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Evaluation of Public Service Electric & Gas Company's Standard Offer Program Volume II

C.A. Goldman, M.S. Kito, and M.M. Moezzi

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Evaluation of Public Service Electric & Gas Company's Standard Offer Program

Volume II: Appendices

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Interviewee List

This appendix lists utility and regulatory staff, and energy service companies (ESCOs) that were interviewed either in-person or by telephone. We also conducted telephone interviews with customer sponsors and host customers (names withheld upon request).

PSE&G Staff

Lawrence Codey
Charles Cuccaro
Brian Daly
Fritz Lark
Joe Pruzik (consultant to PSE&G)
Frank Romano
Jose Torres

New Jersey Board of Regulatory Commissioners staff

Michael Ambrosio

Energy Service Companies

Wayne Brown, Planergy
Art Coughlin, Public Service Conservation Resources Corporation
George Diehl, Viron Energy Services
Joseph Fitzpatrick, EUA Cogenex
Bill Glickman, PERCO
Dan Greco, Landis & Gry Power, Inc.
Mark Hanhurst, Central Hudson Enterprises Corp.
John Jensen, Public Service Conservation Resources Corporation
Bob Kennedy, CES/Way
John Leidy, Energy Investments
Art Lennon, EUA Cogenex
Bill Lisante, Honeywell
Dave Matasek, Johnson Controls
Frank Mazanec, On-Site Energy
Tom Mitchell, Co-Energy Group
Steve Morgan, Citizens Conservation Corp.
Todd Myer, McBride Energy Services

Energy Service Companies - continued

Tom Philbin, HEC
Richard Rathvon, Public Service Conservation Resources Corporation
David Rowland, Scallop Thermal
Russ Spitz, Vision Impact
S. Lynn Sutcliffe, Sycom
Mark Vallen, Demand-Side Resources
Charles Viemiester, Kenetech Energy Management
Phil Walotsky, Energy Options
Chris Wissman, Enersave

Other Companies

Clifford Aron, Consultant
Fred Gordon, Pacific Energy Associates
Lyn Guisenberger, The Roberts Group
Jim Halpern, Measurement and Monitoring Services
Dan Rosenblum, Mid-Atlantic Energy Project
Rich Ingelido, Stone & Webster
Bill Machold, Consultant

Interview Protocol for PSE&G Project Sponsors (Energy Service Companies)

Name: _____

Firm: _____

Title: _____

Phone: _____

Date: _____

Introduction

1. What has been your role (involvement) with the program?

2. Has your organization participated in other DSM bidding or performance contracting programs? How do these programs compare to the DSM Standard Offer program?

3. What do you understand to be the objectives of DSM Standard Offer program?

4. Do you believe the program is meeting these objectives?

Program Design/Administration

1. How did you learn about the standard offer program?

2. As you prepared your project proposal, did you find PSE&G's written material clear on a scale of 1 to 5? [1=poor, 5=excellent]

3. As you prepared your project proposal, would you say that instructions to sponsors in the AESOP (Automated Entry/Standard Offer Program) were:

Very clear Somewhat clear Not too clear Not at all clear

4. Were the requirements for submitting a project proposal:

Very reasonable Somewhat reasonable Not too reasonable Not at all reasonable

5. How much time (or money) does it take to develop a project proposal?

6. What type of marketing and analyses did you do before submitting your project proposal?

7. Have you had to contact PSE&G staff for clarification? Why? Were PSE&G staff responsive and helpful?

8. Did PSE&G provide you with the assistance you expected? (PROBE: In what ways? Have they expedited or hindered the success?)

9. After submitting your proposal, how long does it typically take before you obtained utility approval?

10. Has PSE&G done a good job of handling project proposals and contract execution? Weaknesses? Strengths? Suggestions for improvement?

11. Have you been paid by the utility in a timely manner?

12. Do you find the standard offer contract provisions reasonable?

- measurement and verification?
- pricing?
- performance guarantees?

13. Suggestions for improving the standard offer contract provisions?

14. Has PSE&G implemented the program fairly (e.g., any evidence of differential treatment of project sponsors, different levels of marketing or other administrative support)?

Implementation: Marketing and Customer Response

1. What market segments are you targeting?

2. What kinds of ancillary services are your offering?

   - operation and maintenance?
   - equipment guarantees?
   - performance guarantees?

3. Do you find that customers have been contacted by more than one firm participating in PSE&G's program? Did this cause any confusion?

4. Can you estimate your proposal to closing ratio for individual facilities (the number of proposals required to close a deal)?

   PROBE:
   - How many customers did you contact?
   - How many customers did you enter negotiations with?
   - How many customers did you sign contracts with?

5. Has it been difficult to convince customers to participate in the program and sign contracts?

   PROBE:
   - If so, why?
   - Contract term? M&V requirements? amount of customer contributions?

6. Can you estimate typical time periods that customers take to determine whether they will enter negotiations after you have submitted a proposal? typical time period for contract negotiations with customers?

7. Can you draw any generalizations regarding the types of customers who have chosen not to participate in the program?

8. For participating customers, could you discuss the extent to which customers have chosen comprehensive retrofits at their facilities?

9. What are the salient features of the contracts that you sign with customers at individual facilities?

10. What level of marketing support did you expect from PSE&G?

11. What marketing support has PSE&G provided?

Implementation: Program Costs

1. What percentage of project costs are attributable to M&V and other reporting requirements?

2. What portion of project costs do you set aside to cover administrative costs that can be charged by the utility?

3. Do you have suggestions for ways that either your firms or the utility's administrative costs could be reduced while still preserving major objectives of the program?

Free Ridership and Drivership

1. In your opinion, in the absence of the program, what is the probability that host customers would have installed various measures? [Probe: Number of facilities, variation among different types of measures]

• At the same time?	High	Medium	Low
• Within 1 - 3 years?	High	Medium	Low
• Within 4 - 5 years?	High	Medium	Low
• Within 6 - 10 years?	High	Medium	Low

2. Have customers used the PSE&G transaction to leverage installation of other measures not covered by the program (PROBE: What were these?)

Measurement and Verification

1. How well have the M&V protocols worked?

2. Are there certain types of measures for which there are no accepted M&V protocols? and which you believe are quite cost-effective for customers?

3. Do you have suggestions for acceptable M&V protocols for these types of measures?

Overall Assessment

1. What is your overall assessment of the program at this time? (PROBE: Is the program achieving its goals? strengths, aspects of the program that have been least successful?)

2. What could PSE&G do to improve the program?

Interview Protocol for Energy Service Companies That Are Not Active in PSE&G's Standard Offer Program

Name: _____

Firm: _____

Title: _____

Phone: _____

Date: _____

Introduction

1. How did you learn about PSE&G's Standard Offer Program?

2. What were your first impressions of the program?

3. Have your impressions changed over time and why?

4. Did you attend any meetings sponsored by PSE&G to explain the Standard Offer program? If not, why not? If yes, how satisfied were you with the information that the representative gave you concerning the program?

   ____ Very satisfied
   ____ Satisfied
   ____ Not that satisfied

5. How easy/difficult was the Standard Offer package to understand?

6. Did you contact PSE&G any time after receiving the Standard Offer Package? If so, were they responsive to your questions and concerns?

7. Did you consider participating in PSE&G's Standard Offer Program?

8. Why did you choose not to participate in the program? Please be as specific as possible. [Do Not Read List]:

   - no local presence?_____
   - payments not large enough?_____
   - market too difficult to penetrate?_____
   - too difficult to compete with PSCRC?_____
   - too difficult to compete with so many ESCOs?_____
   - other priorities?_____
   - contracts too stringent?_____
   - M&V protocol too stringent?_____
   - not enough utility support?_____
   - didn't want to expand too fast or in this region?_____

9. Has your organization participated in other DSM bidding or performance contracting programs? please specify which ones?

   PROBE:
   - What attracted you to these programs compared to the DSM Standard Offer?

10. What is your overall assessment of the standard offer program concept at this time (i.e., offering fixed prices for long-term guaranteed savings)?

