Update Database | 7 Assessments Database Updated | <ol style="list-style-type: none"> 1. Anti-Corrosion Surface Coatings for Air-Conditioner Condensers and Evaporators Research at SCE Facility (363) 2. “Super” T8 Fluorescent Instant Start Lighting Systems Assessment for Assembly Facilities Demonstration at Customer Site (362) 3. Electrochromic Windows Demonstration at SCE Facility (364) 4. Classroom Advanced Lighting System Demonstration at SCE Facility (366) 5. Classroom Displacement Ventilation Assessment Demonstration at SCE Facility. (368) 6. “Super” T8 Fluorescent Rapid Start Lighting System for a |

| Utility | Budget / PY2003 Expenditures * | Objective Measures Planned | Objectives Measures Verified | Projects Begun (Project ID in ETCC database) |
|----------------|--|---|--|---|
| | | | | Boiler and Chiller Mechanical Room Demonstration at Customer Site. (361) 7. Network Management of Computer Energy Star Settings Research at SCE Facilities. (360) |
| SCE (Local) | \$500,000 / \$472,095 | 3 Assessments/ Update Database | 6 Assessments Database Updated | 1. Cold Storage Controls (356) 2. Silicon Based Dry Cleaning (357) 3. Hydrocarbon Based Dry Cleaning (358) 4. CO ₂ Based Dry Cleaning (359) 5. 5 Ultra High Lime-Pellet Softening of Brine Concentrate Waste Streams (352) 6. 7. Professional Wet Cleaning with High Spin Speed Water Extraction (353) |
| SDG&E | \$ 200,000 / \$ 174,854 | 2 Assessments / Update Database | 2 Assessments Database Updated | 1. Battery Energizer Demonstration at Customer Site (271) 2. Frictionless Chiller Demonstration at Customer Site (272) |
| SoCalGas | \$ 792,000 (\$100 K Local) / \$ 651,286 | 6 Assessments / Update Database | 8 Assessments Database Updated | 1. Hybrid Air Compression System (344) 2. Forced Internal Recirculation Burner Demonstration at Customer Site (350) 3. Performance and Continuous Recommissioning Analysis Tool (PACRAT) Demonstrations at 3 sites (348) 4. Miele Aqueous Cleaning System (346) 5. Nishiyodo Adsorption Chiller – CHP heat recovery Demonstration at Customer Site (345) 6. Advanced Thermal Oxidizer – Printer VOC Destruction Demonstration at Los Alamitos (351) 7. Lean Burn Engine Demonstration at Customer Site. (349) |

| Utility | Budget / PY2003 Expenditures * | Objective Measures Planned | Objectives Measures Verified | Projects Begun (Project ID in ETCC database) |
|---------|--------------------------------|----------------------------|------------------------------|---|
| | | | | 8. Bio-fuel / Natural Gas Blend for Microturbine-CHIP Research. (347) |

*Budget and expenditures were taken from the IOU quarterly reports. There was no auditing/verification of these values.

**Table 3-3
Description of PY2003 Projects**

| Project ID | Utility | Description of Project |
|------------|--------------------------|--|
| 271 | San Diego Gas & Electric | The battery energizer creates a high frequency pulse into the charging on lead-acid batteries to prevent and reverse sulfation, which is the major cause of battery failure. Also, battery energizers decrease the amount of energy used to re-charge batteries |
| 272 | San Diego Gas & Electric | The frictionless chiller is digitally controlled with a totally oil-free compressor. The chiller utilizes magnetic bearings & bearing sensors and a permanent magnet synchronous motor for very high-efficient and low noise operation. |
| 274 | Pacific Gas & Electric | The objective of this project is to quantify the savings from the use of solar tubes as day lighting sources in relocatable classrooms. Specifically, the classrooms would be retrofitted after baselining to determine the extent to which the use of solar tubes for primary lighting can cut the use of lighting power in the classroom. Monitored data would be used to analyze the savings and to calibrate computer models which would allow the determination of impacts around the state and on the HVAC system of the classroom. |
| 275 | Pacific Gas & Electric | Demonstrate and assess energy and demand savings impacts of the following technologies and design strategies at three sites in northern and central California: · Variable air volume (VAV) for exhaust hoods, including applicable controls, · makeup introduced through backwall supply and/or ceiling mounted perforated plenums, · the addition of side panels to hoods to promote capture, · replacing vane diffusers with perforated diffusers (also to promote capture), and · evaporative cooling of makeup air (depending on climate location and store operating characteristics). |

