Final Report: Evaluation of the California Statewide Emerging Technologies Program

Appendices

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For the

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Energy Division

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## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CEC</td>
<td>California Energy Commission</td>
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<tr>
<td>CEE</td>
<td>Center for Energy Efficiency</td>
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<td>CIEE</td>
<td>California Institute for Energy Efficiency</td>
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<td>CPUC</td>
<td>California Public Utilities Commission</td>
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<td>DEER</td>
<td>Database for Energy Efficiency Resources</td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
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<td>DSM</td>
<td>Demand-Side Management</td>
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<td>ED</td>
<td>Energy Division (of the California Public Utilities Commission)</td>
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<td>EE</td>
<td>Energy Efficiency</td>
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<td>EM&amp;V</td>
<td>Evaluation, Measurement, and Verification</td>
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<tr>
<td>ETCC</td>
<td>Emerging Technology Coordinating Council</td>
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<td>ETP</td>
<td>Emerging Technology Program</td>
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<td>IOU</td>
<td>Investor-Owned Utility</td>
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<td>MECT</td>
<td>Master Evaluation Contractor Team</td>
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<td>PG&amp;E</td>
<td>Pacific Gas and Electric</td>
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<td>PGC</td>
<td>Public Goods Charge</td>
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<tr>
<td>PIER</td>
<td>Public Interest Energy Research</td>
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<tr>
<td>PIP</td>
<td>Program Implementation Plan</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>SCE</td>
<td>Southern California Edison</td>
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<tr>
<td>SCG</td>
<td>Southern California Gas</td>
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<tr>
<td>SDG&amp;E</td>
<td>San Diego Gas and Electric</td>
</tr>
<tr>
<td>TTC</td>
<td>Technology Test Center</td>
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<td>VC</td>
<td>Venture Capital</td>
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</tbody>
</table>
# Table of Contents

**Appendix A: Results of Literature Review** ................................................................. A-1  
**Appendix B: Completed Performance Matrix** ......................................................... B-1  
**Appendix C: Business Risk Assessment Data Collection Tool** ............................. C-1  
**Appendix D: Degree to Which Market Readiness Has Been Assessed** ............ D-1  
**Appendix E: Preliminary Feedback on Business Risk Assessment Data** ........ E-1  
**Appendix F: Business Risk Assessment Scoring Tool** ............................................. F-1  
**Appendix G: Business Risk Assessment Scoring Matrix** ......................................... G-1  
**Appendix H: Aggregate Analysis Final Survey Instrument** .............................. H-1  
**Appendix I: Stakeholder Interview Guide** ................................................................. I-1  
**Appendix J: Case Study Summaries** ...................................................................... J-1  
**Appendix K: Master Database Developed by the Evaluation Team** .................. K-1  
**Appendix L: ETPdb Structure** ................................................................................ L-1  
**Appendix M: Synopses of Transferred ETP Technologies** .............................. M-1  
**Appendix N: Peer Reviewer Conflict of Interest Disclosure Form** ............... N-1  
**Appendix O: Peer Review Reports** ........................................................................ O-1  
**Appendix P: Response to Public Comments** ............................................................... P-1
APPENDIX A: RESULTS OF LITERATURE REVIEW

This literature review was planned to augment the evaluation of the program design for ETP and originally was aimed specifically at the information dissemination component of the program. The evaluation plan stated that the team would use this review to determine “exemplary practices among related programs.” However, the focus of the review changed for three reasons:

1) the programs discussed in the literature were not sufficiently similar to the ETP,
2) for articles that discussed aspects that were similar to ETP, the empirical data were sparse, and
3) the IOU information dissemination efforts were focused primarily on internal clients such as the energy efficiency program managers or account representatives.

The information being collected by the program is being disseminated to internal clients who use that knowledge to determine whether to add measures to their EE programs. Additionally, some of the internal clients use that information to inform their external customers, and a small number of external customers for SCE receive data directly from ETP in the form of seminars. The technologies considered by ETP are new and innovative; they are in an even earlier stage of market adoption than the technologies currently promoted by the IOU resource acquisition programs. Since the characteristics of the target market for technologies in this earlier stage of adoption is different than those in later stages of adoption, it is assumed that customers for these emerging technologies require a different approach than measures already included in the resource acquisition portfolio. The review findings now focus on the type of information needed by customers for successful use of new products rather than how others disseminate information to customers.

The majority of the literature search occurred in November and December of 2007; however, a few additional documents were found in early 2008. The search identified 86 relevant documents; nine documents were inaccessible. The team members briefly read each of the 77 obtainable documents and identified 15 for a more detailed review. This analysis consisted of reading through the document, extracting those parts that were particularly relevant and/or provided a point that we did not want to lose, and coding the excerpts into conceptual categories. Two of the sources, Everett Rogers' *Diffusion of Innovations*¹ and Geoffrey Moore’s *Crossing the Chasm*,² were thoroughly reviewed since they served as the conceptual framework into which the other 13 sources were placed. With the exception of one dissenting opinion,³ the conceptual

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³ Shove, E. 1998. Gaps, barriers and conceptual chasms: theories of technology transfer and energy in buildings. *Energy Policy* 26(15):1105-12. Shove is a sociologist who looks at the decision model in terms of very broad social, cultural, and technical reasons for energy demand that show up in people’s routine behavior. This is very different from the other articles that used the technology diffusion or social psychology framework for how individual people make decisions.
framework consisted of viewing energy efficiency adoption as: 1) occurring within a population that follows Rogers’ adopter categories, 2) attempting to reduce barriers to move people through the adopter categories, and 3) influencing decisions through purposeful communication. Multiple ideas in the Rogers book were substantiated by most of the articles, either empirically or indirectly. One study found evidence of the chasm theory put forward by Geoffrey Moore and two others used the idea of a chasm in their applied research. Rogers, on the other hand, specifically discounted any gaps or chasms in the adopter curve, preferring to hypothesize a continuous diffusion of technologies throughout the population. One could speculate that perhaps these differences are a function of thinking about the groups from a theoretical/empirical versus marketing stance.

In thinking about all the sources reviewed, what stands is the common emphasis on understanding the market for an individual product and communicating in specific ways to different groups within the market. The technological aspects of products were present, but minimized in most of the discussions. Companies trying to sell a new product have many sources of uncertainty, of which technological uncertainty is but one. Other sources include customer needs and perception, a conclusion supported by articles about intervention with customers. One article mentioned technology characteristics as an important factor in the success of a product, but most of the other articles mentioned knowing customers attitudes and providing good marketing as a way to garner success. Therefore, the main finding is not a specific listing of product information to assess, but the fact that a program must know what will appeal to the market. The concepts in Rogers’ *Diffusion of Innovations* are based on multiple empirical studies, are widely used, and should be carefully considered as a viable theoretical framework for ETP. (See Appendix A for the main concepts proposed by Rogers.)

Other interesting ideas brought out by these sources include the following:

- One source presented empirical data showing that new product success rate is around 60% once a product is released into the market, though the definition of “success” is not entirely clear. ETP has the option to work with technologies at various stages of market acceptance. For those in the earliest stages of market acceptance, about 40% will fail regardless of their potential energy savings. This may be a factor that ETP can consider in its screening criteria.

- Many new products are most likely incremental changes from previous items and not truly new or disruptive. Incremental innovation can be the result of many approaches, including new products or an upgrade or improvement of existing products. Conversely, disruptive

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5 Egmond, C., R. Jonkers, and G. Kok. 2006. A strategy and protocol to increase diffusion of energy related innovations into the mainstream of housing associations. *Energy Policy* 34:4042-4049. – the second study is not further referenced here since the same authors (Egmond, etc) provided it to the evaluation team as an unpublished document.


8 Ibid.
technologies typically present a brand new idea to consumers and may require the replacement of existing infrastructure or support systems. To the extent that end users are already familiar with – and using – existing products that are upgraded to produce energy savings, the incremental innovation may require fewer behavior changes than innovations that are disruptive. If an innovation is the result of an incremental change, there may be a lower likelihood for a chasm to exist between the early adopters and the early majority.

- There is evidence that the mere existence of a rebate can be a positive signal to consumers that the product is worthwhile to purchase.\(^9\) This is consistent with the basic objective of the ETP design which is to transfer technologies into the EE programs, which offer rebates.

- Ability of surveys to capture and place consumers into adopter categories.\(^10,11\) Both Rogers and Moore stress the concept that different people require different information as they implement technology. Research demonstrates that surveys can be used to reveal these differences. A better understanding of these differences would enable ETP to better reach the targeted groups for a given technology based on the types of information required. In some cases, this may require providing more than just technical information.

- A labeling system may be needed for new products.\(^12\) As technologies are assessed, ETP should be cognizant of how consumers will differentiate the product from others in the market. Energy Star is one type of recognizable label, and it has also become a brand that consumers recognize. Different labels may reach different groups. If that is the case, ETP could make specific recommendations about the requirements for developing and implementing such a label through the EE programs.

- Some programs do not actively market the products included in their programs.\(^13,14\) This point indicates that, similar to ETP, other programs work upstream of the actual marketing of products to attempt to influence later purchases.

- A research-based entity is using Rogers’ *Diffusion of Innovations* theory to change how they package and market the results of their research.\(^15\) The audience for ETP information is

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currently the EE program managers. The packaging of the technology assessment reports may need to be changed to meet the needs of the EE program managers. Additionally, the program may expand in the future to include market actors, such as individuals that make decisions about capital investment and technology selection, in its information dissemination efforts. Information from the assessments may need to be further modified to fit those audiences.

The next step in the research had been to compare the findings of this literature review to the logic and underlying theory of the 2006-2008 ETP. This comparison was aimed at providing others with the knowledge of where the program aligns with the literature and where it diverges. The number of firm conclusions and recommendations was expected to be low due to the somewhat limited nature of this review. To assure the appropriateness of any conclusions regarding the ETP (as conceived for this program cycle), the team planned two activities:

1. The first is to perform in-depth interviews with stakeholders involved in varying degrees with new energy efficiency products. These interviews will bring in information about specific topics that were brought up in the literature review. Such interviews will allow us to more closely explore these topics as they directly pertain to the ETP.

2. The second activity is to discuss and clarify these initial conclusions with the ETP program managers and identify any erroneous conclusions and unsupported or unnecessary recommendations resulting from an incomplete understanding of the 2006-08 ETP or plans for the 2009-11 ETP.

However, at this point, these in-depth interviews are on hold, and the evaluation team will reassess the need for these data in September 2008.

**LITERATURE REVIEW**

1.1 Overview of Review Process

1.1.1 Reasons for Review

The literature review was planned to augment the evaluation of the program design for ETP. It was aimed specifically at the information dissemination component of the program because past experience with evaluating the program indicated this part of the program was the least fleshed out in terms of theory. To the extent possible, documents were gathered that met the following search criteria:

- articulated the barriers to consumers of new products;
- discussed how barriers were attempted to be reduced (in general);
- discussed how barriers were attempted to be reduced through the use of information or demonstration of new products;

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16 The evaluation team will interview EE program managers during the next phase of the evaluation. These interviews will be one source of information about the effectiveness of ETP’s messages to EE program staff.
described what others have done to attempt to cross the market chasm; and

- described any successful attempts at marketing new products and what occurred to cause the success.

As shown by the list above, the search was to provide documents that covered all products, not just energy related products. As the evaluation work moved forward and discussions with the IOU’s occurred regarding their program theory, it became clear that the information being disseminated was focused on internal clients such as the energy efficiency program managers or account representatives. Barriers to consumers of new products and similar concepts were more distal to the boundaries of the ETP, although are still integral to energy efficiency programs.

The evaluation plan stated that the evaluation team would use this review to determine “exemplary practices among related programs”. However, the focus of the review changed for three reasons: 1) the literature sources found were not from programs that were considered similar to ETP; 2) for articles with discussion around aspects that were similar to ETP, the empirical data were sparse; and 3) it became clear through discussions with the IOUs that the information being disseminated was focused on internal clients and that the extent of external information dissemination was very minimal.

Currently, the ETP collects information and distributes it to clients within the IOU that use the knowledge to add measures to the portfolio of resource acquisition measures. Additionally, some of the internal clients use that information to inform their external customers. The technologies considered by ETP are new and innovative; they are in an earlier stage of market adoption than the suite of technologies already included in the resource acquisition programs. Since the characteristics of the target market for technologies in this earlier stage of adoption is different than those in later stages of adoption, it is assumed that customers for these emerging technologies require a different approach than measures already included in the resource acquisition portfolio. The findings now focus on the type of information needed by a program to influence customers for successful use of new products rather than how other programs disseminate information to customers.

1.1.2 Review Method

The evaluation team performed an exploratory literature review during October and November of 2007. Potential sources were located mainly through an Internet search. Some articles were obtained through college libraries.

The evaluation team created an original list of documents that met the search criteria and obtained as many of the sources from that list as possible. A review of the references in ten documents that appeared to be very relevant led to additional sources being obtained. From the original search in 2007 and a few documents found in early 2008, the search obtained 86 documents to be reviewed. However, there was not the time nor the resources to fully read through each document, and nine documents were inaccessible. Therefore, the evaluation team briefly read each of the 77 obtainable documents and gave a priority of:

- 1 – highly relevant, read thoroughly
- 1.5 – significant, but not among top articles
- 2 – relevant, but covers information not specifically useful for review purpose
The list of all documents and their priorities is shown in Section 0. The 15 documents with a priority of 1 were included in a literature excerpt analysis. This analysis consisted of reading through the document and pulling out excerpts that were particularly relevant and/or provided a point that the evaluation team did not want to lose. Eventually there were 294 excerpts from the 15 documents. The evaluation team made comments on each of the excerpts as well as coded the comments into conceptual ‘buckets’ using NVivo, a qualitative software package. The listing of the excerpts and supplemental evaluation team comments are located in Section Error! Reference source not found.

Although there were a substantial number of excerpts, close to 60 percent of them came from the three books, with one book (Rogers 2005) accounting for 43 percent of the entire number of excerpts (Table 1).
### Table 1. Percent of Excerpts by Source

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<th>Source</th>
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<th>Percent of Excerpts*</th>
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<tr>
<td>22</td>
<td>Egmond, C., R. Jonkers, and G. Kok. 2006. A strategy and protocol to increase diffusion of energy related innovations into the mainstream of housing associations. <em>Energy Policy</em> 34:4042-4049.</td>
<td>3%</td>
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Since each excerpt can constitute a “nugget” of information for analysis to create a cohesive picture, the review has an obvious slant towards the information included in the chosen books. The books were chosen carefully, though, for inclusion into the literature review. Each of the IOU Program Implementation Plans (PIP) sets the context for the 2006-08 ETP. As such, it was a logical choice to include the seminal book about crossing the chasm, written by Gregory Moore (Moore 2003). While none of the PIPs mentions “diffusion of innovations” specifically, they do use the language of innovators, early adopters, early majority, as well as focusing on accelerating a new product into the market. These concepts are embedded in the Rogers book with substantial discussion. Again, it appeared a logical choice to include when attempting to review sources around adoption barriers to new products. However, the evaluation team felt that these two books should be used as the base of knowledge upon which to look at the other sources in the review, not as an equal partner in determining the type of information others have used when disseminating information (or else the presentation would be biased towards the information in the books). The third book (Ettlie, 2006) provided a comparable level of excerpts as the articles and has been used in the analysis as equal to any of the articles.
1.1.3 Structure of Literature Review

After this section, the base of knowledge gleaned from the Rogers and Moore books is presented. The detailed findings from the review of the remaining 13 sources are next followed by conclusions. There are three additional appendices in conjunction with this review: 1) references, 2) listing of all reviewed sources and assessment priorities, and 3) priority one source excerpts and evaluator comments.

1.2 Knowledge Base

1.2.1 Rogers – Diffusion of Innovations

Everett M. Rogers first wrote this book in 1962 and has made four updates to it, the latest being the 2003 edition used in the review. It encompasses forty years of thinking about how innovations move into markets, reviewing research studies on the diffusion of innovations, and working to expand and modify his original theory based on that research. An expert in innovation stated: “One of the first great books in the field of technological innovation and communication research, which examined the diffusion of innovation, came from Everett Rogers.” (Ettlie 2006: 69). As indicated by this quote, the book is considered one of the seminal documents in the theory of how adoption of new products occurs.

In Rogers’ theory, “diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system while communication is a process in which participants create and share information with one another in order to reach a mutual understanding.” (Rogers 2003: 5) He indicates that an “innovation is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” (Rogers 2003: 12) Set in these definitions is the concept of people talking with others, generally in a two-way dialogue, about new “things”. While much discussion around innovations is rooted in the technological aspects, the diffusion of innovations is based on social interactions and how information spreads among people. Rogers acknowledges that the Internet “…may be changing the diffusion process in certain fundamental ways, such as by removing or at least greatly diminishing, the role of spatial distance in who talks to whom about a new idea.” (Rogers 2003: xix) The fact that this theory is grounded on the premise that diffusion is a social process will challenge the next generation of researchers to explore if the current set of technological communication tools are possibly changing how diffusion works in the 21st century.

There are four main elements in this theory, each with ideas and ways of grouping that enhance the ability to understand what occurs in reality. Innovation, the first element, has five different attributes that effect how fast adoption of an innovation occurs. The second element of communication encompasses the myriad of ways in which people can learn about an innovation. Time, as the third element, is an integral part when decision-processes take place and adoptions occur. Rogers presents a couple different nomenclatures to allow people to conceptualize and discuss the dimension of time within diffusion of innovations. The last element is the social system where he looks at how different systems can help or hinder diffusion of innovations. The following information provides detail about these four elements of Rogers’ theory.
1.2.1.1 Element 1 - Innovations

Innovations have five perceived attributes that play a part in how quickly a person or organization may adopt an innovation. These are attributes as perceived by the person doing the adopting, so responses to a technology can vary widely based on with whom one is conversing. The attributes are:

1. “Relative advantage is the degree to which an innovation is perceived as better than the idea it supersedes.
2. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters.
3. Complexity is the degree to which an innovation is perceived as difficult to understand and use.
4. Trialability is the degree to which an innovation may be experimented with on a limited basis.
5. Observability is the degree to which the results of an innovation are visible to others.” (Rogers 2003: 15)

While these are the main attributes, Rogers acknowledges that others may be very important in different situations and that researchers should know how to think about these factors. There has been little research into the relative contribution of these five attributes in the decision process, although the differences between relative advantage and compatibility were found to be similar enough in past research to be empirically indistinct.

