PGE2011 EMERGING TECHNOLOGIES

2006 - 2008

1. Projected Program Budget	$11,790,141
2. Projected Net Program Impacts This is an information only program	
3. Program Cost Effectiveness This is an information only program	

4. Program Descriptors

This statewide program is similar to the existing program with minor modifications.

5. Program Statement

The statewide Emerging Technologies (ET) program is an information-only program that seeks to accelerate the introduction of innovative energy efficient technologies, applications and analytical tools that are not widely adopted in California. Emerging technologies may include a range of products including hardware, software, design tools, strategies and services. A daunting number of market barriers must be overcome for a new energy efficient product to gain acceptance. As the typical product life cycle in Figure 1 illustrates, during initial marketing efforts, products accepted by innovators may fail to gain wider acceptance with more risk-averse customers, and the product's adoption rate may fall off into the chasm.

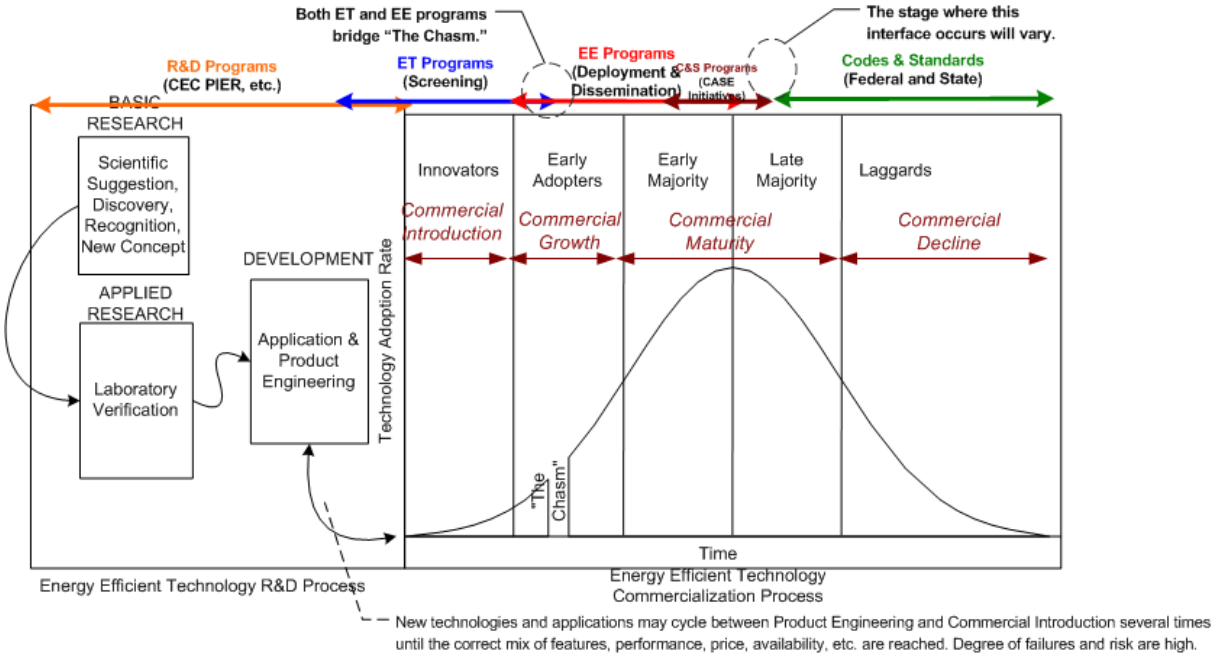

Figure 1. Energy Efficient Technology Commercialization Process

The ET program accelerates a product's market acceptance through a variety of approaches, but mainly by reducing the performance uncertainties associated with new products and applications. In addition, the program managers may investigate opportunities with industry, the California Energy Commission and others to develop new, innovative and cost effective energy efficient technology enhancements to existing products. The ET program targets all market segments.

