BEFORE THE STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

IN THE MATTER OF THE PETITION OF	**) BPU Docket No. E014080897**
PUBLIC SERVICE ELECTRIC AND GAS	**)**
COMPANY TO CONTINUE ITS ENERGY	**)**
EFFICIENCY ECONOMIC EXTENSION	**)**
PROGRAM ON A REGULATED BASIS	**)**
("EEE EXTENSION II")	**)**

DIRECT TESTIMONY OF KENJI TAKAHASHI
ON BEHALF OF THE
STATE OF NEW JERSEY
DIVISION OF RATE COUNSEL

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1. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name, title, and employer.

A. My name is Kenji Takahashi. I am an Associate at Synapse Energy Economics ("Synapse"), located at 485 Massachusetts Avenue, Cambridge, MA 02139.

Q. On whose behalf are you submitting testimony in this proceeding?

A. I am submitting testimony on behalf of the New Jersey Division of Rate Counsel ("Rate Counsel").

Q. Please describe Synapse Energy Economics.

A. Synapse is a research and consulting firm specializing in electricity and gas industry regulation, planning, and analysis. Our work covers a range of issues including integrated resource planning; economic and technical assessments of energy resources; electricity market modeling and assessment; energy efficiency policies and programs; renewable resource technologies and policies; and climate change strategies. Synapse works for a wide range of clients including attorneys general, offices of consumer advocates, public utility commissions, environmental groups, and federal clients such as the U.S. Environmental Protection Agency and the Department of Justice. Synapse has a professional staff of 30 with extensive experience in the electricity industry.

Q. Please summarize your professional and educational experience.

A. Since joining Synapse in 2004, I have provided economic, environmental, and policy analysis of electric system technologies, policies, and regulations associated with both supply- and demand-side resources, on behalf of a diverse set of clients throughout the U.S. and in Canada. In particular, I have:

- Analyzed the performance, costs, benefits, and potential of energy efficiency measures—including state-of-art measures such as cold climate heat pumps, deep energy retrofits, and net zero energy buildings;
- Assessed the design and impact of numerous utility energy efficiency program plans in utility program filings and integrated resource planning documents;

- Assisted stakeholder groups in several states—including Colorado, Maryland, South Carolina, Florida, Alaska, Massachusetts, and Vermont—with developing and analyzing state climate change action plans or state energy plans;
- Assessed load forecasts and resource analyses in utility integrated resource planning documents;
- Examined ratemaking issues such as standby rates for distributed generation and decoupling rate mechanisms for energy efficiency measures; and
- Prepared expert testimony and reports for regulatory proceedings.

Prior to joining Synapse, I was a research associate at the Center for Energy and Environmental Policy of the University of Delaware, where I investigated the impacts of different distribution rate designs on the development of distributed energy resources (e.g., renewable energy, distributed generation, energy efficiency, and demand response). I also held research positions for the Delaware Division of Public Advocate and for Resources for the Future.

I hold an MA in Urban Affairs and Public Policy with a concentration in Energy and Environmental Policy from the University of Delaware, and a BA in Law with a concentration in Public Administration from Kansai University in Osaka, Japan.

My resume is attached as Appendix A.

Q. Please describe your professional experience as it relates to energy efficiency policies and programs.

A. Energy efficiency policies and programs have been a central focus of my professional career. Since joining Synapse, I have reviewed, analyzed, and critiqued energy efficiency policies and programs in over 30 U.S. states. For example, I assisted the Arkansas Public Service Commission staff with reviewing and assessing energy efficiency program proposals and utility integrated resource planning, as well as drafting regulatory orders on comprehensive energy efficiency program designs and reporting methods. For the Sierra Club in Florida, I recently (a) provided a technical assessment of the economic potential of energy efficiency and distributed generation; (b) critiqued the utilities' energy efficiency screening process and resource planning process; and (c) recommended

policies to help promote the development of energy efficiency and distributed generation. I have provided analytical and policy support to the Vermont Department of Public Service in its development of a State Comprehensive Energy Plan including a long-term energy efficiency potential and plan.[1]

With regard to energy efficiency policies I recently have co-authored reports on best practices in energy efficiency cost-effectiveness screening practices for the Regulatory Assistant Project, the National Home Performance Council, and the Michigan Economic Development Corporation.

On the national level, I have conducted a number of analyses on long-term energy efficiency potential for the entire U.S. as a resource to replace aging coal power plants.[2] I have been providing technical support for EPA on energy efficiency costs, savings and potential and other matters, including issues pertaining to U.S. EPA's Clean Power Plan under 111(d). I also provided guidance on program design, analyzed savings and costs and developed a cost effectiveness screening tool, and developed case studies to help state and utility energy efficiency program administrators with implementing offerings to support participation in the U.S. Department of Energy's Superior Energy Performance program.

Further, I was one of the reviewers to the following two recent reports on costs of saved energy and energy efficiency potential published by the American Council for Energy Efficient Economy ("ACEEE").[3]

Q. Do you have any experience relating to energy efficiency policies and programs in New Jersey?

A. Yes. Since 2009, I have provided extensive and ongoing expert analysis and support for Rate Counsel in connection with its review of state- and utility-administered residential, low-income, commercial, and industrial energy efficiency and combined heat and power

[1] http://www.synapse-energy.com/project/vermont-comprehensive-energy-plan

[2] One of the analyses is called "Toward a Sustainable Future for the U.S. Power Sector: Beyond Business as Usual 2011" prepared for Civil Society Institute. The report is available at http://www.synapse-energy.com/project/toward-sustainable-future-us-power-sector-beyond-business-usual-2011

[3] Neubauer, M. (August 2014). Cracking the TEAPOT: Technical, Economic, and Achievable Energy Efficiency Potential Studies: ACEEE; Molina, M. (March 2014). The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs: ACEEE.

programs in New Jersey. To this end, I regularly review, analyze, and comment on the state-administered programs' monthly performance, designs and budgets, avoided energy supply cost estimates, cost-benefit analyses, energy savings protocols, evaluation, measurement, and verification ("EM&V") studies, and overall administrative structure. I also reviewed and commented on New Jersey Energy Master Plans, and the Comprehensive Resource Analyses on behalf of Rate Counsel. In over a dozen dockets regarding utility-administered efficiency programs including cases for New Jersey Natural Gas, Elizabethtown Gas, and PSE&G, I conducted expert analysis, provided litigation support, and drafted testimony and comments when appropriate on behalf of the Rate Counsel with respect to energy efficiency implementation, cost recovery, program budgets, performance, evaluation, cost-benefit analysis, and overlap between utility- and state-administered programs.

My work has encompassed many aspects of energy efficiency program design and implementation, including efficiency measure screening, program delivery options, program budgeting, cost-benefit analyses, avoided costs, and other relevant regulatory policies.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe and present concerns regarding energy efficiency program design and implementation with the August 7, 2014 filing by Public Service Electric and Gas Company ("PSE&G" or "Company") to the New Jersey Board of Public Utilities ("BPU" or "Board") in BPU Docket No. EO14080897. In this filing, the Company proposes to modify and extend for four years (from 2015 to 2018) new enrollments in the three energy efficiency sub-programs constituting the current version of the Company's Energy Efficiency Economic Stimulus ("EEE") program: the Multi-family Housing sub-program ("Multi-family"), the Direct Install sub-program (previously the Government/Municipal/Non-Profit l Direct Install sub-program), and the Hospital Efficiency sub-program ("Hospital").[4] PSE&G's proposal will be referred to in this testimony as the "EEE Extension II" program.

[4] New participants by year are shown in Schedule JEM-EEEXII-7.

Q. How is your testimony organized?

A. This testimony is organized as follows:

1. Introduction and Qualifications
2. Summary of Conclusions and Recommendations
3. Overview of PSE&G's filing
4. Alternative incentive structure
5. Program coordination and customer eligibility
6. Program evaluation
7. Cost-benefit analysis
8. Conclusions and Recommendations

2. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q. Please summarize your primary conclusions.

A. I make the following findings:

1. The current and proposed incentives are very generous to program participants. On average, participants receive subsidies amounting to approximately 70 percent of the total installed costs of the projects. In addition, participants receive no-interest on-bill financing for their share of the project cost and also receive, at no cost to the participant, a walk-through audit (for the Direct Install sub-program) or investment grade audit (through the Hospital and Multi-family sub-programs). These incentives exceed what is necessary to promote energy efficiency for the target customer segments, and provide disproportionate benefits to program participants compared to ratepayers in light of their relative funding contributions. The proposed incentives are also generally higher than offerings by similar programs offered by the New Jersey Clean Energy Program ("NJCEP") and in many other jurisdictions, provide very high benefit-cost ratios from the participant perspective, and are unnecessarily costly to ratepayers.

2. It is likely that the Company's generous incentive packages are undermining participation in the NJCEP, in particular the NJCEP Direct Install program.

3. The current and proposed programs lack effective mechanisms to ensure that the program is available to as many participants as possible. In particular, the

Company funded two large Direct Install projects at costs totaling $5 million on the same day in the same year for a single large entity, notwithstanding the currently effective entity eligibility demand limit of 150 kW.

4. Since the inception of the Direct Install, Multi-family, and Hospital sub-programs around 2008, the Company has not completed any impact evaluation studies that evaluate and verify energy and demand savings for past or ongoing activity. Without an impact evaluation, it is difficult to know how the programs have performed historically in terms of cost, performance, and other factors, and whether the assumptions used in the extension proposal are appropriate as a basis for extending the programs.

5. It is not clear whether the Company is collecting data on what is being replaced by energy efficiency projects (including remaining measure life of existing, functional equipment, if any) or on the incremental costs associated with the projects. These data are important to determine appropriate measure costs, incentive levels, and actual savings associated with the sub-programs.

6. The cost-benefit analysis ("CBA") performed by the Rutgers University Center for Energy, Economic and Environmental Policy ("CEEEP") and submitted with the Petition does not accurately represent the costs and savings associated with the proposed program, for the following reasons:

   a) Projected costs and savings do not align with the Company's historical experience with the sub-programs.

   b) The CBA uses total project costs, rather than the incremental costs of the measures promoted by the proposed sub-programs, to calculate the cost-benefit ratios included in the analysis.

   c) The CBA does not appear to include the costs of program incentives as part of the project costs used for the purposes of the Total Resource Cost ("TRC") test calculations.

Q. Please summarize your primary recommendations.

A. I offer the following recommendations:

1. The proposed Extension II program should offer lower incentive levels. The incentive levels should be reduced to 45 percent of the total installed cost for the Hospital and Multi-family sub-programs, and 50 percent of the installed cost for the Direct Install sub-program. At the same time, the repayment period for the Direct Install sub-program should be extended to four years from the current proposal for three years, and the repayment period for the Hospital sub-program extended to five years from the current proposal for three years, in order to ensure that the participants in these programs see net energy bill reductions during the repayment period even after the reduction in incentives. It is not necessary to extend the repayment period for the Multi-family sub-program.