Relative advantage, defined as the ratio of the expected benefits to the expected costs of innovation adoption, is the strongest predictor of adoption rates. People thinking about adoption want to talk with peers to determine the relative advantage. Because of the interaction of incentives with relative advantage, incentives increase the rate of adoption. Although based on family planning research, adopter incentives were found to lead to “... adoption of an innovation by individuals different from those who would otherwise adopt.” (Rogers 2003: 238)

Linked between relative advantage and compatibility is the use by potential adopters of an item that is very similar to the innovation. “Previous practice provides a standard against which an innovation can be interpreted, thus decreasing its uncertainty.” (Rogers 2003: 243) Rogers stresses that anyone attempting to create a change must have good knowledge about what their customers have experience with and how their customers have viewed prior experiences with innovations as these can make a difference in the likelihood of future adoption.

There is no conclusive evidence regarding the interaction of complexity as a concept with adoption rates. However, Rogers posits that complexity is negatively related to the rate of adoption and can have a stronger relationship among certain innovations. On the other hand, both trialability and observability are generalized to have a positive relationship with adoption rates. That is, the more opportunities a person has to observe an innovation, the faster the innovation will be adopted. However, trialability, is more useful for different groups of adopters. People who are in the first group of people to adopt an innovation regard the ability to initially try it out as highly desirable and may try many different innovations without moving to full-scale
use. Those who are the last to adopt move more quickly from trial to full use, so the ability to try out a product does not matter as much.

1.2.1.2 Element 2 – Communications

According to the book, communications that cause diffusion must have one individual or adopting unit who has knowledge of (or experience using) an innovation, another individual or adopting unit without that knowledge, and some way to connect the two. A wrinkle in this is that the two units who are communicating must be somewhat heterophilous or else diffusion does not occur. While a group of like-minded people (i.e., a homophilous group) may all use the same innovation, unless it leaves that group, the innovation does not diffuse throughout society (or a market).

Communication channels are either mass communication channels (i.e., radio, TV, newspapers) or interpersonal channels. Mass media can create awareness and knowledge of innovations but it is the interpersonal channels (i.e., a face-to-face exchange) that are more effective at persuading someone to accept an innovation (Rogers 2003: 18). Obviously, the Internet is a communication tool, but there was little discussion of its impact on diffusion in this book.

1.2.1.3 Element 3 - Time

This element has two different attributes that are described in the book. The first is the innovation-decision process and the second is adopter categories. Both represent some aspect of time because they have the ability to categorize people or organizations based on where they are now and the path which they may follow over time. While the innovation-decision process is specific to a single adopting person or company, the adopter categories are defined by the dispersion of multiple people or companies.

Innovation-Decision Process

The innovation-decision process is different than a regular decision. “The perceived newness of an innovation, and the uncertainty associated with this newness, is a distinctive aspect of innovation decision making (compared to other types of decision making).” (Rogers 2003: 168) Past research into this process have all found stages that fit into similar categories. A person (or organization) must first have knowledge about an innovation, then be persuaded, which is followed by a decision to implement, the actual implementation, and then a last stage in which they look at the innovation and confirm their earlier decision (Figure 1).

17 The degree to which two or more individuals who interact are different in certain attributes (Rogers 2003, 19.)
While past research showed the presence of the stages, there has been less research into how often the stages occur as people make decision. In research on farmers, though, “none reported skipping the knowledge or decision stages, but a few farmers did not report a trial stage prior to adoption (perhaps because of the nature of the innovation under study, a chemical weed spray)” (Rogers 2003: 197). So Rogers suggests a generalization that stages exist in the decision making process, with stronger empirical backing for the knowledge and decision stages and less evidence of the persuasion stage. He states that “only limited data are available on the distinctiveness of the implementation and confirmation stages.” (Rogers 2003: 198)

According to Rogers, “. . . the innovation-decision process is essentially an information-seeking and information-processing activity in which an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation.” (Rogers 2003: 172) However, he cautions that just because someone knows about an innovation does not mean they will actually implement. If the innovation is not thought to be relevant to the situation of the potential adopter, or insufficient knowledge is passed on, then the persuasion stage does not occur (and neither does the implementation choice). Also, different psychological components come into play at the knowledge versus persuasion stages. Whereas the mental activity at the knowledge stage was mainly cognitive (or knowing), the main type of thinking at the persuasion stage is affective (or feeling).

We [Rogers] do not define persuasion in exactly the same way as some other scholars, who use the term to imply a source’s communication with the intent to induce attitude change in a desire direction on the part of the receiver. The meaning of persuasion for this literature
review is equivalent to attitude formation and change on the part of an individual, but not necessarily in the direction intended by some source, such as a change agent\(^\text{18}\). (Rogers 2003: 175)

At the persuasion stage and at the decision stage, an individual seeks innovation evaluation information, messages that reduce uncertainty about an innovation’s expected consequences. Here an individual usually wants to know the answer to the question “What are the innovation’s advantages and disadvantages in my situation?” This type of information, while often available from scientific evaluations of an innovation, is instead sought by most individuals from their near peers, whose subjective opinions of the innovation are more accessible and convincing to them. (Rogers 2003: 175)

Moving along the continuum from persuasion to decision, though, is not easy to forecast. The time elapsing between awareness-knowledge of an innovation and decision for an individual is measured in days, months, or years. “The period is thus a gestation period during which a new idea ferments in an individual’s mind.” (Rogers 2003: 213)

Once the decision is made, implementation is the next stage. According to Rogers, “problems of implementation are usually more serious when the adopter is an organization rather than an individual.” (Rogers 2003: 179) This is because organizations tend to have different people who decide to adopt an innovation and those who actually implement it, which can slow down this stage. Also, previous research on innovation in organizations assumed that a new technological idea enters a system from external sources and it then adopted (with relatively little adaptation of the innovation) and implemented as part of the organization’s ongoing operations. “Thus it was assumed that adoption of an innovation by individual A or organization A will look much like adoption of this same innovation by individual B or by organization B. Recent investigations show that this assumption should be seriously questioned.” (Rogers 2003: 182) Rogers found enough evidence to support the generalization: “re-invention occurs at the implementation stage for many innovations and for many adopters.” (Rogers 2003: 183) For energy efficiency, this may manifest itself more with efficiency processes than the use of a specific “widget” technology.

The last stage is the confirmation stage. This is a loop back type of stage in which it is acknowledged that just because an innovation is implemented that it is there to stay. “The individual (or other decision-making unit) seeks reinforcement for the innovation-decision already made, and may reverse this decision if exposed to conflicting messages about the innovation.” (Rogers 2003: 189)

**Adopter Categories**

While the innovation-decision process focuses on what occurs within an individual or a decision-making unit such as an organization, adopter categories help to think of the characteristics within a population and how these affect when an implementation may occur. In some sense, the adopter categories may be a representation of the length of time of the

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\(^{18}\) See Element 4 in the review for a description of a change agent.
innovation-decision process. Those early in the adopter category scheme may have a compressed timeline of the innovation-decision process while those at the other end have an extended timeline.

The adopter categories of innovators, early adopters, early majority, late majority, and laggards (Figure 2) have been used for many years.

Figure 2. Adopter Categorization on the Basis of Innovativeness

Why did such a categorization scheme make sense? According to Rogers, “many human traits are normally distributed, whether the trait is a physical characteristic, such as weight or height, or a behavioral trait, such as intelligence or the learning of new information. Hence, a variable such as the degree of innovativeness is also expected to be normally distributed. If a social system is substituted for the individual in the learning curve, it seems reasonable to expect that the experience with the innovation is gained as each successive member in the social system adopts it.” (Rogers 2003: 272) Using empirical evidence from agricultural consumers as well as other research, Rogers’ generalized that: “Adopter distributions follow a bell shaped curve over time and approach normality.” (Rogers 2003: 275)

This doesn’t mean that all innovations follow this normal distribution. If a product is not successful in reaching the entire population, the curve can go into a steep decline and would not look like Figure 2 if a study occurred. Rogers’ cautions against assuming that there is a normal distribution and indicates that empirical data is the best way to determine an adoption curve

Rogers discounts the concept of a chasm:

“Pronounced breaks in the innovativeness continuum do not occur between each of the five categories, although some scholars claimed that a discontinuity exists between the innovators and early adopters versus the early majority, late majority, and laggards (Moore, 1991). Past research shows no support for this claim of a “chasm” between certain adopter categories. On the contrary, innovativeness, if measured properly, is a continuous variable and there are no
sharp breaks or discontinuities between adjacent adopter categories (although there are important differences between them).” (Rogers 2003: 282)

Much has been written about each of these categories. For this review, only a succinct description of each of the characteristics of the categories that differentiates them from each other is presented.

1. Innovators (Venturesome). This group of people is able to cope with a high degree of uncertainty about an innovation at the time they adopt. They tend to have more financial resources to help cushion losses.

2. Early Adopters (Respect). Early adopters help trigger the critical mass when they adopt an innovation. The early adopter decreases uncertainty about a new idea by adopting it, and then conveying a subjective evaluation of the innovation to near peers through interpersonal networks.

3. Early Majority (Deliberate). The early majority interacts frequently with their peers but seldom hold positions of opinion leadership in a system.

4. Late Majority (Skeptical). This group must be pressured by peers to adopt. Their relatively scarce resources mean that most of the uncertainty about a new idea must be removed before the late majority feel that it is safe to adopt.

5. Laggards (Traditional). The laggard’s precarious economic position forces the individual to be extremely cautious in adopting innovations.

Rogers believes the differences in the adopter categories indicate varied approaches should be taken by someone attempting to effect change. Additionally, even within the adopter categories, he indicated three different variables about which to be aware: 1) socioeconomic, 2) personality, and 3) communication behavior. The book makes many generalizations, based on research, that help to differentiate those that adopt innovations earlier than others. Because ETP often works with earlier adopters, these generalizations are condensed and copied here (Table 2).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Generalization*</th>
<th>Earlier adopters....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socioeconomic</td>
<td>7-2</td>
<td>are no different from later adopters in age.</td>
</tr>
<tr>
<td></td>
<td>7-3</td>
<td>have more years of formal education than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-4</td>
<td>are more likely to be literate than are later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-5</td>
<td>have higher social status than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-6</td>
<td>have a greater degree of upward social mobility than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-7</td>
<td>have larger-sized units (farms, schools, companies, and so on) than do later adopters.</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Generalization*</td>
<td>Earlier adopters....</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Personality Variables**</td>
<td>7-8</td>
<td>have greater empathy than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-9</td>
<td>may be less dogmatic than are later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-10</td>
<td>have a greater ability to deal with abstractions than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-11</td>
<td>have greater rationality than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-12</td>
<td>have more intelligence than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-13</td>
<td>have a more favorable attitude toward change than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-14</td>
<td>are better able to cope with uncertainty and risk than are later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-15</td>
<td>have a more favorable attitude toward science than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-16</td>
<td>are less fatalistic than are later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-17</td>
<td>have higher aspirations (for formal education, higher status, occupations, and so on) than do later adopters.</td>
</tr>
<tr>
<td>Communication Behavior</td>
<td>7-18</td>
<td>have more social participations than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-19</td>
<td>are more highly interconnected through interpersonal networks in their social systems than are later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-20</td>
<td>are more cosmopolite than are later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-21</td>
<td>have more contact with change agents than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-22</td>
<td>have greater exposure to mass media communication channels than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-23</td>
<td>have greater exposure to interpersonal communication channels than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-24</td>
<td>seek information about innovations more actively than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-25</td>
<td>have greater knowledge of innovations than do later adopters.</td>
</tr>
<tr>
<td></td>
<td>7-26</td>
<td>have a higher degree of opinion leadership than do later adopters</td>
</tr>
</tbody>
</table>

*The generalization numbers are provided as a reference to each of the different statements. Rogers provided multiple generalizations throughout the book, referenced by chapter number and an incremental value.
**Personality variables associated with innovativeness have not yet received much research attention, in part because of difficulties in measuring personality dimension in diffusion surveys.**  

*Source: Rogers 2003, 288-291.*

### 1.2.1.4 Element 4 – Social Systems

The first three elements help set the stage for discussions about how people interact in a system. The social system is the boundary within which diffusion is expected to occur. For a diffusion study, it could be a small system, such as all the doctors in a hospital, or a large system, such as all the consumers in the United States. Rogers explores “how the system’s social structure affects diffusion, the effect of norms on diffusion, the roles of opinion leaders and change agents, types of innovation-decisions, and the consequences of innovation. Each of these issues involves relationships between the social system and the diffusion process that occurs within it.” (Rogers 2003: 24) A quote within the book states: “It is as unthinkable to study diffusion without some knowledge of the social structures in which potential adopters are located as it is to study blood circulation without adequate knowledge of the veins and arteries.” (Rogers 2003: 25) The social system, then, could be considered the contextual background to diffusion of innovations.

The social systems tended to be researched and discussed based on information flow within the system. Early research in diffusion communication outlined a model which was found to provide useful understanding of how information flowed. In this two-step flow hypothesis, messages from a source, via mass media channels, move to opinion leaders who then passed the messages on to their followers. “Mass communication channels are primarily knowledge creators, whereas interpersonal networks are more important in persuading individuals to adopt or reject. This notion was masked in the original statement of the two-step model because the time sequence involved in an individual’s innovation decision-making process was ignored.” (Rogers 2003: 305)

A concept within the social system is that of an opinion leader. Opinion leaders are not necessarily innovators. They are, however, those people within a group to whom others tend to look to because of their technical competence, social accessibility, and similarity to the group. If an entire social system gravitates to innovation, then the opinion leaders are also more oriented to change. “So it is the system’s norms that determine whether or not opinion leaders are innovators.” (Rogers 2003: 318) If a person gets too far out of step with the rest of the group, then their leadership role can be shifted to someone else within the group. How does one know that someone is an opinion leader? According to Rogers, using “any one of four methods (sociometric, key-informants, self-designating, and observation) can be based on convenience, as all four are about equally valid.” (Rogers 2003: 312) There is empirical evidence that using opinion leaders helps diffuse innovations.

Another useful concept for discussion around occurrences within a social system is that of a change agent. “A change agent is an individual who influences clients’ innovation-decisions in a direction deemed desirable by a change agency. A change agent usually seeks to secure the adoption of new ideas, but he or she may also attempt to slow the diffusion process and prevent the adoption of certain innovations with undesirable effects.” (Rogers 2003: 366) There are several relevant points made in the book about change agents. These are presented here as bullet
points with some detail as the IOUs are considered to be change agents in the context of energy efficiency programs.

- Most change agents are university graduates in some technical field. Their superior know-how actually poses a barrier, making it difficult for them to communicate directly with clients. Their heterophily in technical competence usually is accompanied by heterophily in subcultural language differences, socioeconomic status, and beliefs and attitudes. Change agents, even though they link their clients with technical experts in the change agency, may be relatively heterophilous from either system. This heterophily gap on both sides of the change agent creates role conflicts and certain problems in communication. (Rogers 2003: 368)

- Seven roles can be identified for the change agent in the process of introducing an innovation in a client system.
  1. To develop a need for change.
  2. To establish an information change relationship.
  3. To diagnose problems.
  4. To create an intention to change in the client.
  5. To translate an intent into action.
  6. To stabilize adoption and prevent discontinuance.
  7. To achieve a terminal relationship.

  However, Rogers acknowledges that the reality of the seven steps is often idyllic and not necessarily exactly how it occurs in reality.

- There are several generalizations made in the book about change agents. Five of the most relevant ones are presented here:
  o Generalization 9-2: “Change agents’ success in securing the adoption of innovations by clients is positively related to a client orientation, rather than to a change agency orientation. Client-oriented change agents are more feedback-minded, have closer rapport with their clients, enjoy higher credibility in the eyes of their clients, and base their diffusion activities primarily on clients’ need.” (Rogers 2003: 374)
  o Generalization 9-3: “Change agents’ success in securing the adoption of innovations by clients is positively related to the degree to which a diffusion program is compatible with clients’ needs”. (Rogers 2003: 374)
  o Generalization 9-9: “Change agents’ success in securing the adoption of innovations by clients is positively related to their homophily with clients”. (Rogers 2003: 384)
  o Generalization 9-11: “Change agents’ success in securing the adoption of innovations by clients is positively related to the extent that he or she works through opinion leaders. Network messages from near peers such as opinion leaders are regarded as credible in convincing an individual to adopt and innovation. After the opinion leaders in a system adopt an innovation, it may be impossible to stop its further spread.” (Rogers 2003: 388)
  o Generalization 9-12: “Change agents’ success in securing the adoption of innovations by clients is positively related to increasing clients’ ability to evaluate innovations. Unfortunately, change agents are often primarily concerned with
such short-range goals as increasing the rate of adoption of innovations. Instead, increasing the self-reliance of clients should be the goal of change agencies, leading to termination of client dependence upon the change agent. This goal, however, is seldom reached by most change agencies. They usually promote the adoption of innovations, rather than seek to teach clients the basic skills of how to evaluate innovations themselves.” (Rogers 2003: 391)

A discussion about the relationship between change agents, socioeconomic status, and innovativeness is warranted. Through multiple investigations into innovativeness among farmer, Rogers found that, “The single variable that emerges as most highly related to change agent contact, even when the effect of other variables is controlled, is agricultural innovativeness.” These variables were related as shown below.