6. Program Rationale

The ET program is currently classified as an information program. Energy efficiency programs cannot remain static in the face of ever evolving customer needs and program portfolios. As the next generation of energy efficient technologies and applications emerge, they face market hurdles that may either delay their introduction or consign them to failure. The ET program is a statewide program that seeks to identify and help overcome those barriers and to gain acceptance of innovative energy efficiency options that are not widely adopted in California. As shown in Figure 1, the program forms an important link between new energy efficient technologies and applications emerging from the research and development (R&D) cycle and their introduction into the marketplace. It also shows the relationship of the Emerging Technologies program, the energy efficiency programs, and the Codes and Standards program over the product life of the technology.

In 2004 and 2005, utilities and the California Energy Commission's (CEC) Public Interest Energy Research (PIER) staff met to discuss and coordinate future statewide activities through the Emerging Technologies Coordinating Council (ETCC). As a result of ETCC planning efforts, the proposed 2006-2008 statewide ET program will be slightly different from the 2004 and 2005 program. The synergy between R&D programs, like PIER, and the utilities' ET program is working well and will continue. However, the overall objective for the ET program is to verify the performance of new and innovative products for the integrated portfolio supporting resource acquisition. The success of the energy efficiency programs will depend on the types of products that can achieve the greatest demand reduction and energy savings. It is also important that a balance of new innovations for various market segments, including residential, commercial, industrial and agricultural, be achieved. PG&E has developed enhanced ET project selection criteria to create an ET portfolio that meets all of these energy efficiency programs' objectives.

Through PIER, the CEC helps to develop, test and demonstrate products up to the end of the R&D cycle. During the 2004-05 meetings, the PIER program managers and contractors reviewed with the utilities those projects and technologies that have advanced enough to warrant utility ET program consideration, given the stronger future focus on the energy efficiency programs' success criteria.

At PG&E, work is progressing on several ET assessment projects based on PIER technologies that are in their final development stages. In addition, program staff may investigate opportunities with manufacturers, CEC PIER, and others to develop new, innovative and cost effective energy efficient technology enhancement to existing products. ET program staff briefed and prepared materials for the energy efficiency program planners regarding emerging technology applications that may be considered ready for the 2006 - 2008 energy efficiency programs.

7. Program Outcomes

The aim of the ET program is to develop all the necessary information required for the energy efficiency program to employ the technology to achieve their energy savings goal. That information includes verified energy savings and demand reductions, market potential and market barriers, incremental cost, and the technology's life expectancy. The ET application assessments are critical to inform other EE program measure development activities by utility and third-party energy efficiency programs and to produce refined estimates and expectations of future energy savings.

The outcome of each individual energy technology is very difficult to predict especially for high-risk projects. It is expected that a few projects may not turn out to be successful. Even unsuccessful assessments may provide insight so that improvement can be made in the future.

8. Program Strategy

The utilities will deliver the program through custom demonstration projects, often working with targeted innovators and coordination efforts such as the ETCC ET database. Information transfer efforts disseminate project results through many different outlets, including the Energy Centers, utility personnel and community organizations. These information transfer activities leverage the utilities' overall energy efficiency communication efforts to disseminate information resources such as reports, fact sheets, design methods and tools developed through the demonstration projects.

9. Program Objectives

The ET program will initiate a wide range of new Emerging Technology Application Assessments during 2006 - 2008. New technologies will be selected for assessment depending upon the market potential of the innovation, market barriers, incremental cost, life expectancy of the technology, the cost of the assessment, and the time required for the assessment. Since the energy efficiency program managers are the recipients of those technologies, they will be involved in the selection process. In order to guarantee a truly integrated portfolio, it is necessary to provide technologies for all market segments although savings will vary between segments.

Assessments initiated in prior program years will continue until completion. Project results and information will be made available to targeted markets and the utilities' energy efficiency program planners will be briefed on emerging technology applications that may be considered ready for future efficiency program efforts. Once an assessment project concludes and the results are understood, many of the demonstrated applications become part of the portfolios of mainstream energy efficiency programs, form the basis of future energy-related codes and standards, or are adopted as standard design practice in the marketplace.