2. In order to avoid undermining the NJCEP Direct Install program, PSE&G's proposed extension of its Direct Install sub-program offerings to small business customers should be limited to those located in Urban Enterprise Zones ("UEZs").

3. The Company should be allowed to increase its current 150 kW peak-usage eligibility cap per facility for the Direct Install sub-program to 200 kW. However, the Company should not be permitted to allow exemptions to the 200 kW cap. In addition, for all sub-programs, incentives should be limited to one project per facility per year.

4. The Board should consider the impact evaluation report on an earlier version of the EEE program, expected to be available in November 2014, and input on that report, as part of the review process for the proposed EEE Extension II program. Furthermore, the Company should plan and budget for more frequent evaluation, measurement, and verification activities, particularly for an impact evaluation before the program ends.

5. The Company should be required to regularly collect data to enable a better understanding of what is being replaced (including remaining life of existing equipment, if any) and the incremental costs associated with the projects. For the purposes of estimating incremental savings and costs, PSE&G should be required to collect costs and energy consumption for both program measures and similar, standard efficiency measures of all types, including measures involving early

retirements. For measures involving early retirements, PSE&G should be required to collect the type of data that California investor-owned utilities require for their Statewide Customized Retrofit program in order to ensure that projects do actually involve early retirements, and that costs and savings for such projects are analyzed in a way appropriate for early retirements.

6. The Board should require the Company to submit a revised CBA that (a) uses estimates of costs and savings that reflect historical experience with the program, (b) uses incremental costs of the measures promoted by the proposed program, and (c) accounts for program incentives in the calculation of the TRC test. Once these issues have been addressed, the cost-benefit analysis should be re-run using the revised inputs, and the results should be provided to parties in this proceeding.

3. OVERVIEW OF PSE&G'S FILING

Q. Please describe the history of the sub-programs.

A. Two of the three sub-programs proposed for extension in the current filing, the Hospital and Small Business Direct Install sub-programs, originated in the Carbon Abatement pilot program, which was filed on June 23, 2008 and approved by the Board in Docket No. EO08060426 on December 16, 2008.[5] The Multi-family sub-program and Municipal/Local/State Government Direct Install sub-program were originally proposed to the Board as part of the Company's proposed Energy Efficiency Economic Stimulus ("Original EEE") program filing in a Petition filed January 21, 2009, and a Stipulation including these three sub-programs was approved by the Board in Docket Nos. EO09010056 and EO09010058 on July 16, 2009.[6] On January 25, 2011, the Company requested an extension of the three sub-programs for three years (from 2012 to 2014), and requested an expansion of the Direct Install program to non-profit participants, in Docket No. EO11010030 ("EEE Extension"). The Company's EEE Extension proposal

[5] I/M/O The Petition of Public Service Electric and Gas Company Offering a Carbon Abatement Program in it Service Territory on a Regulated Basis and Associated Cost Recovery Mechanism Pursuant to N.J.S.A. 48:3-98.1 BPU Docket No. EO08060426 (Dec. 17. 2009).

[6] I/M/O the Petition of Public Service Electric and Gas Company Offering and Energy Efficiency Economic Stimulus Program in its Service Territory on a Regulated Basis and Associate Coste Recovery Mechanism Pursuant to N.J.S.A. 48:3-98.1, BPU Docket Nos. EO09010056 and EO09010058 (July 16, 2009).

was approved on July 14, 2011.[7] The budget for the EEE Extension sub-programs was approximately $100 million.

Q. What is the Company requesting in the EEE Extension II?

A. PSE&G is petitioning the Board for authorization to extend the Multi-family, Direct Install, and Hospital sub-programs, with some modifications, for four more years, from 2015 to 2018 at a budgeted cost of nearly $110 million. (Schedule JEM-EEEXII-6.) The budget breakdown for the sub-programs and other program costs is presented in Table 1.

Table 1. Proposed Extension II Budget by Sub-program and Administrative Function

Sub-program Component	Budget ($ million)	Allocation (%)
Program Budget		
Multi-Family Housing	$30.0	27%
Hospital Efficiency	$40.0	36%
Direct Install	$25.0	23%
Sub-total	$95.0	87%
Administrative Budget		
Administration, Program Management, Quality Assurance/Quality Control and Evaluation	$13.7	12%
IT System Enhancement Costs	$1.1	1%
Sub-total	$14.8	13%
Total EEE Extension II Budget	$109.8	100%

Source: Schedule JEM-EEEXII-6 and Testimony of Jess E. Melanson, p. 14, lines 14-16

Q. Please describe the sub-program offerings proposed by the Company in this filing.

A. For the Multi-family and Hospital sub-programs, the Company proposes to offer the following services:

- Provide, at no cost to the participant, a walk-through or investment grade audit to identify cost-effective energy conservation measures ("ECMs").

[7] I/M/O the Petition of Public Service Electric and Gas Company for an Extension of Three Sub-components of its Energy Efficiency Economic Stimulus Program in its Service Territory on a Regulated Basis and Associated Cost Recovery and for Changes in the Tariff for Electric Service, B.P.U.N.J. No. 15 Electric and the Tariff for Gas Service B.P.U.N.J No. 15 Gas, Pursant to N.J.S.A. 48:2-21, 48:2-21.1 and N.J.S.A. 48:3-98.1, BPU Docket No. EO11010030 (July 14, 2011).

- Provide, at no cost to the participant, an engineering analysis as needed, and payback and project screening analyses.
- Prepare, at no cost to the participant, a project Scope of Work for contractor bidding.
- Services will be directly provided by qualified audit and engineering professionals hired by the Company through a competitive bid process. (Schedule JEM-EEEII-2, p. 12, 22.)
- After a contractor bid is accepted, advance 100 percent of up-front project costs to implement ECMs recommended by the audit or engineering analysis and selected by the customer.
- Recover a certain portion of the project cost through a zero percent interest loan that is repaid through charges to participants' utility bills over time. (Schedule JEM-EEEXII-2, p. 14-15 and 24.)

For the Direct Install sub-program, the Company will offer, at no cost to the participant, a walk-through energy audit and provide a report of recommended energy savings improvements. These services will be directly provided at no cost to the participant by qualified auditors and installation professionals hired by the Company through a competitive bid process. In addition, PSE&G will provide direct installation of ECMs recommended by the energy assessment, for which PSE&G recovers a certain portion of the project cost through a zero percent interest loan that is repaid through charges to participants' utility bills over time. (Schedule JEM-EEEII-2, p. 30, 31.)

Both the Multi-family and Hospital sub-programs promote various measures, including efficient heating, ventilation, and air conditioning ("HVAC"); building envelope; air sealing; motors; lighting: domestic hot water equipment; appliances; and other energy-consuming equipment. (Schedule JEM-EEEXII-2, p. 12 and 22.) The Direct Install sub-program primarily promotes efficient lighting and may also promote efficient HVAC, refrigeration, motors, and variable speed drives. (Schedule JEM-EEEXII-2, p. 32.)

The rebate amount (i.e., the amount the participant is not required to repay) and financing periods for the participants' share of the project costs are summarized below for each sub-program:

- Multi-family: the rebate is set to buy down the simple payback of the project costs by seven years, but not to less than two years. Remaining costs will be repaid by program participants, interest free, on their utility bills over a ten-year period for New Jersey Housing and Mortgage Financing Agency ("NJHMFA") projects or a five-year period for non-NJHMFA projects. (Schedule JEM-EEEXII-2, p. 12.)

- Hospital: the rebate is set to buy down the simple payback of the project costs by seven years, but not to less than two years. Remaining costs will be repaid by program participants, interest free, on their utility bills over a three-year period. (Schedule JEM-EEEXII-2, p. 22.)

- Direct Install: the rebate is set equal to 70 percent of total project cost. The remaining 30 percent of project costs will be repaid by program participants, interest free, on their utility bills over a period of three years.[8] (Schedule JEM-EEEXII-2, p. 31.)

All three sub-programs will offer participants the option of repaying the participant portion of the cost in a lump sum payment at the completion of the work. PSE&G is proposing that there be no incentive caps (e.g., limiting the amount of incentives that any individual project or customer could receive per year) for any of the sub-programs. (Schedule JEM-EEEXII-2, p. 12, 26, 31.)

Q. Is the Company proposing any changes to the existing sub-programs?

A. Yes. I summarize major proposed changes to the existing sub-programs below.

1. Previously, incentives under the Direct Install sub-program were set to provide a subsidy of 80 percent of the total project cost. PSE&G is proposing to increase the participant's share of the project cost from 20 percent to 30 percent in order to better align with the NJCEP Direct Install program. The Company also proposes to increase the customer's repayment term to three years for the proposed

[8] Previously, incentives under the DI sub-program were set to provide 80% of the total project cost.

Extension II program, from two years for the current EEE Extension Municipal Direct Install sub-program. (Schedule JEM-EEEXII-2, p. 31.)

2. The Company proposes to make the Direct Install sub-program, currently only available to government and non-profit entities, also available to small business customers,[9] primarily based on a September 2012 study conducted by the Electric Power Research Institute ("EPRI") that found significant energy savings potential for these customers in the Company's service area. (Testimony of Jess E. Melanson, p. 9.)

3. The Company proposes to change eligibility criteria for the Direct Install sub-program to a peak kW usage of 200 kW or less per facility, from the current requirement of 150 kW or less, to better align the proposed sub-program with the NJCEP Direct Install program. (Schedule JEM-EEEXII-2, p. 30.)

4. The Company proposes to amortize program costs over a period of 15 years. Currently, EEE Extension program costs are amortized over 5 years. (Response to RCR-A-0005.)

5. The Company also proposes to collect a new participation fee from each participant through the current on-bill repayment mechanism. This fee would be set equal to 1.5 percent of the participant's total project cost, and is meant to recover lost revenues that the Company expects from this program. (Schedule JEM-EEEXII-2, p. 3.)

Issues relating to program cost amortization and the proposed participation fee are discussed in the testimony of Rate Counsel Witness Andrea Crane.

4. ALTERNATIVE INCENTIVE STRUCTURE

Q. Please describe financial incentives offered and assumed under each sub-program.

A. As discussed above, the Company proposes to offer zero percent, on-bill financing across all sub-programs, just as it has provided under the Original EEE and EEE Extension

[9] PSE&G previously offered a Direct Install sub-program to small businesses (the Small Business Direct Install sub-program), starting in 2008.

programs. In addition, the Company proposes to buy down the simple payback of total project costs by seven years, but not to less than two years for the Multi-family and the Hospital sub-programs, and to offer incentives at 70 percent of the total installed costs for the Direct Install sub-program. Based on the Company's filing and supporting workpapers, it appears that the incentives for the Multi-family and Hospital sub-programs were structured with a target of providing incentives valued at approximately 70 percent of total installed costs. The 70 percent target is reflected in the electronic workbook titled "WP-JEM-1 EEEXII.xlsx" filed along with the Company's petition.[10]

Q. How does on-bill financing encourage customers to implement energy efficiency measures?

A. One feature of the Company's existing and proposed sub-programs that is most attractive to participants is no-interest, on-bill financing that does not require customers to pay any up-front costs. For customers with constraints on the availability of capital (such as small businesses, multi-family, and hospital customers), on-bill financing has substantial potential for removing barriers to implementing energy efficiency measures and for significantly increasing both program participation and energy savings.