| Project ID | Utility | Description of Project |
|------------|------------------------|--|
| 276 | Pacific Gas & Electric | PG&E has commissioned a study which will identify, technically evaluate, and examine market readiness for all existing residential air conditioner charge and air flow verification services. Verification service companies train, certify, list and collect testing data for independent contractors who agree to participate in charge and airflow verification. The verification service provides charge and air flow data which can be used to document energy savings. |
| 278 | Pacific Gas & Electric | This project will investigate technical opportunities for and barriers to tankless (a.k.a. instantaneous) natural gas water heater use in residential single family and multi-family buildings, initially for new construction applications and in the future, for retrofit applications. |
| 279 | Pacific Gas & Electric | This project includes the design, installation, energy usage monitoring, and user/visitor satisfaction measurement for a High Color Temperature Lighting System at a demonstration site with significant target market visitor traffic. The design will demonstrate best lighting design practice utilizing High Color Temperature Lighting in a real working environment. The intent of the project is to confirm user acceptance of High Color Temperature Lighting and provide a venue where the target market can view the energy-saving benefits of the technology. |
| 280 | Pacific Gas & Electric | Three tools for diagnosing Air Handler Unit (AHU) problems will be demonstrated and compared to evaluate their attributes in diagnosing problems with air distribution systems. |
| 281 | Pacific Gas & Electric | The purpose of this project is to evaluate and compare the performance of two types of advanced evaporative coolers to the traditional evaporative cooler. The results will allow validation of energy savings and other manufacturer performance information. |
| 282 | Pacific Gas & Electric | This scoping study builds on the multi-agency Integrated Design Charrette for energy efficient data centers that took place February 2-3, 2003 at the Pacific Energy Center. Scoping work will focus on the areas of uninterrupted power supply (UPS), high efficiency cooling strategies, and the "hyperserver" concept to identify opportunities for future emerging energy efficient technology demonstration projects. |

| Project ID | Utility | Description of Project |
|------------|-------------------------|--|
| 344 | Southern California Gas | An assessment of process savings over time will be conducted to determine energy and cost savings and system reliability at a medical device manufacturing concern where product quality and process reliability are extremely important. |
| 345 | Southern California Gas | A manufacturer of plastic parts has purchased and installed a 1 MW on site generation system (3 rich burn engines). We are evaluating the coupling of this system with a Nishiyodo adsorption chiller, driven by heat recovered from the engines. |
| 346 | Southern California Gas | This is one of several anticipated evaluation/assessments of a water-based professional garment care business transformation. In this case the equipment is Miele and the working hypothesis is that it provides the owner with significant energy and wastewater savings. |
| 347 | Southern California Gas | In an effort to use the flexible fuel feature of microturbine combustion, we are attempting to optimize power output and consumption of bio-gas derived from dairy cows |
| 348 | Southern California Gas | In the first of several intended trials of the PACRAT HVAC modules, several building at the USC campus will be chosen to have the EMS information extracted, uploaded, and reviewed through PACRAT in order to attempt to trend performance and identify faults and inefficiencies. |
| 349 | Southern California Gas | There are several technology strategies emerging that allow for energy efficiency gains in IC Engine performance. This project will investigate the gains from a lean burn concept incorporating patented HPDI technology (high pressure direct injection) of a small amount of diesel fuel into the fuel delivery system. Results are anticipated to show emissions reductions as well as efficiency gains. |
| 350 | Southern California Gas | This project is one of several anticipated to demonstrate the effectiveness and scalability of a new technology for large firetube boilers to both reduce NOx pollution while maintaining or improving the combustion efficiency of the boiler. This project involves a larger burner than the Fullerton College site. |
| 351 | Southern California Gas | A central thermal regenerative oxidizer system will be demonstrated and evaluated at a customer's printing plant facility. |