11. Would you consider participating in this program in the future? Can you suggest modifications that would encourage you to participate?

12. What is the single most important piece of advice you can give PSE&G as it revises its Standard Offer Program?

Interview Protocol for PSE&G Host Customers

Name: _____

Firm: _____

Title: _____

Phone: _____

Date: _____

Introduction

1. What has been your role (involvement) with the program?

2. What type of facilities are receiving the new energy-efficient equipment or measures?

_____ Large Offices
_____ Retail
_____ Restaurants
_____ Health care facilities
_____ Elementary/secondary
_____ Colleges
_____ Warehouse
_____ Small C/I
_____ Industrial

3. Has your organization participated in other utility DSM programs or performance contracting programs?

_____ Yes (see 3a. below)
_____ No
_____ Don't know

3a. How do these programs compare with the Standard Offer program?

Implementation

1. How did you first learn about the Standard Offer program?

_____ PSE&G (see 1a., 1b., and 1c. below)
_____ Energy consultant/ESCO
_____ Other businesses/participants

1a. Did you attend meetings sponsored by PSE&G on the Standard Offer program?

_____ Yes
_____ No
_____ Don't know

1b. Were you contacted by a PSE&G representative?

_____ Yes
_____ No
_____ Don't know

1c. How satisfied were you with the information the representative gave you concerning the Standard Offer program?

_____ Very satisfied
_____ Satisfied
_____ Not that satisfied

2. Did you consider being a project sponsor (or sponsoring your own project)?

_____ Yes (see 2a below)
_____ No
_____ Don't know

2a. Why did you decide to work with an energy service company?

3. What type of energy-efficient measures or equipment will you be installing?

4. Were there other efficiency measures recommended in the ESCO's audit or proposal that you did not chose to install or go ahead with?

_____ Yes (see 4a.)
_____ No
_____ Don't know

4a. What types of measures and why did you choose not to install them?

5. Will you be installing other measures not covered by PSE&G's program at the same time?

_____ Yes (see 5a)
_____ No
_____ Don't know

5a. What types of measures?

5b. Were you planning to install these measures before you know about the Standard Offer program?

Program Design/Administration

1. Have you had to contact PSE&G staff for assistance with the program?

_____ Yes (see 1a and 1b)
_____ No
_____ Don't know

1a. What types of assistance?

1b. Did you find PSE&G staff:

_____ Very helpful and responsive
_____ Somewhat helpful and responsive
_____ Not helpful nor responsive

2. How much time did it take you to decide to go ahead with the project after you received the ESCO proposal(s)?

3. Were you involved in preparing the project proposal for the utility's approval?

If so, did you find PSE&G's written material clear and useful? on scale of 1 to 5? (1= poor, 5= excellent)

4. After you decided to go ahead with the project, how long did it take for the ESCO to obtain utility approval?

Factors Influencing Choice of ESCO/Contractor

1. Were you contacted by other (or more than one) energy service company or energy consultants about the Standard Offer program? How many?

2. What were the primary factors that led you to choose your energy service contractor? [Answers are unprompted]

3. Please rate each of the following factors on a scale of 1 to 5 where 1 is most important and 5 is unimportant:

_____ price
_____ financing conditions
_____ experience/technical expertise
_____ service quality
_____ contract length and provisions
_____ affiliation with the utility

4. Could you discuss your financing arrangement with the energy service company?

5. Does your contract with the ESCO include penalty provisions if hours of operation are reduced or the facility closes prior to the end of the contract?

_____ Yes
_____ No
_____ Don't know

Measurement and Verification

1. How well have the M&V protocols worked?

Customer Satisfaction

1. Overall, how satisfied are you with the Standard Offer Program? If dissatisfied, why?

   _____ Very satisfied
   _____ Somewhat satisfied
   _____ Neither satisfied/dissatisfied
   _____ Somewhat dissatisfied
   _____ Very dissatisfied

Reasons:

2. How satisfied are you with the performance of the Energy Service Company that you chose? If dissatisfied, why?

   _____ Very satisfied
   _____ Somewhat satisfied
   _____ Neither satisfied/dissatisfied
   _____ Somewhat dissatisfied
   _____ Very dissatisfied

Reasons:

3. Are you dissatisfied in any way with the quality of performance of the measure(s) you installed through the Standard Offer program?

   _____ Yes (see 3a below)
   _____ No
   _____ Don't know

3 What are you dissatisfied with? [respondents are not prompted]

____ lack of energy savings
____ equipment performance
____ failure of equipment
____ quality of installation
____ other
____ nothing

Freeridership & Free Drivership

1. Had your firm considered this project prior to the Standard Offer program? [PROBE: How was the decision to participate in the program made?]

_____ Yes
_____ No
_____ Don't know

2. Why were these measures not installed before?

3. [Effect on timing] If PSE&G's Standard Offer Program did not exist, what is the probability that your firm would have undertaken this project:

•	At the same time?	High	Medium	Low
•	Within 1 - 3 years?	High	Medium	Low
•	Within 4 - 5 years?	High	Medium	Low
•	Within 6 - 10 years?	High	Medium	Low

4. What is the main reason you chose to install [measure]? [Answers are unprompted and respondents can give more than one answer.]

____ Wanted to reduce operating costs
____ Because incentive was a good deal
____ Conserve energy
____ Opportunity to get state of the art equipment/quality of lighting, etc.
____ Remodeling/updating existing facility
____ Recommended by contractor/vendor

5. Now that you have had some experience with [measure], would you choose to purchase this same energy efficient equipment on your own without a utility sponsored program?

_____ Yes
_____ No
_____ Don't know

Overall Assessment

1. What is your overall assessment of the program at this time? strengths? aspects of the program have been the least successful?

2. What could PSE&G do to improve the program?
PROBE:
What is the single most important piece of advice you can give PSE&G as it revises its Standard Offer Program?

Interview Protocol for PSE&G Project Sponsors (Customer Sponsors)

Name: _____

Firm: _____

Title: _____

Phone: _____

Date: _____

Introduction

1. What has been your role (involvement) with the project?

2. What type of facilities are receiving the new energy-efficient equipment or measures?

   _____ Large Offices
   _____ Retail
   _____ Restaurants
   _____ Health care facilities
   _____ Elementary/secondary
   _____ Colleges
   _____ Warehouse
   _____ Small C/I
   _____ Industrial

3. Has your organization participated in other utility DSM programs or performance contracting programs?

   _____ Yes (see 3a below)
   _____ No

_____ Don't know

3a. How have these programs compared with the Standard Offer?

4. What do you understand to be the objectives of DSM Standard Offer program?

5. Do you believe the program is meeting these objectives?

Implementation

1. How did you first learn about the Standard Offer Program?

_____ PSE&G
_____ Energy consultant/ESCO
_____ Other businesses/participants

1a. Did you attend any meetings sponsored by PSE&G on the Standard Offer program?

_____ Yes
_____ No
_____ Don't know

1b. Were you contacted by a PSE&G representative?

_____ Yes
_____ No
_____ Don't know

1c.. How satisfied were you with the information the representative gave you concerning the Standard Offer program?

_____ Very Satisfied
_____ Satisfied

_____ Not that satisfied

2. Were you contacted by any energy service companies or energy consultants about the Standard Offer program? How many?

   _____ Yes
   _____ No
   _____ Don't know

   Number of contracts: _____

3. Did a consultant or vendor help prepare your proposal or did you do it with in-house staff?

4. How did you decide to participate in this program alone and not work through an energy service company?

5. What type of energy-efficient measures or equipment will you be installing?

6. Did you solicit bids from ESCOs, vendors, or contracts for the projects? How many?

7. Are you financing this project from internal funds/sources or obtaining capital from an ESCO?

8. Will you be installing other measures not covered by PSE&G's program at the same time?

   _____ Yes (see 8a and 8b)

_____ No
_____ Don't know

8a. What types of measures?

8b. Were you planning to install these measures before you knew about the Standard Offer program?