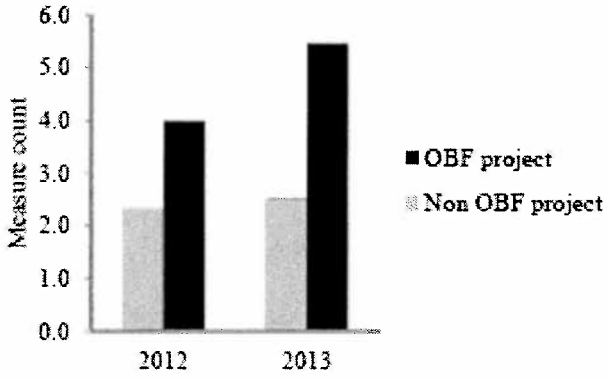
It also has the potential to promote comprehensive energy efficiency upgrades by allowing customers to implement multiple energy efficiency measures at once, when financial constraints would otherwise limit the customer to fewer measures. While studies on on-bill financing are still lacking, a case from Pacific Gas & Electric ("PG&E")'s EnergySmart Grocer ("ESG") program suggests that on-bill financing does promote more comprehensive upgrades. The ESG program offers prescriptive financial incentives incentives (i.e., specified incentives for measures from a pre-qualified list of measures) to mid-to-large size grocery stores and supermarkets (e.g., $10 to $125 per unit for fluorescent lighting fixtures and $150 to $500 per unit for commercial ice machines)[11], and started offering on-bill financing in 2012 in order to increase the comprehensiveness of efficiency projects and produce more energy savings from each project. As a result, the

[10] The cell B31 of the worksheets called "DI," "MF," and "Hosp & Health" indicate 30 percent as the ratio of customer repayments relative to the project total costs.

[11] http://www.energysmartgrocer.org/ca/documents/PG&E-ESG-IncentiveWorksheet.pdf

average number of measures per project was double the number of measures installed for projects without on-bill financing (or "OBF"), as shown below.[12]

Figure 1. Number of Measures with and without OBF for PG&E's EnergySmart Grocer program



It is important to note that on-bill financing works very effectively when customers do not pay any up-front costs, and could enjoy net energy bill savings even with future repayments. This could happen when customers' energy bill savings due to energy efficiency upgrades are greater than their monthly or annual on-bill financing repayment amounts. Thus, when developing repayment periods, it is important to examine net energy bill reduction for potential program participants.

Q. Should the availability of on-bill repayment be considered in establishing the level of up-front rebates being offered?

A. Yes. Since on-bill repayment provides significant value to participants, upfront cash incentives can be lower than would be required in a program that does not include on-bill repayment.

Q. Are the incentive levels appropriate under PSE&G's proposed sub-programs?

A. No. These incentives exceed what is necessary to promote energy efficiency for the targeted customer segments, and therefore are unnecessarily costly to ratepayers. The proposed incentives are also higher than offerings under similar programs in New Jersey and in other states, and provide very high benefit-to-cost ratios from the participant

[12] Geers, D., et al (2014). Widening Access to Energy Savings: Using On-Bill Financing to Bring Comprehensive Projects to Hard-to-Reach Customers. Proceedings of the 2014 ACEEE Summer Study on Energy Efficiency in Buildings.

perspective and comparatively low benefit-to-cost ratios from the ratepayers' perspective. It is notable that many of the other programs I reviewed do not provide on-bill financing and/or offer lower incentives than the Company has been offering and is planning to offer through the proposed extension.

Q. What is the basis for your conclusion that the Company's proposed incentive levels are too high?

A. There are a number of reasons for concluding that the Company's incentive levels are too high, including the following:

- The benefit-to-cost ratios for the proposed programs range from 5 to 7 from the program participants' perspective, while the benefit-cost ratios from the ratepayers' perspective (determined by the Program Administrator Cost test, or "PAC") range from 1 to 2.6. (Schedule JEM-EEEXII-12.) In other words, participants receive benefits worth $5 to $7 for every dollar they spend on energy efficiency measures, while the ratepayers in general receive only $1 to $2.60 in benefits for every dollar spent on the program.

- All three sub-programs have growing waiting lists of potential participants. (Company's response to Staff discovery request S-PSEG-ENE-0006.)

- A review of similar programs in offered by the NJCEP and in other jurisdictions (including six small business direct install programs, seven multi-family programs, four healthcare programs, and three custom retrofit programs) found that other programs are generally providing much lower incentives.

- The Company set incentive levels based on a target percentage of the full costs of total installed measures, rather than a percentage of the incremental cost of energy-efficient equipment compared to standard equipment.

Q. Please describe in detail your findings regarding benefit-to-cost ratios for the proposed sub-programs.

A. The results of the CEEEP cost-benefit analyses of the proposed Extension II program results were provided in Schedule JEM-EEEXII-12 to Direct Testimony of Company witness, Jess Melanson. The supporting workpapers for these analyses, in the form of an Excel workbook entitled "PSEG EE Program CBA - Res MF, Hosp, Muni DI - 07312014

v.7.xls," were provided to the parties in response to Rate Counsel discovery request RCR-EE-0006. Table 2 below presents the results of two of several cost-benefit tests performed by CEEEP for each of the three proposed sub-programs. The Participant Cost Test compares the costs paid by program participants with the value of the benefits they receive. The PAC Test compares the cost of the program from the viewpoint of ratepayers (i.e., the costs of the incentives plus administrative costs) with the value of the benefits received by ratepayers.[13]

Table 2. Cost benefit test results

Results		Residential Multi-Family	Direct Install - Municipal & Small Business	Hospital Efficiency
Participant Cost Test				
(a). Participant Benefits	PV of yearly bill reduction (electric & gas) at retail	$32,763,941	$28,919,474	$37,325,797
(b). Participant Costs	PV of yearly repayments	$4,766,425	$5,119,529	$7,278,892
Benefit-Cost Ratio	**(a) / (b)**	**6.9**	**5.6**	**5.1**
Program Administrator Cost Test				
(a). Program Administrator Benefit	PV of avoided energy supply, capacity, and T&D	$27,434,202	$47,843,152	$47,648,125
(b). Program Administrator Costs	PV of program incentive and administration costs	$20,979,416	$18,270,213	$25,545,719
Benefit-Cost Ratio	**(a) / (b)**	**1.3**	**2.6**	**1.9**

Source: based on Schedule JEM-EEEXII-12.

The results of the Participant Cost Test for the three sub-programs show that program participants would receive substantial benefits (in the form of reduced retail energy bills) on a net present value basis, on the order of approximately five times (for the Hospital sub-program) to nearly seven times (for the Multi-family sub-program) more than the costs borne by the participants. In contrast, the results of the PAC Test (which represents benefits and costs for all ratepayers) are significantly less favorable: benefits range from 1.3 times ratepayer costs for the Multi-family sub-program to 2.6 times ratepayer costs for the Direct Install sub-program. These results indicate that participants are receiving a

[13] The PAC Test excludes program participants' out-of-pocket costs not covered by program incentives and any non-energy benefits enjoyed by participants due to energy efficiency upgrades (e.g., improved comfort, air quality, and productivity, and increased property value). In contrast, as I discuss in more detail below, the TRC Test by definition includes these participant-related benefits and costs.

disproportionate share of the benefits from these programs compared to ratepayers, given their relative contributions to the costs of the programs.

Q. Please describe the status of the customers on the waiting lists for the three sub-programs.

A. The Hospital sub-program has a waiting list of 21 customers, the Multi-family sub-program has a waiting list of 45 customers, and the Direct Install sub-program has a waiting list of 304 customers. (Company's response to S-PSEG-ENE-0006.) These are significant numbers of customers when compared to the numbers enrolled to date under the Original EEE and EEE Extension programs: 27 customers enrolled in the Hospital sub-program, 31 customers enrolled in the Multi-family sub-program, and 611 customers enrolled in the Municipal Direct Install sub-program. (RCR-EE_4_Project Data.xlsx workbook provided by the Company in response to discovery RCR-EE-0004.)

Q. What is your observation on the number of customers on the waiting lists?

A. This is a strong indication that the Company's incentive levels are too high.

Q. Do you have any other concerns regarding the high levels of the proposed incentives?

A. Yes. With lower incentive levels, PSE&G's programs could serve more customers.

Q. Are you aware of any evidence that illustrates that programs with lower incentives can achieve higher levels of participation in PSE&G's program?

A. Yes. A December 2013 study by the ACEEE titled "Apartment Hunters: Program Searching for Energy Savings in Multifamily Buildings" revealed that PSE&G's Multi-family sub-program has one of the lowest (if not the lowest) annual participation rates among the nine multi-family programs examined in the report. Schedule KT 1, "Summary of Multifamily Program Participation Rates by ACEEE," presents the results of this ACEEE survey. PSE&G's Multi-family sub-program has an annual participation rate of about 0.5 percent, relative to the total number of eligible customers. In contrast, about seven programs in other jurisdictions have higher participation rates, ranging from 1 percent (in programs by NYSERDA, Efficiency Vermont, CNT Energy, and SMUD) to as high as about 10 percent (in programs by Austin Energy and Energy Trust of Oregon) to 16 percent (in Puget Sound Energy's program). I reviewed the incentive offerings of most of these multi-family programs as well as other programs. The results of this review

are summarized at pages 2-3 and Table 2 of attached Schedule KT-2 "A Review of Other Program Incentives." As I discuss further below, I found that other jurisdictions offer much lower incentives per participant than what PSE&G is offering.

This suggests that other multifamily programs are attracting more participants—which could result in more energy savings at the program level with the same incentive budget as proposed by PSE&G—while spending less on program incentives per participant than PSE&G is spending. This is true at least for multi-family programs, but the same conclusion may be true for the other sub-programs.

Q. Please provide your assessment of incentives offered through the NJCEP programs and in other jurisdictions relative to the proposed incentives for the proposed Direct Install, Multi-family and Hospital sub-programs.

A. Schedule KT-2 includes the results of my review of six small business direct install programs, seven multi-family programs, four healthcare programs, and three custom retrofit programs in New Jersey and in other jurisdictions. This review found that other programs are generally providing much lower incentives.