| Project ID | Utility | Description of Project |
|------------|----------------------------|---|
| 352 | Southern California Edison | This assessment project will produce a field study report for a site, and estimate the potential savings for water and wastewater membrane plants within SCE's service territory. |
| 353 | Southern California Edison | This assessment project will determine the electric demand and energy impacts of high-end Professional Wet Cleaning equipment at Black Tie Cleaners. This project is a partnership between Southern California Gas Co., the South Coast Air Quality Management District, Occidental College, and SCE. |
| 356 | Southern California Edison | Food processing plants use refrigerated storage facilities to preserve foods for processing until shipped to market. The efficiency of the refrigeration system depends on many variables including the outside air temperature. This assessment project will use advanced controls to reduce refrigeration system operating hours during the day. The strategy allows the indoor temperature to float relying on the facility's and product's thermal mass during the hottest part of the day and to sub-cool the facility and product at other times. The lower ambient air temperatures for heat rejection should improve the refrigeration system's operating efficiency. |
| 357 | Southern California Edison | This assessment project will determine the demand and energy impacts of silicon based dry cleaning equipment. This project is a partnership between Southern California Gas Co., Occidental College, and SCE. |
| 358 | Southern California Edison | This assessment project will determine the demand and energy impacts of hydrocarbon based dry cleaning equipment. This project is a partnership between Southern California Gas Co., Occidental College, and SCE. |
| 359 | Southern California Edison | This assessment project will determine the demand and energy impacts of CO2 based dry cleaning equipment. This project is a partnership between Southern California Gas Co., Occidental College, and SCE. |
| 360 | Southern California Edison | This assessment project seeks to determine the demand and energy savings potential of managing the power management settings of networked personal computers through both local and wide area networks. The assessment is underway using SCE's network facilities using a commercially available client-server software system for Windows based computers. |

| Project ID | Utility | Description of Project |
|------------|----------------------------|---|
| 361 | Southern California Edison | This assessment project will determine the impacts of retrofitting a rapid start “Super” T8 fluorescent lighting system into the boiler and chiller mechanical room at the Los Angeles County Internal Services Division’s Los Padrinos Center in Downey. |
| 362 | Southern California Edison | This assessment will document the costs and impacts of retrofitting the lighting system of several building areas of a church in Covina. The retrofits include the church assembly, dining, and classroom areas. The instant start system allows for longer wiring distances, parallel lamp circuits, less complicated wiring, a somewhat lower initial investment, and a reported higher savings potential than rapid start systems. The reported main drawback for the instant start system is that they may not operate below 60 °F. |
| 363 | Southern California Edison | New inorganic coatings and cleaning processes for air conditioner condensers and evaporators have become available. The coatings, cleaning, and application processes are reported to significantly restore the operating efficiency of existing air conditioning units, and reduce the rate of their future degradation. This assessment will verify and expand upon the test results from the Florida Solar Energy Center. The assessment will establish an initial set of deemed savings estimates, as well as time-of-use profiles, measure cost and life, for potential use in energy efficiency program planning. |
| 364 | Southern California Edison | The technology will be installed in SCE’s High Performance Classroom at the Customer Technology Application Center (CTAC) facilities in Irwindale. The classroom remained under construction during the third quarter of 2003. The High Performance Classroom combines multiple emerging technologies into a single classroom. This assessment builds upon research from PIER Contract No. 500-01-023. Electrochromic windows can be darkened or lightened electronically allowing the windows to be used as energy-saving devices. |
| 366 | Southern California Edison | An advanced T5 HO fluorescent lighting system with dimmable ballasts and daylighting controls will be installed in the High Performance Classroom demonstration at SCE’s CTAC facilities in Irwindale. The advanced lighting system will work in conjunction with the classroom’s electrochromic windows. |

| Project ID | Utility | Description of Project |
|-------------------|----------------------------|--|
| 368 | Southern California Edison | A displacement ventilation system will be installed in the High Performance Classroom demonstration at SCE's CTAC facilities in Irwindale. |