Socioeconomic Status → Change Agent Contact → Innovativeness

According to Rogers, “This circle of interrelated variables means that change agents help those clients least who are most in need of their help.” (Rogers 2003: 383)

Change agents work within systems to attempt to effect decision choices. Those same social systems have different ways of making innovation-decisions of which the change agent should be aware. The types of innovation-decisions come into play during the third stage of innovation-decision making (as shown in Figure 2) and create four different groups: 1) optional, 2) collective, 3) authority, and 4) contingent. Optional innovation-decision is one made by an individual. They can be influenced by others within their social system, but only a single person ultimately makes the decision to adopt an innovation or not. This was the type of decision making first researched by Rogers in the 1940’s when he talked to multiple farmers about why they chose to adopt (or not) hybrid corn. The second type of decision making is a collective decision. Here the social group works together to reach consensus to adopt or reject an innovation. The example in the book of this type of decision making is when a city council passes an ordinance which the remainder of the city must follow (such as a no-smoking ban). The third type of decision making is authority driven. A few individuals make acceptance or rejection choices for the rest of the social system. The example given is when a CEO of a company makes choices with which the employees of that company must follow. The last type of decision mentioned in the book is that of a contingent innovative-decision in which the choice to adopt or reject an innovation can only occur after some previous choice. The book’s example of this was if a Doctor wanted to use a new procedure, but the hospital in which he worked did not have the correct equipment to perform the procedure. He cannot make the innovation-decision to accept or reject the procedure until the equipment is actually available.

Energy efficiency programs often work with organizations, in which the collective or authoritative decision making process is present. Rogers does not cover much more about these types of decisions in the book, but does go on to discuss innovation in organizations. Size of an organization is directly tied to how much they innovate. Besides being a relatively easy variable to measure and being involved in almost every relevant research study, Rogers felt that “… size is probably a surrogate measure of several dimensions that lead to innovation: total resources, slack resources (defined as the degree to which an organization has more resources than those required for its ongoing operations), employees’ technical expertise, organizational structure, and so on. These unidentified variables have not been clearly understood or adequately measured by
most studies. These “lurking” variables may be a fundamental reason for the common finding that size and innovativeness are related.” (Rogers 2003: 411)

Additionally, Rogers found that because of the different structures present in most organizations, without a person to follow through with actions, adoption of innovations often is reduced. A generalization presented in the book states: “The presence of an innovation champion contributes to the success of an innovation in an organization.” (Rogers 2003: 414) However Rogers wrote that the champion does not have to be the CEO or manager within a company. Champions can be in many different locations of formal power within an organization, but in all cases this person initiates and guides the new idea through the approval and implementation process.

The book brings out an innovative process within an organization that encompasses two broad activities – initiation and implementation. The concept is shown graphically in Figure 3.

**Figure 3. Five Stages in the Innovation Process in an Organization**

![Five Stages in the Innovation Process in an Organization](image)

*Source: Rogers 2003, Figure 10-3, 421.*

The first stage is when the agenda is set. “At the agenda-setting stage, one or more individuals in an organization identify an important problem and then identify an innovation as one means of coping with the problem.” (Rogers 2003: 422) In thinking about how organizations work, though, if this is the key to getting things started, then a person generally needs to have some sort of power within an organization to even get something on an agenda. This somewhat negates the earlier writing about how anyone in an organization can be a champion of an innovation.
In reality, the process outlined in Figure 3 is not necessarily neat and organized. Sometimes knowledge of an innovation, rather than the recognition of a problem or need by an organization leading to search for a solution launches the innovation process. An example of not really following the process was in a study by Wildenmuth. In this study, participants took an opportunistic approach to the acquisition of computing resources. Prior to the purchase of hardware and software, there were no specific plans for its use" (Wildemuth: 1992).” (Rogers 2003: 423) However, if the process is followed more systematically, “the matching decision marks the watershed in the innovation process between initiation and implementation, all of the events actions, and decisions involved in putting an innovation into use.” (Rogers 2003: 424)

The last concept in the book discusses the consequences of the innovation. According to Rogers, the unpredictability of an innovation’s consequences, at least in the long term, is one important type of uncertainty in the diffusion process. “Change agents generally give little attention to consequences. They often assume that adoption of a given innovation will produce mainly beneficial results for adopters. Ideally, they should be able to predict the advantages and disadvantages of an innovation before introducing it to their clients. This is seldom done, and often it cannot be done.” (Rogers 2003: 436)

The review of this lengthy book (~500 pages) only brings out the main concepts presented without the supporting discussion. However, it provides context for articles discussed in this literature review. Diffusion of innovations is a theory of how ideas and innovations move into a social system (or market). It can be thought of as one framework for how to effect change.

1.2.2 Moore – Crossing the Chasm

Geoffrey Moore’s book “Crossing the Chasm” was written in 1991 and updated in 1999 and 2002. The latest version was used in this literature review. Unlike the Rogers book with its many references to research, Moore states:

It chagrins me to have to say, therefore, that there are no documented sources of evidence anywhere in the book that follows. All of the information I use in day-to-day consulting comes to me by way of word of mouth. The fundamental research process for any given subject is to ‘ask around’. (Moore 2006: xix).

It is, though, a book that has resonated with many people. Feedback to the author by readers indicated that the language in the book provided them with a context to bring together ideas they knew, but could not adequately express. This ability, plus specific actions that can be taken to cross the chasm, could be reasons for the success of the book and the concepts described within it.

Moore uses the technology diffusion framework to describe his model.

The chasm model represents a pattern in market development that is based on the tendency of pragmatic people who adopt new technology when they see other people like them doing the same. This causes them to hang together as a group, and the group’s initial reaction, like teenagers at a junior high dance, is to hesitate and watch. This is the chasm effect. The tendency is very deep-rooted, and so the pattern is very persistent. As a result, marketers can predict its appearance and build strategies to cope with it, and it is the purpose of this book to help in that process. (Moore 2006: xi)
Moore uses the same adopter categories as Rogers in his discussions and states that each adopter group has their own psychographic tendencies that marketers should know about and work with to create sales. He indicates that “the gap between these two markets [visionary and mainstream], heretofore ignored, is in fact so significant as to warrant being called a chasm, and crossing this chasm must be the primary focus of any long-term high-tech marketing plan.” (Moore 2006: 5) The location of the chasm is shown in Figure 4.

**Figure 4. Moore’s Revised Adopter Categories and Chasm**

![Moore's Revised Adopter Categories and Chasm](image)

*Source: Moore 2006: 17.*

The first part of the book provides definitions about the adopter categories and marketing followed by how a company can cross the chasm. For this review, some of the definitions and concepts to use when attempting to cross the chasm are presented.

According to Moore, there are two types of innovations based on the attitudes of the adopter towards change: discontinuous and continuous. “In academic terms, such change-sensitive products are called discontinuous innovation. The contrasting term, continuous innovations, refers to the normal upgrading of products that does not require us to change behavior.” (Moore 2006: 10) These terms are helpful when thinking about different products and what they can mean to a customer. The book’s subtitle, “Marketing and Selling Disruptive Products to Mainstream Customers”, stresses that it is a marketing book. He defines marketing as “taking actions to create, grow, maintain, or defend markets. [He follows] Of course, talking this way about marketing merely throws the burden of definition onto market, which is defined for the purposes of high tech, as:

- A set of actual or potential customers
- For a given set of products or services
- Who have a common set of needs or wants, and
- Who reference each other when making a buying decision.” (Moore 2006, 28)

Moore indicates that there are “cracks in the bell curve” of small magnitude between the innovators and early adopters and between the early majority and late majority based on the differences between the groups (shown as gaps in Figure 4). However, the chasm is between the
early adopters and early majority. (See Figure 4) The marketing that is needed to bridge these two groups on either side of the chasm is fundamentally different. Early adopters (on the left side of the chasm) are called visionaries in Moore’s book. They are the people who tend to see the opportunity in innovations and push for their use. “Visionaries are not looking for an improvement; they are looking for a fundamental breakthrough.” (Moore 2006: 34) The early majority, on the other hand, are pragmatists. To look more closely into these values, “. . . if the goal of visionaries is to take a quantum leap forward, the goal of pragmatists is to make a percentage improvement—incremental, measurable, predictable progress.” (Moore 2006: 42) These definitions are not that dissimilar from the definitions in Rogers where early adopters take on new ideas as a way to earn respect and the early majority are more deliberate. Both Moore and Rogers discuss the late majority in a similar manner as well. According to Moore, the late majority, or conservatives, represent approximately one-third of the total available customers within any given Technology Adoption Life Cycle. “Therefore, they tend to invest only at the end of a technology life cycle, when products are extremely mature, market-share competition is driving low prices, and the products themselves can be treated as commodities.” (Moore 2006: 46)

While the book provides more detailed explanations, a summary of the pragmatists is provided because this is the group on the far side of the chasm and to whom the ETP indicates they are helping products reach. Looking at attempting to sell to the early majority, Moore states:

- “Mainstream markets in high tech look a lot like mainstream markets in any other industry, particularly those that sell business to business.” (Moore 2006: 38)
- [Pragmatists] “are hard to characterize because they do not have the visionary’s penchant for drawing attention to themselves.” (Moore 2006: 42)
- “If pragmatists are hard to win over, they are loyal once won, often enforcing a company standard that requires the purchase of your product, and only your product, for a given requirement.” (Moore 2006: 43)
- “When pragmatists buy, they care about the company they are buying from, the quality of the product they are buying, the infrastructure of supporting products and system interfaces, and the reliability of the service they are going to get.” (Moore 2006: 43)
- “This means it is very tough to break into a new industry selling to pragmatists. References and relationships are very important to these people.” (Moore 2006: 44)
- “Market leadership is crucial, therefore, to winning pragmatist customers.” (Moore 2006: 45)

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19 SDG&E 2006-2008 PIP, under #5 Program Statement states: 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-adverse customers, and the product’s adoption rate may fall off into “the chasm.” The ET program intends to help accelerate a product’s market acceptance through a variety of approaches, but mainly by reducing the performance uncertainties associated with new products and applications. We note that it is unclear whether the program continues to fully subscribe to this theory.

20 Moore defines the mainstream market as beginning with the early majority. The early majority are pragmatists.
- “The key point here is that mainstream customers truly abhor discontinuous innovations.”
  (Moore 2006: 51)

After describing the adopter categories and the chasm in the first third of the book, most of the remaining two-thirds are spent providing a strategy for crossing the chasm. There is a small component of the book that discusses things to consider once a company is past the chasm, but the evaluation team will not cover that in the review as the PIPs show that the ETP and resource acquisition programs work together to “cross the chasm”, but then the resource acquisition programs take over from there.

Moore brings out two interesting concepts. The first is: “To enter the mainstream market is an act of aggression.” (Moore 2006: 65). The second concept is:

I don’t know who said it—it sounds like the sort of thing that gets attributed to Yogi Berra or to his mentor, Casey Stengel—but in any event, when it comes to crossing the chasm, this saying absolutely holds true: ‘If you don’t know where you are going, you probably aren’t going to get there.’ The fundamental principle for crossing the chasm is to target a specific niche market as your point of attack and focus all your resources on achieving the dominant leadership position in that segment. (Moore 2006: 89).

These are interesting concepts because of the viewpoint that others are already ensconced in the market and by attempting to sell a product to customers, others are going to see the entrance of a new company as threatening to their existence. This is closely followed by the statement that sounds akin to a war strategy – know the enemy and have a focused plan of attack.

There is substantial discussion of how to cross the chasm, but two graphics reflect many of the key concepts and so they are provided. Figure 5 is needed to fully understand Figure 6. Figure 6 shows a quadrant with the different adopter categories moving from the bottom left (innovators), directly up (early adopters), then back down and right (early majority) before finally ending up in the top right quadrant with the late majority and laggards.

As products move through the Technology Adoption Life Cycle, the domain of greatest value to the customer changes. In the early market, where decisions are dominated by technology enthusiasts and visionaries, the key value domains are technology and product. In the mainstream, where decisions are dominated by pragmatists and conservatives, the key domains are market and company. Crossing the chasm, in this context, represents a transition from product-based to market-based values. (Moore 2006: 134)
Figure 5. The Competitive-Positioning Compass

The Competitive-Positioning Compass

Product

Company

Supporters

Conservatives

Visionaries

Pragmatist

Specialist

Technology Enthusiasts

Generalist

Technology

Market

Skeptics

A = Developing the Early Market
B = Crossing the Chasm
C = Developing the Mainstream Market


Figure 6 shows the different types of evidence needed within each quadrant. A company attempting to sell to customers in a particular quadrant has to prove the points shown in the quadrant to achieve success.
Past ET programs have focused in the technology sector with some work in the product component. The current program appears to be focused similarly.

The chasm, represented in Figure 4 and Figure 5, occurs partly because of the size of the market, but also because of differences in what is needed to successfully sell a product in the early adopter versus the early majority group. “Most companies fail to cross the chasm because, confronted with the immensity of opportunity represented by a mainstream market, they lose their focus, chasing every opportunity that presents itself, but finding themselves unable to deliver a salable proposition to any true pragmatist buyer.” (Moore 2006: 67)

So what is a company to do to cross the chasm? Marketing knowledge about the early majority for a new disruptive product is acknowledged to be a low, yet it is a high-risk situation for a company. According to Moore, “informed intuition, rather than analytical reason, is the most trustworthy decision-making tool to use [to decide how to cross the chasm].” (Moore 2006, 92) “One of the keys in breaking into a new market is to establish a strong word-of-mouth reputation among buyers.” (Moore 2006: 69). He compares this to a set of bowling pins in which a company can have a successful “strike” by bringing down only one or two pins. “The size of the first pin is not the issue, but the economic value of the problem it fixes is.” (Moore 2006, 79). To make this work, though, much of the social components in Rogers’ diffusion of innovations are needed. One cannot have a word-of-mouth reputation if there is no social networking among those to whom a company is selling their product. Instead of going after a few customers in multiple market segments, “...winning four or five customers in one segment will create the desired effect.” (Moore 2006: 69) “For all these reasons—for whole product leverage, for word-of-mouth effectiveness, and for perceived market leadership—it is critical that, when crossing the chasm, you focus exclusively on achieving a dominant position in one or two narrowly bounded market segments.” (Moore 2006: 71)
There are more specifics written in the book about what a company could/should do to cross the chasm, but the main concepts have been brought out here and are considered to be sufficient for the purposes of the literature review. To close this segment about Moore’s book, a reiteration of the focus for crossing the chasm is provided: “The number-one corporate objective, when crossing the chasm, is to secure a channel into the mainstream market with which the pragmatist customer will be comfortable.” (Moore 2006: 163)

1.2.3 Detailed Findings

The remaining 12 of the 13 sources reviewed are varied and will not be presented in as much depth as the two knowledge base documents were. Instead, the remaining 12 sources were the focus of a qualitative assessment in which each of the documents were coded by themes around marketing and information. Eight of the sources have empirical data based on evaluation (although not specifically impact type data), while the remaining five are a discussion of a program or project (See Section Error! Reference source not found. for a table of codes used and number of codes per source.) An analysis of all the literature combined is provided below.

1.2.3.1 Is a new paradigm in the works?

Shove (1999) is interesting because it presents an alternative sociological framework within which to consider energy efficiency. This framework is very broad, and within it, intervention can take a long time to be successful and may be very difficult to measure. The short answer to whether a new paradigm is forming is “no”: a new paradigm for thinking about new technologies in energy efficiency is not gaining support in the research field. The long answer is based on the Shove’s research. Shove examined the current paradigm for developing technical agendas and the models of technical change that underpin research and development programs. After explicating the paradigm that arose from her data collection, Shove posited that the current paradigm is not necessarily the best, nor the only, approach to consider options for bringing about technical change.

Shove concluded the following:

. . . almost all the project managers and research funders interviews subscribed to a limited range of inter-related, taken-for-granted, beliefs about the nature and role of technical research and its relationship to practice. Although the following discussion simplifies some of their views, it reflects what were essentially common themes. The first concerns the nature of technical potential. The second relates to the gaps and barriers believed to inhibit the realization of that technical potential while the third concerns the process of technology transfer. Locked together, these three elements

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21 The first article discussed is a straight review rather than a synthesis which includes all other documents.
22 Sixty researchers, research managers and project officers in the UK, Ireland, France, Italy, Sweden, Finland, and the USA were interviewed.
23 Shove is a Professor of Sociology at Lancaster University in the UK and has been writing about how humans interact with technology and the sociology of consumption since the 1999 article was written. While the evaluation team contained its research to the items described, it is expected that the theory written about in this source has been refined over the past nine years.
provided an underlying rationale for energy related research and development in all the countries included in the study. (Shove 1999: 1,106).

The article presents further details about the elements and the unquestioned belief system that maintains the elements. She discounts the concepts of Rogers, technical potential, energy efficiency gaps, non-technical barriers, and technology transfer as attractive, but ultimately not useful, for explaining the process of technological change.

Her new paradigm is only briefly discussed, but focuses on a technical change as a closely related social process. Shove states:

The vocabulary of gaps and barriers forms part of this package, depending upon and reinforcing a conceptual split between the social and technical. Worries about how well this model is doing, even in its own terms, coincide with the development and popularization of rather different theories of sociotechnical change. Arguments about the linear relationship between research, development and practice have, for instance, been subject to sustained criticism. Equally, there is nothing novel about the view that technical change is a social process. Even so, such notions have yet to upset the conventional apple cart. (Shove 1999: 1,111)

Ultimately, this article was found to be a good description of the current paradigm for policy intervention and the research needed to support decisions, but poor at defining a new paradigm to use or supporting the argument that the old paradigm should not be kept.