Program Design/Administration

1. As you prepared your project proposal, would you say that instructions to sponsors in the AESOP (Automated Entry/Standard Offer Program) were:

_____ Very clear
_____ Somewhat clear
_____ Not too clear
_____ Not at all clear

2. Were the requirements for submitting a project proposal:

_____ Very reasonable
_____ Somewhat reasonable
_____ Not too reasonable
_____ Not at all reasonable

3. Have you had to contact PSE&G staff for clarification?

_____ Yes (see 3a and 3b below)
_____ No
_____ Don't know

3a. What types of assistance?

3b. Did you find PSE&G staff:

_____ Very responsive and helpful
_____ Somewhat helpful and responsive
_____ Not helpful nor responsive

4. Did PSE&G provide you with the assistance you expected? (PROBE: In what ways? Have they expedited or hindered the success?)

5. After submitting your proposal, how long does it typically take before you obtained utility approval?

6. Has PSE&G done a good job of handling project proposals and contract execution? Weaknesses? Strengths? Suggestions for improvement?

7. Have you been paid by the utility in a timely manner?

8. Do you find the standard offer contract provisions reasonable?

   - measurement and verification?
   - pricing?
   - performance guarantees?

9. Suggestions for improving the standard offer contract provisions?

10. Has PSE&G implemented the program fairly (e.g., any evidence of differential treatment of project sponsors, different levels of marketing or other administrative support)?

Implementation: Program Costs

1. What percentage of project costs are attributable to M&V and other reporting requirements?

2. What portion of project costs do you set aside to cover administrative costs that can be charged by the utility?

3. Do you have suggestions for ways that either your firms or the utility's administrative costs could be reduced while still preserving major objectives of the program?

Measurement and Verification

1. How well have the M&V protocols worked?

2. Are there certain types of measures for which there are no accepted M&V protocols and which you believe are quite cost-effective?

Customer Satisfaction

1. Overall, how satisfied are you with the Standard Offer Program? If dissatisfied, why?

   _____ Very satisfied
   _____ Somewhat satisfied
   _____ Neither satisfied/dissatisfied
   _____ Somewhat dissatisfied
   _____ Very dissatisfied

Reasons:

2. Are you dissatisfied in any way with the quality of performance of the measure(s) you installed through the Standard Offer program?

_____ Yes (see 2a below)
_____ No
_____ Don't know

2a. What are you dissatisfied with? (respondents are not prompted)

_____ lack of energy savings
_____ equipment performance
_____ failure of equipment
_____ quality of installation
_____ other
_____ nothing

Freeridership & Free Drivership

1. Had your firm considered this project prior to the standard offer program? [PROBE: How was the decision to participate in the program made?]

_____ Yes
_____ No
_____ Don't know

2. Why were these measures not installed before?

3. If PSE&G's Standard Offer Program did not exist, what is the probability that your firm would have undertaken this project:

•	At the same time?	High	Medium	Low
•	Within 1 - 3 years?	High	Medium	Low
•	Within 4 - 5 years?	High	Medium	Low
•	Within 6 - 10 years?	High	Medium	Low

4. Did the program affect your choice of the efficiency level?

_____ Yes
_____ No
_____ Don't know

5. What is the main reason you chose to install [measure]? [Answers are unprompted and respondents can give more than one answer.]

____ Wanted to reduce operating costs
____ Because incentive was a good deal
____ Conserve energy
____ Opportunity to get state of the art equipment/quality of lighting, etc.
____ Remodeling/updating existing facility
____ Recommended by contractor/vendor

6. Now that you have had some experience with [measure], would you choose to purchase this same energy efficient equipment on your own without a utility sponsored program?

7. Has the Standard Offer Program encouraged you to install additional energy efficiency equipment on your own?

Overall Assessment

1. What is your overall assessment of the program at this time? strengths? aspects of the program that have been the least successful?

2. What could PSE&G do to improve the program?

PROBE:
What is the single most important piece of advice you can give PSE&G as it revises its Standard Offer Program?

Interview Protocol for Bright Investment Customers

Name: _____

Firm: _____

Title: _____

Phone: _____

Date: _____

Introduction

1. What has been your role (involvement) with the program?

2. What type of facilities are receiving the new energy-efficient equipment or measures?

   _____ Large Offices
   _____ Retail
   _____ Restaurants
   _____ Health care facilities
   _____ Elementary/secondary
   _____ Colleges
   _____ Warehouse
   _____ Small C/I
   _____ Industrial

3. Has your organization participated in other PSE&G DSM rebate programs?

   _____ Yes (see 3a. below)
   _____ No
   _____ Don't know

3a. How do these programs compare with the Standard Offer program?

4. Why did you choose the Standard Offer program as opposed to the utility rebate program?

Implementation

1. How did you first learn about the Standard Offer program?

_____ PSE&G (see 1a., 1b., and 1c. below)
_____ Energy consultant/ESCO
_____ Other businesses/participants

2. How satisfied were you with the information you received about the Standard Offer program?

_____ Very satisfied
_____ Satisfied
_____ Not that satisfied

3. What type of energy-efficient measures or equipment will you be installing?

4. Will you be installing other measures not covered by PSE&G's program at the same time?

_____ Yes (see 5a)
_____ No
_____ Don't know

4a. What types of measures?

4b. Were you planning to install these measures before you know about the Standard Offer program?

Program Design/Administration

1. Have you had to contact PSE&G staff for assistance with the program?

_____ Yes (see 1a and 1b)
_____ No
_____ Don't know

1a. What types of assistance?

1b. Did you find PSE&G staff:

_____ Very helpful and responsive
_____ Somewhat helpful and responsive
_____ Not helpful nor responsive

2. How much time did it take you to decide to go ahead with the project after you received the ESCO proposal(s)?

3. After you decided to go ahead with the project, how long did it take for the ESCO to obtain utility approval?

Factors Influencing Choice of ESCO/Contractor

1. Were you contacted by other (or more than one) energy service company or energy consultants about the Standard Offer program? How many?

2. What were the primary factors that led you to choose your energy service contractor? [Answers are unprompted]

3. Please rate each of the following factors on a scale of 1 to 5 where 1 is most important and 5 is unimportant:

   _____ price
   _____ financing conditions
   _____ experience/technical expertise
   _____ service quality
   _____ contract length and provisions
   _____ affiliation with the utility

4. Could you discuss your financing arrangement with the energy service company?

5. Does your contract with the ESCO include penalty provisions if hours of operation are reduced or the facility closes prior to the end of the contract?

   _____ Yes
   _____ No
   _____ Don't know

Customer Satisfaction

1. Overall, how satisfied are you with the Standard Offer Program? If dissatisfied, why?

   _____ Very satisfied
   _____ Somewhat satisfied

_____ Neither satisfied/dissatisfied
_____ Somewhat dissatisfied
_____ Very dissatisfied

Reasons:

2. How satisfied are you with the performance of the Energy Service Company that you chose? If dissatisfied, why?

_____ Very satisfied
_____ Somewhat satisfied
_____ Neither satisfied/dissatisfied
_____ Somewhat dissatisfied
_____ Very dissatisfied

Reasons:

3. Are you dissatisfied in any way with the quality of performance of the measure(s) you installed through the Standard Offer program?

_____ Yes (see 3a below)
_____ No
_____ Don't know

3 What are you dissatisfied with? [respondents are not prompted]

____ lack of energy savings
____ equipment performance
____ failure of equipment
____ quality of installation
____ other
____ nothing

Freeridership & Free Drivership

1. Had your firm considered this project prior to the Standard Offer program? [PROBE: How was the decision to participate in the program made?]

_____ Yes
_____ No

_____ Don't know

2. Why were these measures not installed before?

3. [Effect on timing] If PSE&G's Standard Offer Program did not exist, what is the probability that your firm would have undertaken this project:

• At the same time?	High	Medium	Low
• Within 1 - 3 years?	High	Medium	Low
• Within 4 - 5 years?	High	Medium	Low
• Within 6 - 10 years?	High	Medium	Low

4. What is the main reason you chose to install [measure]? [Answers are unprompted and respondents can give more than one answer.]