3.2 Implementation of Past Recommendations

The project initiation meeting for the evaluation of the PY2003 Statewide and Local Emerging Technologies Program took place on April 21, 2004. At that time, a short review of the previous evaluation conclusions and recommendations occurred to determine the current status of those recommendations. As the previous evaluations were not available to the ETP program staff until late in 2003 or early 2004 (the PY2002 Statewide ETP Evaluation final report was dated 12/23/03 and the PY2002 ETP Local Evaluation was dated 2/26/04), it was acknowledged that no changes would be seen in the evaluation of the PY2003 program. However, knowledge of possible changes in PY2004 or beyond based on the recommendations would help focus future evaluation efforts.

There were eight main conclusions and recommendations brought forward to the group during the project initiation meeting. They are indicated below with the current status. The excerpt of the full recommendation section of the PY2002 evaluation report is included in Appendix A.

1. **Emerging-Technology Database:** Discussion of the recommendations has occurred within the ETP program managers and funding has been allocated for work in 2004 to create changes within the database and ETCC website. A scoping document has also been created by the utilities for this work. A review of the changes may be useful within the PY2004/2005 evaluation.
2. **Program-Tracking Database:** While the program managers understood the need for a detailed program tracking database that would supply specific information for future evaluations of their program, all indicated that the current funding level was insufficient to assure that an actual database be created to meet this recommendation. They acknowledged that specific variables such as contact names, lists of seminars, etc. are available in other formats, such as hard copy. They agreed that they could pull this information together for future evaluations, but not in a database type of format. At the time of the project initiation meeting, the evaluation team agreed to provide a high-level list of crucial data to the program managers so they can start making sure that this type of information is collected for PY2004 and PY2005. This document was sent out to the program managers on 5/19/04 and is included in this report in Appendix B.
3. **Technology Selection and Information Dissemination:** The program managers indicated that many of the project managers used different sources other than the recommended market share and potential studies to determine appropriate technologies to pursue within ETP. They indicated that there were resource constraints to fully using secondary data sources as suggested by the previous evaluation. There was some discussion about the template that SCE has created and shared with the other utilities on information about potential new technologies to include in the program, but it did not appear that this approach for documentation of project choices was really planned to be used by all four utilities. There are seminars planned in PY2004 for information dissemination by SCE while SoCalGas updates their regional account executives on current technologies in the program and PG&E works with internal staff to make them aware of projects.
4. **Refine Program Theory:** It was agreed at the time of the project initiation meeting to perform this work in the current PY2003 evaluation. An overarching program theory

would have been determined with each utility potentially have a more detailed theory logic model that pulls out the specific approach they may have and how they work within the larger logic model. However, as time went on and the program design for ETP remained ongoing, it was decided to drop this from the PY2003 evaluation and, instead, be included in the PY2004-2005 evaluation.

5. **Track and Document Project Selection:** There was much discussion about the ability to filter through crank calls and “snake-oil” salesmen, but with no real resolution. It was agreed that there probably should be some ability to have people interested in projects seen on the ETCC website contact the program, but no specifics were indicated.
6. **Develop Final Information Dissemination Plan for Each Project:** There was concern expressed by the program managers about legal issues around failed projects. They felt that the fact that there were failures in the program should be acknowledged, just not the specific name of the project.
7. **Prepare Project Close-Out Report:** There was no discussion on this point.
8. **Future Evaluation Efforts:** There was no specific discussion on this point.

Thus, to date, some of the recommendations have been implemented and discussions regarding the others have taken place. Others, such as refinement of the program theory, have not taken place because, at the time this evaluation report was developed, the ETP program managers state that the program is undergoing significant changes in design and delivery.

While this report is abbreviated, it provides the verification that the utilities met their expected objectives during PY 2003. Because of the renewed acknowledgement by the State in 2004 of the high need to prioritize emerging energy efficiency technologies and the expected influx of funding for PY 2006 and beyond for these programs, future evaluations of these two programs will necessarily be expanded. These future evaluations are expected to be multifaceted, possibly using statistical analyses, case studies, surveys, value-cost analyses, and other methodological approaches to measure the effectiveness of the programs.