10. Program Implementation

The ET program consists of two parts: Assessment and Information Transfer, and the ETCC. Assessment and Information Transfer focuses on analysis of promising, early prototypes or commercially available technologies which have not yet obtained adequate penetration or acceptance in the marketplace. Emerging technologies may include hardware, software, design tools, strategies and services. Part of the assessment may include field demonstrations, conducted at either customer sites or in controlled environments, which provide design and performance information, and verify novel energy efficient systems. Verification helps to reduce market barriers inhibiting wider acceptance of a technology. Demonstration projects help to measure, verify, analyze, and quantify the potential demand and energy savings, and document customer acceptance of specific applications in different market segments. Small scale market potential studies will aid in understanding and documenting customer acceptance of specific applications in different market segments, better informing the process to create and prioritize a new EE measure. Information transfer disseminates the results of emerging technology application assessment projects in a way which is customized to reach the most appropriate target markets.

The ETCC is a statewide information exchange and coordination effort between Pacific Gas & Electric Company (PG&E), Southern California Edison Company (SCE), Southern California Gas Company (SoCalGas), and San Diego Gas & Electric Company (SDG&E), and the CEC PIER programs. The PIER programs, like other public and private R&D efforts, develop, test, and demonstrate prototype products. The utilities' ET efforts form an important link in the commercialization of emerging energy efficient natural gas and electric technologies and their applications. Program efforts to select technology applications for assessment projects include working with the CEC PIER program, members of the research and design communities, manufacturers, energy efficiency advocates, and public entities such as Electric Power Research Institute (EPRI), Gas Technology Institute (GTI), universities, E-Source, California Institute for Energy Efficiency (CIEE), The Air-Conditioning and Refrigeration Institute (ARI), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Illuminating Engineering Society (IES), Institute of Electrical and Electronics Engineers (IEEE), national laboratories, Department of Energy (DOE), Environmental Protection Agency (EPA), NASA, engineering firms,

industry and trade groups and customers. Contacts with these groups through both the individual utilities and the CEC PIER program constitute a large part of the public input the ETCC receives concerning energy efficient emerging technologies.

The ETCC will hold quarterly meetings to coordinate project activities, exchange information about specific customer projects and technologies, and discuss ways to enhance the utilities' statewide ET program efforts and collaboration with the CEC PIER, the ETCC Web site and the ET database. During ETCC business meetings, discussions concerning ongoing and/or proposed projects at times involve privileged customer information, business strategic and operational details, or privileged manufacturer product details that are too sensitive to discuss in an open forum. These exchanges are necessary to ensure truly effective coordination and collaboration effort between the utilities and the CEC PIER. For this reason, ETCC business meetings will not be open to the general public. At times, the ETCC may invite speakers to a portion of a work meeting to present advances in energy efficient emerging technologies that fit within the context and interests of the existing statewide ET program.

The ETCC will hold an initial public workshop to learn about available ET application opportunities from interested parties. Based on the number and quality of the responses, the ETCC will select an appropriate meeting format for the selected presentations.

Each utility's ET program consists of activities that may be coordinated with other utilities' approved ET programs and the CEC, and activities that are unique to each utility service area and customer base. The efforts that each utility undertakes, as part of the statewide ET program, will be guided and prioritized based on the following criteria: customer needs, coordinated ETCC activities, technology readiness, potential energy and demand savings, approved program funding levels, and other relevant objectives.

The program will focus on new energy efficient emerging technology assessment projects in 2006 through 2008. The ET program efforts form an important link between ongoing R&D efforts on energy efficient technology applications and their commercialization. Applications mature out of the R&D cycle at different times and are not always available for consideration during initial program planning efforts. Thus, program staff works to remain informed on a broad range of emerging technology applications from many information sources. Any of the technologies may prove to be a viable project candidate. Currently, some of the technology areas that PG&E may assess through the program and coordinate through the ETCC include, but are not limited to:

- Phase change construction material;
- LED lighting for display cases;
- Compact ceramic metal halide lighting;

- Duct sealer for commercial buildings;
- Evaporative condenser for residential air-conditioners;
- Advanced controls for boilers and industrial equipment;
- Building system diagnostics that advance toward continuous commissioning;
- High efficiency gas-fired rooftop HVAC units;
- High-efficiency, low-emission burner systems for boilers, process heaters, furnaces and commercial hot water and cooking equipment;
- New water heating products and systems;
- Emerging technologies connected with cost-effective thermal solar energy options;
- Collaborative demonstrations of "Cool Roof" technologies;
- Efficient agricultural field precooling systems;
- High-efficiency and highly reliable data center systems;
- High-efficiency water and wastewater treatment systems; and
- Innovative package air conditioners and evaporative coolers for hot, dry climates.