____ Wanted to reduce operating costs
____ Because incentive was a good deal
____ Conserve energy
____ Opportunity to get state of the art equipment/quality of lighting, etc.
____ Remodeling/updating existing facility
____ Recommended by contractor/vendor

5. Now that you have had some experience with [measure], would you choose to purchase this same energy efficient equipment on your own without a utility sponsored program?

_____ Yes
_____ No
_____ Don't know

Overall Assessment

1. What is your overall assessment of the program at this time? strengths? aspects of the program have been the least successful?

2. What could PSE&G do to improve the program?

PROBE:
What is the single most important piece of advice you can give PSE&G as it revises its Standard Offer Program?

Interview Protocol for PSE&G Utility Staff

Name: _____

Firm: _____

Title: _____

Phone: _____

Date: _____

Overview

1. Briefly describe the main phases and timeline of the DSM Standard Offer Program to date.

2. Briefly describe your role or roles in the program.

   PROBE:

   - How much of your time is currently committed to the program? (during previous periods)?

3. What would you say are the program's primary goals?

   PROBE:
   - Have the goals changed over time?
   - Response of upper-level utility management to the program goals and design?
   - Do the Commission, project sponsors, and host customers share a similar understanding of program goals?

4. Do you think the program is meeting these objectives?

   PROBE:
   - [If not:] Why weren't they achieved? Do you think the program goals were reasonable?

Program Design

1. Could you discuss the program design & planning process?

   PROBE:
   - Who had responsibility for program planning and what were their roles?
   - What other people or groups were involved?

2. How were consultants and outside parties used during the planning phase?

   PROBE:
   - What were the advantages and disadvantages of involving these outside parties?

3. What were the critical issues of program and RFP design?

   PROBE:
   - How were these resolved?
   - Did the resolution prove to be satisfactory in practice?

4. What was the Commission's (or Commission staff) involvement in the program design?

Program Implementation

1. How are responsibilities for the program shared by different departments at PSE&G (e.g., program vs. field staff)?

2. How do PSE&G customer representatives work with customers in the program?

   PROBE:
   - Do they help customers prepare proposals?
   - What training did customer representatives have concerning program rules and objectives?

3. How is information about the program being communicated to those outside the utility?

4. Did the time it took to review project sponsor proposals meet your expectations?

   PROBE:
   - Were there sufficient resources (staff and time) available to review project proposals?
   - What were (are) the major time-intensive aspects of the evaluation?
   - Were certain features of proposals *not* evaluated that should have been, or perhaps should have been addressed in more detail?

Contract Administration

1. What provisions have been made for contract administration?

   PROBE:
   - Are there sufficient resources (e.g., staff, software) available to manage the projects?
   - Describe Automated Entry/Standard Offer Program (AESOP) project sponsor database tracking system?

2. Are you involved in contract administration? If so, how much time?

Program Costs

1. How much time (FTE) does PSE&G allocate to program administration?

2. Have staffing requirements changed during program implementation?

   PROBE:
   - Do you believe that staffing is adequate?

3. What are the administrative costs for this program?

   PROBE:
   - How does this compare to other PSE&G DSM programs?)

Program Implementation: Customer & Market Response

1. Do you think there are any differences among potential project sponsors (e.g., ESCOs, vendors, customers) in their ability to understand and respond to the program?

2. Do you find that customers have been contacted by more than one firm participating in PSE&G's program?

   PROBE:
   - Did you find that there was confusion among customers who had several firms contact them?)

Program Implementation: Measurement & Verification

1. How well have the M&V protocols worked?

2. Are there certain types of measures for which there are no accepted M&V protocols?

3. Do you have suggestions for acceptable M&V protocols for these types of measures?

Overall Assessment

1. What is your overall assessment of the program at this time? (PROBE: Is the program achieving its goals?)

2. Given our discussion, what are the program's main strengths?

3. Overall, what aspects of the program have been the least successful?

4. What advice would you give for improving the program?

Interview Protocol for New Jersey Board of Public Utilities Staff

Name(s): _____

Title (s): _____

Date: _____

Overview

1. Briefly describe NJBRC's role in the development and implementation of PSE&G's DSM Standard Offer program?

   PROBE:
   - Other groups that were heavily involved in program development?

2. What's the extent of NJBRC staff involvement in program monitoring & oversight?

   - How many staff? What level? What responsibilities?
   - Any mgmt. audits by third party consultants?

3. What would you say are the primary objectives of the program?

   PROBE:
   - Cost-effective DSM for ratepayers?
   - Development of a vibrant ESCO market?
   - Experimentation with alternative delivery mechanisms?
   - How have these goals changed over time?

4. To what extent, are the objectives being achieved? Please explain. Why or why not?

Program Development

1. How extensive was NJBRC staff involvement in the development of the standard offer?

    - # of staff members?
    - Amount of time spent?

2. How did this process work and over what timeframe?

    - Utility submitted proposal, NJBRC reviewed?

3. What were some of the major issues that arose during this process?

    - What were some of the concerns of NJBRC (e.g., measurement and verification)?
    - What were some of the concerns of other parties?

4. How were these issues resolved?

5. Was the standard offer adopted as submitted or substantially modified as a result of NJBRC review?

    - What were the changes?

6. Was this process viewed as collaborative or adversarial? If so, why?

7. Do you think this process worked well?

Program Implementation: Contract and Contract Negotiations

1. Has (will) PSE&G be filing contracts that the utility signs with Project Sponsors?

   PROBE:
   - Will NJBRC also be reviewing contracts signed between Project Sponsors and customers at host facilities?

2. Has PSE&G proposed major modifications to standard offer contract? NJBRC rulings?

Program Implementation: Regulatory Monitoring & Oversight

1. What are some of the major issues that have arisen during this oversight period?

   - What are the major concerns of the NJBRC (e.g., billing and payment, measurement and verification, comprehensiveness, free riders)?
   - What were some of the concerns of other parties?

2. How have these issues been resolved?

3. Are you comfortable with NJBRC's role?

   - Do you need more staff? For what?
   - Is it necessary to take a more active or less active role? Why?

4. Has NJBRC received complaints about the program?

- Competitiveness or fair competition issues raised by project sponsors?
- Customer complaints?
- Has the NJBRC investigated and what have they found, if anything?

5. What measures have been taken to ensure separation between PSE&G and PSCRC?

PROBE:

- Have any problems/issues arisen?
- How were these issues resolved?

Program Implementation: Measurement and Evaluation Issues

1. How well has the adopted M&V protocol worked?

PROBE:

- Have there been modifications?
- Have protocols been developed for additional types of measures?
- Discuss any concerns about reliability of savings: confidence levels & precision?

Overall Impression

1. Overall, has the program lived up to your expectations? Please explain.

2. What aspects are working well? what aspects of the program have been the least successful?

3. What could PSE&G do to improve the program?

Review of PSE&G Verification Procedures and Sampling Plan

I.1 Overview

In this appendix, we review selected portions of PSE&G's sampling plan and measurement and verification procedures as outlined in the Standard Offer RFP. We discuss several statistical issues relevant to Method 1, a protocol for determining savings resulting from the modification of lighting systems in commercial and industrial facilities for which connected loads are reduced but operating hours are unaffected.[1] We examined this protocol in detail because most of the program's savings are from lighting efficiency measures. After discussing limitations of the current sampling plan, we suggest alternatives that may provide better potential accuracy for an equivalent or reduced cost.[2] We also discuss issues relating to establishing appropriate baseline conditions to determine energy savings, accounting for lighting-HVAC interactive effects in determining savings from lighting measures, and approach towards maintaining and improving lighting quality.

I.2 Description of Current Protocol

The stated objective of the M&V protocol is to provide "90% confidence that savings equal or exceed the value measured". The basic procedure called for to achieve this objective is as follows:

(1) establish the baseline connected load

For each luminaire type to be modified or replaced in the retrofit, the sum of connected loads is determined based on tabulated values.

(2) establish the post-installation connected load

For each luminaire type to be installed, the sum of connected loads is to be determined based on either tabulated values or on metering of the installed luminaires.