Appendix A
Excerpt from PY2002 Statewide Evaluation Report
Recommendations and Conclusions (Section 6)

6 Conclusions and Recommendations

6.1 The Emerging Technology Coordinating Council

Both the frequency of ETCC meetings and topics discussed seem appropriate. In addition, the ETCC is an effective forum for sharing information among its members and a strategically sound mechanism for coordinating the statewide emerging technology effort.

6.2 Emerging-Technology Database

Overall, the Emerging Technologies Database (the database) appears to have met its original purpose of serving as a repository for information about emerging technologies. With respect to the database, we recommend the following:

- The database should have a unique identifier for each project. The structure of the database should allow a unique project to have multiple technologies associated with it.
- Variables within the main tables for which all data are missing should be reviewed and updated to include relevant data as necessary.
- Full documentation of the database structure and definitions of the terms within the database should be prepared. A dictionary of each of the variables should be created along with a full description of the structure of the database and how records should be added. This information is mandatory for a database for which multiple parties have responsibility for updating. Written instructions will insure that all terms are being used correctly and that all information is correctly entered. This will improve the overall consistency with which multiple users enter data.

For the data that are available in summary form as PDF documents on the ETCC website, we make the following recommendations:

- On the web site, describe the various files that are available and how they can be used to find information.
- Create the ability to contact project managers regarding specific technologies and/or projects.
- Fully describe and populate the variables that are used within the summaries so that interested parties can understand what is within the summary.
- Each project indicated within the report summaries should have a unique identifier

6.3 Program-Tracking Database

To insure that the ETP is accountable to the CPUC and more easily evaluated in the future, we recommend that a Program Tracking (PT) Database be created by each utility. With respect to the program-tracking (PT) database, we recommend the following:

- The core variables collected and stored in the PT Database should satisfy the needs of the various stakeholders, including the CPUC, program managers, and the EM&V staff within each utility.
- Full documentation of the PT Database structure and definitions of the terms within the database should be prepared.
- The PT Database must be built so that specific variables can be merged at the project level with the ET Database.

6.4 Regulatory Framework

In this section, we address regulatory uncertainty and as well as the CPUC's definition of effectiveness.

First, the number and type of technologies and their duration have to some extent been affected, since 1998, by the year-to-year uncertainty regarding the existence and levels of funding. This uncertainty and changes in budget amounts very likely affected whether certain projects were initiated and decisions to terminate existing projects. The importance of multi-year funding necessary for long-term stability for such programs as the ETP cannot be over-emphasized.

With respect to effectiveness, we begin by noting that the Energy Efficiency Policy Manual (CPUC, 2001) provides only very general guidance regarding the evaluation of information-only programs. The two *evaluation* objectives that were relevant for information-only programs were to:

- evaluate program success by measuring indicators of program effectiveness and test the assumptions underlying the program theory, and
- provide ongoing feedback and corrective guidance regarding program design and implementation,

The best way to evaluate effectiveness is to focus on measuring the extent to which the agreed-upon program objectives have been met. If they are met, then the program is deemed successful.

The ETP program objectives negotiated by utilities with the CPUC and presented in their Program Implementation Plans were to:

- conduct a certain number of technology assessments (the number varied by utility), and
- update the ET database.

Thus, the only *official* indicators of ETP effectiveness were whether the utilities conducted the agreed-upon number of technology assessments and whether they updated the database⁵. Of course, by focusing only on these two objectives, one clearly risks ignoring the other equally important objectives of the ETP such as the systematic and comprehensive screening of

⁵ Of course, after the fact, one can, guided by the ETP program theory, embrace other objectives. However, the only objectives that are likely to matter are those that are agreed-upon *a priori*. Failing to meet the agreed-upon objectives while at the same time arguing *ex post* that other objectives equally important objectives have been achieved is likely to be a quixotic exercise.

candidate technologies, the dissemination of the results of demonstration projects, and changes in awareness, knowledge, and attitudes towards specific emerging technologies among the various target audiences. This failure to adequately consider all the objectives of the ETP has two important consequences.