1.2.3.2 Intervention

This section discusses how programs have intervened in the market and, where possible, the results of that intervention. The “old” paradigm discussed by Shove, of figuring out the potential of a technology and intervening to reduce barriers that are in the way of meeting that potential, remain unquestioned in the other sources. These seem to apply a social psychology framework in which psychological variables such as attitudes and contextual variables such as resources are used to determine how to intervene in the market. Articles with titles such as “Market failures and barriers as a basis for clean energy policies” and “How perceived uncertainties influence transitions; the case of micro-CHP in the Netherlands” all support the idea of looking at the market and attempting to figure out how to affect technological change, most likely through an intervention that attempts to reduce barriers.

Two of the articles discussed studies that provided empirical evidence about how to intervene, although they did not explore the impact of the intervention. Egmond (2005) created a strategy and protocol for an intervention method for innovative energy technologies that relied on the theories of Rogers and Moore. Their method identified the technology they wanted to increase (energy conservation innovations by housing associations in this article), determined the mainstream niche market to target, figured out what that niche wanted in a technology, and pulled together vendors and customers in that niche to help figure out how to appropriately adjust the technology. This European program used a survey to place customers along the technology adoption curve and learn who the early majority were but left the actual crossing of the chasm to market forces. The same group, beginning in 2007, used the method and applied it to compressed natural gas cars in an attempt to speed up adoption of the new technology. Unfortunately, in both cases, there has been no available impact study of the results of using the
method, although there are plans for such an evaluation for the compressed natural gas cars effort.  

Faires (2005) discussed how the technology diffusion framework was used as the basis for a survey of households to determine their attitudes towards solar power systems. Adoption of the measure was desired by policy-makers, but was occurring at a very slow rate. Information was needed to help determine the best intervention approach. This study followed a line of reasoning about how to separate people into the Rogers’ groups and query them about attitudes. According to the authors:

Understanding consumers’ attitudes towards an innovative product provides two key benefits. First, strengths and weaknesses in the innovation attributes can be identified and managed effectively (Hsu et al., 2000). Second, more control can be imposed on the marketing strategy in order that the innovation is made attractive to the most receptive audience (Auty and Elliott, 1998) (Faiers 2005: 1,800)

The survey results showed differences between early adopters and those in the early majority and they were able to make targeted recommendations on how to approach the early majority. The research found support for the concept of a chasm in a different segment from Moore’s original high-tech sector. As with the Egmond (2005), the assessment of whether the information gained through this study effected future adoptions was not noted.

These were the only two articles that discussed the chasm specifically, although several articles used Rogers’ diffusion of innovations as a conceptual theory. One of the more detailed articles was written by Weber, Gebhardt, and Fahl (2002). They acknowledged the aspects of time within Rogers theory and performed a retrospective study of an innovative technology (gas condensing boilers) in four countries in Europe (Netherlands, France, UK, and Germany) as well as a more detailed assessment of four distinct programs in Germany. The timeline covered in the study was a twenty-year period from the early 1980’s to around 2000. The study found that success of the boiler was positively influenced by the level of natural gas infrastructure within a country, the support of a network of market actors, a good marketing campaign, financial rebates, a stable program (i.e., the program is present over time), ease of a program application process, and the image of the technology. The efficiency and reliability of the boilers did not differ among the four countries and was not considered to be an important factor for explaining the differences in success. The existence of standards did not result in substantial differences in the efficiencies of condensing or conventional boilers available on the market in the four countries. The pay-back period was only partial indicator of success as Germany had a high market penetration, but also had long pay-backs. Finally, who initiated the program was not found to be important in the eventual success of the technology.

This article brings out important differences in the market structures between the four countries and ties them directly to success. The differences are presented here in more detail as they provide a good comparison of market differences. In the Netherlands, condensing boilers of multiple manufacturers were successfully demonstrated in an attempt to use a demand pull

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24 Based on email conversation with the author and an unpublished article sent to us.
strategy. After demonstration, a subsidy program was implemented and a labeling system devised. However, the lack of trained contractors to install or advise about the technology caused bottlenecks in adoption. This was rectified through a technology specific training program. Eventually the training moved to the vocational training programs in the country as well as courses offered by manufacturers. While first only for condensing boilers, the subsidy program attempted to obtain even more energy savings by pairing subsidies for insulation and boilers. In the Netherlands, at the beginning of this technology, multiple actors were present, including the gas supplier, an energy agency, a gas research institute, gas utilities, manufacturers and the government. Fifteen years later, the gas supplier, energy agency, and government had dropped out as an involved market actor while the research institute and utilities continued to support the technology through labeling and subsidies. The article does not state what the market penetration was in the Netherlands.

France used a different strategy as manufacturers were more involved from the beginning of the effort and two distinct lines of condensing boilers were created – one for single family households and one for larger buildings. In France, the individual units were not very successful and showed a rise and fall that mimicked the availability of subsidies. No labeling efforts were undertaken in France and manufacturers were not involved in training efforts for the individual units. The larger units, though, were more successful even without subsidies from the utility. It was thought that how the unit was sold (in conjunction with a standard system), more perceptible energy savings, and better informed and trained installers (the article does not state who does the training for this different group of installers) helped create this success. In the late 1980’s, 65 percent of the larger boilers installed contained a condensation system and accounted for about 10 percent of boiler sales in France. Only a few years later, this had fallen to around 2 percent, a value explained by a new housing construction slump and the end of subsidies.

Germany attempted to promote the technology for quite a long time with limited success. This was attributed to unclear legal conditions for installation and condensate removal and to the drastic decline in energy prices in the early 1990’s. “Since then, there has been a substantial growth of this market, partly forced by tightened emission thresholds and a voluntary emission label.” (Weber 2002: 301) In Germany, public dollars were used for information and incentives while marketing and training costs were picked up by the manufacturers. At the time of the article, condensing boilers in Germany had a market share of 18 percent.

The last of the four countries reviewed, the UK, utilized a customer rebate that moved the market penetration from 1 percent to over 2 percent and increased the number of manufacturers from three to twelve. However, once the rebates were stopped, sales declined back to around 2 percent. Two years later they provided a lower rebate and gave some cash to installers as well in the belief that increased awareness of condensing boilers and the reduced incremental cost would counterbalance the lower rebate level and overcome installer reluctance to work with the boilers. The article does not indicate the success of this venture, although it does state they moved back to a higher customer rebate and no installer incentive after two years and dropped it altogether in 2000. Besides rebates, the UK was involved with establishing efficiency levels for the technology.

This retrospective study of four European countries provided evidence of the influence of financial subsidies in marketing new products as well as the need for multiple market actors to assure success. The use of some sort of labeling system for the new product and the necessity of
ongoing policy support was noted. Assuring that those who install and maintain the new product have the proper skill set was also shown to be a component of success.

Another retrospective study looked at the drivers of CFL adoption in Hungary in a two-year period from 1995 to 1997. Intervention in the market came from multiple sources.

There were a large number of small-scale energy-efficiency programmes initiated by various organizations including industry and government that included the promotion of the CFL to various extents. The vast majority of these programmes concentrated on raising awareness. Industry initiatives ranged from information and advertising campaigns, professional and community education programmes, articles and advertisements in newspapers and professional publications, trainings, to promotional sales at low prices. (Urge-Vorsatz 2001: 804)

Market studies, focus groups, and in-depth interviews used within this study showed a market penetration increase from 5 percent to 19 percent in the two-year period as well as an increase in awareness from under half the households to 80 percent. Market penetration was found to be quite varied by market segments, though, and highly related to socio-demographic elements. Those with higher levels of education, as higher adopters, were thought to better understand the economic implications of using the CFL. However, in the end “…there was no single, nationwide market transformation program to which the entire market success can be attributed, and no major programmes were targeted to overcoming other barriers than the lack of information.” (Urge-Vorsatz 2001, 805). The author did identify two key drivers to the successful penetration of CFLs in Hungary. The first was the competition among market actors (mainly manufacturers) that resulted in broad marketing and raised awareness of the public. However, she points out that simple awareness does not guarantee success and credits the shock of drastic hikes in electricity costs as the other key driver. The market was primed for a desire to save energy because of a ten fold increase in nominal electricity prices over an eight year period. In 1995, when the study began, “a jump in nominal prices led to a 35.5 percent increase of electrical prices in real terms.” (Urge-Vorsatz 2001, 806) What seemed to come from this study (although the author does not state it quite so specifically) was that the intervention of multiple CFL adoption programs was successful because of a public need driven by high electricity prices.

Moving back to California, and very closely related to ETP, the Public Investment Energy Research (PIER) Program, implemented by the California Energy Commission (CEC), has structured their intervention to include a separate marketing group that works with many of the different technology specific groups.

PIER’s implementing legislation requires that the program focus on the development of practical products but avoid direct marketing of specific products. This requirement reflects the State’s concern that PIER not act in ways that unfairly favor a particular manufacturer or otherwise distort the private free market for lighting products. (Johnson 2004: 6-236)

The article describes one area in which this marketing group was active, although its impact is not covered in the article.

Called a ‘market connection,’ the PIER marketing group was conceived to fill a perceived gap between how a public sector program and a private sector program support a
new product. In the public-sector applied R&D process the situation is somewhat different from private-sector technology innovations. Often the private innovator is the R&D funder, manufacturer, and marketer, whereas the public R&D programs often deal with complex contractual relationships and are not directly connected to the manufacturing and marketing agents who must ultimate adopt and deliver their innovations to the market. This means that a variety of key steps must be explicitly added to the public-sector product value chain to avoid investment in innovations that would otherwise be of limited market value or face insurmountable market barriers. A comprehensive market connection model must be used to manage such risks and gain maximum value from the public R&D investment. (Johnson 2004: 6-231)

The article stresses the need for public funds to be spent very intentionally and that the skill sets of many of those working with new technologies is often not conducive to considering multiple components of a technology. As the authors states:

Without such a focus, R&D projects can easily minimize such market-related considerations in favor of a more exclusive emphasis on refinement of the technology, with the result that the product may be stranded without adequate production interest, support of key intermediaries, or momentum toward the market. With independent market connection planning and coordination, all parties including the technology developers can participate actively in a variety of coordinated market connection activities, from tech transfer planning to market research, manufacturer engagement, and barrier-breaking. (Johnson 2004: 6-238).

The authors indicate that there are many ways in which a product can fail in the marketplace, yet be technically sound. They reiterate the need for intentional choices when performing applied Research & Development (R&D) and show where problems can occur. The next set of bullet points are drawn directly from the article as they quickly outline where problems could occur as well as providing a possible antidote.

- Lack of early economic analysis and business-case development. This results when products are motivated by technical possibilities, but with abstract and over-generalized applications. The product then becomes an impractical technical capability looking for a problem that can afford it. Although such freedom is properly encouraged in basic scientific research, in product development it can render the result irrelevant to market needs and acceptability. In applied R&D, it is crucial to have a clear vision of the product's ultimate place in a competitive market from the start, with continuous reiteration of the market connection model as the product is developed and refined.

- Lack of early manufacturer commitment. This most often occurs when R&D is directed by organizations other than the ultimate manufacturers. The early development of a business plan is an effective antidote to this problem, since as it develops alongside the product, key business concerns such as cost, market preferences and application, competitive advantages, and pricing are all refined to assure a practical result. Ideally, manufacturers would be directly involved as early in the process as possible, either through cofunding, joint development, or advisory review.

- Failure to build value-chain support. If distributors will not carry the new product (for example, because of excessive inventory carrying costs, warranty-support risks, or installer/user education requirements), it will have difficulty reaching the market.
Similarly, if engineering specifiers perceive problems with design time, quality control, or installation/support cost penalties, they are likely to avoid the product even if the distributor carries it. In addition, if the installer is skeptical or confused, the product will be seen as too burdensome. Finally, if all involved do not understand how the products can help meet building code compliance requirements, success is unlikely. For these reasons, case studies of early implementations are often valuable tools.” (Johnson 2004: 6-234)

The article closes with a statement that the inclusion of a market connections group has helped in many aspects of the PIER work, including adoption of utility incentives and manufacturer interest. There was purported to be a cultural change among the researchers involved so that marketing issues were a higher priority than previously. However, as stated previously, there was no research evidence to support some of the claims.

Similar to PIER, but funded by the federal government, the Department of Energy’s (DOE’s) Inventions & Innovations (I&I) Program worked with individual inventors and very small businesses to move inventions and innovations to commercially successful technologies. I&I intervenes in the market by selecting appropriate “...grantees [they found that those with commercialization experience and/or willingness to seek outside advice was key to a successful market entry], educating grantees in commercialization strategies, disseminating information on grants’ technical and commercialization progress, and providing post-grant tracking and commercialization assistance.” (Moore 2004: 6-264) The last annual report on the website was March 2005 and there were no funds available in 2007, so it does not appear that this program is currently active. However, when they were up and running, they issued grants ranging from $50,000 to $250,000 in three categories: conceptual, developmental, and demonstration. Multiple segments were covered as well including biomass, building technologies, distributed energy, FreedomCAR & Vehicle technologies, industrial technologies, and solar energy technologies. The 23-year period from 1982 to 2005 saw close to $2.3 million in I&I funding for 22 California projects.25

Moore (2004) described three emerging technologies and the help I&I is providing these grantees. This included fact sheets (generally a 1 to 2 page description of the technology, benefits, and energy savings and system economics), market assessments, technical & market assistance (of an unspecified nature), placement of the technology of the I&I website, and assistance creating alliances with the I&I grantee and DOE national laboratories. The program studies the market for the company and provides technical advice, but does not actively market the product. Commercialized products are tracked for 10 years by I&I to determine energy and dollar savings. While the specific analysis used to track savings is unknown, the program appears to claim all the estimated savings from installed units of products started in the I&I program.

One intervention that is different from what has already been reviewed and specific to energy efficiency is that of a circuit rider. “Circuit riders provide a flexible assistance service that is

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25 In the 26 year period included in the articles, I&I sponsored a total of 187 projects with a cumulative funding of $117 million.
designed to deliver exactly what the recipient is seeking.” (Epstein 2004, 6-156) However, a successful circuit rider does not just have a technically sound background, they

. . . had to be animated and dynamic. In effect, they had to be prepared and capable to motivate the group to ask questions, maintain focus, and limit potentially disruptive digressions. Our experience leads us to conclude that these interpersonal abilities, as much as technical expertise, were necessary to ensure support sessions were of high value and impact. (Epstein 2004, 6-160)

The peer-to-peer approach used by a circuit rider follows the diffusion of innovations theory, where the innovation decision is made based on face-to-face interactions.

The authors highlighted areas in which their company performed circuit rider activities around code requirements and high performance lighting. Within the code requirement work, a pilot (with 28 sessions) and a full scale program (with 120 circuit rider sessions) used three-hour sessions at firms where 15-20 design professionals attended to learn not only ways to be code compliant, but approaches for efficient design. According to the author, there was minimal promotion, but interest levels were so high that they were oversubscribed for sessions. The lighting project circuit rider work included two sessions with management and staff of a partner within a design program and follow up support for a project that arose from the original session information. According to the authors, these few sessions helped to reactivate the company as a partner within the energy efficiency program.

1.2.4 Market Imperfections and Product Promotion

The previous section discussed specific interventions by different programs. This section provides information about other views of why an intervention is needed (i.e., market failure), what are some of the imperfections, how companies handle producing new products and factors for product success.

“It is widely argued by neoclassical economists that the existence of market failures is a prerequisite for market intervention. However, the existence of such failures is also seen as an insufficient justification for government involvement.” (Brown 2001: 1199) Market failures can create a need for intervention, which may mean government intervention, but not always. If emerging technologies do have market failures, then a market intervention may be needed, which could be performed by a utility program or it could be performed by another entity. This implies that not all market interventions are best performed by any one actor, but rather by different actors depending on specific measure needs. Brown provided details about policy successes in the energy efficiency realm (although not specifically to emerging technologies) that she felt verified the importance of intervention in energy efficiency. Broadly, the policy successes were in public/private RD&D partnerships; voluntary, information and technical assistance programs; regulatory policies; and financing, investment enabling, and fiscal policies. According to her: “The following sampling of policy successes [listed above] provides further evidence that energy-use decisions are not made in efficient markets. Further, they verify that policy mechanisms exist that can eliminate, reduce, or compensate for market imperfections.” (Brown 2001: 1204)
Shove’s discussion that intervention is needed to correct market imperfections was one of her main points about how the current paradigm works, although she disagreed with the concept. She states:

Repeated calls for ‘additional research to understand barriers, to assess their importance, sector by sector and to examine the effectiveness of policy options that might overcome them’ (Hirst and Brown, 1990: 278; Bondi, 1988) reinforce the belief, first, that such barriers are real and, second, that governments have a legitimate part to play in supporting efforts to correct these and other market imperfections. (Shove 1998: 1,106)

Her countering argument, from a sociological viewpoint, was that:

. . . it is enormously helpful to see the world out there as a bumpy and uneven terrain in which new and not so new technological strategies ‘make sense’ in different ways and at different moments in time. Instead of resorting to all encompassing arguments about non-technical barriers, the effort is focused on making more precise sense of the ways in which energy-related ideas are selectively incorporated, adapted and abandoned. (Shove 1998: 1,109)

She suggests that technical change is a context-specific, local, and time specific process and that simply looking at barriers does not effectively allow a program to influence change.

However, given that the evaluation team operates in the current paradigm of barriers and uncertainties in which programs are used to influence the market, what are some of those barriers and uncertainties that should be considered? An econometric analysis (based on a survey of a representative sample of 2,848 commercial and services sector companies in Germany) looked at the perceived barriers to energy efficiency within the organizations. The analysis included the barriers of information and other transaction costs, bounded rationality, capital constraints, uncertainty and risk, and investor/user dilemma (i.e., tenant versus owner and who pays the bills). The study found statistically significant barriers, but that these barriers varied considerably across the sectors in the study. Detailed findings of the study were:

- Lack of information about the pattern of energy consumption was prevalent within a third of the sub-sectors examined.
- . . . the investor/user dilemma arising from rented office space turned out to be a significant barrier in more than half the sub-sectors analysed.
- According to our findings, organizations with public or quasi-public ownership structure (i.e., who are not profit oriented) exhibit the most barriers, and those with high energy consumption levels exhibit the least. But within sub-sectors, variations in energy costs appear to matter in only a few sub-sectors. (Schleich 2006: 13)

This data is not necessarily new as the difficulty between renters and building owners has been acknowledged for quite some time. What this study does provide, though, is empirical evidence of the existence of, and need to work within, the variation of barriers seen by different commercial segments.