Many programs, including programs targeting multifamily buildings, hospitals and other customer segments, offer financial incentives based on the incremental costs of the measures, rather than the total cost of the program measure. ConEdison's Multi-family program, for example, offers prescriptive incentives (i.e., specified incentives for measures from a pre-qualified list of measures), such as $50 per ton for heat pumps and air conditioners, $3 to $4 per common area CFL, and $50 per LED exit light. Given a three-ton heat pump system—a typical capacity for heat pumps—the total incentive for a heat pump would be only $150 under ConEdison's Multi-family program. Energy efficient heat pumps can cost over $3,000 per ton or $9,000 for a three ton unit. Thus, PSE&G's incentive of 70% of the total cost of the heat pump plus installation costs would be roughly $6,300, considerably higher than the $150 offered through the ConEd program. Some of the other programs summarized in Schedule KT-1, Table 2 are structured similarly to ConEdison's and others include per-participant caps and other limitations on incentive levels that result in lower incentive levels than PSE&G's program. Most of the multifamily programs and the hospital programs I reviewed offer incentives based on the incremental costs, similar to ConEdison's incentive approach.

The results of my review of other small business direct install programs are summarized at page 1-2 and Table 1 of Schedule KT-2. Some small business programs also offer incentives based on the incremental costs similar to those offered through the ConEdison multifamily program (e.g., $0.20 per kWh annual savings for lighting by Connecticut Light and Power's Small Business Energy Advantage program). Others offer 70 percent of the total installed costs. However, the 70 percent incentive costs are typically offered for low-cost measures such as lighting, occupancy sensors, and refrigeration equipment. Other direct install programs offer incentives as low as 35 percent of total project costs.

For most of the programs I reviewed, the highest incentive levels I observed were 50 percent of the total installed costs when major HVAC replacements are excluded.[14] This 50 percent incentive is provided for various measures, including normal and early retirements of HVAC offered by programs in California, Connecticut, New Jersey, and Wisconsin.[15]

Q. What is your recommendation for the alternative incentive levels?

A. The incentive levels for the Extension II program should be reduced to 45 percent of the total installed cost of measures for the Hospital and Multi-family sub-programs, and 50 percent of the installed cost of measures for the Direct Install sub-program. The incentive levels I propose for the Hospital and Multi-family sub-programs are close to the highest incentive levels I found in other states for similar types of customers and measures, including major HVAC replacement projects. (See p. 2-4 and Tables 2 and 4 in Schedule KT-2 "A Review of Other Program Incentives.") I do not recommend a 50 percent incentive for PSE&G's proposed Hospital and Multi-family sub-programs, because the Company offers on-bill financing to participants that requires no up-front cost to them, while other programs reviewed do not offer this attractive financing option. For the Direct Install sub-program, I propose an incentive level (50 percent) that is close to the midpoint of the maximum incentive levels by other programs I found in the same research, ranging from 30 percent to 70 percent.

[14] The Direct Install programs by NJCEP and NSTAR Massachusetts offer 70 percent incentives.

[15] Note there are a few other direct install programs that offer 70 percent incentives, but such a high incentive level is mainly offered to low cost measures such as lighting and occupancy sensors, and not offered for major replacements of HVAC replacement.

In addition, the repayment period for the Direct Install sub-program should be extended to four years from the current proposal for three years, and the repayment period for the Hospital sub-program extended to five years from the current proposal for three years, in order to ensure that the participants in these programs see net energy bill reductions during the repayment period even after the reduction of incentives. I find that Multi-family sub-program participants will continue to see net energy bill reductions at the current repayment terms, even with higher participant cost shares. Thus, it is not necessary to extend the repayment period for the Multi-family sub-program.

The above recommendations are based on my analysis of two electronic workbooks provided by the Company titled "WP-JEM-1 EEEXII.xlsx" (provided with the original petition) and "PSEG EE Program CBA - Res MF, Hosp, Muni DI - 07312014 v.7.xlsx" (provided in response to RCR-EE-0006). I modified the repayment ratios as a percentage of the total project cost and the repayment schedules that are provided in the three worksheets titled "MF," "DI," and "Hosp & Health" in the "WP-JEM-1 EEEXII.xlsx" file, and reflected the resulting changes in repayment amounts and schedules in the "WP-JEM-1 EEEXII.xlsx" workbook to the "PSEG EE Program CBA - Res MF, Hosp, Muni DI - 07312014 v.7.xlsx." workbook.

Q. How would your proposal for lower incentive levels change the benefit-cost ratios under the Participant Cost Test and the PAC Test?

The resulting benefit-cost ratios are provided below in Table 3. I reflected my recommended changes in incentive levels and repayment schedules in the CEEEP calculations of the Participant Cost Test and the PAC Test for each sub-program. The benefit-cost ratios under the PAC Test increase to 1.6 for the Multi-family sub-program, 3.2 for the Direct Install sub-program, and 3 for the Hospital program. This indicates that the ratepayers are better off under this revised scenario than under the scenario the Company proposed. In contrast, the Participant Cost Test ratios for the sub-programs decrease from ratios in the range of 5 to 6 to ratios in the range of 3.0 to 3.7. However, this suggests that the lower incentive levels continue to provide attractive benefits for the target customer segments: customers would still be receiving significant benefits valued at 3 to approximately 4 times their investments.

Table 3. Participant and Program Administrator Benefit Cost Ratios for Lower Incentive Levels

Results		Residential Multi-Family	Direct Install - Municipal & Small Business	Hospital Efficiency
Participant Cost Test				
(a). Participant Benefits	PV of yearly bill reduction (electric & gas) at retail	$32,763,941	$28,919,474	$37,325,797
(b). Participant Costs	PV of yearly repayments by participants (electric & gas)	$8,738,446	$8,224,628	$12,404,949
Benefit-Cost Ratio	**(a) / (b)**	**3.7**	**3.5**	**3.0**
Program Administrator Cost Test				
(a). Program Administrator Benefit	PV of avoided energy supply, capacity, and T&D	$27,434,202	$47,843,152	$47,648,125
(b). Program Administrator Costs	PV of program incentive and administration costs	$17,007,395	$15,165,115	$20,419,662
Benefit-Cost Ratio	**(a) / (b)**	**1.6**	**3.2**	**2.3**

Q. Are there any other factors that might change these results?

A. Yes. The costs of energy efficiency measures are likely to be overstated, because the Company uses the total project costs as the cost of energy efficiency measures (per the cost assumptions used in the "PSEG EE Program CBA - Res MF, Hosp, Muni DI - 07312014 v.7.xlsx" workbook prepared by CEEEP).

Q. Please explain in detail any issues with the Company's energy efficiency cost assumption.

A. In a discovery conference on October 14, 2014, the Company stated that it uses total project costs—instead of incremental costs—because the Company's sub-programs promote early retirement measures by replacing old but functional existing systems with energy efficiency measures. There are two issues with this approach. First, the Company assumes that all measures they implement are early retirements. Second, the Company assumes that the old systems would not be replaced in the future, absent PSE&G's programs.

With regard to the first issue, it is reasonable to assume that not all measures are early retirement. There could be many measures that replace existing systems that are reaching the end of their measure life. Replacements of a system with a remaining life of one year or less should not be considered an early retirement.[16] In response to the second issue,

[16] The remaining useful life will become zero if the equipment age is greater than or equal to the assumed useful life of the measure (also called effective useful life). See Evergreen Economics, Michael Energy and Phil Willems

and more importantly, the true cost (or the incremental cost) of early retirement measures should actually be significantly lower than the total installed costs, because most customers will replace aging, existing systems at some point in the future even without program intervention.

Q. How should the cost and incentives for early retirement be developed?

A. The incremental cost of energy-efficient measures that result in early replacements should generally be the difference between (a) the upfront cost of energy-efficient measures and (b) the net present value of the future capital outlay to buy a standard system to replace the old existing systems assuming no PSE&G program existed.

The Regional Evaluation, Measurement and Verification Forum, an initiative by the Northeast Energy Efficiency Partnerships ("NEEP"), issued a comprehensive report on early retirement measures entitled "Early Replacement Measures Scoping Study: Phase I Research Report" ("the NEEP report") in August 2014. According to this report, early replacement costs are calculated as "the cost of the new efficient equipment minus the present value ("PV") of the cost that is avoided in the future for the code/standard equipment."[17] In other words, the incremental cost of energy efficient measures that result in early replacements should be the difference between (a) the up-front cost of energy efficient measures and (b) the net present value of the future capital outlay to buy and install a standard system to replace the old existing systems assuming no PSE&G program existed.[18] This method results in a cost that is slightly higher than the simple difference between the cost of an efficiency measure and the cost of a standard measure today, but is still much lower than the total project cost of the measures. This method also suggests that incentive levels for early retirement measures should be developed relative to the cost estimated by this method.

(August 2014). Early Replacement Measures Scoping Study: Phase I Research Report, A Report to the Regional Evaluation, Measurement and Verification Forum, facilitated, p. 19.

[17] Evergreen Economics, Michael Energy and Phil Willems (August 2014). Early Replacement Measures Scoping Study: Phase I Research Report, A Report to the Regional Evaluation, Measurement and Verification Forum, facilitated by NEEP, p. 32.

[18] The NEEP report cited in note 17 conducted a survey of incentives for early retirements. The survey found many measures for which full project costs are used (e.g., to set incentive levels in cost-benefit analyses), but also found slightly fewer, but still many, measures for which methods that discount the future capital cost of a standard measure are used. Further, the report stated the full cost method artificially increase the total cost of measure, hurting cost-effectiveness.

My proposed incentive levels appear even more generous when compared to incremental costs, rather than total project costs. In my opinion, even the reduced incentive costs would cover more than the true, incremental cost of energy efficiency measures resulting in early replacement for participants.

5. PROGRAM COORDINATION AND CUSTOMER ELIGIBILITY

Q. Do you have any concerns about customer eligibility for any of the proposed Extension II sub-programs?

A. Yes. First, I am concerned that offering the Direct Install program to small business customers is likely to undermine participation in the NJCEP Direct Install program. I am also concerned about how the Company handles customer eligibility in terms of the maximum electric peak load.

Q. Would you please explain your first concern?

A. With the proposed expansion to small business customers, PSE&G would be targeting the same customers that are eligible to participate in the NJCEP Direct Install program. PSE&G's higher incentives for the same types of measures are likely to undermine efforts to attract participants to the NJCEP program.

Q. Do you have any recommendations for reducing potential conflicts between PSE&G's Direct Install sub-program and NJCEP's Direct Install program?

A. Yes. The proposed coverage of small businesses under the Extension II Direct Install sub-program should be only offered to businesses located in Urban Enterprise Zones. In addition, reduced up-front incentive amounts while allowing on-bill financing (as I recommended under the Alternative Incentive section) would also help reduce competition between the two programs. With this change, customers with capital constraints could participate in PSE&G's sub-program, and customers who can fund their share of the costs of energy-efficient measures on their own could participate in the NJCEP Direct Install program.