Of this broader range of emerging technology options that may be pursued, the table below shows those technologies already identified for development by the ET Program prior to 2006, their expected program years for implementation, and energy savings potentials (by percentage). New technologies will be added annually, beginning in 2006. This list is subject to substantial change each year as technology opportunity and market factors change potential for market savings in future years.

Example Technologies	Energy Savings Potential Compared to Existing Technologies (%)
Lighting • Wireless lighting and controls (2006-2008) • Daylighting (residential and non-residential, 2006-2008) • Light emitting diode lighting (2006-2008) • Compact metal halide lighting (2007-2008)	50
Space Conditioning and Building Integration • Evaporative cooling (2006-2008) • Cool roofs (2006-2008) • Thermal energy storage (2008+) • Night ventilation (2006-2008)	35

• Variable ventilation and controls (2007-2008) • Building system diagnostics (2006-2008)	
Plug and Phantom loads • Office equipment (2006-2008) • Home electronics (2006-2008)	50
Other • Water and wastewater technologies (2007-2008) • Solar end use technologies (2008+)	25

It is important to note that the less mature a technology is, the higher the risk that the technology may fail in an application. The identified risks are among the many factors that the utilities use to select technology applications for demonstration projects and to establish project contingency requirements. Starting in 2006, PG&E may direct some resources toward market research to achieve a better initial understanding of a technology's market potential in order to improve the overall selection process. The significant increase in budget requested for program years 2006 through 2008 will be used to increase the number and scope of Technology Application Assessments, improve the ETCC Web site and ET database, increase assessment information transfer activities, and comply with added program tracking requirements and increased risks due to working with less mature products emerging from research.

In past program years, the estimated specific costs of projects undertaken are reported in monthly workbooks once the projects are committed. These costs will continue to be reported as required in the reporting workbooks. Likewise, narratives discussing initiated assessment projects and their progress are provided in past narrative reports. As requested, these narratives will be expanded to include projects initiated in previous program years. As assessment projects are concluded, their results will be summarized in the annual report narratives including which associated products have since been incorporated into the utilities' energy efficiency program efforts.

11. Customer Description and Selection

Customers from all markets segments are eligible to host emerging technology application demonstration projects. In general, the information the program generates through its demonstration activities benefits all customers. One of the aims of an ET program is to explore the extent an application of a new technology will be used in various market segments, in order to characterize the widest possible deployment. Thus, the utilities seek opportunities to host appropriate demonstration projects at hard-to-reach customer sites.

The program does not use a mass marketing approach to finding interested customers willing to participate in an emerging technology application demonstration and does not enroll customers. The utilities may implement the program through custom demonstration projects. For projects that require a customer demonstration site, the program works with customers that are willing to accept the potential risks and

expenses associated with relatively new energy efficient technology applications. Residential and nonresidential customers from all market segments are potential participants. Figure 2 illustrates the general project and customer selection process. Customer site demonstration projects may come about in one of two ways:

- Customer "Pull." A utility account representative may approach the program staff on behalf of a customer interested in pursuing energy efficiency. The ET program staff will help the account representative address the customer's needs, and at the same time, consider a range of potential energy efficient emerging technology applications.