While the previous study looked at the difficulties in diffusing energy efficiency measures through the lens of specific barriers, a slightly different tact is taken when considering the
difficulties in which an innovation decision is made by a company. Rogers outlined an innovation-decision process that a consumer goes through once a product is available. However, the decision of a company to create and market an innovation is made with recognition of many uncertainties. According to Meijer, the six sources of perceived uncertainty with respect to innovation decision-making are:

1. Technological uncertainty: This uncertainty source includes uncertainty about the characteristics of the new technology (such as costs or performance), uncertainty about the relation between the new technology and the infrastructure in which the technology is embedded (uncertainty to what extent adaptations to the infrastructure are needed) and uncertainty about the possibility of choosing alternative (future) technological options.

2. Resource uncertainty: Resource uncertainty is uncertainty about the amount and availability of raw material, human and financial resources needed for the innovation. Resource uncertainty also includes uncertainty about how to organize the innovation process (e.g. in-house or external R&D, technology-transfer, educating personnel). Resource uncertainty both resides at the level of the individual firm, as well as at the level of the innovation system.

3. Competitive uncertainty: Whereas technological uncertainty includes uncertainty about competing technological options, competitive uncertainty relates to uncertainty about the behavior of (potential or actual) competitors and the effects of this behavior.

4. Supplier uncertainty: Uncertainty about the actions of suppliers amounts to uncertainty about timing, quality and price of the delivery. Supplier uncertainty becomes increasingly important when the dependence on a supplier is high.

5. Consumer uncertainty: Uncertainty about consumers relates to uncertainty about consumers preferences with respect to the new technology, uncertainty about consumers’ characteristics and, in general, uncertainty about the long-term development of the demand over time.

6. Political uncertainty: Political uncertainty comprises uncertainty about governmental behavior, regimes and policies. Uncertainty can emerge about current policy (e.g. uncertainty about the interpretation or effect of policy, or uncertainty due to a lack of regulation) or about future changes in policy. Uncertainty about governmental behavior (reliability of the government) is also an important cause for political uncertainty. (Meijer 2007, 523-524)

Meijer studied a new technology early in the R&D stage (micro-combined heat & power technology) and found that technological and political uncertainty were the dominant sources of uncertainty, with consumer uncertainty next. By determining these, he could provide appropriate recommendations about how any sort of intervention could help with transitioning the technology beyond the R&D stage if the policy choice was to intervene.

Keeping with the viewpoint of a company performing new product development, Ettlie summarized National Science Foundation research to observe that:

Findings reveal, not surprisingly, that the success of a product depends primarily on three things: selecting the right projects, involving the customer throughout the process, and
handing off the project in a smooth fashion to marketing and manufacturing. However, not everything is common sense here:

- Surprisingly, the maturity of processes did not turn out to be significant, nor did the presence of a structured process, contrary to established concepts that lie at the heart of existing NPD [new product development] literature. Further
- In estimating actual implementation time, the companies’ numbers were significantly off the mark. Instead of an estimated one to two years, the actual processes probably would take five years.
- Even though companies were very successful at identifying what was wrong in the development process, they had a very difficult time implementing changes (due to risk aversion).” (Ettlie 2006: 264)

He follows on with the fact that, while it is called new product development, “. . . most new products are really not new to the world, but just copies of one-off imitators of existing products, with only slight changes from existing products.” (Ettlie 2006: 265) The rate of new products is declining from 19 percent in 1986 to 6 percent in 1997. Therefore, many of the products worked with by ETP are most likely not new products, but incremental changes to existing products. Regardless of whether a product is truly new to the world, a meta-analysis of 12 studies found four significant correlates of a new product’s success.

1. Customer perception of product advantage (.363)26 Product advantage refers to the customer’s perception of product superiority with respect to quality, cost-benefit ratio, or function relative to competitors.

2. Protocol (product and marketing requirements) (.341) Protocol refers to the firm’s knowledge and understanding of specific marketing and technical aspects prior to product development; for example, (1) the target market; (2) customer needs, wants, and preferences; (3) the product concept; and (4) product specification and requirements. This factor includes “origin of ideas” measures as well.

3. Proficiency in marketing activities (.337) This factor specifies proficiency of marketing research, customer tests of prototypes or samples, test markets/trial selling, service, advertising, distribution, and market launch.

4. Strategy for the project. (324) This factor indicates the strategic impetus for the development of a project (for example, defensive, reactive, proactive, imitative). Measures of product positioning strategy are included, as are measures of “fit” between the new product and corporate strategy. (Ettlie 2006: 281)

A set of best practices of firms who perform new product development (NPD) were pulled from a benchmarking study by the Product Development Management Association. Three of the nine best practice points are presented in detail here as they are relevant if ETP chooses to look closely at the companies with whom they work.

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26 While not specifically noted in the text, the values in parentheses are assumed to the correlation coefficients.
1. The Best practice firms do not succeed by using just one NPD practice more extensively or better, but by using a number of them more effectively simultaneously.

2. [Points 2-7 mention how the company that is performing the NPD works, which is not as relevant for ETP as the assumption, is that the product has been developed by the time it is in the program.]

3. Best practice firms are more likely to measure NPD performance and expect more out of their NPD efforts. Best practice firms expect 45 percent of their sales to come from products commercialized in the last three years. In actuality, 49.2 percent of their sales did come from products commercialized over the last five years, about twice the rate of the rest of the firms.

4. Even with all the NPD improvements implemented, the average outcomes have improved only slightly across many measures.
   a. The success rate is stable at 59 percent of those products that make it to market.
   b. It takes 6.6 ideas to generate one success, down from 7 in 1982. Firms are more efficient in weeding out less probable projects earlier in the NPD process.” (Ettlie 2006: 298-299)

These best practices present interesting pieces of data regarding the company that is creating the product. The sales component in point #3 seems to hold for larger companies but it is unclear how smaller companies that ETP may work with fit into this practice. The fact that companies who follow best practices do more measurement and have more expectations is very interesting. The last point seems to indicate that best practices have decreased the number of ideas generated for a success, but not the ultimate commercialization success. The important point brought out here and previously in the book is that approximately 60 percent of new products are successful in the market, once they make it out of the company and to the market. Obviously, this is for all products, and whether energy efficiency products have a different success rate is unknown.

Moving back to the viewpoint of the consumer, certain factors were relevant for product success. Weber, in studying condensing boilers in Europe, found that technology characteristics (efficiency and reliability), energy markets, price, image of the technology and actor involvement all were important. Interestingly, he found that the mere existence of a rebate was more a signal to consumers about the value of the boilers than the actual level of the rebate. A good marketing campaign was also more important than the level of the rebate. Earlier, Faires was quoted connecting consumer attitudes and marketing: “… more control can be imposed on the marketing strategy in order that the innovation is made attractive to the most receptive audience.” (Faires 2006: 1,800) The research by Urge-Vorsatz suggested that “advertising and information campaigns, educational programs and other awareness raising activities are the most important tools for the promotion of the CFL (and perhaps it is also worth investigating to what extent this applies for other energy-efficient technologies as well).” (Urge-Vorsatz 2001, 808) Egmond (2006) and Faires (2006) strongly subscribe to the diffusion of innovations theory and indicate that knowing the different proclivities of market actors and providing information that matches their tendencies helps assure success. Johnson (2004) indicates that knowledge of the economic viability and competitiveness, marketability, user needs, and value-chains are all needed for new products promotion.
1.2.5 Dissemination

All of the above literature discusses markets or interventions from the viewpoint of a NPD company or a customer. However, one source gave relevant information about how they worked with clients to disseminate their research findings. SKB, the Netherlands Centre for Soil Quality Management and Knowledge Transfer, is responsible for research around soil related strategic and applied research. They have been disseminating research information for over a decade. The review highlighted the different groups with whom SKB worked and the change the organization underwent in an attempt to have their research used more often. Their initial dissemination activities were very inclusive, attempting to interact with multiple market actors such as contractors, consultants, and those with the problem that the research was attempting to solve. They believed the dissemination process was “natural” and they only had to facilitate getting everyone together for research to be used. They provided CD’s and web based information and created subject specific meetings with over 200 in attendance. It was not specifically indicated in the presentation, but the approach appeared to not work well as they changed how they were disseminating information. They moved to the Internet in 1998 with the perverse results of fewer of their reports read. They created a portal in which a small group of specialists determined the demand for a large group of users and invested over a half million Euro to bring it to fruition. However, nobody used it. This failure along with a growing awareness of non-use of the reports coming out of SKB signaled them to change their strategy. Again, they went back to an inclusive approach, but with a changed dissemination strategy – they would fit the dissemination to the user. Using Rogers’ diffusion of innovations approach, they viewed users of their research as those who fell into the innovator, early adopter, and early majority categories. Each category was considered a stakeholder and SKB created characteristics of the different group to help SKB focus on how they would communicate. They put 30 percent of their budget towards this new dissemination strategy that included seeking partners in the dissemination of results and attempting to embed research results. For example, the characteristics for early adopters led them to plan to invite these early adopters to meetings and give them credit for success while the early majority dissemination plan was to translate research into “digestible bits” (van Reijsen 2007: 22). They were going to attempt to have their research results put into guidelines with the belief that verified techniques provides status and helps to minimize risk. Because of a limited budget, they chose to find partners to work with to help access the early and late majority and pass on the research findings. This is an ongoing process and the success of this approach to information dissemination is not yet known.

1.2.6 Conclusions

With the exception of one dissenting opinion, the concept of viewing energy efficiency adoption as: 1) occurring within a population that follows Rogers’ adopter categories, 2) attempting to reduce barriers to move people through the adopter categories, and 3) influencing decisions through purposeful communication, was the framework of the articles reviewed. Multiple ideas in the Rogers book were substantiated by most of the articles, either directly or indirectly. One study found evidence of the chasm theory put forward by Geoffrey Moore and two others used the idea of a chasm in their applied research. Rogers, on the other hand, specifically discounted any gaps or chasms in the adopter curve, preferring to believe in a continuous distribution of the population, perhaps these differences are a function of thinking about the groups from a theoretical/empirical versus marketing stance.
In thinking about all the sources reviewed, what stands out is the refrain of understanding the market for an individual product and communicating in specific ways to different groups within the market. The technological aspects of products were present, but minimized in most of the discussions. Companies looking to sell a new product have many sources of uncertainty, of which technological uncertainty is one, but the main issues around product success involve working within the market to understand customer’s needs and perceptions. The articles about intervention with customers backed up this viewpoint. One article mentioned technology characteristics as an important factor in the success of a product, but most of the other articles mentioned knowing customers attitudes and providing good marketing as a way to garner success. Therefore, the main finding is not the presentation of a specific listing of product information to assess, but the fact that a program must know what it is about a product that will appeal to the market in addition to the needs of determining specific energy efficiency possibilities. The concepts in Rogers’ Diffusion of Innovations are based on multiple empirical studies, their use is widespread, and it should be closely reviewed as a viable framework for ETP. (See the appendix for the main concepts put forth by Rogers.)

Other interesting ideas brought out by these sources include the following:

- One source presented empirical data showing that new product success rate is around 60 percent once a product is released into the market, though the definition of “success” is not entirely clear. ETP has the option to work with technologies at various stages of market acceptance. For those in the earliest stages of market acceptance, about 40 percent will fail regardless of their potential energy savings. This may be a factor that ETP can consider in its screening criteria.

- Many new products are most likely incremental changes from previous items and not truly new or disruptive. Incremental innovation can be the result of many approaches, including new products or an upgrade or improvement of existing products. Conversely, disruptive technologies typically present a brand new idea to consumers and may require the replacement of existing infrastructure or support systems. To the extent that end users are already familiar with – and using – existing products that are upgraded to produce energy savings, the incremental innovation may require fewer behavior changes than innovations that are disruptive. If an innovation is the result of an incremental change, there may be a lower likelihood for a chasm to exist between the early adopters and the early majority.

- There is evidence that the mere existence of a rebate can be a positive signal to consumers that the product is worthwhile to purchase. This is consistent with the basic objective of the ETP design which is to transfer technologies into the EE programs, which offer rebates.

- Ability of surveys to capture and place consumers into adopter categories. Both Rogers and Moore stress the concept that different people require different information as they

---

28 Ibid.
implement technology. Research demonstrates that surveys can be used to reveal these differences. A better understanding of these differences would enable ETP to better reach the targeted groups for a given technology based on the types of information required. In some cases, this may require providing more than just technical information.

- A labeling system may be needed for new products. As technologies are assessed, ETP should be cognizant of how consumers will differentiate the product from others in the market. Energy Star is one type of recognizable label, and it has also become a brand that consumers recognize. Different labels may reach different groups. If that is the case, ETP could make specific recommendations about the requirements for developing and implementing such a label.

- Some programs do not actively market the products included in their programs. This point indicates that, similar to ETP, other programs work upstream of the actual marketing of products to attempt to influence later purchases.

- A research-based entity is using Rogers’ *Diffusion of Innovations* theory to change how they package and market the results of their research. The audience for ETP information is currently the EE program managers. The packaging of the technology assessment reports may need to be changed to meet the needs of the EE program managers. Additionally, the program may expand in the future to include market actors in its information dissemination efforts. Information from the assessments may need to be further modified to fit those audiences.

The next step in the research had been to compare the findings of this literature review to the logic and underlying theory of the 2006-2008 ETP. This comparison was aimed at providing others with the knowledge of where the program aligns with the literature and where it diverges. The number of firm conclusions and recommendations was expected to be low due to the somewhat limited nature of this review. To assure the appropriateness of any conclusions regarding the ETP (as conceived for this program cycle), the team planned two activities:

---

36 The evaluation team will interview EE program managers during the next phase of the evaluation. These interviews will be one source of information about the effectiveness of ETP’s messages to EE program staff.
1. The first is to perform in-depth interviews with stakeholders involved in varying degrees with new energy efficiency products. These interviews cover specific topics that were brought up in the literature review. Such interviews will allow us to more closely explore these topics as they directly pertain to the ETP.

2. The second activity is to discuss and clarify these initial conclusions with the ETP program managers and identify any erroneous conclusions and unsupported or unnecessary recommendations resulting from an incomplete understanding of the 2006-08 ETP or plans for the 2009-11 ETP.

However, at this point, these depth interviews are on hold and the need for these data will be reassessed in September 2008.
BIBLIOGRAPHY FOR LITERATURE REVIEW


### 2. DATA SOURCES AND PRIORITY FOR LITERATURE REVIEW

To access the embedded document, double-click on the tag to the left of the sentence.

### 3. EXCERPTS FROM HIGH PRIORITY SOURCES, EVALUATOR COMMENTS, AND CODING COUNTS

To access the embedded document, double-click on the tag to the left of the sentence.
APPENDIX B: COMPLETED PERFORMANCE MATRIX

The performance indicators and success criteria are provided in the table in this appendix. The key to the variables is provided first for ease of use.

**KEY TO VARIABLES**

<table>
<thead>
<tr>
<th>PG&amp;E Link</th>
<th>Number of link associated with logic model</th>
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</thead>
<tbody>
<tr>
<td>SCE Link</td>
<td>Number of link associated with logic model</td>
</tr>
<tr>
<td>SEMPRRA Link</td>
<td>Number of link associated with logic model</td>
</tr>
<tr>
<td>Description of Link</td>
<td>Text description of what occurs during this link</td>
</tr>
<tr>
<td>Performance Indicator</td>
<td>Performance indicator - what data will be used to assess success. Numbers shown here correspond to success criteria number. That is, performance indicator #1 maps directly to success criteria #1.</td>
</tr>
<tr>
<td>PG&amp;E Success Criteria for Performance Indicator</td>
<td>Success criteria - the criteria against which the program will be judged.</td>
</tr>
<tr>
<td>SCE Success Criteria for Performance Indicator</td>
<td>Success criteria - the criteria against which the program will be judged.</td>
</tr>
<tr>
<td>SEMPRRA Success Criteria for Performance Indicator</td>
<td>Success criteria - the criteria against which the program will be judged.</td>
</tr>
<tr>
<td>Evaluator Data Collection Activities Associated with Link</td>
<td>What the evaluation team would perform under data collection tasks.</td>
</tr>
<tr>
<td>Tracking Activities by IOUs to Support Link</td>
<td>What the evaluation team needs the IOUs to track to facilitate evaluation of the links</td>
</tr>
<tr>
<td>Discussion points</td>
<td>Areas that were brought out by the evaluation team during the creation of the indicators and criteria that need further discussion. This does not preclude discussion on any link, just that these were specifically noted.</td>
</tr>
<tr>
<td>Reporting</td>
<td>Draft period of time in which tracked data would be reported on by the IOUs to the CPUC.</td>
</tr>
</tbody>
</table>

Data in bold correspond to those links which are planned to be evaluated with a high or medium priority during this evaluation.