The first consequence is that the nature of the ETP is often misunderstood, and as a result, its performance only partially documented. The second consequence is that while, on its face, the funds available for the ETP in 2002 were sufficient to achieve the *two* objectives stated in the implementation plans of the four IOUs, it becomes clear that the level of funding is inadequate when these other objectives are taken into account. By focusing on the two official objectives, one can lose sight of the fact that there are other equally critical activities and goals that also require adequate funding. For example, the dissemination activities that were necessary to adequately inform all the relevant targeted markets could not be fully implemented due to a lack of funds.

Another issue is that the number of technology assessments that should be conducted in any given program year should take into account both the energy policy goals of California and the number of promising technologies emerging from the PIER Program and other research organizations. In the current aggressive resource acquisition framework, for the ETP to be unable to explore all promising technologies is suboptimal. In-depth interviews indicate that there are additional PIER technologies that cannot be reviewed or investigated further by the ETP due to a lack of funds.

The extent to which such key activities are under-funded and promising technologies are left unexplored might make it more difficult to achieve and even surpass the maximum achievable energy efficiency potential identified in Rufo and Coito (2003a and 2003b)⁶. Capturing this potential requires a steady flow of new, more efficient technologies into the portfolios of energy efficiency programs. Failure to do this means that the savings associated with the current energy efficiency program technologies will shrink as the efficiency of the baseline technologies and efficiency standards rise.

Thus, we recommend that key stakeholders, prior to the implementation of the 2004-05 ETP or prior to the end of the first quarter of 2004, establish additional, measurable objectives that address the *key* linkages in the ETP logic model. Some of these new objectives could be related to activities currently carried out by the ETP such as the screening of new technologies, dissemination of information about emerging technologies to targeted audiences, and deployment of new technologies into utility, third-party, or municipal energy efficiency programs or directly into the market. This does not mean that evaluators should ignore other

⁶ We recognize that the Rufo and Coito (2003a and 2003b) did not explicitly consider emerging technologies due to the uncertainty about which and when certain technologies might emerge. They state: "In addition, our original scope was also limited to commercially available measures; thus, few emerging technologies are included. This is again appropriate for a medium-term view of potential, but as one forecasts further into the future, the effect of excluding emerging technologies is to underestimate long-term potential.

As a result, savings decline over time as the gap in energy use between standard equipment and efficient equipment narrows. In order for savings not to decline over time requires that a steady stream of emerging technologies be deployed into energy efficiency programs and into the market.

important linkages but that evaluators should focus most of the efforts on measuring progress towards meeting formally agreed-upon objectives. We emphasize that all objectives should be established in light of the eventual budgets for 2004-05. If the budgets for 2004-05 are decreased, we recommend a proportional scaling back of all ETP activities and goals rather than completely dropping a key activity or activities.

Second, we recommend that the number of promising technologies explored be expanded in order to avoid missed opportunities. A third recommendation that follows from the first two is to increase substantially ETP funding. All three recommendations are designed to increase the likelihood that all achievable energy efficiency potential will be realized.

6.5 ETP Projects, Technologies, and Transfer

Clearly, the ETP has a multi-year focus and has extensive activities going on in any one calendar year. Budgets allocated in one program year are spent across multiple years, with a typical project lasting 2.5 years. The majority of technologies within the program are considered to be in the commercial introduction stage. However, there are many projects in which a more mature technology is being introduced to a new market sector. ETP covers a wide range of end uses, from HVAC to lighting to manufacturing processes. Within 2002, there were eleven projects completed. Over half of the completed projects were described as having been transferred to an energy efficiency program (either within an incentive program or an information program). Only one of the eleven completed projects was not recommended as worth pursuing. With respect to sectors, 74 percent of the ETP projects cover the commercial sector while 36 percent cover the industrial sector.⁷

The type and number of projects, the time to complete them, and the rate at which they are being deployed into energy efficiency programs or into the market seem reasonable given the resources available.