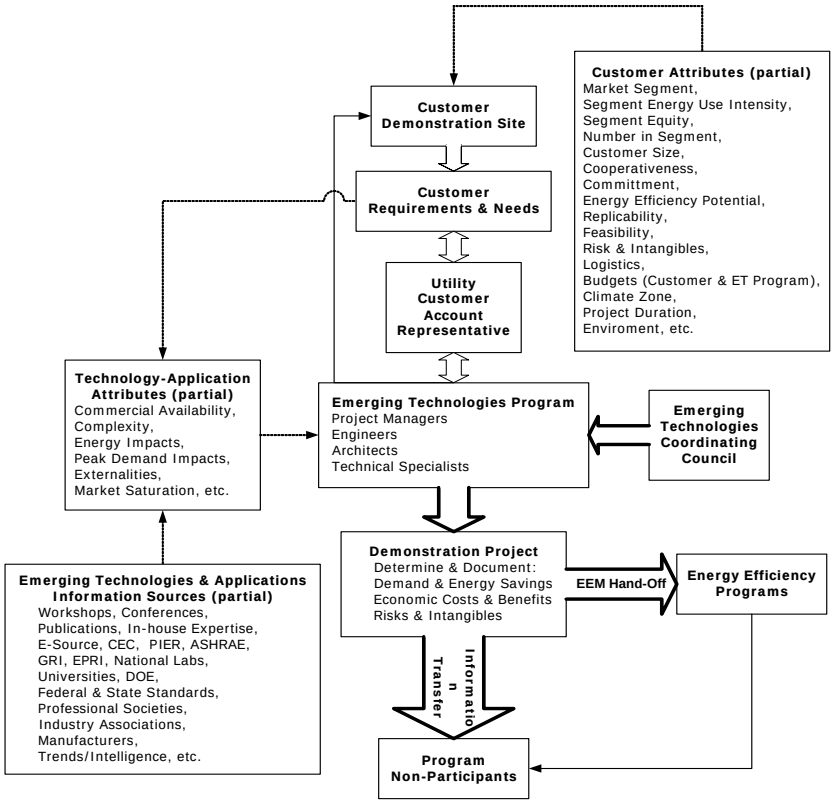

Figure 2. General Emerging Technologies Program Process

- Technology "Push." The second manner that a project may come about is that a significant new technology application emerges. ET program staff then approach the utility account representatives for a particular market segment, inform them about the new technology application, and ask them to help identify a potential demonstration site from among their customers. The program follows a targeted marketing approach to work with "innovators." These "innovators" may further influence other customers. Note that the utility's customer account representative plays an important role in the overall

process. For those projects that do not require a field demonstration at a customer site, the program staff seeks to develop the project targeting a customer's needs and requirements. This helps ensure that project objectives are aligned with customer needs and expectations.

Before a customer site demonstration project can take place, a legal agreement acceptable to both the customer and the utility is developed, negotiated, and executed. These agreements specify the terms of the projects, maximum duration, dispute resolution methods, termination provisions and general liability. It is important to note that some demonstration projects may require up to four years to complete, commencing on the date an agreement is signed with a customer. The time required to complete a project will vary due to how complex a new technology application is, construction schedules, building and process commissioning and logistics.

12. Customer Interface

Interaction with customers is unique to this program and typically results from the discovery from researchers, or utility staff that a customer is willing to take a higher level of risk and serve as a test bed for a new or improved product or process control scheme.

Other customers will benefit at a later stage through the different channels for information dissemination (e.g. workshops, training seminars, visits to the demonstrations and literature). Predominantly, this program is meant to inform the process of modifying existing or developing new energy efficiency measures for utility EE programs or third party efforts. It is usually by this method that the successes of the ET program will be made known to the residential commercial and industrial energy customers.

13. Energy Measures and Program Activities

13.1 Measures Information

Based upon the California Public Utilities Commission's (Commission's) approved Energy Efficiency Policy Manual, an information-only program is not expected to provide an estimate of energy savings. 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. Neither should it imply that there is no impact to the customer's use of electricity or natural gas, nor a corresponding impact to the electricity or natural gas system. Although this program does not create immediate short-term energy savings, it provides a clear, logical, and verifiable link between program activities and eventual energy savings.

The ET program performs assessments of emerging technologies. The number of emerging technology assessments initiated each year will be reported to the Commission and can be verified. Some of those assessments may include performance of field demonstrations at customer sites. These field demonstrations may take as long as four years to complete, especially at new customer sites. The progress of the project will be reported throughout the funding cycle.