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1 See Section 2, Table 2-5.

2 Our analysis benefitted from the work of others, specifically Halpern (1995) and the M&V and sampling protocols used in PG&E's DSM bidding program (Schiller 1995).

(3) determine the number of run hours

Run hours are estimated by monitoring a sample of control circuits within strata, where the strata are defined by estimated hours and timing of operation. The details of this sampling scheme are given in Appendix A (Exhibit 5) of the Standard Offer RFP. Our critique of PSE&G's plan concentrates on this portion of the M&V protocol.

The sampling plan employs a stratification scheme that classifies control circuits according to combinations of estimated weekly On-Peak and Off-Peak hours of operation. [3] Weekly On-Peak hours of operation are grouped into three bins: 0 to 30 hours per week, 31 to 50 hours per week, and 51 to 70 hours per week. Weekly Off-Peak hours of operation are grouped into five bins: 0 to 5 hours per week, 6 to 20 hours per week, 21 to 50 hours per week, 51 to 75 hours per week, and 76 to 98 hours per week. Thus there are fifteen (3 x 5) groups defined by the sampling scheme. Each affected control circuit in a facility is assigned to one of these 15 groups.

The number of control circuits metered in a group depends on the total number of control circuits assigned to the group, up to a maximum of 15 metered circuits in a group for groups containing more than 100 control circuits: for 1 to 3 circuits in a group, all will be metered, for 4 to 10 circuits in a group, 3 + 20% of total circuits will be metered, etc.[4] The metering is to continue for the duration of the contract.[5] The resulting data is used to determine whether the control circuit has been correctly classified: if data for a circuit lies more than 10 percent from the bounds of the bin to which the circuit is assigned, the circuit will be reassigned to another bin on the basis of the observed data. Reapportionment will be made monthly barring extenuating circumstances. Within an assigned group, the selection of control circuits to be metered is not necessarily random: control circuits with large connected loads are in general to be selected for metering to represent the group.

The data from each sampling group are combined using simple or load-weighted averaging to derive a single estimate of run hours for the group, by Utility Time Period.

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[3] Measurement Protocol for Commercial, Industrial, and Residential Facilities, Appendix A, Exhibit 5.

[4] In general, the smaller the number of circuits in a group, the higher the rate of sampling, up to this maximum. For example, if there are 10 circuits in a group, this scheme requires that half of them (3 + 2 = 5) be metered.

[5] (A.5 section 2).

(4) determine energy savings as the product of run hours and the difference between pre-installation and post-installation connected loads.

For each group, the difference between the pre-connected load (Step 1 above) and post-connected load (Step 2) over all affected equipment is determined. The product of this difference and the estimated run hours for the group (Step 3) yields the estimate of connected load reduction. Run hours for the group are determined in Step 3.

I.3 Critique of PSE&G's Sampling Plan

Without knowing the reasoning used to develop this stratification and sampling scheme, the motivation behind some aspects of the scheme remain unclear. Below we enumerate several of these issues:

- First, it may be difficult to appropriately *allocate* control circuits to hours of operation bins, which seem fairly narrow relative to the probable accuracy of a priori estimates of hours of operation.

- Second, there is no requirement that control circuits within a bin be *randomly selected* for metering; instead sample selection within a bin appears to be based on a combination of convenience and of connected load.

- Third, the monthly *reallocation* of mis-binned control circuits violates the statistical basis of stratified sampling.

- Fourth, the articulation of the *required statistical level* of the estimate "90 percent confident that the true value equals or exceeds the estimated value" seems incomplete in that there is no requirements for statistical power of the test or precision of the estimate.

- Fifth, the strata definition and therefore the resulting *groups* do not seem completely coherent in terms of payment and other dimensions.

- Sixth, we see no explicit acknowledgment of the connection between the specifications of the *number of control circuits to be metered within a group* and the expected contribution of the estimates made for the bin to the accuracy of the overall estimate of hours of operation, energy savings, or monetary savings.

- Seventh, the way in which *final calculations* are to be made from the bin-specific estimates is not articulated clearly.

- Eighth, it may be useful to consider the *potential value of the information* gained by the sampling scheme to both the utility and the ESCO, in particular in light of other uncertainties, in order to gain a better understanding of the precision required, rather than accept an a priori design objective.

Below, we address each of these issues in more detail., and then offer an example that illustrates several aspects in which the proposed scheme could be improved to deliver increased precision and accuracy for a given monitoring and validation cost. We then propose a possible alternative to the PSE&G scheme that bypasses some of the difficulties listed above.

I.3.1 Allocation

It may be difficult to assign control circuits to groups on the basis of weekly hours of operation because hours of operation is not a readily observable characteristic. While the appropriateness of the group assignment made for any particular metered circuit may be judged after some data are collected, the accuracy of the assignment of other control circuits relative to their true group membership will remain unknown. While the PSE&G plan provides for the reassignment of *metered* control circuits to new groups if they appear not to fall in the group to which they are originally designed, the majority of control circuits are not metered and therefore not their group assignment remains in question. The reassignment of metered control circuits to new groups based on observed data raises additional statistical issues, which we discuss below in the section on Reallocation.

I.3.2 Non-random Selection within Strata

In practice, truly random selection of subjects in any sampling scheme is difficult to achieve. However, the statistical validity of estimates derived from any sampling scheme depends on an appropriate definitions of populations and/or subpopulations, and on random sampling within such groups. PSE&G's plan, as stands, does not appear to have provisions for encouraging random sampling, leaving the door open for samples of convenience. This increases the potential for sample bias and reduces the accuracy of estimates derived from such a scheme. Moreover, the plan calls for preferential sampling of circuits with high connected loads within any sampling group. Whereas it is true that circuits with high connected loads have potentially higher impact on energy savings, it is methodologically preferable to have such considerations explicitly introduced into the sampling scheme (e.g. stratifying control circuits on the basis of connected load), rather than the ad hoc procedure suggested.

I.3.3 Reallocation

The PSE&G plan calls for reallocation of points for which observed data does not fall within ten percent of the bounds for the bin to which it is currently assigned. While this seems intuitively reasonable, such reassignment complicates, and perhaps invalidates, the statistical interpretation of estimates (Halpern 1995). The statistical model presumes that each control circuit falls into one of the assigned bins. However, stochastic variation of the measurement of hours of operation for a control circuit in any given month may render the control circuit officially outside of its predetermined, and perhaps proper, bin.[6] The bin reassignment of a control circuit has a dual impact: first, the hours accorded to the monitored point are reassigned to a new group, impacting the mean hours of operation determined for both the old and the new group; and second, the connected load associated with that control circuit also switches from one bin to another.

This reallocation raises several issues: (1) reassignment *may* lead to bias in bin estimates; (2) the subpopulation represented by a reassigned control circuit - and perhaps, therefore, any metered control circuit - is poorly defined. The importance of the first issue remains unclear.[7] The second issue, however, may be quite important, and is perhaps best described by an illustration:

> Suppose 115 control circuits are assigned to Group O. Corresponding to the sampling plan, 15 of these control circuits are selected for metering. Say eight - just over half - of these are found to be misassigned, according to observed data, and are thus reassigned to Group J. This reclassification may lead one to question whether the assignment of all of the remaining nonmetered control circuits assigned to Group O was appropriate, and thus the weight of each group in terms of number of control circuits represented.

Some groups may then be under-represented, or even unrepresented, and others over-represented by the sample. Nonmetered circuits may be misallocated. *In summary, the subpopulation being represented by any metered circuit is unclear, particularly under reassignment.*

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6 By reassigning control circuits in such a manner, each group may tend toward its *defined* center.

7 Biases may cancel out when bins are combined, and the interaction of the difference between pre-installation and post-installation connected loads and hours of operation (and shifts made by reallocation) complicate the interpretation.