6.6 Technology Selection and Information Dissemination

Project managers use a variety of strategies and sources to identify new ETP technologies and disseminate information. However, these efforts could be strengthened by improving market research and targeted marketing. Having such skills would assist the ETP in identifying such specific information as market potential and customer wants and needs regarding new technologies and crafting new-product marketing campaigns targeted at specific market segments/actors among the early majority, which is critical if the chasm is to be effectively bridged (Wiefels, 2002; Moore 1995; Moore, 2002). Having these skills would also assist the ETP in establishing mechanisms by which contact information for the various market actors targeted by the various ETP outreach efforts is collected and stored. Having this contact information will allow future evaluations to assess the various outreach efforts and their impact on awareness, knowledge, and attitudes regarding emerging technologies. We conclude by noting that the ETP and utility energy efficiency programs can collaborate on marketing to the extent that the latter possess the necessary new-product marketing expertise.

⁷ Because there are projects that cover more than one sector, the percentages sum to greater than 100%.

Currently, the Internet is not used to its full extent as a tool for disseminating information about ETP. We recommend that the statewide ETP determine the best approach to using the various IOU websites and update these sites appropriately. This would minimally include information about the program projects, past projects, and contact information.

Finally, we have one key recommendation regarding the design of the ETP. We noted earlier that the ETP focuses on providing utility-sponsored energy efficiency programs and the market with a steady stream of new technologies. This basic model should be modified so that third-party energy efficiency programs can benefit from the same information. A formal mechanism such as formal, regularly scheduled workshops could be established so that information about those technologies that are ready for deployment can be shared.

6.7 Program Logic Validation

In addition to addressing the extent to which the four IOUs met the two main ETP objectives (conducting a certain number of technology assessments and updating the ET database), the evaluation team was also able to test 6 linkages from the program logic model. The data presented in the previous sections can now be used to validate 6 of the linkages in the program logic model. Validation included the assessment of whether the activity or output was observed and the quality of the activity or output. The results are summarized below in Table 6-1.

Note that the hypothesis for each linkage is often tested using more than a single piece of information. Also, recall that this evaluation was focused on process rather than impact. As a result, it focused on activities and outputs rather than outcomes and impacts. The linkages that we attempted to verify are only process-related linkages.

Based on the available evidence, we were able to observe activities associated with 6 linkages, with all but two linkages receiving moderate or strong support. Those linkages receiving weak support are concerned with the use of market-related primary and secondary research to identify potential demonstration projects, to disseminate the results of demonstration projects, and to create strategic marketing campaigns.

Table 6-1. Validation of Program Logic

| Linkage | Expected Activities & Outputs | Weak Validation | Moderate Validation | Strong Validation |
|---------|---|-----------------|---------------------|-------------------|
| 7 | ETP staff are informed by the technology-application attributes. | | | X |
| 8 | ETP staff use information on customer segment attributes to identify potential demonstration projects and to craft strategic marketing campaigns. | X | | |
| 9 | Emerging Technologies Coordinating Council and ETP engage in on-going two-way communications to better | | | X |

| Linkage | Expected Activities & Outputs | Weak Validation | Moderate Validation | Strong Validation |
|---------|---|-----------------|---------------------|-------------------|
| | coordinate the statewide emerging technology effort | | | |
| 10 | ETP staff select and pursue demonstration projects of emerging technologies. | | | X |
| 13 | The results of demonstration projects are deployed to energy efficiency programs. | | | X |
| 15 | Results of demonstration projects are disseminated through various means. | X | | |

We repeat the point made earlier regarding utility-specific variation in ETP program design. It's important to recognize that the definition of the *statewide* ETP program should be defined by a common set of linked activities, outputs, and outcomes across all four IOUs. It will be those linkages that should receive most of the attention from evaluators. However, we recognize that the ETP should be allowed to vary somewhat in order to respond to the unique customer characteristics, customer mix, weather, and economics that characterize the four service territories. Subject to budget constraints, future evaluations should also examine those program design features that are unique to each utility program.

6.8 New Evaluation Model

We begin by noting that, because the ETP activities with respect to selected technologies require more than one year to complete, an evaluation of the ETP should cover at least one cycle. This would allow evaluators to more consistently and accurately observe the implementation of the program and measure any impacts.