Q. Would you please elaborate on your second concern?

A. PSE&G is proposing to change the current 150 kW peak usage eligibility cap for the Direct Install program to 200 kW and, in addition, allow projects exceeding the revised cap to be considered on a case-by-case basis. (Testimony of Jess E. Melanson, p. 10, lines

5-17.) While I do not have an issue with the increased cap of 200 kW, I have a concern with the proposal to allow the cap to be exceeded on a case-by case basis.

A case illustrating the reason for my concern is the two past projects in which the same single large customer, the Port Authority of New York and New Jersey, received incentives for measures installed at Newark Airport. Based on the Company's response to Rate Counsel discovery, the projects consumed $5 million in ratepayer-funded incentives. Although I do not have information on maximum peak loads associated with customers that received incentives, it is almost certain that peak load for this customer was larger than the current 150 kW limit for the Government/Municipal/Non-profit Direct Install program. ("RCR-EE_4_Project Data .xlsx" workbook provided in the Company's response to RCR-EE-4; Company response to RCR-EE-0018.))

Q. Do you have any recommendation for avoiding the case where customers exceed the 200 kW load limit?

A. Yes. The Company should not be permitted to exceed the 200 kW peak usage eligibility cap in the Direct Install sub-program. Further, the Company should not allow more than one project each year for each customer under all sub-programs. In this regard, it should be made clear that the limit is "per customer facility" rather than "per metered account."

6. PROGRAM EVALUATION, MEASUREMENT AND VERIFICATION

Q. What is the purpose of program evaluation?

A. There are many reasons for conducting program evaluation. The 2010-2011 NJCEP evaluation plan indicates that the need for evaluation is based on several factors, such as the following:

- The need for regulatory accountability given the significant and increasing level of public funds dedicated to energy efficiency programs,
- The need to establish progress towards state policy and program goals, including in deferring the need for generation, transmission, and distribution infrastructure upgrades and meeting greenhouse gas goals,
- The potential for efficiency savings and distributed renewables to be bid into the PJM Reliability Pricing Market, and

- The need to ensure that energy efficiency programs are designed and administered to achieve the desired goals in a cost-effective manner.[19]

In addition, evaluation has an important role in assessing the effects that the presence of overlapping programs had on the impacts and administration of each. In order for evaluation to meet these objectives, it must provide timely feedback to program managers, program administrators, and policymakers.

Q. What are the main types of evaluation activities that are of importance for energy efficiency programs?

A. Evaluation activities generally include cost-benefit analysis, market potential studies, market assessments, baseline studies, impact evaluations, process evaluations, tracking system assessments, and review of protocols for estimating program impacts.[20] Among them, impact evaluation and process evaluation are the most important studies for verifying that the Company's programs are effective and cost-effective, and for finding any areas in need of improvement. These two studies are described further below.

- **Impact evaluation** is the key evaluation activity in terms of revealing actual energy and demand savings impacts from efficiency programs. It involves finding the level of energy and demand savings attributable to the programs, which is the net savings that can be claimed by the program administrator (PSE&G). Where the customers targeted by the Company's programs (e.g., small business) overlap significantly with customers targeted by other programs (e.g., NJCEP programs), additional evaluation to identify the incremental contribution of the Company's program may be needed. An impact evaluation can also determine the persistence of annual energy savings and evaluate free ridership, spillover, and market transformation effects.[21]

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[19] 2010-2011 Evaluation and Research Plan: New Jersey's Clean Energy Program Energy Efficiency and Renewable Energy Programs: Final Report. January 27, 2010. pp. 5-6.
http://www.njcleanenergy.com/files/file/Library/2010%20evaluation%20plan%20final%201-26-10.pdf.

[20] 2010-2011 Evaluation and Research Plan: New Jersey's Clean Energy Program Energy Efficiency and Renewable Energy Programs: Final Report. January 27, 2010. pp. 5-6.
http://www.njcleanenergy.com/files/file/Library/2010%20evaluation%20plan%20final%201-26-10.pdf

[21] Free ridership represents the savings impacts that would have occurred without the Company's programs. Spillover refers to additional reductions in energy consumption and/or demand due to program influences beyond those directly associated with program participation. Non-energy benefits (e.g., improved comfort, better indoor air quality, increased property value, reduced environmental impacts) can also be included as a part of impact evaluation.

- **Process evaluation** is vital for identifying strengths and weaknesses of each program and improving program operation and delivery in order to increase customer participation and energy and capacity savings. It involves a systematic assessment of program operations and processes and provides recommendations for improving the programs' delivery efficiency. Process evaluation also assesses whether certain markets have been transformed or not.

Q. At what level should evaluation activities be conducted?

A. Some of these activities are conducted at the state level, because it is more economical to conduct state-level evaluations. Studies are conducted at a higher level when the benefits of conducting them at a finer scale (i.e., more detailed results) do not outweigh the costs. For example, review of protocols for estimating energy savings from energy efficiency programs and projects is generally conducted on a statewide basis in New Jersey, because conditions throughout the state are similar enough that measures can reasonably be expected to perform similarly wherever they are installed. Other activities should be conducted on a finer scale to justify specific program activities and designs. Impact evaluation in particular should be conducted on the level of the program administrator, especially when program activities are novel and their savings impacts are not well studied.

Q. When should impact evaluations be conducted?

A. Impact evaluations can be done after several projects have been completed. The schedule depends in part on a program's typical design and construction timeline. This could occur around two years after implementation of the program for programs promoting prescriptive measures (such as Direct Install) and around three years for programs promoting custom measures (such as the Hospital and Multi-family sub-programs), because custom projects tend to be more complicated and longer in duration.

Q. Is it necessary to wait until a program has been completed to conduct an impact evaluation?

A. No. Some programs go on for many years. Without the results of an impact evaluation, policymakers do not know how program performance compares to alternative resources, and thus have little basis for allocating funding to that program.

Q. Has the Company conducted and submitted the results of program evaluation on the sub-programs it proposes to extend?

A. No. The Company has not completed any impact evaluation or process evaluation studies for the past and ongoing Direct Install, Multi-family, and Hospital efficiency programs since program inception (around 2008). In a discovery conference on October 14, 2014, the Company stated that an evaluation of the original EEE program would likely to be completed around the end of October or beginning of November 2014; however, no results have been provided at the time of this writing.[22]

Q. Are you concerned that no results have been reported to date?

A. Yes. Without program evaluation, and impact evaluation in particular, it is difficult to know the effects of the program on the market. Moreover, it is not possible to assess whether the programs have been cost effective. Thus, it is premature to allow an extension without considering the results of an impact evaluation study. An impact evaluation study should have been included with the Petition.

Q. What does the Company propose regarding evaluation of the sub-programs if the extension is approved?

A. The Company has not developed any evaluation plan for the proposed Extension II program. The Company is working with the CEEEP to develop an evaluation plan for the proposed program. (EEE Extension II petition, p. 14 – 15.)

Q. Do you have other concerns regarding evaluation, measurement and verification?

A. Yes. It is not clear if the Company is collecting data on systems being replaced (including remaining measure life, if any) and on the incremental costs associated with the projects. These data are important to determine appropriate measure costs, incentive levels, and actual savings associated with the sub-programs.

Q. Can you provide an example of such data collection requirements from other states?

A. Yes. A case in point is the California Statewide Customized Retrofit program offered by all California investor-owned utilities ("IOUs"). This program requires submission of both the full measure cost and incremental measure cost disaggregated for each measure

[22] In response to RCR-EE-0009, the Company stated that the Cadmus Group is performing impact evaluation studies for CA, EEE Stimulus, and EEE Extension sub-programs, and a process evaluation study for CA and EEE Stimulus sub-programs.

within a project.[23] The full measure cost is the total amount paid to implement the energy efficiency measure. The incremental cost is the cost premium for implementing an energy efficient measure above and beyond the cost of a similar, standard efficiency measure.

In addition, the California program requires projects involving early retirements of existing systems to submit various types of data in order to ensure that projects are indeed early retirement and savings and costs are appropriately calculated. Such data submission requirements include, but are not limited to:

- Providing energy savings that would result from replacement of existing systems with systems meeting current codes or industry standard practice.
- Providing description of dialogue(s) from previous customer/IOU meetings showing how the IOU accelerated the retirement of the existing system (including details on the high efficiency measure(s) that were proposed by the IOU, some of the program features that the IOU educated the customer(s) on that they were previously unaware of, meeting dates, and participant names).
- Providing simple payback calculations with and without the IOU incentive.
- Providing documentation of any preliminary measurements performed for the customer by the IOU.
- Documenting the known standard-efficiency equipment alternatives that are available in the market or that were considered by the customer.
- Including existing equipment installation dates (and old existing equipment invoices if available).
- Providing a calculation of the remaining useful life ("RUL") of the existing system based on its previous installation date and/or other forms of evidence to support estimated RUL.

[23] Pacific Gas and Electric, Southern California Edison, Southern California Gas, and San Diego Gas & Electric (July 2014). 2013-14 Statewide Customized Retrofit Offering Procedures Manual for Business, p. 1-20.

- Providing a customer statement that the existing equipment is still in proper working condition and would continue to operate for the greater of one year or the claimed RUL.

- Including readily available records of ongoing equipment maintenance and equipment performance.[24]

Q. Do you have any recommendations regarding evaluation?

A. Yes. I have the following recommendations regarding evaluation:

- The Board should not allow the Company to continue operating its efficiency programs for another four years until there is an opportunity to review the results of the impact evaluation that was expected to be completed in late October or early November 2014, confirm the actual impacts of the sub-programs, and determine whether or not the programs are truly cost-effective. Further, input on the impact evaluation study should be part of consideration for the EEE Extension II proposal. I reserve the right to supplement testimony after I have received and reviewed the impact evaluation report.

- PSE&G should develop a new evaluation plan with input from CEEEP as soon as the proposed program is approved by the Board, and provide ample opportunity for review and comment on the evaluation plan.

- PSE&G should conduct an impact evaluation of the EEE Extension program as soon as possible, and on its proposed EEE Extension II program before the program ends.

- PSE&G should be required to regularly collect data to enable a better understanding of what is being replaced (including remaining life of existing equipment, if any) and the incremental costs associated with the projects. For estimating incremental savings and costs, PSE&G should be required to collect costs and energy performance data for both energy-efficient measures and similar, standard efficiency measures for all types of measures, including measures involving early retirements. For measures involving early retirements, PSE&G should be required to collect the type of data that

[24] Ibid. p. 1-13 – 1-14.

California IOUs are requiring for their Statewide Customized Retrofit program in order to ensure that projects do actually involve early retirements, and that costs and savings for such projects are analyzed in a way appropriate for early retirements.