I.3.4 Required Statistical Level

The sampling plan is based on hours of operation, and thus the target levels of precision and accuracy for *hours of operation.*[8] The true target of the sampling, we believe, may not be hours of operation, but rather energy savings and/or the concomitant value of energy savings (i.e., lifecycle net benefits). While hours of operation constitutes an absolute measurement, savings constitutes a relative one. The stated design objective for utility sampling plans is "90 percent confidence that savings equal or exceed the value measured"[9] Equivalently, this means that for the hypothesis that the true mean is less than the estimated mean will be rejected at level 0.10 (the p-value must be less than or equal to 0.10). This articulation is insufficient, because it fails to specify the required power of the test. That is, if one sampled very few circuits, confidence intervals would be very broad and therefore probably cover the "true" mean, but fail to give sufficiently precise information. Statistical power or an equivalent threshold, such as 10 percent precision as commonly articulated in the so-called "90/10" standards, should be specified for the stipulation to be meaningful. More importantly, we can not adduce from the plan as it stands any direct connection between the sample sizes specified and the achievement of 90 percent confidence even if required minimum levels of precision were stipulated.

I.3.5 Number of Circuits Metered Within a Group

Stratified sampling can increase the precision of population estimates over that achieved by simple random sampling if a heterogeneous population is appropriately divided into relatively homogeneous subpopulations. Sampling points may be allocated to provide different levels of precision for different strata, for example, to achieve higher levels of precision in "more important" groups such as those with high connected loads and/or high levels of coincident operating hours.[10]

However, the stratification offered in the PSE&G plan does not appear to take advantages of these properties. The strata described there do not seem to define appropriately

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8 Because the sampling plan is based on hours of operation, it does not necessarily translate directly to either annual energy savings, or the value of those savings to the utility (i.e., net benefits), which are the more relevant design objectives. This issue will be discussed in more detail below.

9 "That is, if the sampling operation were repeated many times, and for each time a 90 percent confidence interval was computed, then in about 90 percent of these many trials, the bounds about the estimated value would equal or exceed the true value." There are other possible interpretations of confidence intervals (for example, a Bayesian interpretation), but the one described above is a "traditional" (most frequent) interpretation.

10 "The theory of stratified sampling deals with the properties of the estimates from a stratified sample and with the best choice of the sample sizes n_h to obtain maximum precision" (Cochran 1977:90).

homogenous bins, nor does the sample size for each group appear proportional to the potential importance of the bin. These two issues are illustrated in Section 1.4.

I.3.6 Group Definitions

The bin groups specified (a) show substantial overlap in terms of the total hours of operation and the potential value of the energy savings within each bin; (b) show the finest gradation of bins in the off-peak rather than on-peak hours of operation dimension; and © combine the summer prime and summer peak periods into one category.

I.3.7 Value of Information

So far PSE&G's M&V plan has only implicit tradeoffs between the cost of obtaining information and the potential value of the information thus obtained. It may be useful to make these tradeoffs more explicit.

I.3.8 Computation of Final Estimates

The PSE&G sampling plan calls for separate calculation of kWh savings within each group, and calls for a "simple or weighted average (based on connected load) of run hour meters." This specification is somewhat vague, and without a clearer articulation of how the data are to be combined, it is difficult to see whether the calculations will be applied appropriately. Specifically, we would like clarification on:

(1) how weighting by connected load is conducted within the computations for any sample group;
(2) how the computations made for each sample group are combined to create final estimates; and
(3) how estimates of hours and timing of operation and changes in connected load are combined across the consideration of utility time periods to address energy and cost savings.

I.4 Computations & Example

In this section we examine PSE&G's bin definitions more closely, and provide an example to illustrate potential shortcomings of the current sampling plan. Table I-1 transforms the hours of operation bins specified in the PSE&G plan into (a) ranges of potential energy use per fixed wattage throughout the population; and (b) corresponding ranges of payment per kW of energy savings. The latter are determined using the 1993 "Standard Offer-Electric Unlevelized

Payment" Summer rates. The bins are defined by crossing three On-Peak categories of weekly hours of operation (0-30, 31-50, 51-70) with five Off-Peak categories of weekly hours of operation (0-5, 6-20, 21-50, 51-75, 76-98). Consider the following chart, calculated from the PSE&G table and the aforementioned payment schedule.[11]

Table I-1. Potential Energy Use and Energy Value Ranges Corresponding to the Sampling Group Definitions Given in PSE&G's Sampling Plan for Control Circuits.

Group	Potential Energy Use (Range of Weekly Hours of Operation)	Potential Energy Value (Range of Weekly Payment per kW, in cents)
A	0-35	0-326.5 [12]
B	6-50	9.8-351.1
C	21-80	34.4-400
D	31-105	83.4-441.3
E	76-128	124.6-479
F	31-55	321.7-389.7
G	37-70	331.5-414.3
H	52-100	356.1-463.5
I	82-125	405.3-504.5
J	107-148	446.3-542.2
K	51-75	385.7-454.7
L	57-90	395.5-479.3
M	72-120	420.1-538.5
N	102-145	469.3-569.5
O	127-168	510.3-607.2

Sampling is based strictly on the number of control circuits in a bin, rather than on the potential importance of the bin. For an illustration of how this seems suboptimal under certain conditions, consider the following extreme example:

> Facility X has 903 control circuits: 3 classified as Group A, and 900 classified as Group O. According to the sampling plan, 18 control circuits should be metered: all 3 of the Group A

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[11] Note that the distribution of wattages are likely to be unequal across the bins, although in this example a constant wattage is assumed.

[12] This is calculated as the maximum range possible by combining the on-peak cost (here, for Group A, a maximum of 25 hours * 12.1 cents/kWh + 5 hours * 3.16 cents/kWh=318.3) with the off-peak costs (for Group A, a maximum of 5 hours * 1.64 cents/kWh = 8.2) for a range of 0 to 326.5.

control circuits, and 15 of the Group O circuits. Thus 100 percent of the circuits estimated to have at most 30 on-peak and 5 off-peak hours - but perhaps as few as zero on-peak hours - would be metered, but only 1.7 percent of those which are estimated to have a minimum of 51 on-peak hours. It is true that within a bin, the incremental value of sampling gradually decreases (yielding smaller and smaller potential increases in precision). Still, given a fixed number of control circuits to be metered, intuition suggests that the best value in terms of precision and accuracy could be achieved by concentrating on the circuits which have relatively high potential influence on savings (like those in Group O), rather than those that have minimal influence on savings (like those in Group A).

I.5 Alternative Sampling Plans

We propose two alternative approaches to the PSE&G sampling plan as currently articulated: (1) to change the experimental design from stratification on hours of operation to one which stratifies on the basis of usage areas, with simple random sampling within each of these strata; or (2) to retain the stratification on hours of operation, but to modify the group definitions and the allocation of samples within each group. We prefer the first option, that of employing strata defined by usage area, and focus primarily on this option in the remainder of this section.

I.5.1 Stratification on Usage Area

In its DSM bidding program, PG&E uses a sampling plan that stratifies on the basis of usage areas that are defined by the project sponsor (PG&E 1995, Appendix K). While the computation of savings as the weighted product of estimated hours of operation and estimated reduction in connected load remains similar to that in the PSE&G plan, the stratification employed to determine hours of operation is quite different. Rather than making a priori estimates of weekly hours of operation, the basis of the stratification can instead be usage area, such as hallway , building entrance, office, etc. One key feature of this plan is that once appropriate usage areas have been defined, simple random samples can be taken from each usage area.[13] The size of such samples may depend on the anticipated impact of the usage area on estimated total savings, which in turn depends on number of fixtures, the change in connected load relative to pre-installation levels, and the hours of operation.[14] An important advantage of such a scheme over one based only on hours of operation strata is that, although the definition of usage areas is somewhat subjective, once such areas are defined, the assignment of control circuits to groups is relatively simple and straightforward, with low potential for error.

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[13] In contrast, the PSE&G plan does not use simple random sampling within sampling strata, which we and other regard as a significant shortcoming (Halpern 1995).

[14] Sample allocation can also depend on expected variability of run hours within a usage area, since variability affects estimate precision.