Data not in bold correspond to those links which are currently not planned to be evaluated during this evaluation.
<table>
<thead>
<tr>
<th>PG&amp;E Link</th>
<th>SCE Link</th>
<th>SEMPRA Link</th>
<th>Description of Link</th>
<th>Performance Indicator</th>
<th>Success Criteria for Performance Indicator</th>
<th>Evaluator Data Collection Activities Associated with Link</th>
<th>Tracking Activities by IOUs to Support Link</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Information Acquisition - ETP staff attend conferences, talk with colleagues, peruse the Internet, read professional journals, and meet with vendors in an effort to find emerging energy savings technologies or systems that require testing by the program to assure impacts.</td>
<td>1) Information acquisition activities by ETP staff.</td>
<td>1) ETP staff engaged in different activities.</td>
<td>Program manager interviews</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Information Acquisition - Scanned opportunities are reviewed by multiple stakeholders and prioritize them for Phase II opportunity assessment.</td>
<td>1) Number of meeting held.</td>
<td>1) Meetings are generally held with 2 or more internal stakeholders on at least quarterly basis.</td>
<td>NA as decisions are within the ETP team for prioritization. No formal meetings at this point.</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
<td>Information Acquisition - Phase II opportunity assessment screening brings forward market and technology specific information. This information is used to screen list for viable technologies to assess. The chosen technologies create a portfolio of technologies for assessment.</td>
<td>1) Number of viable technologies and associated completed screening tool. 2, 4, 5) Specific market data for each viable technology.</td>
<td>2) Market and technology specific information in the associated screening tool is sufficient to make decisions on whether to include the technology in the assessment portfolio. 1) List of viable technologies is created. 4) List of viable technologies shows potential for energy and/or demand savings. 5) Current technologies under assessment are aligned with planned goals for the portfolio as outlined in the Program Implementation Plan.</td>
<td>Obtain list from IOU and obtain associated screening tool for technologies assigned as completed in the screening status.</td>
<td>Excel sheet (or program tracking database extract) of technologies with designation of current status and date of this designation.</td>
</tr>
<tr>
<td>PG&amp;E Link</td>
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<td>4</td>
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<td>4</td>
<td>Technologies that pass criteria for inclusion are assessed.</td>
<td>1) Number of assessments begun.</td>
<td>1) 45 assessments during cycle with PCG funds from current program cycle. 1) 18 assessments begun during the program cycle with PCG funds from current program cycle for SoCalGas and 21 begun during the program cycle for SDG&amp;E.</td>
<td>Obtain list from IOU of technologies with launched assessments.</td>
<td>Same as link 3 for technologies with launched assessment.</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5</td>
<td>Assessment of technologies results in a document of findings.</td>
<td>1) Number of assessment reports created.</td>
<td>1) 100% of completed assessments have assessment report. 2) For those assessments that are terminated / cancelled, a document is created that indicated the reason.</td>
<td>Obtain assessment reports from IOUs for completed assessment.</td>
<td>Same as link 3 for which projects have assessment reports.</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
<td>Knowledge Creation - Assessment report provides information about technology to internal IOU staff.</td>
<td>1) Quality of the report.</td>
<td>1) 100% of assessment reports are complete, well written, highlight knowledge gained, and has sufficient details to enable decisions about the technology by the IOU.</td>
<td>Would have collected this data under link 5  Interviews with internal EE staff</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>7</td>
<td>Information Dissemination - Assessment report (or fact sheet based upon the report) is used as the basis for passing on knowledge about successful technologies (i.e., those that validated by the assessment process)</td>
<td>1) Availability of report to internal EE staff.</td>
<td>1) Reports, summary data, or fact sheets are readily available to internal IOU staff (i.e., staff know that they exist, where they are, when they are available, and can access them easily)</td>
<td>None - would have collected this data under link 6</td>
<td>None</td>
</tr>
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<td>PG&amp;E Link</td>
<td>SCE Link</td>
<td>SEMPRALink</td>
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| 8         | -        | -          | Assessment report or fact sheet is used to create audience-specific marketing documents as well as informing appropriate rebate levels. | 1) Number of emerging technologies integrated into EE portfolio.  
2) Quality of content of different collateral pieces produced  
3) Data available to support rebate / incentive calculations | 1) Successful technologies are integrated into the EE portfolio.  
2) Marketing documents accurately describe attributes of successful technology in terms understood by all targeted audiences.  
3) Reasonable and sufficient data used for incentive and rebate calculations. | NA | Excel sheet with number of collateral pieces produced, mapping of collateral to technology, and date of production. |
<table>
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<tr>
<th>PG&amp;E Link</th>
<th>SCE Link</th>
<th>SEMPR A Link</th>
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<td>SEMPR A Link</td>
<td>ETP staff informally discuss findings from assessments with multiple internal employees.</td>
<td>1) Informal internal discussions are occurring.</td>
<td>1) Staff discuss successful technology with at least 2 program managers within the company within 3 month of assessment completion. Program managers with whom ETP staff have had discussions are aware and knowledgeable about successful technologies and can relate the</td>
<td>Program manager interviews, obtain list from IOU</td>
<td>List of PMs with whom ETP PM discussed assessment, date of discussion, technology discussed.</td>
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<td>NA</td>
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<td>ETP staff bring assessment results to formal internal team as well as provide assessment updates in less formal internal seminar presentations.</td>
<td>1) Number of formal meetings in which assessments were discussed. 2) Number and content of seminars provided in which assessments discussed 3) Number of attendees in seminars.</td>
<td>1) Staff discuss assessment in formal meeting within 3 months of assessment completion. (IET Meeting) 2) Staff discuss ongoing and completed assessments during informal seminars that occur twice a year. (Technology Update Meeting) 3) Seminar participants include program managers and delivery personnel. Internal clients with whom ETP</td>
<td>Obtain tracking activity data for this link from IOU. Interviews with seminar attendees.</td>
<td>Date of seminars/meeting, names and contact information of people attending seminars/meeting, agenda of meetings, PowerPoint presentation and other information from seminars</td>
</tr>
<tr>
<td>PG&amp;E Link</td>
<td>SCE Link</td>
<td>SEMPRALink</td>
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<td>9</td>
<td>Information brought to internal team increases the awareness and knowledge about the potential to use the technology within the EE portfolio.</td>
<td>1) Awareness and knowledge about newly assessed successful technology.</td>
<td>1) Internal team members find the information about recently assessed successful technologies useful. Internal clients with whom ETP staff interact are aware and knowledgeable about successful technology.</td>
<td>Interviews with EE Program Managers or delivery people</td>
<td>None</td>
</tr>
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<td></td>
<td>10</td>
<td>10</td>
<td>EE staff decide to integrate emerging technology into EE programs. Assessment report provides information about measure performance (e.g. cost effectiveness, measure cost, etc.) of newly assessed successful technology.</td>
<td>1) Data available to support incentive / rebate calculation. 2) Number of emerging technologies integrated into the EE Portfolio</td>
<td>NA</td>
<td>1) Reasonable and sufficient data used for incentive and rebate calculations. 2) Successful technologies are integrated into the EE portfolio.</td>
<td>Obtain information under link 3 for transferred technologies. Obtain information regarding incentive/rebate calculation under link 7</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>11</td>
<td>Marketing materials and rebate information about newly assessed successful technologies are created by EE programs.</td>
<td>1) Number and content of marketing and rebate collateral created and produced.</td>
<td>1) 100% of transferred technologies have adequate marketing and rebate material prepared.</td>
<td>Obtain different collateral pieces and number produced from IOU</td>
<td>Excel sheet with number of collateral pieces produced, mapping of collateral to technology, and date of production.</td>
</tr>
<tr>
<td>PG&amp;E Link</td>
<td>SCE Link</td>
<td>SEMPR A Link</td>
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<td>Seminars/presentations to market actors and/or end-use customers that include information about successful newly assessed technologies cause customers to be more aware and knowledgeable about these technologies.</td>
<td>1) Customer awareness and knowledge about newly assessed successful technologies. 2) Number of seminars / presentations to internal and external people.</td>
<td>NA</td>
<td>NA</td>
<td>Date of seminars, PowerPoint presentation and other information from seminars. Where available, names and contact information of people attending seminars.</td>
</tr>
<tr>
<td>9</td>
<td>13</td>
<td>12</td>
<td>Customers become more aware and knowledgeable about emerging technologies in portfolio through the marketing materials or rebates.</td>
<td>1) Awareness and knowledge of emerging technologies in portfolio by customers.</td>
<td>1) Increase in both awareness and knowledge of emerging technologies that came through ETP by customers.</td>
<td>EE Participant survey</td>
<td>None</td>
</tr>
<tr>
<td>-</td>
<td>14</td>
<td>-</td>
<td>Customers become more aware and knowledgeable about emerging technologies in portfolio through the marketing materials or rebates through interactions with account executives.</td>
<td>1) Awareness and knowledge of emerging technologies in portfolio by customers.</td>
<td>NA</td>
<td>NA</td>
<td>None</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td>13</td>
<td>Information learned earlier reduces market barriers among which can be performance uncertainty, asymmetric information, hassle, and information search costs.</td>
<td>1) Influence of marketing on market barriers that are in effect.</td>
<td>1) Relevant market actors report that marketing collateral reduces known market barriers.</td>
<td>Focus group of market actors or EE participant/no participant survey</td>
<td>None</td>
</tr>
<tr>
<td>PG&amp;E Link</td>
<td>SCE Link</td>
<td>SEMPRA Link</td>
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<td>11</td>
<td>16</td>
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<td>Rebate alone induces some customers to intend to purchase technology.</td>
<td>1) Influence of rebate on intent to purchase.</td>
<td>1) Customers report that a rebate helps induce them to purchase a technology.</td>
<td>NA</td>
<td>Focus group of market actors</td>
</tr>
<tr>
<td>12</td>
<td>17</td>
<td>14</td>
<td>A decrease in market barriers plus cash incentives increases the intent of a customer to purchase a technology transferred from ETP if there is a need for the technology.</td>
<td>1) Influence of market barriers and cash incentives on customer intent to make EE purchases.</td>
<td>1) Customer report an increased intent to purchase (when there is a need) based on reduction of market barriers and available cash incentive.</td>
<td>Focus group of market actors</td>
<td>None</td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td>15</td>
<td>A customer’s intention to purchase a technology that was transferred from ETP will be followed up by actual behavior.</td>
<td>1) Impact of technologies that were transferred from ETP and were installed through EE programs.</td>
<td>1) The number of installations/adoptions for technologies from ETP in the EE portfolio increase annually, calibrating for measures that move to Codes &amp; Standards. 2) The lifecycle energy gross savings for technologies transferred from ETP to the EE portfolio increase annually.</td>
<td>EE paid measures from all IOUs by year</td>
<td>Create and maintain measure value to enable direct mapping of measure from ETP</td>
</tr>
<tr>
<td>14</td>
<td>19</td>
<td>16</td>
<td>As customers see other companies obtaining incentives and using technologies transferred from ETP, the information about the positive aspects of the technology are diffused through the market and additional customers choose to use the technology as well.</td>
<td>1) Diffusion rate of technologies from ETP.</td>
<td>1) Diffusion rate is positive over a 10 year period.</td>
<td>Regular residential and nonresidential saturation surveys</td>
<td>None</td>
</tr>
<tr>
<td>PG&amp;E Link</td>
<td>SCE Link</td>
<td>SEMPRALink</td>
<td>Description of Link</td>
<td>Performance Indicator</td>
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<tr>
<td>15</td>
<td>20</td>
<td>17</td>
<td>Installation of technology transferred from ETP will lead to energy and/or demand savings.</td>
<td>1) Energy Impact assessment.</td>
<td>1) kWh / kW/therm impacts</td>
<td>Various</td>
<td>None</td>
</tr>
<tr>
<td>16</td>
<td>21</td>
<td>18</td>
<td>DSM programs can constrain the per-capita energy use of Californians.</td>
<td>1) Meta-analysis of energy use.</td>
<td>1) Per capita kWh/therm impacts</td>
<td>Various</td>
<td>None</td>
</tr>
</tbody>
</table>

**A successful technology is one that has passed the ETP criteria as a technology that has the potential to save energy or demand. It differs from a successful assessment in which the technology may or may have been shown to have the potential to save energy or demand.**
APPENDIX C: BUSINESS RISK ASSESSMENT DATA COLLECTION TOOL

Technology / Assessment Name ________________________________

ETP Database Number ________________________________

Project Manager ________________________________

Name of Value Proposition Preparer ________________________________

Step 1: Please prepare a value proposition statement for this technology for the target market. The value proposition will take the following form:

- For _________________ (target customer)
- who _________________ (statement of customer need)
- the _________________ (product) is a ___________________ (recognized product category)
- that _____________________ (statement of key benefit).
- Unlike _________________ (primary competitive alternative),
- this product _____________________ (statement of primary differentiation).

Please be clear in your value proposition about which words refer to which elements by bolding the words in the sentence with the parenthetical notation indicating which element is being described. For example:

- For IOU ETP program managers (target market) who need to feed the pipeline of energy efficient technologies for EE Programs (statement of customer need),

- the Value Proposition (product)

- is a leading indicator for evaluating the effectiveness of the Screening function of ETP (recognized product category)

- that provides clear documentation of the reasons why a technology assessed by ETP would (eventually) be deployed in the field and enable energy savings (statement of key benefit).

- Unlike the utility’s existing documentation of the Screening function (the data provided in the Long Form, ETOS, and ETPA) (primary competitive alternative),
- the Value Proposition addresses the market need for a technology beyond the implicit energy savings benefit (statement of primary differentiation).

Step 2: Clearly indicate the sources that were used to develop each component of the value proposition. A table similar to the one below would be appropriate. For primary sources, please include contact names, position titles, and company/organization affiliation of participants. For secondary sources, please use full citations and reference websites when the sources are available electronically. The goal is to enable a member of the evaluation team to replicate the data collection efforts that you performed.

<table>
<thead>
<tr>
<th>Value Proposition Component</th>
<th>Primary Sources</th>
<th>Secondary Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Customer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement of Customer Need</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognized Product Category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement of Key Benefit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Competitive Alternative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement of Primary Differentiation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Step 3: Please describe the value of this assessment to the California ratepayers. Please complete the following statements:

1. Please describe the incremental benefits of ETP’s activities related to this technology. That is, what value has the ETP added that would not exist otherwise?

2. Was the incremental cost of this technology (when compared to the nearest baseline) considered when selecting the technology? If it was, what was the approximate incremental cost? Please provide any data used.

Please complete the table below to describe the sources of information for these two questions. For primary sources, please include contact names, position titles, and company/organization affiliation of participants. For secondary sources, please use full citations and reference websites when the sources are available electronically. The goal is to enable a member of the evaluation team to replicate the data collection efforts that you performed.

<table>
<thead>
<tr>
<th>Value Proposition Component</th>
<th>Primary Sources</th>
<th>Secondary Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental Effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental Cost</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**APPENDIX D: DEGREE TO WHICH MARKET READINESS HAS BEEN ASSESSED**

An important determinant of product success relates to the structure of the market into which it is entering. For example, some industries are so tightly held (e.g., the diamond industry) that the failure of any new market entrants is practically guaranteed. In other cases, the market is completely satisfied with existing product offerings and will not consider replacements. In either of these scenarios, investors should think carefully about the risks associated with such barriers to entry before committing resources.

The Market Readiness Analysis seeks to help investors identify such barriers. This analysis creates six categories of questions that will create a picture of the current state of the market as it relates to the receptivity to new market entrants. Considering the responses to these questions will enable investors to determine whether the resource commitment needed to overcome these barriers is justified by the likelihood of succeeding in the marketplace and the potential return.

**Table 4. Market Readiness Analysis Questions**

<table>
<thead>
<tr>
<th>Market Readiness Category</th>
<th>Questions to Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market perception of the need for alternatives</td>
<td>• How have you assessed perceived need in the market for offerings of this type?</td>
</tr>
<tr>
<td></td>
<td>• How have you applied the results of that analysis in your proposed offering?</td>
</tr>
<tr>
<td></td>
<td>• What are the qualitative and quantitative measures of latent market demand?</td>
</tr>
<tr>
<td>Market understanding of the alternatives offered</td>
<td>• Is the alternative offering perceived as a nice-to-have, must-have or shadow-cost opportunity?</td>
</tr>
<tr>
<td></td>
<td>• Does the market perceive a shift in total cost of ownership vis-à-vis purchase price?</td>
</tr>
<tr>
<td></td>
<td>• Is there a reference customer base for the alternative offering or an equivalent offering?</td>
</tr>
<tr>
<td>Market traction of alternatives offered to-date</td>
<td>• Are there sufficient adopters in the market to make the new offering viable?</td>
</tr>
<tr>
<td></td>
<td>• What stage of adoption (qualitatively and quantitatively) has been reached to-date?</td>
</tr>
<tr>
<td></td>
<td>• Is market adoption accelerating or decelerating?</td>
</tr>
<tr>
<td>Market Readiness Category</td>
<td>Questions to Address</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Market adoption barriers encountered to-date</td>
<td>• What adoption barriers pose the greatest threat to the viability of this offering?</td>
</tr>
<tr>
<td></td>
<td>• What is the business plan to address these barriers?</td>
</tr>
<tr>
<td></td>
<td>• Does the market perceive a performance or reliability risk?</td>
</tr>
<tr>
<td>Factors in entrenchment of incumbent technology</td>
<td>• Are sunk costs, depreciation, or other financial considerations a factor in resistance to adoption?</td>
</tr>
<tr>
<td></td>
<td>• Are service, support, or operational factors such as tacit knowledge a factor in resistance to adoption?</td>
</tr>
<tr>
<td></td>
<td>• How dependent is adoption on evaluation or demonstration systems?</td>
</tr>
<tr>
<td>Goodness of fit of the alternative offering with the pre-existing system of use</td>
<td>• Is a new business model or finance model required for adoption, and if so, is it a model familiar to the market?</td>
</tr>
<tr>
<td></td>
<td>• Is a new technical infrastructure required for adoption, and if so, is it inexpensive and readily available?</td>
</tr>
<tr>
<td></td>
<td>• Is a new personnel or training infrastructure required for adoption, and if so, is it perceived as reasonable vis-à-vis the expected benefit?</td>
</tr>
</tbody>
</table>
APPENDIX E: PRELIMINARY FEEDBACK ON BUSINESS RISK ASSESSMENT DATA

The evaluation team provided preliminary feedback to ETP staff on their draft data collection instruments, which were submitted between March and July 2009. The first round of responses did not vary along the lines of sector, technology, or utility. The value propositions submitted each had a unique combination of strengths and weaknesses. As a result, some of the issues highlighted in this section do not apply to all of the draft value propositions submitted. These general findings are provided here in order to streamline the discussion of areas of common misunderstanding.