7. COST-BENEFIT ANALYSIS

Q. Has the Company provided a cost-benefit analysis for its proposed sub-programs?

A. Yes. As previously noted, the Company provided the results of a cost-benefit analysis performed by CEEEP in Schedule JEM-EEEXII-12 to the Petition and in its response to RCR-EE 6. (PSEG EE Program CBA - Res MF, Hosp, Muni DI - 07312014 v.7.xlsx.)

Q. Have you reviewed this analysis?

A. Yes.

Q. What are your findings regarding this analysis?

A. A review of these materials found problems with some key assumptions used in the CBA (e.g., projected savings and costs). In particular:

1. Program incentives were not included as a cost in the TRC analysis.
2. Savings and costs assumed in the CBA do not reflect historical experience with the program.
3. Total installed costs for energy efficient measures were used instead of incremental costs.

Q. Please describe the first concern, regarding the TRC test analysis.

A. CEEEP's CBA provides the benefit-cost ratios for the three sub-programs using five cost-effectiveness tests (TRC, PAC, Participant Cost, Ratepayer Impact Measure, and Societal Cost). As presented by CEEEP, the benefit-cost ratios for the proposed sub-programs are very favorable. These ratios are well above 1, ranging from 3.3 to 5.0 under the TRC test and from 1.3 to 2.7 under the PAC test. However, CEEEP's CBA workbook (PSEG EE Program CBA - Res MF, Hosp, Muni DI - 07312014 v.7.xlsx, provided in the Company's response to RCR-EE-6) appears to contain some errors in the way that the cost-effectiveness tests are calculated. In particular, the TRC test analysis does not include all relevant costs (as will be discussed below).

The TRC test is the most widely used cost-effectiveness test in the country according to a 2012 national survey on the energy efficiency cost effectiveness tests by ACEEE.[25] The TRC test essentially examines whether a program will result in a net reduction in costs to all customers (including participants' own contributions). As shown in Table 4 below, which is taken directly from a report called "Best Practices for Screening Energy Efficiency Programs," the TRC test compares the total costs (including the contributions of both participants and program administrators) with the total benefits (e.g., avoided generation, transmission, distribution, avoided cost of environmental compliance, and non-energy benefits) for all utility customers (including program participants and non-participants) resulting from the program measures.

Table 4. Components of the Energy Efficiency Cost-Effectiveness Tests[26]

	Participant Test	RIM Test	PAC Test	TRC Test	Societal Cost Test
Energy Efficiency Program Benefits:					
Customer Bill Savings	Yes	---	---	---	---
Avoided Generation Costs	---	Yes	Yes	Yes	Yes
Avoided Transmission and Distribution Costs	---	Yes	Yes	Yes	Yes
Avoided Cost of Environmental Compliance	---	Yes	Yes	Yes	Yes
Other Program Benefits (utility perspective)	---	---	Yes	Yes	Yes
Other Program Benefits (participant perspective)	Yes	---	---	Yes	Yes
Other Program Benefits (societal perspective)	---	---	---	---	Yes
Energy Efficiency Program Costs:					
Program Administrator Costs	---	Yes	Yes	Yes	Yes
EE Measure Cost: Rebate to Participant	---	Yes	Yes	Yes	Yes
EE Measure Cost: Participant Contribution	Yes	---	---	Yes	Yes
Other Program Costs	Yes	---	Yes	Yes	Yes
Lost Revenues to the Utility	---	Yes	---	---	---

Based on my review of CEEEP's workpapers, it appears that CEEEP did not include the costs of ratepayer-funded incentives as part of the total cost used to calculate the TRC Test.[27] If this error is corrected for each of the proposed sub-programs, the TRC ratios

[25] Kushler, Nowak, & Witte. (2012, February). A national survey of state policies and practices for the evaluation of ratepayerfunded energy efficiency programs. ACEEE Report Number U122.

[26] Woolf, T., E. Malone, K. Takahashi, W. Steinhurst. 2012. Best Practices in Energy Efficiency Program Screening: How to Ensure that the Value of Energy Efficiency is Properly Accounted For. Synapse Energy Economics for National Home Performance Council., available at http://www.synapse-energy.com/project/best-practices-screening-energy-efficiency-programs

[27] On November 6, 2014, the day before the filing deadline for this testimony, the Company issued its response to Rate Counsel Discovery request RCR-EE-0024, in which it acknowledged this error. I will review this along

would be reduced to 1.07 for the Multi-family sub-program, to 2.05 for the Direct Install sub-program, and to 1.45 for the Hospital sub-program. (PSEG EE Program CBA - Res MF, Hosp, Muni DI - 07312014 v.7.xlsx.)

Q. Please describe your second concern with regard to the consistency of savings and cost assumptions with historical experience.

A. Savings and costs assumed in the CBA do not reflect historical experience with the program. The Company's estimates of costs and savings are not aligned with the historical performance of the sub-programs. Estimates of costs and savings going forward should reflect historical experience with the program. For both gas and electric programs, the estimated energy savings used in the cost-benefit calculations are higher than warranted given actual historical experience. Table 5, below, compares the cost per kWh of lifetime energy savings that was used in the CEEEP analysis with PSE&G's actual historical cost of energy savings for its electric programs. Table 6 is a similar comparison of costs per MMBtu of savings for the gas programs.

As an example, as shown in Table 5, the historical cost of lifetime electricity savings for the Multi-family sub-program under the EEE Stimulus and Extension is about 20 cents per kWh lifetime energy savings, while the cost of the proposed Multi-family sub-program used in the CEEEP analysis is only 7.8 cents per kWh lifetime savings—60 percent less than the historical performance. This means that either the Company's budget for this program is not sufficient to achieve the level of proposed electric savings for this sub-program, or the Company's electricity savings projection is overestimated by 60 percent for this sub-program. On the gas side, as shown in Table 6, the Company underestimated the cost per MMBtu of saved natural gas by 38% for the Hospital sub-program as the historical estimate is about $9.1 per MMBtu lifetime saved, and the proposed estimate is about $5.7 per MMBtu lifetime saved. Overall the costs of saved electricity and cost of saved natural gas at the portfolio level that were used in the CBA are lower by 12% and 29% respectively than its historical costs of saved energy for the same sub-programs.

with other relevant discovery responses that are still outstanding and address this matter further in my surrebuttal testimony.

Table 5. Cost of Saved Electricity ($/kWh lifetime savings

	EEE Ext II used in CBA	Historical	Percentage difference
Multi-Family Housing	0.078	0.199	-61%
Hospital Efficiency	0.057	0.072	-21%
Municipal Direct Install	0.066	0.060	10%
Total	0.065	0.073	-12%

Source: JEM-5 and JEM-8 worksheets in RCR-EE_1_Sch-JEM-5 thru JEM-10.xlsx, RCR-EE_2_Lifetime Annual Savings and Cost.xlsx

Table 6. Cost of Saved Gas ($/MMBtu lifetime savings)

	EEE Ext II used in CBA	Historical	Percentage difference
Multi-Family Housing	5.7	5.7	-1%
Hospital Efficiency	5.7	9.1	-38%
Municipal Direct Install	6.6	12.9	-48%
Total	5.7	8.1	-29%

Source: JEM-5 and JEM-8 worksheets in RCR-EE_1_Sch-JEM-5 thru JEM-10.xlsx, RCR-EE_2_Lifetime Annual Savings and Cost.xlsx

A related concern is how the Company tracks program costs. Rate Counsel discovery request RCR-EE-0031 asked the Company to explain why the lifetime cost of natural gas savings for the Direct Install program provided in an earlier discovery response ($154 per MMBtu) was so much higher than the $6 to $13 per MMBtu lifetime costs of gas savings for the other two sub-programs. The Company's response (which was received on November 5, 2014) stated that the previously provided expenditures levels for the gas-saving measures in the Direct Install program (provided in response to RCR-EE-0002[28]) were not based on actual data. The Company stated that expenditures for the Direct Install program had been allocated between electric and gas measures, based on "the approved split of 90 percent electric and 10 percent gas." (Company response to RCR-EE-0031.) The implications of the response to RCR-EE-0031 are not clear, however I am concerned that the Company does not seem to have data on actual spending for electric and gas measures readily available. The Company should be estimating the amount

[28] The "RCR-EE_2_Lifetime Annual Savings and Cost.xlsx workbook."

historically spent on gas and electric measures for each participant, and it should have these data readily available. Furthermore, this discovery response indicates that there may be an inconsistency in how costs are being allocated between gas and electric for the purposes of program planning and how they are being allocated between gas and electric customers for cost recovery. Finally, this may further complicate the process of developing accurate estimates of the cost-effectiveness of PSE&G's programs. Along with the previous recommendations under the Evaluation section above, I recommend the Company track detailed measure cost data separately for gas savings measures and electric savings measures.

Q. Turning to your third concern, why should incremental costs be used in the CBA?

A. The incremental cost is the difference in the total costs of a standard measure and an energy-efficient measure. The incremental cost is typically significantly lower than total installed cost (used in the CEEEP's CBA) when the energy efficiency improvement involves replacing an existing measure. In contrast, certain energy efficiency measures, such as adding insulation or new controls, are not typically installed unless they are promoted by energy efficiency programs; for these measures, the incremental cost typically is equal to the total installed cost. A review of the Company's response to RCR-EE-0003 and its attachment on measure costs and savings found that the majority of energy savings from the EEE Stimulus and Extension programs (from 70 percent to 90 percent of sub-program savings) represents savings from measures that have standard measures for comparison. Thus, the incremental costs for these measures are significantly smaller than the total installed costs. Further, as mentioned above, the incremental cost of early replacements of existing systems with energy efficient systems should be much smaller than the total installed cost, as participants would likely replace old systems with a new, code-compliant system at their own expense at some point, even if efficiency programs did not exist. This implies that a cost-effectiveness analysis using the incremental cost data for the proposed sub-programs (instead of total installed costs) would show much better results than CEEEP's CBA analysis, given that this analysis used total installed costs. (As discussed in the Alternative Incentive Structure section above, use of incremental cost data may also suggest that program participants should bear a larger share of the costs of installing the new measures.) For prescriptive programs, such as Direct Install, for which prescriptive energy efficiency measures are

already defined in energy savings protocols, incremental cost data should be readily available. For custom programs, such as Hospitals and Multi-family, the calculation of incremental cost is more complicated.

Q. What are your conclusions regarding the cost effectiveness of the sub-programs?

A. It is not possible to know whether the proposed sub-programs will be cost-effective (nor that the past Original EEE and EEE Extension sub-programs have been cost-effective) for three reasons: (a) the Company's project cost and savings are not aligned with the historical performance; (b) the Company has not completed any savings impact evaluation studies for its energy efficiency programs since program inception; and (c) CEEEP's CBA of the proposed sub-programs has not been conducted correctly, particularly since it uses total installed costs for energy-efficient measures instead of incremental costs.