I.5.2 Modifications to Current Plan

Another possible alternative is to retain stratification on hours of operation, but to institute changes in some elements to address issues we touched upon above. For example, precision may be improved by concentrating monitoring on control circuits likely to have the most impact on the estimated energy savings, and random sampling could required within any strata.

I.6 M&V Policy Issues

Our technical discussion of PSE&G's sampling plan has alluded to several broader policy issues, which should be highlighted. These include: (1) The incremental costs of verifying savings should be weighed against the incremental benefits or value of such efforts, specifically improved accuracy or precision of savings estimates. Thus, attempts should be made to link the costs of obtaining savings estimates to their value, particularly in the context of overall uncertainty; and (2) We urge parties in New Jersey to reassess the standard "90/10" criteria in light of the previous issue and moreover, in addressing potential differences in the value of information in cases like this, where payments are made to a third party (the ESCO), rather than to the customer.

I.7 Measurement & Verification Procedures

In this section, we comment on several aspects of the M&V procedure: (1) the approach used by PSE&G to establish baseline conditions against which savings are estimated, (2) limitations of the current approach used to estimate and credit lighting measures installed in conditioned space with reductions in secondary demand and energy because of reduced HVAC consumption, and (3) methods used to maintain and ensure lighting quality.

I.7.1 Determining the Appropriate Baseline

Savings from specific measures are typically estimated relative to the appropriate baseline condition. The Standard Offer RFP indicates that "any energy savings measure that is required by law, is required by building or other codes, or in the opinion of PSE&G, which represents standard industry practice, is not eligible." It appears that PSE&G program staff have interpreted this language in the following fashion. For new buildings, the New Jersey Energy Building Code is used to establish the baseline. In retrofit situations in existing buildings, the equipment in place at the time of intervention is used to establish baseline

condition for estimating savings. In situations where equipment replacement or conversion is planned, PSE&G determines savings by comparing the estimated usage of the conventional equipment that the customer would have purchased with the high-efficiency equipment proposed by the sponsor. We would offer the following comments on PSE&G's approach:

- The language gives PSE&G the option of excluding measures that are standard industry practice. This approach is reasonable and works well for certain situations and measures. For example, in new construction, PSE&G could exclude certain measures that have become common practice; some New England utilities have excluded certain types of variable speed drives for variable air volume equipment for this reason (Gordon et al 1994). However, the language is ambiguous in situations where the customer proposes a high-efficiency product and wants to take credit for the difference between that product and existing equipment, although, based on standard practice, the customer would choose a similar product with somewhat lower efficiency (but still more efficient than the existing equipment). In this situation, it is not a question of excluding the measure, but rather establishing the appropriate baseline.

New Construction

- In new construction, PSE&G uses the State energy building code as the "baseline" against which energy-efficiency improvements are compared. Conceptually, savings should be determined relative to "typical construction practice" which may exceed or lag current building codes depending on building type, end use, and code enforcement. If current practice exceeds the State energy code, then savings attributable to the program may be overstated because developers are being paid to install equipment which is typical of current construction. PSE&G should conduct a detailed study of baseline practices in new construction as well as an evaluation of potential "loopholes" in the State energy building code (e.g., important aspects of energy efficiency not covered by code).

- We agree with Gordon et al (1994) that the M&V protocols are particularly problematic in many new construction situations. For example, in lighting retrofits, the developer/sponsor must measure hours of operation. For buildings constructed on spec or build to rent, the developer is not the occupant and usually doesn't even know the ultimate tenants, yet project economics are based on hours of operation. In these situations, hours of operation almost become a random and uncontrolled factor for the developer. It would be simpler and no less risky (for the developer) to pay incentives for lighting efficiency in new construction based on typical operating hours for each particular building type. In new construction, it is more realistic to conduct program-wide evaluations to assess overall savings, assure contractor performance

through visual inspection, equipment testing, and spot metering, and verify typical savings of individual equipment through laboratory and field testing.

Existing Buildings

- For existing buildings, PSE&G typically uses the connected load of existing equipment to establish baseline conditions. This method is reasonable for early replacement (i.e., retrofit) situations, but not for situations where the customer was already planning to replace the equipment. In planned equipment replacement situations, use of existing equipment is likely to overstate savings because standard equipment that would be used in the replacement would be more efficient than existing equipment.

- Similarly, if an existing building is undergoing a major renovation or remodel and has standard magnetic ballasts (which were commonly used in the 1970s and 1980s), the appropriate baseline should be energy-efficient magnetic ballasts (which are required by the NAECA standards), which have higher minimum efficiencies than the standard magnetic ballasts. In reviewing the program tracking database, we found that prior to retrofit, about 85% of the ballasts were standard efficiency magnetic ballasts, while only 15% of the ballasts were high-efficiency magnetic ballasts.[15] For lighting, it appears that PSE&G assumes that all lighting system changes involve retrofit situations rather than remodel or major renovation situations. At a minimum, we would recommend that PSE&G conduct a study that examines the incidence of major remodeling/renovation in commercial buildings in order to get a better understanding of this issue to ensure that savings are not being over-estimated in some situations.

I.7.2 Accounting for Lighting-HVAC Interactive Effects from Lighting Measures

PSE&G currently uses a 5% credit on lighting energy savings installed in conditioned space to reflect HVAC savings that are assumed to occur as a result of decreased indoor lighting wattages. At the time that the M&V protocols were adopted, all parties recognized that this was a first approximation because there was insufficient field data and results were inconclusive or not available from research studies based on building simulation models. We believe that the 5% credit that PSE&G currently applies for energy savings during all time periods overstates the savings in the heating periods and understates the savings in the cooling periods. PSE&G is expected to submit a new methodology for incorporating interactive effects in its next DSM plan (due April 1995), as directed by the original M&V protocol. We encourage PSE&G to examine several recent research studies that used sophisticated simulation models (e.g., DOE-2) in some cases to investigate lighting-HVAC interactive

[15] We used information on pre-retrofit condition in the program tracking database and calculated for four and eight foot fixtures (for each lamp combinations) and standard vs. high-efficiency magnetic ballasts.

effects (Crossman 1995; Rundquist et al. 1993; Sezgen and Huang 1994, and Sonnenblick and Eto 1995). The magnitude of this effect is dependant on building characteristics, weather, and heating and cooling equipment. Thus, it is difficult to assume apriori that a 5% increase in electricity savings is attributable to these lighting-HVAC interactive effects and should be added to estimates of savings produced by monitoring lighting circuits for hours of use multiplied by differences in connected load. Sezgen and Huang (1994) examined the magnitude of these interactive effects among various building types and climate zones. Sonnenblick and Eto (1995) made parametric runs of the DOE-2 building simulation model to examine the magnitude of the HVAC-lighting interactive effects for different types of HVAC system in large and small office buildings. These results suggest that sophisticated building simulation models could be used in a research study to develop more accurate estimates of the lighting-HVAC interactive effects which would account for building and HVAC type using New Jersey weather data.

I.7.3 Lighting Quality

PSE&G has developed a standardized procedure for ensuring lighting quality under the Standard Offer program. PSE&G reduces payments if lighting levels decrease by more than 10% compared to lighting levels prior to the retrofit. During the pre-implementation audit, the auditor records light levels based on footcandle (FC) readings and these are checked periodically over the lifetime of the contract. Payments are reduced in proportion to the FC reductions (above the 10% deadband) and thus the standard encourages equivalent lumens in building spaces before and after retrofit. We and others (Gordon et al 1994) would recommend some minor changes to the current approach.

We are concerned because the lighting quality may allow substandard lighting in some cases and preclude additional savings in others. The procedures may perpetuate substandard lighting in facilities that are initially underlit and preclude savings in facilities that are initially overlit. PSE&G has addressed the first issue in part by allowing customers to increase lighting levels (not to exceed the upper limit of the Illuminating Engineering (IES) standard) and then excluding the increase in kW associated with new fixtures from the post-implementation audit. The costs associated with these measures are also excluded from the TRC test, which is reasonable. However, some building spaces are significantly overlit (e.g., exceed the IES standards by 10%). In these situations, we recommend that PSE&G allow sponsors to reduce lighting levels to IES standards and claim credit for these savings, but they must have written approval from affected customers for all areas where light levels are to be reduced. This is the approach currently used by PG&E in its bidding programs and we think it is preferable because it does not preclude additional savings, while still maintaining quality of service (Schiller 1995).