One recommendation for all preparers of the data is to review the White Paper prior to revising these forms. The organization of the white paper corresponds to the three Steps in the data collection tool. Each section provides guidance on how to complete each component of the value proposition as well as each additional request for data in the data collection tool. The guiding questions in the White Paper will help the preparer provide content that is more closely aligned with the metrics by which they will be scored.

STEP 1: VALUE PROPOSITIONS

The draft value propositions provided in this first round of data collection serve as a foundation upon which additional detail can be added. There are some conceptual issues that could be addressed better by many of the value propositions presented. We discuss those conceptual issues in this section.

Value propositions should be developed from the perspective of the Target Customer. The Customer Need, Key Benefit, Competitive Alternative, and Primary Differentiation should all be relevant to the Target Customer’s point of view because the value proposition is intended to determine the market worthiness of each ETP technology. For this component of the evaluation, the market worthiness of the technology is dependent on the extent to which Target Customers have a business case for purchasing the technology. As such, the entire value proposition should be designed to move the Target Customer to action. (Value propositions that convince the utility to invest in the technology through ETP or through the EE programs can also be developed, but those are not the intent of this exercise.)

Energy savings must serve some larger goal. On the scale of Key Benefits (Nice-to-Have, Must-Have, Shadow Cost), energy savings are typically a Nice-to-Have value proposition unless they are connected with some other, more compelling need. In other words, energy savings are not sufficient to convince a Target Customer to purchase a technology. Energy savings may contribute to some larger goal: cost reductions, corporate energy savings goals, “green” marketing efforts, or greenhouse gas reduction benefits, to name a few. These larger goals are

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37 At the time of this writing, only the first round of draft data had been submitted. Additional feedback will be compiled as additional rounds of data are submitted; these findings will be included in the final report.
more convincing from a business standpoint as Key Benefits or Primary Differentiation and should be explicitly stated. (Other benefits may relate to system performance, product quality, or maintenance requirements.)

**It is important to coordinate the Statement of Customer Need with the Key Benefit of the product.** In keeping with the mindset that the value proposition is designed to compel the Target Customer to purchase the product, the Statement of Key Benefit should be directly related to the Statement of Customer Need. It is logical that the best product positioning demonstrates how the product meets the Target Customer’s primary need, and the value proposition should achieve that goal.

**The value proposition should focus on Benefits rather than Features.** The Target Customer typically does not need to understand all of the technical features of the products to make the purchase decision. To clarify, features are technical attributes of a product. Benefits are the intended outcome that the Target Customer hopes to achieve by using the product. Features include the product’s expected useful life, the process used to achieve the benefits (e.g., use of an evaporative heat exchange process), and the color of the product. Focus on the results (i.e., benefits), not the process (i.e., features).

**Statement of Customer Need does not identify a need.** Several value propositions have used the Statement of Customer Need field to describe a characteristic of the Target Customer. For example, one value proposition described the Customer Need as "likes to use vsds," and another described the Customer Need as "has a kitchen hood ventilation system." Either of these terms could be used to segment the group of Target Customers, and the evaluation team encourages this. However, the Statement of Customer Need should describe a gap between the ideal world as perceived by the Target Customer and the world as it currently exists. It should lay the foundation for the Statement of Primary Benefit, which should show some connection to the Statement of Customer Need without re-stating it.
### Table 5. Step 1: Value Proposition - Common Errors Made and Recommended Remedies

<table>
<thead>
<tr>
<th>Code</th>
<th>Weakness</th>
<th>Recommendation for Addressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Target Customer is not an individual.</td>
<td>Identify the <em>individual</em> making the purchasing decision for the technology as the Target Customer.</td>
</tr>
<tr>
<td>B</td>
<td>Customer Need, Key Benefit, and Primary Differentiation focus too much on the benefits of reduced energy use and not enough on other benefits created by the technology.</td>
<td>The <em>primary</em> Customer Need, the <em>primary</em> benefit, and the <em>Primary</em> Differentiation should be the focus of these blanks. These are the <em>primary</em> factors that lead the Target Customer to purchase the technology. Other benefits, including safety or marketing benefits, may be more significant in the decision process than energy savings and should be mentioned here.</td>
</tr>
<tr>
<td>C</td>
<td>The benefits of the technology are considered from the perspective of the utility rather than from the perspective of the Target Customer.</td>
<td>It is important to consider the technology's Benefits and Differentiation from the Target Customer's standpoint, not from the perspective of the utility. Consider the factors that have the most influence on the Target Customer's decision to purchase the technology. (See Table 1 of <em>White Paper</em>.)</td>
</tr>
<tr>
<td>D</td>
<td>Key Benefit and Primary Differentiation are too general.</td>
<td>Where possible, quantify &quot;reductions&quot; or &quot;improvements.&quot; For example, &quot;leads to a 20% reduction in energy costs, which comprise 20% of Cost of Goods Sold.&quot;</td>
</tr>
<tr>
<td>E</td>
<td>Recognized Product Category is too complex.</td>
<td>Generally speaking, this category should be fairly simple and easily recognizable by the reader. For example, &quot;commercial lighting technology&quot; or &quot;residential air conditioner.&quot; Any clauses (e.g., &quot;that improves process efficiency&quot;) should be used in the Key Benefit or Primary Differentiation blanks.</td>
</tr>
<tr>
<td>F</td>
<td>Statement of Primary Differentiation focuses on Features rather than Benefits.</td>
<td>The Primary Differentiation should focus on the unique <em>benefits</em> that this product creates for the Target Customer. Features can be the technical features that lead to these benefits (e.g., &quot;more efficient motors&quot;). The Target Customer needs to know what the result of this innovation is, not what it is. Focus on the results - not the path to creating them. Answer the question, &quot;Why would the Target Customer select this product over its competitors?&quot; (See Slide 23 of the PPT provided with the data request.)</td>
</tr>
<tr>
<td>Code</td>
<td>Weakness</td>
<td>Recommendation for Addressing</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>G</td>
<td>There is no relationship between the Statement of Customer Need and the Key Benefit.</td>
<td>The Key Benefit should directly address the Customer Need. For example, if a customer needs to reduce heating load, the key benefit should state the amount by which heating load is reduced. (See Table 1 of White Paper.)</td>
</tr>
<tr>
<td>H</td>
<td>Customer Need is too often a &quot;nice to have&quot; rather than a &quot;must have&quot; or &quot;shadow cost.&quot;</td>
<td>The value propositions that address the most compelling customer needs (the &quot;shadow cost&quot; and &quot;must-haves&quot;) are more robust than those that address &quot;nice-to-haves.&quot; The value proposition should identify the most compelling reason that the Target Customer would want to buy the product. Typically, this is not an energy-related issue. Alternatives may include reliability, maintenance costs, attracting a new customer segment. (See slide 19 of the PPT provided with the data request.)</td>
</tr>
<tr>
<td>Q</td>
<td>Statement of Customer Need does not identify a need.</td>
<td>The Statement of Customer Need should identify a gap between the way the Target Customer would like things to be and the way that they actually are (e.g., &quot;requires high levels of light to illuminate products&quot; or &quot;seeks to achieve ideal comfort levels at the press of a button).&quot;</td>
</tr>
</tbody>
</table>
STEP 2: SOURCES SUPPORTING VALUE PROPOSITIONS

The sources of information provided in Step 2 are intended to document the resources used to complete the value proposition. In some cases, the evaluation team can locate specific sources provided in Step 2, either through contact information or through direct web links provided by the preparer. This is important because it enables the evaluation team to verify the claims made in the value proposition.38

Three areas are of general concern for this component of the data and are discussed here. Table 6 provides additional depth on other errors made in the completion of Step 2.

There is some confusion about what constitutes a Primary Source and what constitutes a Secondary Source. Some preparers listed individuals with whom interviews were conducted as Secondary Sources and reports prepared by other entities as Primary Sources; this is the reverse of what should be the case. As discussed in Section 2.1.3 of the White Paper, Primary Sources include information developed by the ETP staff; this may include interviews, conversations, surveys, focus groups, or original analysis of pre-existing data. Secondary Sources are the result of research efforts by entities outside of ETP staff. The terms "Primary" and "Secondary" do not reflect judgment about the quality of the data obtained or the relative importance of the data. This will need to be corrected on several data collection tools.

Some sources used as references may have interests that are in conflict with those of ETP. Individuals who are employed by the firms that manufacture or market the technology that is the subject of an ETP assessment should not be used as the exclusive source of information about a component of the value proposition. These individuals may serve as one of several sources of information about a component of the value proposition, but their analysis of the market should be verified by outside sources in most cases. (The exception may be the Product component of the value proposition.) Note that the data presented by a vendor are by definition a secondary data source. Unless those data are independently validated (e.g., by Underwriters Lab, a university, or other independent third party), the information provided by a vendor should be discounted as biased.

Some sources of data are not provided in enough detail. Part of the goal of Step 2 is to enable the evaluation team to verify the data collected by the preparer to support the value proposition. As such, the table in Step 2 should include enough detail for both Primary and Secondary sources for the evaluation team to re-create the value proposition that is submitted. For Primary Sources, such information would include names, company, position title, phone number, and email address at a minimum. For Secondary Sources, such information would include the title of the paper/report/article, author name, publishing organization’s name, date of publication, and a link to where the source can be found.

38 The evaluation team has not yet gone so far as to locate all the sources and locate the data points used to create the value proposition. Such verification and fact checking will be completed upon submission of the final value propositions.
The table in Step 2 is used to provide additional detail on components of the value proposition rather than to document the sources of information from which the information has been gathered. Some preparers have used Step 2 to re-state the contents of the value proposition or to provide additional detail on the content of each component of the value proposition. To the extent possible, the value proposition itself should be self-contained. That is, all of the relevant information about the value of the product to the Target Market should be included in the value proposition prepared in Step 1. The table in Step 2 should be used to identify the sources used to develop the value proposition, according to the directions in the template and supplemented by the feedback provided in the first round of data collection (Attachment A). The preparer may identify specific page numbers or excerpt quotations from the sources in the table in Step 2, but each time such details are provided, they should be connected to a cited source.
<table>
<thead>
<tr>
<th>Code</th>
<th>Weakness</th>
<th>Recommendation for Addressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contact information is not provided for primary sources</td>
<td>The source information should enable the evaluators to verify the data used to craft the value proposition. Current (working) phone numbers and/or email addresses for primary sources are needed. (See directions for Step 2.)</td>
</tr>
<tr>
<td>J</td>
<td>Primary sources are not identified by name.</td>
<td>Please provide individuals’ first and last names for primary sources. (See directions for Step 2.)</td>
</tr>
<tr>
<td>K</td>
<td>Confusion about what constitutes a Primary Source and what constitutes a Secondary Source.</td>
<td>Primary Sources include information developed by the ETP staff; this may include interviews, conversations, surveys, focus groups, or original analysis of pre-existing data. Secondary Sources are the result of research efforts by entities outside of ETP staff. The terms &quot;Primary&quot; and &quot;Secondary&quot; do not reflect judgment about the quality of the data obtained or the relative importance of the data. It is not necessary to have both a Primary and Secondary Source for each category of information. If both were used, however, they should be provided. (See Section 2.1.3 of <em>White Paper.</em> )</td>
</tr>
<tr>
<td>L</td>
<td>Use of sources whose interests may be compromised</td>
<td>The vendors of the technologies that are being assessed are not the most reliable sources of information. Unless they have studies from independent third parties, their input will be considered on the lower end of the &quot;Trusted source&quot; spectrum. These parties' ability to participate in the program depends on their ability to create a credible business case for the technology. As a result, their self-interest will come before the interests of ETP. These individuals may be one of several sources used, but exclusive use of the vendors is questionable.</td>
</tr>
<tr>
<td>M</td>
<td>Secondary Sources are not specifically listed, include incomplete citations, and/or are not currently available to the evaluation team.</td>
<td>&quot;Literature reference&quot; is not a sufficient citation. Please use full citations and references websites when the sources are available. The goal is to enable a member of the evaluation team to replicate the data collection efforts that you performed. (See directions for Step 2.)</td>
</tr>
<tr>
<td>N</td>
<td>Sources are not provided for some categories of information (e.g., Target Customer).</td>
<td>Please provide sources for all components of the value proposition.</td>
</tr>
<tr>
<td>Code</td>
<td>Weakness</td>
<td>Recommendation for Addressing</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>O</td>
<td>Sources do not cite specific market trends that support the claims made in the value proposition.</td>
<td>It is important to provide support, to the extent it is available, for most of the components of the value proposition (the Product and Recognized Product Category components are the exceptions). Examples of relevant support include market research that segments the market into relevant customer segments (one of which is the Target Customer); the results of interviews or surveys that clearly state a Customer Need or Primary Differentiation that is in line with the one in the value proposition.</td>
</tr>
<tr>
<td>R</td>
<td>The table in Step 2 is used to provide additional detail on components of the value proposition rather than to document the sources of information from which the information has been gathered.</td>
<td>The table in Step 2 should first and foremost be used to document sources. If the preparer wishes to excerpt details from those sources (e.g., page numbers or quotations from interviews), that may also be done in this table. Such specific details should always be linked directly to a source.</td>
</tr>
</tbody>
</table>
**STEP 3: VALUE OF THE ASSESSMENT AND SUPPORTING SOURCES**

The final section of the data collection tool provides the preparer with the opportunity to explain the value of the assessment to California ratepayers and document support for that explanation. It is important that the answer to the first question explain the benefits of the assessment to the California ratepayers. The evaluation team is looking for a statement about why ETP's involvement in this technology added value. The response should answer this question: What value was created by ETP's involvement in this technology that would not have been created by other market actors if ETP did not assess the technology? Section 2.1.2 of the White Paper provides additional clarification on this topic.

Most of the draft data provided in the first round of data collection described the value that the technology might have if it is adopted into the marketplace. This quantitative analysis is important, but it answers a different question than the one asked in Question 1: “Please describe the incremental benefits of ETP’s activities related to this technology. That is, what value has the ETP added that would not exist otherwise?” The quantitative answer is collected through the Aggregate Analysis database, which is being completed separately.

For consistency with the other sections of this report, Table 7 describes this error.

**Table 7. Step 3: Value of the Assessment and Supporting Sources: Common Errors Made and Recommended Remedies**

<table>
<thead>
<tr>
<th>Code</th>
<th>Weakness</th>
<th>Recommendation for Addressing</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Response to question #1 identifies the benefit of the technology for California ratepayers rather than the benefit of the assessment.</td>
<td>Question 1 of Step 3 asks for the benefit of &quot;ETP's activities related to this technology.&quot; In other words, this question asks for the benefit of the assessment to the California ratepayers. We are looking for a statement about why ETP's involvement in this technology added value. What value was created by ETP's involvement in this technology that would not have been created by other market actors if ETP did not assess the technology? (See Section 2.1.2 of the White Paper.)</td>
</tr>
<tr>
<td>S</td>
<td>No information about the consideration of incremental cost was included.</td>
<td>Incremental cost is typically one of the most important barriers to adoption of energy efficient technologies. If incremental cost is not considered at the time of selection, an explanation of why it was not considered should also be included.</td>
</tr>
</tbody>
</table>
**APPENDIX F: BUSINESS RISK ASSESSMENT SCORING TOOL**

Technology / Assessment Name ________________________________

ETP Database Number ________________________________

Project Manager ________________________________

Name of Value Proposition Preparer ________________________________

<table>
<thead>
<tr>
<th>Evaluation metric</th>
<th>Points Earned</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Robustness of Value Proposition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resembles value proposition of a technology that has demonstrated commercial success</td>
<td>/20</td>
<td></td>
</tr>
<tr>
<td>Each element is described to a reasonable level of specificity</td>
<td>/10</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal: Robustness of Value Proposition</strong></td>
<td>/30</td>
<td></td>
</tr>
<tr>
<td><strong>Extent to Which Due Diligence Has Been Conducted</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From a trusted source</td>
<td>/10</td>
<td></td>
</tr>
<tr>
<td>Verifiable</td>
<td>/10</td>
<td></td>
</tr>
<tr>
<td>Captures enduring, lasting market trends</td>
<td>/5</td>
<td></td>
</tr>
<tr>
<td>Relevant to the product at hand</td>
<td>/15</td>
<td></td>
</tr>
<tr>
<td>Support the claims made in the value proposition</td>
<td>/15</td>
<td></td>
</tr>
<tr>
<td>Statistically significant (if relevant)</td>
<td>/5</td>
<td></td>
</tr>
<tr>
<td>Degree to which market readiness has been assessed</td>
<td>/10</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal: Extent to Which Due Diligence Has Been Conducted</strong></td>
<td>/70</td>
<td></td>
</tr>
<tr>
<td><strong>Total Points Earned</strong></td>
<td>/100</td>
<td></td>
</tr>
</tbody>
</table>

Qualitative comments regarding value of the assessment to California ratepayers:
APPENDIX G: BUSINESS RISK ASSESSMENT SCORING MATRIX
APPENDIX H: AGGREGATE ANALYSIS FINAL SURVEY INSTRUMENT

Emerging Technologies Survey

PROJECT OVERVIEW

1. Name of Project: [Highlighted questions do not have to be filled in by respondent for the survey to be considered completed.]