The impact of using the historical data is substantial, as the current costs of saved energy presented above are much higher than the historical cost of saved energy depending on programs. On the other hand, these results are based on total installed costs instead of incremental costs; if the incremental costs were used, the cost element of the cost-effectiveness tests would be much lower. The impact of changing total installed costs to incremental costs may be more significant than the impact of using historical costs and savings data, and thus the overall benefit-cost ratios would likely improve.

Q. Do you have any recommendations regarding the CBA?

A. Yes, I recommend the following:

1. Estimates of costs and savings going forward (including for the purpose of settlement within this proceeding) should reflect historical experience with the program, including the cost split between gas savings measures and electric savings measures.

2. The Company should provide the incremental costs of the measures promoted by the proposed program, and these should be used in the cost-benefit analysis.

3. The TRC test used in the cost-benefit analysis should account for program incentives.

4. Once these issues have been addressed, the cost-benefit analysis should be re-run using the revised inputs, and the results should be provided to parties in this proceeding.

Q. Does this conclude your pre-filed testimony?

A. Yes, it does. However, I reserve my right to supplement this testimony after I have reviewed the impact analysis that was expected to be completed in October or early November of 2014, and after I have received and reviewed the Company's responses to outstanding discovery requests.

SCHEDULES

SUMMARY OF MULTIFAMILY PROGRAM PARTICIPATION RATES BY ACEEE[1]

Program	Year launched	Annual participation (units in the most recent year)	Annual participation rate (% of eligible customers)	Cumulative participation (units)	Cumulative participation rate (% of eligible customers)
Austin Energy Power Saver Multifamily Rebates[1]	1989	18,213	9%	191,309	93%[2]
Puget Sound Energy Existing Multifamily Retrofit Program	2006	39,489	16%	120,000	49%
Energy Trust of Oregon Existing Multifamily Program	2011	21,765	10%	35,718	16%
SMUD Multifamily Home Performance Program	2012	1,200	1%	12,100	10%
NYSERDA Multifamily Performance Program	2007	28,429	1%	180,352	7%
CNT Energy Energy Savers	2007	4,126	1%	14,422	4%
Efficiency Vermont Multifamily Program	1998	450 (comprehensive projects only)	1%	Not available	Not available
PSE&G Residential Multi-Family	2010	2,295	.5%	10,322	2%
LEAN Massachusetts Low-Income Multi Family Energy Retrofit	2010	6,715 gas, 14,535 electric	Not available	10,715 gas, 28,524 electric	Not available

Notes: [1]Austin Energy's eligible customers estimated using the number of households living in buildings with 3 or more units according to the 2011 American Community Survey (United States Census Bureau 2011).

[2]Due to the longevity of Austin Energy's program, this percentage is slightly misleading since many of the buildings and units may have participated multiple times as the installed energy efficiency measures reached the end of their life cycle. Units are only counted once per year, regardless of how many measures are installed.

[1] ACEEE (2013). Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings.

A REVIEW OF OTHER PROGRAM INCENTIVES

This attachment discusses program incentives offered in New Jersey and other jurisdictions for three types of programs: Small Business/Direct Install, Multifamily, and Hospital programs. At the end of this document, I provide four summary tables on program incentives for the programs I reviewed.

Small Business and Direct Install Program

Table 1 at the end of this document summarizes the incentives offered in small business direct install programs for several states.

In New Jersey, the NJCEP Direct Install program, like PSE&G's proposed Direct Install sub-program, offers incentives up to 70 percent of the installed cost. However, the NJCEP program does not offer on-bill financing.[1] Also, on the Direct Install website, the New Jersey Office of Clean Energy states that an upgrade project can very quickly pay for itself,[2] suggesting that the payback period associated with 70 percent of installed cost is very short.

National Grid's small business programs in Massachusetts and Rhode Island also offer 70 percent incentives relative to installed costs, but the incentives are limited to very cost-effective, lower-cost measures such as lighting, occupancy sensors, and commercial refrigeration equipment, unlike PSE&G's Direct Install sub-program (which includes HVAC measures).[3]

Connecticut and Arkansas also offer small business programs. Connecticut Light & Power (CLP)'s Small Business Energy Advantage program offers incentives at 35 percent to 40 percent of total installed cost or $0.30 per annual kWh in performance incentives for lighting and non-lighting measures.[4] Entergy Arkansas' small business program offers $0.20 per annual kWh savings for lighting measures.[5] In contrast to the Connecticut and Arkansas programs, PSE&G's Direct Install sub-program is expected to provide substantially larger incentives in terms of dollars per kWh savings.

Table A below summarizes incentives per kWh of annual savings[6] for historical PSE&G Direct Install sub-program customers (under the EEE Stimulus and Extension programs).[7] I have adjusted these incentive values downward to 70 percent of the total costs from 80 percent (which was the incentive level for past and ongoing EEE programs) to reflect the level of incentives these customers would receive at the 70

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[1] The program also places limits on heating equipment capacity (i.e., 500 kBtu for boilers and 140 kBtu for furnaces) in addition to the maximum electric load of 200 kW. Further, it has a maximum funding capacity of $125,000 per project.

[2] http://www.njcleanenergy.com/di

[3] National Grid Massachusetts' program is available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA76F&re=0&ee=1; National Grid Rhode Island's program, see http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=RI23F&re=0&ee=0

[4] http://www.cl-p.com/business/saveenergy/services/energyadvantage.aspx

[5] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AR68F&re=0&ee=1

[6] Incentives per kWh of annual savings are calculated by dividing the total incentive received by each historical participant by the annual or first year energy savings in kWh.

[7] Per RCR-EE_4_Project Data.xlsx workbook, provided in response to RCR-EE-004.

percent level being proposed for the EEE Extension II program. Of the 593 projects (which saved electricity mainly from lighting), 529 projects, or 89% percent, would have received incentives of at least $0.30 per kWh annual savings, and 373 projects (or about 63 percent of the projects) would have received incentives over $0.50 per kWh. Further, there are 6 projects that would receive more than $2.00 per kWh annual savings (or 10 times more than the incentive offered by Entergy Arkansas' small business program), and 3 projects that would receive more than $3.0 per kWh (or 10 times more than the incentive level offered by CLP's small business program).

Table A. Historical NJ PSE&G Municipal Direct Install Program Incentives Adjusted to 70% of Total Costs ($ per annual kWh)[8]

Incentive per kWh annual savings	# of Projects	Project Share (%)	Cumulative # of Projects	Cumulative Share (%)
At and above $3.0/kWh	3	1%	3	1%
$2.0/kWh to less than $3.0/kWh	3	1%	6	1%
$1.0/kWh to less than $2.0/kWh	30	5%	36	6%
$0.5/kWh to less than $1.0/kWh	337	57%	373	63%
$0.3/kWh to less than $0.5/kWh	156	26%	529	89%
Below $0.3/kWh	64	11%	593	100%
Total	593	100%	593	100%

Multi-family Programs

As mentioned in my testimony, there are many multifamily programs that achieved higher annual participation rates (i.e., the number of participants relative to the total number of eligible customers) than the Company's Multi-family sub-program. My review of multifamily program incentives examined seven programs across the nation. The incentives provided through these other programs are summarized in Table 2 at the end of this document. All of the programs, including those programs that have achieved higher participation rates, offer less generous incentives than those offered through the Company's Multi-family sub-program.

For example, in Washington, Puget Sound Energy's multifamily program, which is achieving the highest participation rate (16 percent) of the programs reviewed, offers prescriptive incentives such as $350 per unit for in-unit boilers, $15 per fluorescent fixture, and $0.75 per square foot of insulation.[9] The multifamily programs offered by Austin Energy and the Energy Trust of Oregon (which are achieving about 10 percent annual participation rates) offer prescriptive incentives similar to Puget Sound Energy's program.[10]

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[8] Developed based on the RCR-EE_4_Project Data.xlsx workbook the Company provided in response to RCR-EE-004

[9] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WA139F&re=1&ee=1

[10] For Austin Energy's program see, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX34F&re=0&ee=1; for the Energy Trust of Oregon's program see http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OR145F&re=0&ee=1

The levels of incentives provided through these programs indicate that they are designed to cover a limited portion of the incremental cost of energy efficiency measures, rather than a generous share of total installed costs as in PSE&G's program. Take for example a boiler that costs $3,000 per unit. The $350 offered by Puget Sound Energy as incentive is meant to cover some of the incremental costs of a high efficiency boiler beyond the cost of a standard efficiency boiler. In contrast, PSE&G's Multi-family sub-program would pay 70 percent of the total project cost, which would be more than $3,000 due to the installation labor costs beyond the unit cost.

Austin Energy's Power Saver Multifamily program also has a maximum incentive cap of $200,000 per fiscal year.[11] In contrast, PSE&G's Multi-family sub-program has provided higher total incentives to a vast majority of its 26 previous multifamily projects. Six of the 26 projects were provided with less than $200,000 in incentives. The remaining 20 received incentives ranging from about $207,000 to as high as $1.4 million.[12]

In New York, NYSERDA provides incentives based on a certain dollar amount per multifamily unit. For existing multifamily buildings, the total incentives vary from $800 to $1,000 per unit depending on the participant's gas service company. For low-income customers, incentives range from $1,100 to $1,300 per unit.[13] If PSE&G had paid these levels of incentives to its Multi-family sub-program participants, the average number of multifamily apartment units would be nearly 500 units, and the project that received $1.4 million incentive would have had about 1,400 units. These unrealistically large numbers indicate that PSE&G's incentives are significantly larger, potentially an order of magnitude larger than the level of incentives offered by NYSERDA for multifamily projects.[14] As of 2013, NYSERDA has achieved a one percent participation rate, higher than the 0.5% achieved by PSE&G's Multi-family sub-program.[15] With lower incentive levels, PSE&G's programs could serve more customers and achieve higher program participation rates (i.e., the number of participants relative to the total number of eligible customers).

As PSE&G's Multi-family and Hospital sub-programs involve custom projects, I also reviewed incentives offered by business custom incentive programs offered by California investor-owned utilities, NJCEP, and Focus on Energy in Wisconsin,[16] as described in Table 3, at the end of this document. While incentive levels for the business custom programs I reviewed are higher than those discussed for multifamily customers above, all of these custom incentive programs have an incentive cap of 50

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[11] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX34F&re=0&ee=1

[12] Per the RCR-EE_4_Project Data.xlsx workbook provided in response to RCR-EE-004

[13] NYSERDA provides financing to multifamily projects, but limits the financed amount to 50 percent of the principal borrowed up to $500,000 per project and charges interest at a rate of 2 percent. This information is available at http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY36F&re=0&ee=1

[14] ConEdision's Multifamily program limits the number of multifamily units to 75 units. http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY70F&re=0&ee=1

[15] ACEEE 2013. "Apartment Hunters: Program Searching for Energy Savings in Multifamily Buildings."