The statewide ET program progress will be measured through the following three annual metrics:

- PG&E will perform a total of 45 ET Application Assessments over the three years period (2006 through 2008). The technology-application assessments may consist of a diversity of project types including: feasibility studies, simulation analysis, field demonstrations and pilots, controlled environment tests, commercial product development, design methodologies and tool development. Application assessment projects will be initiated throughout the program year to assess energy efficient emerging technology applications. Some assessments may take up to four years to complete.
- ET Database Enhancements and Updates. PG&E will collaborate with the other participating utilities to develop and maintain an enhanced database for reporting and transferring information connected with ET program activities. This database will replace that which is currently available on the ETCC Web site (www.ca-etcc.com). Each utility as well as the CEC will be responsible for providing the project information to the contractor who will incorporate it into the new database.
- Emerging Technologies Coordinating Council Meetings. PG&E will continue to be an active member of the ETCC and will participate in four quarterly meetings per year to ensure adequate inter-utility communication and cooperation. The ETCC will assess whether energy efficient emerging technology applications have reached a sufficient stage of maturity for the utilities to consider them in the statewide program efforts. In addition, to better monitor PIER progress, utility program staff members will attend PIER project meetings to remain current of PIER project developments.

13.2 Energy Savings and Demand Reduction Level Data

Section 13.2 is not applicable.

13.3 Non-energy Activities

After the emerging technologies are assessed, it is important to have the information transferred to the energy efficiency program managers as well as to the customers. Information transfer efforts disseminate project results through many different outlets, including the energy centers, utility personnel, community organizations and other

entities. These information transfer activities leverage the utilities' overall energy efficiency communication efforts to disseminate reports, fact sheets, design methods and tools developed through the demonstration projects.

13.4 Subcontractor Activities

The ET program staff is responsible for all aspects of the program. Subcontractors may be used to perform the actual construction and installation of the equipment and hardware at customers' sites. Subcontractors may also be employed to develop market potential data applicable to the ET portfolio.

13.5 Quality Assurance and Evaluation Activities

This statewide evaluation plan was developed in accordance with EM&V requirements as specified in the current Energy Efficiency Policy Manual. The Manual does not require the evaluation plan for this information-only program to have an energy savings measurement and verification component. Pursuant with Commission instructions, this plan should not be regarded as final. A final, more complete plan will be specified in accordance with the forthcoming new California Evaluation Framework at a later date.

- Process Evaluation: This task will include evaluation of program delivery mechanisms, marketing and delivery channels, timelines and customer satisfaction. The proposed evaluation plan contains two primary objectives: 1) to evaluate program success by measuring indicators (after determined) of program effectiveness and test the assumptions underlying the program theory, and 2) to provide ongoing feedback and corrective guidance regarding program design and implementation. The research will provide ongoing feedback and guidance on program implementation through customer behavior and market actor studies. It will measure indicators of the program effectiveness. Surveys undertaken as part of the process evaluation are likely to include participating and non-participating customers and trade allies.

- Market Assessment and Customer Behavior Analysis: These tasks will assist in assessing customer awareness, behaviors and practices given their participation in the Emerging Technology program. The data used will be drawn from the process evaluation survey of customers and from the verification data collected.

- Interim Impact Assessment and Feedback Analyses: These tasks will provide ongoing feedback to program managers on the impacts being achieved. The analyses will let the program managers know early what measures are capturing large savings opportunities and what are not progressing and recommend timely program changes. Program data on the number of sponsored technology assessments, field demonstrations, published articles, workshops, professional forums conducted and other information dissemination opportunities will be collected and reviewed to verify and document 2006-2008 program accomplishments. Information obtained from in- depth interviews with program staff and available data on the number of workshop and forum attendees

will provide supplemental information on program activities and accomplishments. In the past evaluation report, a recommendation to improve the design of the ET program tracking database was made. Future program evaluations will monitor the program's progress in accomplishing this goal.

13.6 Marketing Activities

The ET program is an information program. The only marketing is for information dissemination. Seminars will be presented at the PG&E Food Service Technology Center, the Energy Training Center, and the Pacific Energy Center, as well as other locations as appropriate. Seminars will be promoted through e-mail, Web site access, newspaper and trade association advertisements, posted seminar schedules and flyer mailings to targeted audiences.

14. Conclusion

This Market Integrated DSM program complements the rest of PG&E's portfolio, contributes to the overall balance of the entire portfolio and is designed to contribute to achieving the Commission's energy savings targets.

15. Appendices

Documents shared with PG&E's Public Advisory Group and at the Public Workshops on the development of PG&E's 2006-2008 portfolio can be found on PG&E's Web site at http://www.pge.com/rebates/program_evaluation/advisory_group/ .