DSM Economic Potential in PSE&G Service Area

This appendix summarizes results from a PSE&G- sponsored study which estimated the economic potential for DSM, including fuel switching, in their service territory (Xenergy 1994).

J.1 Approach

The study defined economic potential as those measures that passed a Total Resource Cost Test including environmental externality benefits. Externality benefits were quantified as being worth $0.02/kWh. Measure costs were increased by 9% to reflect average program costs and adjusted for interactive effects of various measures on savings as well as measures that were mutually exclusive. In order to estimate benefits, Xenergy used long-run avoided costs that were based on PSE&G's adopted 1993 DSM plan, which are consistent with avoided costs used to develop the Standard Offer payments.[1] In terms of scope, Xenergy evaluated the DSM potential for sixteen residential and nineteen commercial/industrial energy efficiency measures for lighting, heating, cooling, hot water, and process end uses, a curtailable load reduction option, and several fuel substitution measures in the C/I sector (e.g., electric centrifugal or reciprocating chiller to gas engine drive or absorption chiller). Table J-1 lists the market sectors and electric efficiency and fuel substitution options that were analyzed.

Table J-2 presents estimates of the economic potential for major customer classes and types of DSM. The total economic potential for measures (including fuel switching) in existing residential, commercial, and industrial buildings is estimated at 5,112 GWh, or 13 % of 1994 projected sales, and 2,807 MW coincident with PSE&G's system peak, approximately 29 % of 1994 projected peak. The peak reduction potential is much higher than the potential to reduce sales because of the load management programs. The C/I sector represents about two-thirds of PSE&G's overall DSM potential, which includes about 1,115 MW of end use efficiency measures and 335 MW of fuel substitution measures, assuming that the specified high-efficiency measures could instantaneously replace the existing building and equipment stock. Within the C/I class (excluding fuel switching measures), lighting, HVAC and process measures account for about 71, 21, and 8 % respectively of the efficiency opportunities.

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[1] We regard the Xenergy estimates of economic potential as an upper bound for several reasons. PSE&G's current avoided costs are projected to be significantly lower than 1993 estimates. We would also increase measure costs by 15-30% to account for administrative costs incurred by utilities and third party energy service providers. However, the Xenergy study did not consider all potential cost-effective efficiency options, particularly in the industrial sector.

Table J-1. Commercial Market Sectors and Measures Analyzed

Sectors	Energy Efficiency	Fuel Switching
Office	Incandescent to High Intensity Discharge	Engine Driven Chiller
Retail	Compact Fluorescent	Gas Absorption Chiller
Hotel	T8 Lamps and Electronic Ballasts	
Health	Exit Signs	
Education	High Efficiency Air Conditioner - Window	
Wholesale	High Efficiency Air Conditioner - Roof Top	
Grocery	High Efficiency Heat Pumps	
Industrial	High Efficiency Chillers	
Other	High Efficiency Motors - Cooling	
	High Efficiency Motors - Ventilation	
	Adjustable Speed Drives - Ventilation	
	High Efficiency Motors - Process	
	Adjustable Speed Drives - Process	
	Curtailable Load	

Table J-2. Estimates of Economic Potential for DSM at PSE&G

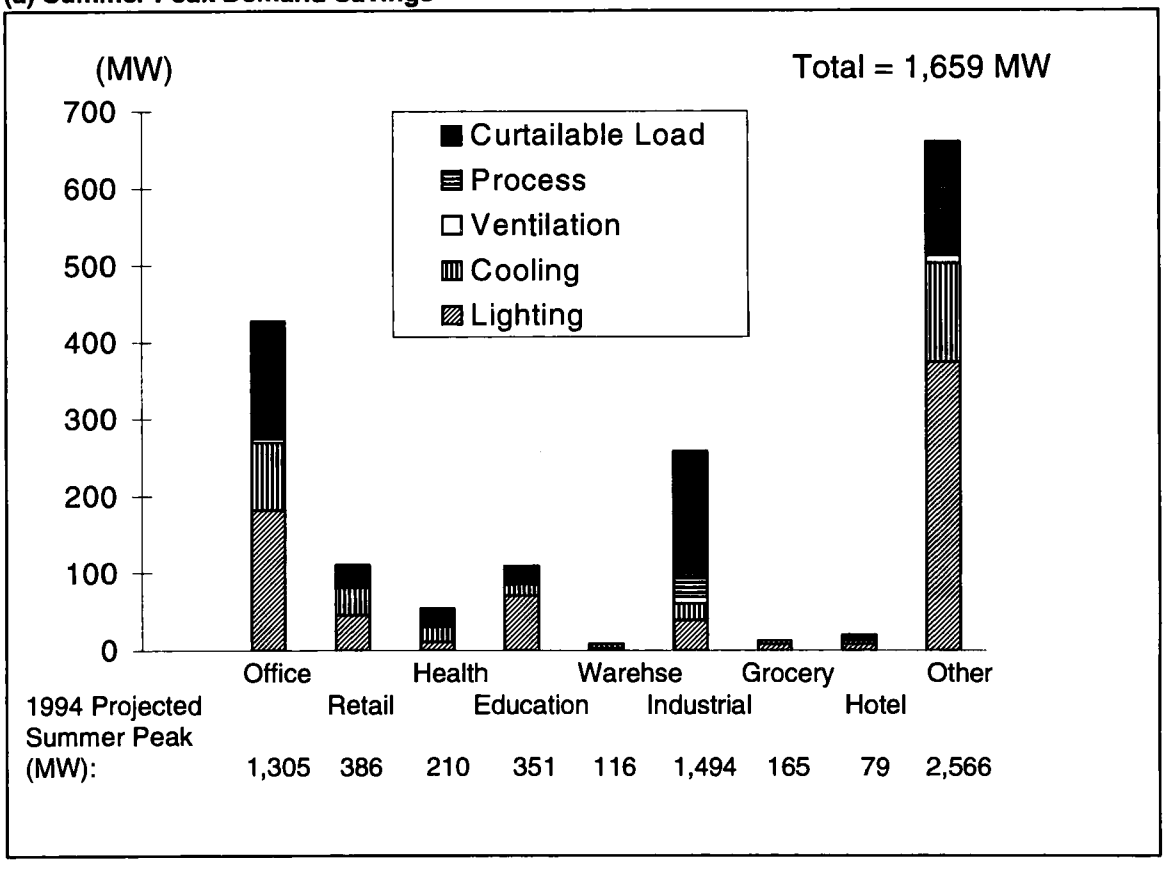
Customer Class	Annual Savings (GWh)	Summer Coincident Peak (MW)
Residential		
Strategic Conservation	1,421.5	440
Direct Load Control	0	373
Commercial/Industrial		
Strategic Conservation	3,218.7	1,115
Curtailable Load	0	544
Fuel Substitution	471.9	335
TOTAL	5,112	2,807

Source: Xenergy, 1994. Table ES-4, Table ES-7, and Table 5-6.

Figure J-1 shows the economic potential in various C/I market sectors by type of DSM measure and also compares estimates of summer peak demand and electricity savings to the projected summer peak and annual sales in 1994 for a particular market sector (see numbers in row in Figure 4-1). The industrial, office, education, and retail sectors provide the bulk of the savings opportunities in existing buildings.

For new construction, the estimated economic potential for energy efficiency measures is two orders of magnitude lower, at 20 MW and 50 GWh. Lighting measures account for about 40 % of the total savings potential in this market segment. The Xenergy study assumed that summer coincident peak demand would increase by about 128 MW and electric sales would increase by about 477 GWh, so the savings potential represents about 16 % of peak demand and 10 % of sales growth.

Figure J-1. Estimates of Economic Potential in Commercial/Industrial Sector
(a) Summer Peak Demand Savings



(b) Electricity Savings