Next, we address the issue of cost-effectiveness for information and education programs such as the ETP. In the PY 2002 Program Implementation Plans submitted by the four IOUs, it states:

There is no estimate of energy, capacity, therm savings, or cost effectiveness for this information program. Although it is the intention of each energy efficiency program to encourage the efficient utilization of electricity and/or natural gas, the calculations performed for the 2002 program cost-effectiveness utilize energy, capacity, and therm savings estimates for measures and programs for which there is a lower degree of speculation. The lack of energy savings, capacity savings, therm savings, resource benefits, or a TRC ratio for any particular program (i.e., information programs) should not imply that a measure or program does not promote energy efficiency nor should it imply that there is not an impact to the customer's use of electricity or natural gas or a corresponding impact to the electricity or natural gas system. However, pursuant to the CPUC's approved Energy Efficiency Policy Manual, this proposal for an information-only program is not reasonably expected to provide an estimate of energy savings.

We suggest that this does not mean that some assessment of the effectiveness of the ETP, with its multiple objectives, as compared to its costs cannot be carried out and tracked over time. Key stakeholders need to know whether energy efficiency-related emerging technology demonstration and deployment activities are effective. Having an index, such as a cost-effectiveness ratio (Levin and McEwan, 2001), makes it possible to evaluate a program and compare it to an *a priori* standard or track its performance over time.

We note that the recently-released draft of the protocols for the evaluation of information and education programs⁸ recommends many of the evaluation strategies contained in our initial and final research plan for the ETP.

⁸ Draft Information/Educational Program Evaluations. Prepared by TecMRKT Works Framework Team for the Southern California Edison Company as mandated by the CPUC, November 6, 2003

Appendix B
Data Collection Memo
from Evaluation Team to ETP Program Managers

R I D G E & A S S O C I A T E S

M E M O R A N D U M

DATE: May 19, 2004
TO: Angela Jones; Rafael Friedmann; Mary Wold;
CC: Gregg Ander; Henry Lau; Jon Livingston; Ed Becker; Michael Guin; Gerry Humphrey
FROM: Richard Ridge, Mary Sutter, and Rob Bordner
RE: Tracking Data for the PY 2003 Emerging Technologies Program

This is a list of major items to keep track of for EM&V purposes. We provide this list now so that opportunities to collect information that we consider to be critical to the EM&V effort are not missed. We will provide a list of additional variables as other performance indicators are identified. While it would be better if this information were kept electronically, it is understood that this cannot always happen due to resource constraints by the program.

Information Dissemination

- Seminars/workshops - name of seminar, date, length of seminar/workshop, location, # in attendance, contact information for those in attendance, the emerging technology discussed in seminar, and all presentation materials and handouts.
- Reports on projects – name of report and project ID associated with the report, where located (i.e. on web, at ERC or PEC), how disseminated, approximate # disseminated. To the extent that marketing involved direct mailing or e-mailing, we will need the complete mail or e-mail list.
- Fact sheet/brochure/pamphlet – copy of item, how disseminated, approximate # disseminated, project ID associated with item, and contact information. To the extent that marketing involved direct mailing or e-mailing, we will need the complete mail or e-mail list.
- Demonstrations (showcases) – location and contact information for demonstration site, fact sheet on technology being demonstrated, and project ID associated with demonstration.
- Any other venue of information dissemination such as conferences attended where a paper was given or publications (e.g., journal articles, newsletters) not included above should be noted. EM&V will need to know the date, location, copy of information disseminated, approximate # of people to whom the data was provided, and any relevant bibliographic information.

- A list of all efforts to deploy technologies to utility and/or third party programs. Such information could include a list of meetings, dates, attendees, and e-mails.

Projects

- Name and project ID of projects initiated in 2004 or 2005
- Name and project ID of projects active in 2004 or 2005 (regardless of year of technical assessment and when the \$\$ were encumbered)
- Name and project ID of projects concluded in 2004 or 2005. It is assumed that the ultimate fate of this technology would be contained in the database and the EM&V team would be able to easily determine its ultimate status through the project ID provided.