2. IOU:

3. ETP Project Manager:

4. IOU database Project Number:

5. ETCC Project ID:

6. ETCC Project Number:

7. Please indicate the type of project. (Check all that apply)
   a. Software Assessment
   b. Hardware Assessment
   c. Market Assessment
   d. Other: (Specify: ____________________________)

8. Please indicate the type of research being used in this assessment? (Check both if it applies)
   a. Primary (i.e., gathering data from the original source)
   b. Secondary (i.e., gathering data from other sources such as reports)

[ASK IF 8A=1, ELSE SKIP TO 10]

9. If you are performing primary research, where is the data being collected?
   a. Survey of Customers
   b. Laboratory testing
   c. Testing at customer site(s)
   d. Other (please specify)
   e. Don't Know

SCANNING PHASE

10. Where did you first hear about this technology? (Check all that apply)
    a. PIER
    b. Company approached me
c. Customer approached me
d. Internal IOU person (please specify title) ____________________________
e. Conference
f. An article in a professional journal/newsletter
g. Professional organization (ASHRAE, etc)
h. Other (please specify) ____________________________

SCREENING PHASE

11. Is there IOU documentation at the screening stage for this technology?
   a. Yes
   b. No (GO TO 13)
   c. Not Applicable (SKIP TO 13)
   d. Don't Know (SKIP TO 13)

12. Please tell us the source or type of documentation used within the screening stage for this project. (Check all that apply)
   a. ETOS (Emerging Technology Opportunity Summary)
   b. ETPA (Emerging Technology Project Assessment)
   c. Short form
   d. Long form
   e. Other (Specify:_____________________)  
   f. Don't Know

ASSESSMENT PHASE

13. Why are you performing this assessment?
    [OPEN END]
    [i.e., what are you attempting to learn and share about the technology - what are your research goals?]

14. What program cycle funds support this assessment?
    a. 2004-2005
    b. 2006-2008
    c. 2009-2011

15. What other entities are working with you on the project by providing funding?
    a. None
    b. Don't Know
    c. Partner #1 is:
i) One of the other IOUs (Please Specify: ____________)  

ii) An energy efficiency program within my IOU (Please Specify: ______)  

iii) An outside company/organization (either private or public) (Please Specify: _____)  

iv) A university (Please Specify: ______)  

v) Other (please specify) (Please Specify: ______)  

d. Partner #2 is a:  

i) One of the other IOUs (Please Specify: ____________)  

ii) An energy efficiency program within my IOU (Please Specify: ______)  

iii) An outside company/organization (either private or public) (Please Specify: _____)  

iv) A university (Please Specify: ______)  

v) Other (please specify) (Please Specify: ______)  

16. Annual expenditures:  

[In this question, we are looking for the spending in each calendar year. That is, if the project started in November 2006, you would put those expenditures in 2006. Any expenditure in 2007 would be put in 2007 and expenditures to date in 2008 would be put in 2008.]  

<table>
<thead>
<tr>
<th>Year</th>
<th>ETP Expenditures</th>
<th>Co-funding Expenditures – Partner #1</th>
<th>Co-funding Expenditures – Partner #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006*</td>
<td>i)</td>
<td>ii) $</td>
<td>iii) $</td>
</tr>
<tr>
<td>2007</td>
<td>i)</td>
<td>ii) $</td>
<td>iii) $</td>
</tr>
<tr>
<td>2008</td>
<td>i)</td>
<td>ii) $</td>
<td>iii) $</td>
</tr>
</tbody>
</table>

* Note: Please put zero for any years with no expenditures. For example, if the project began in 2007, input a zero in 2006.  

17. What other entities are working with you on the project by providing in-kind services (e.g., volunteer labor, technology hardware, meeting space, etc.)?  

a. None  

b. Don't Know
c. Partner #1 is a:
   i) One of the other IOUs (Please Specify: _____________)
   ii) An outside company/organization (either private or public) (Please Specify: _____)
   iii) A university (Please Specify: ______)
   iv) Other (please specify) (Please Specify: ______)

d. Partner #2 is a:
   i) One of the other IOUs (Please Specify: _____________)
   ii) An outside company/organization (either private or public) (Please Specify: _____)
   iii) A university (Please Specify: ______)
   iv) Other (please specify) (Please Specify: ______)

18. At what stage is the assessment as of today’s date?

<table>
<thead>
<tr>
<th>Stage</th>
<th>Ye</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. In planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. In monitoring &amp; data collection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. In analysis &amp; final report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Cancelled</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. When was the funding encumbered (or committed) for this project?
   a) Month
   b) Year

20. If 18d=Yes, what is the date of completion (i.e., when the assessment report was completed)?
   a) Month
b) Year

GO TO 25.

21. If 18d=No AND 18e=No, what is the expected date of completion of the assessment (i.e., when the assessment report will be completed)?
   a) Month
   b) Year

22. If 18e=Yes, why was it cancelled?
   a. Could not find a host site
   b. Contracting difficulties
   c. Company went out of business
   d. Technology not performing as expected
   e. Determined that market was not available for the technology
   f. Determined that the likely incremental cost was too high.
   g. Other (Please specify__________________________________)

23. Is the manufacturer still pursuing this technology?
   a. Yes
   b. No
   c. Not Applicable
   d. Don't Know

24. Is there documentation (hardcopy or electronic) that discusses the reasons for the cancelled project?
   a. Yes
   b. No
   c. Not Applicable
   d. Don't Know

DONE - THANK & TERMINATE

25. [IF 18d=Yes, ELSE SKIP TO 29] Based on the completed assessment, what are the estimated annual savings for a single unit of the technology:
   a. kWh:________________________________________
   b. Therms:_____________________________________
   c. Peak kW:_____________________________________
   d. Not applicable
   e. Don’t know

26. Is there a final report associated with this assessment (i.e., the final written document created at the end of an assessment)?
27. Other than the final report, is there any other summary documentation associated with this assessment, such as a one-page fact sheet?
   a. Yes
   b. No
   c. Don't Know

28. Was a work paper prepared for this technology?
   a. Yes
   b. No
   c. Don't Know

**TECHNOLOGY OVERVIEW**

29. [ASK IF 7B=1, ELSE SKIP TO 1] Please identify the technology category (Please check all that apply)
   a. 
   b. Building Controls
   c. Building Envelope
   d. Commercial Cooking
   e. Daylighting, Commercial
   f. Daylighting, Residential
   g. Demand Response
   h. Desiccant Systems
   i. Distributive Generation
   j. Electronics Lamp
   k. Process Controls
   l. Evaporative Cooling
   m. Heat Recovery
   n. Heat Treatment
   o. Hot Water, Commercial
   p. Hot Water, Residential
   q. HVAC, Commercial
   r. HVAC, Residential
   s. Industrial Processes (other)
   t. Industrial Refrigeration
   u. Lighting, Commercial
   v. Lighting, Residential
   w. Motors, Industrial
   x. Motors, small
   y. Power Supplies
   z. Steam Boilers
   aa. Transformers
   bb. Water Pumping
   cc. Wastewater Treatment
   dd. Optical Sensors
   ee. Compressed Air Systems
   ff. Other
30. Provide a brief description of the technology.

[OPEN END]

31. [ASK IF 7B=1, ELSE SKIP TO 32] Please check the type of savings possible with this technology.
   a. Gas Energy Savings
   b. Electric Energy Savings
   c. Demand Savings

**MARKET INFORMATION**

32. What is the size of the company that owns this technology?
   a. Very small (less than 5 full-time equivalent employees)
   b. Small (5 to less than 50 full-time equivalent employees)
   c. Medium (50 to less than 500 full-time equivalent employees)
   d. Large (500 or more full-time equivalent employees)
   e. Don't Know

33. How long has this product been on the market?
   a. In production and being marketed by company for < 1 year (SKIP TO 35)
   b. In production and being marketed by company for >=1 and < 3 years (SKIP TO 35)
   c. In production and being marketed by company for >=3 years (SKIP TO 35)
   d. Not yet in production
   e. Don’t Know

34. How many months from now do you think this product will be in the production and marketing phase by the company?
   a. Fastest Possible Time: ________(Months)
   b. Longest Possible Time: ________(Months)

35. To which sector(s) is this technology targeted? (Please check all that apply.)
   a. Industrial
   b. Commercial
   c. Agricultural
   d. Residential

36. We need to determine, to the best of our ability using your data, what the overall technical potential is of all the projects currently under assessment (or recently completed). Please fill in the following table for your project using the information you have available. If you do not know an item, just simply leave the default value of DK.
   a) The data provided is based on:
      i. Our screening phase assessment
ii. The completed technology assessment

Technical Potential is defined as the complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective. That is, the population of customers has facilities and technologies in which the energy efficiency technologies or behaviors can be used.

If you are unsure of how to complete this question, you can ask us a question by clicking on the button here. A question box will show up and you can write your question. It will be emailed to Mary Sutter and she will respond back to you via email ASAP.

Example of data completion:

<table>
<thead>
<tr>
<th>Site Type</th>
<th>N Sites in your service territory</th>
<th>Percent of sites in your service territory where this technology could be used</th>
<th>Annual kWh / site</th>
<th>Peak kW Savings / Site</th>
<th>Annual Therm Savings /Site</th>
<th>Estimated Effective Useful Life of the Technology in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>217</td>
<td>55%</td>
<td>445,000</td>
<td>0</td>
<td>280,000</td>
<td>10</td>
</tr>
<tr>
<td>Nursing Home</td>
<td>2,918</td>
<td>100%</td>
<td>10,900</td>
<td>0</td>
<td>75,000</td>
<td>10</td>
</tr>
</tbody>
</table>

b) Please fill in this table:

<table>
<thead>
<tr>
<th>Site Type</th>
<th>N Sites in your service territory</th>
<th>Percent of sites in your service territory who could use this technology</th>
<th>Annual kWh / site</th>
<th>Peak kW Savings / Site</th>
<th>Annual Therm Savings /Year</th>
<th>Estimated Effective Useful Life of the Technology in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TRANSFER PHASE**

37. To which audiences have you presented information about this project? (CHECK ALL THAT APPLY)

a. EE Program Managers
b. Account representatives
c. Customers
d. ETCC
e. Conferences
f. Professional organizations (e.g., ASHRAE, IESNA, etc.) _______________
g. Other (please specify)__________________________________________________
h. None
38. For which internal or closely affiliated energy centers have you prepared information about this technology that was then used to reach other audiences? (CHECK ALL THAT APPLY)
   a. Technology Test Center
   b. California Lighting Technology Center
   c. Western Cooling Efficiency Center
   d. CTAC
   e. AgTac
   f. Pacific Energy Center
   g. Food Service Technology Center
   h. Other (please specify____________________________________________)
   i. None

39. Is there documentation relating to information dissemination of the technology? (e.g., presentation to internal staff, identity of EE program to which it was transferred)
   a. Yes
   b. No
   c. Don’t Know

40. Was this technology recommended for adoption into an EE program?
   a. Not applicable since the assessment is not yet completed. (Thank and Terminate)
   b. Yes (Specify which EE program: i)__________________________)
   c. No (Why not? i)__________________________________________
   d. Don’t know

41. Was this technology formally incorporated into an EE program(s) to the best of your knowledge? (Formal incorporation means that a given program offers a rebate for this technology or offers this technology as a recommended measure in an audit program.)
   a. Yes (Specify which EE program(s): i)__________________________)
   b. No (Why not? i)__________________________________________
   c. Don’t know

42. Was there an ETP unique measure name assigned to this technology?
   a. Yes
   b. No – THANK AND TERMINATE
   c. Don’t Know – THANK AND TERMINATE

43. What was the measure name?
   a. [OPEN END]
   b. Don’t Know

Thank you very much for your time in completing this survey.
APPENDIX I: STAKEHOLDER INTERVIEW GUIDE

CPUC Statewide Emerging Technology Program Evaluation
Implementation Assessment
Stakeholder Interview Guide
(February 09)

Under contract to the Energy Division of the California Public Utilities Commission (CPUC), Energy Marketing Innovations (EMI) is working with Summit Blue Consulting, to evaluate the 2006-08 Statewide Emerging Technologies Program (hereafter referred to as the ETP). As part of that effort, EMI is conducting a series of interviews with people who have had an interest in the statewide Emerging Technologies Program implemented by the four investor-owned utilities in California (PG&E, SCE, SoCal Gas, and SDG&E). We’re talking with policymakers, utility management, and various other stakeholders who interacted with one or more of the four IOU ETPs in some way and can offer some valuable perspective related to the mission and vision of this Program.

1. First, before we dive in, and to help us shape our discussion today, we have two initial background questions:

   How would you characterize both your past and current involvement with the ET programs in California?

   How familiar are you at this point with the specifics of the how this Program operates?

2. One element we are interested in understanding, at a very high level, is how various people view the overall vision for emerging technologies in California and the mission of this Program in supporting that vision? Should you define these terms so that all respondents, who will have different answers, have at least a shared understanding of the question?

   First, How would you frame the mission of the Emerging Technologies Program?

   Then, understanding that this term may mean different things to different people, how would you characterize what you understand to be the vision for this Program First, what would be the results of this Program in five years)? How about in ten years?
3. From your perspective, do you believe that this mission is well understood and is shared consistently across the various stakeholders?

4. What do you see as the critical success factors to the ETP in creating this vision?

5. What do you see as the critical success factors to the ETP in fulfilling its mission?

5. How does the ultimate success of ETP relate to, or affect, the success of your organization?

6. Relative to other programs in the energy efficiency arena, how does the ETP compare in importance for achieving the intermediate- and longer-term energy efficiency goals of the State of California? Please describe what factors are considered in your response.

7. Relating back to your understanding of the Program, what other programs, efforts and initiatives do you see interacting with the ETP? Are some of these more important than others in terms of relative importance to achieving the mission of the ETP?

8. Do you think that the private sector views the ETP as an effective strategy for increasing investment in new technologies that those in the private sector are trying to bring to market?

9. What do you view as the major accomplishments of the ETP to date?

10. How successful do you think the ETP has been in achieving its mission? What factors do you take into consideration when thinking about this?

11. Looking forward, what role do you see the ETP playing in support the objectives of the California Energy Efficiency Strategic Plan (CEESP)?

12. The ET programs have focused historically on conducting technology assessments that serve to critique the effectiveness of specific technologies, and to then work on transferring these technologies into utility efficiency programs. Are there any other (potentially “outside the
box” roles that the ETP might play in order to achieve the objectives of the California Energy Efficiency Strategic Plan (CEESP)?

13. Are there any specific refinements that you can identify that would improve the overall effectiveness of the ETP in fulfilling its mission? [probe to include “outside the box” thinking, similar to Q. 12]

14. Finally, for 2009-11, IOUs have requested $30,000,000 for the Statewide ETP. Do you believe that this proposed budget is sufficient for the ETP to achieve its mission? Please describe.
APPENDIX J: CASE STUDY SUMMARIES

ETP Compiled Case Study Summaries_Fin.
APPENDIX K: MASTER DATABASE DEVELOPED BY THE EVALUATION TEAM

ETP Master Database_Final Report.xls
APPENDIX L: ETPdb STRUCTURE
APPENDIX M: SYNOPSIS OF TRANSFERRED ETP TECHNOLOGIES

ETP Technologies
Transferred to EE Pro
**APPENDIX N: PEER REVIEWER CONFLICT OF INTEREST DISCLOSURE FORM**

Please identify any areas related to this project where a conflict or appearance of conflict could exist and explain the nature of that conflict. Please check “Yes” or “No” for each known or possible conflict of interest. If you select “Yes” for any question, please provide a description in the space provided below each question.

<table>
<thead>
<tr>
<th>Potential Conflict Area</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Could you or individuals or organizations that you work for be directly affected by your ratings on the project you have been asked to review?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please describe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Have you had any previous involvement with the specific technology that was evaluated by the project you have been asked to review?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please describe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. To your knowledge, are you familiar with any of the individuals developing or promoting the technology in question, or any of the individuals that managed or conducted the assessment of the technology?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please describe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Did you play any role in the selection of this or any other technologies for assessment under the Emerging Technologies Program?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please describe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Have you ever had any financial relationship with the utility that provided funding for the technology assessment project you have been asked to review? For example have you ever been an employee of or contractor to the utility or received funding from it for a research project?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Please describe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Are you aware of any other potential conflicts of interest not covered by the above questions?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Potential Conflict Area

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please describe:

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#### 1.2.7 Conflict of Interest Agreement

This agreement must be completed by individuals prior to their participation in this project review. Please date and sign in the spaces below and return the completed form at your earliest convenience to Dan Greenberg, E Source, 1965 N. 57th Ct., Boulder, CO 80301. If you have any questions or need to discuss any serious potential conflict of interest issues, please call Dan directly at 303-345-9118.

I have reviewed the information contained on this form and to the best of my knowledge I have disclosed any actual or potential conflicts of interest that I may have in regard to the projects that I have been nominated to evaluate. In addition, should circumstances change prior to or during my participation as a peer reviewer, I agree to disclose any actual or perceived conflicts of interest as soon as I am aware of the conflict.

_____________________________  ______________________
Signature                     Date

______________________________
Printed Name
APPENDIX O: PEER REVIEW REPORTS

SCE_ LED Open Signs  SDG&E_Ice Bear  ThePGE_Hot Dry Climate  SCE_LED MR16_final  PG&E LED Streetlight

SCE_Induction Lighting  PG&E_HID Electronic Ballast  Report-SCG ENI 85 CSDGE Hotel Guest Room  PG&E Data Center Air

SDG&E Hotel Guest Room Energy Controls  PG&E Data Center Airflow Management Tool  SDG&E UCSD Data Center

SDGE_Interior LED Lighting  Peer review report  Peer review report  Peer review report  Peer review report
SCE_Variable Speed Dust Collection  SCE Office of the Future  PG&E Mechanical Vapor Compression  SCE Automatic Sash
APPENDIX P: RESPONSE TO PUBLIC COMMENTS

ETP Final Report Comments_02-04-10.