[16] For the California's program see http://www.aesc-inc.com/download/spc/2013SPCDocs/PGE/Customized%201.0%20Policy.pdf; for Wisconsin's program see http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=WI19F&re=1&ee=1; For NJCEP's program see http://www.njcleanenergy.com/main/public-reports-and-library/program-budgets-and-filing/program-budgets-and-filing-0

percent of total installed project costs.[17] The programs in California also explicitly include early retirement energy efficiency measures.

Hospital Programs

I reviewed the incentive structures of three hospital/healthcare-related energy efficiency programs in California and one program in New York. Of the four programs I reviewed, three are discussed in Schedule JEM-EEEXII-2, page 28 and 29. The three programs in California are under the Healthcare Energy Efficiency Program (HEEP). The HEEP offers custom performance incentives by end use, including $0.03 to $0.08 per kWh annual savings plus $100 per kW reduction for lighting, and $0.15 per kWh savings for major system replacements of air conditioning, energy management system controls, and refrigeration. Two of the HEEP programs also offer a performance incentive of $1 per annual therm savings for natural gas savings measures. All of the HEEP incentives are capped at 50 percent of the total project costs. The one program in New York was managed by National Grid and NYSERDA, but is no longer active.[18] These incentive offerings are summarized in Table 4 at the end of this document.

[17] Custom measures allows program participants the opportunity to receive an incentive for unique energy-efficiency measures that are not on the prescriptive equipment incentive list for a given program, but are project/facility specific.

[18] Personal communication with Jim Ferris, Luthin Associates (NYSERDA outreach subcontractor) on October 31, 2014.

Table 1. Summary of Small Business/Direct Install Program Incentives in Other Jurisdictions

Program	Administrator	State	Incentive Structure	Eligible Measures	Source
Direct Install	CEP	NJ	• Up to 70% of the installed cost of cost-effective, approved measures • Project incentive cap of $125,000	Lighting, HVAC & HW controls, sensors, VFDs, cooling, programmable thermostats, boilers and furnaces, ENERGY STAR Products, refrigeration	http://www.njcleanenergy.com/di
Small Business Direct Install	ConEd	NY	• Con Edison will pay up to 70% of the remaining cost directly to the contractor	Lighting, Programmable Thermostats, Custom/Others pending approval (No major upgrades such as HVAC replacements are included)	http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY110F&re=0&ee=1
Small Business	NSTAR	MA	• Free energy audit • 70% of installed cost	Lighting, occupancy sensors, coolers refrigeration, boilers, heat pumps, etc.	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA76F&re=0&ee=1
Small Business	National Grid	RI	• Free energy audit • 70% of installed cost • Participant repays its portion of costs (30%) at 0% interest over 2 years	Lighting, lighting controls/sensors, commercial refrigeration equipment, walk-in cooler efficiency measures (No major upgrades such as HVAC replacements are included)	http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=RI23F&re=0&ee=0

Program	Administrator	State	Incentive Structure	Eligible Measures	Source
Small Business Energy Advantage	CL&P	CT	• Prescriptive or custom incentive. E.g., lighting: 35% to 40% of installed cost or $0.30/kWh; non-lighting custom measure: 40% of installed cost or $0.30/kWh; comprehensive project: up to 50% of installed costs with $0.40/kWh cap. • Interest free loan available from a minimum of $500 to a maximum of $100,000	Lighting, controls, refrigerators, HVAC, VFD, motors, etc.	http://www.cl-p.com/business/saveenergy/services/energyadvantage.aspx
Small Business	Entergy Arkansas	AR	• Prescriptive incentives. E.g., lighting: $0.21/kWh; insulation: $0.35/kWh; refrigerator: $0.50/kWh • Project incentives capped at 75% of the total "incremental" project cost and any additional incentives paid at a rate of $0.21/kWh	Lighting, controls, refrigerators, chillers, heat pump and AC	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AR68F&re=0&ee=1

Table 2. Summary of Multifamily Program Incentives in Other Jurisdictions

Program	Administrator	State	Incentive Structure	Eligible Measures	Source
Multifamily Energy Savings Program: Custom Incentive	Austin Energy	TX	• $200,000 maximum incentive • Prescriptive incentives. E.g., A/C: $200 - $550/unit, window: $2/sf.ft, Roof insulation: $0.1/sq.ft., fluorescent fixtures: $30 - $35, occupancy sensors: $5 - $32	various measures including HVAC	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=TX34F&re=0&ee=1
Multifamily	Puget Sound Energy	WA	• Prescriptive incentives. E.g., In-Unit Boiler: $350/unit, Fluorescent Fixtures: $15, Insulation: $0.75/sq.ft.	various measures including HVAC	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WA139F&re=1&ee=1
Multifamily	Energy Trust of Oregon	OR	• A post-installation inspection may be required if total incentive is greater than $3,000 • Prescriptive incentives. E.g., Boiler: $4/kBtuh, gas furnace: $150, refrigerator: $50/unit, lighting: $2-$100/fixture or sensor	various measures including HVAC	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OR145F&re=0&ee=1
Multifamily Energy Savings Program: Custom Incentive	Focus on Energy	WI	• Cannot exceed 50% of a project's total cost without special approval.	various measures including HVAC	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=WI77F&re=0&ee=1
Multifamily	Efficiency Vermont	VT	• Total incentives of more than $5,000 should be pre-approved by Efficiency Vermont • Prescriptive incentives. Refrigerators: $250/unit, ventilation : $110 per fan, Boilers: $2/MBh, Furnaces: $2/MBh • Free Products: CFLs and Low-flow Shower Heads and Aerators	various measures including HVAC	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=VT27F&re=0&ee=1

Program	Administrator	State	Incentive Structure	Eligible Measures	Source
Multifamily	ConEdison	NY	• Five to 75 units multifamily buildings • Prescriptive incentives. E.g., heat pump: $50/ton, CFL: $3- $4, LED exit signs: $50, occupancy sensors: $50, VFD motors: $60/HP, refrigerators: $400-$325 • free CFLs and smart power strips	various measures including HVAC	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY70F&re=0&ee=1
Multifamily	NYSERDA	NY	• Varies by income eligibility and efficiency level • For existing buildings, the total incentives caps vary from $800 to $1000 per unit depending on gas service companies. For low income customers, incentive caps range from $1100 to $1300 per unit. • For new construction, incentive caps vary from $675 per unit for prescriptive to $1,200 per unit for low income buildings. • Financing available up to 50 % of the principal borrowed, to a maximum of $5,000 per unit or $500,000 per energy-saving project, at a 2% interest rate.	various measures including HVAC and whole building	http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY36F&re=0&ee=1; http://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Multifamily-Performance-Program/GJGNY-Borrower.aspx

Table 3. Summary of C&I Custom Program Incentives in Other Jurisdictions

Program	Administrator	State	Incentive Structure	Eligible Measures	Source
Customized Retrofit Offering	PG&E, SCE, SDG&E, SCG	CA	Depends on measure; ranges from $0.03 - $0.15/kWh and $150/kW, or $1/therm, subject to a cap equal to the lesser of: • 50% of full measure costs for early retirement, retrofit add-on, or normal replacement (PG&E only) measures • 100% of incremental measure costs for replace on burnout, new load, and normal replacement (SCE, SCG, SDG&E) measures • Max of 15% of program administrator incentive funds	lighting, HVAC, refrigeration, process (VSDs, pumps, fans, controls), building envelope & windows	http://www.aesc-inc.com/download/spc/2013SPCDocs/PGE/Customized%201.0%20Policy.pdf
C&I Custom Measure Incentives	CEP	NJ	Cap at the lesser of: • $0.16/kWh and $1.60/therm based on estimated annual savings • 50% of total installed project cost • Buy down to a one-year payback Per fiscal year, capped at $500,000 per electric account and $500,000 per natural gas account	lighting systems, HVAC systems, motor systems, large boiler systems, gas-engine driven chillers and other non-prescriptive measures	http://www.njcleanenergy.com/main/public-reports-and-library/program-budgets-and-filing/program-budgets-and-filing-0
Business Incentive Program: Custom Incentive	Focus on Energy	WI	• Projects must have ≥1.5-yr payback and may be limited to <10-yr payback • 10% - 30% of project cost • $200,000 max • For prescriptive & custom projects combined, $400,000 per customer per yrs	Heating, Cooling , Domestic Hot Water, Lighting, Data Center, Refrigeration, Food Service, Building Shell, HVAC Controls, Lighting Controls, Compressed Air, Process	http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=WI19F&re=1&ee=1

Table 4. Summary of Hospital/Healthcare Program Incentives in Other Jurisdictions

Program	Administrator	State	Incentive Structure	Eligible Measures	Source
Healthcare	PG&E	CA	• Incentives vary by measures, but are capped at 50% of the project cost • Lighting: $0.03/kWh to $ 0.08/kWh plus $100/kW savings • Other equipment (e.g., compressors, EMS controls, motors) :$0.08/kWh + $100/kW savings • AC & refrigeration (chillers, refrigeration, packaged units): $0.15/kWh + $100/kW savings • Retrocommissioning (RCx): up to $0.08/kWh + $100/kW savings • Natural gas savings: $1 per therm	Lighting, building shell, VSD, retro-commissioning (RCx), HVAC, EMS, refrigeration systems	http://www.willdan.com/energy/HEEP-PGE.html
Healthcare	SCE	CA	• Incentives vary by measures, but are capped at 50% of the project cost • Lighting: $0.03/kWh to $ 0.08/kWh plus $100/kW savings • Basic non-lighting (building shell, VSD, RCx): $0.08/kWh + $100/kW savings • Targeted non-lighting: major system replacements such as AC, EMS controls, and refrigeration: $0.15/kWh + $100/kW	Lighting, building shell, VSD, retro-commissioning (RCx), A/C, EMS, refrigeration systems	http://www.willdan.com/energy/HEEP-SCE.html

Program	Administrator	State	Incentive Structure	Eligible Measures	Source
Healthcare	SCE	CA	• Incentives vary by measures, but are capped at 50% of the project cost. • Lighting: $0.03/kWh to $ 0.08/kWh plus $100/kW savings. • Basic non-lighting (building shell, VSD, RCx): $0.08/kWh + $100/kW savings • Targeted non-lighting: major system replacements such as AC, EMS controls, and refrigeration: $0.15/kWh + $100/kW • Natural gas savings: $1 per therm.	Lighting, building shell, VSD, retro-commissioning (RCx), EMS, refrigeration systems	http://www.willdan.com/energy/HEEP-SDGE.html
Energy Efficiency for Health	National Grid and NYSERDA	NY	n/a	n/a	n/a

APPENDIX A

Kenji Takahashi, Associate

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc, Cambridge, MA. *Associate*, 2004 – present.

Analyze technologies, policies, and regulations associated with supply and demand side energy resources. Assess potentials of electric and natural gas energy efficiency measures. Examine economic and environmental implications of clean energy policies and programs associated with energy efficiency, demand response, distributed generation, and renewable energy. Examine ratemaking issues such as standby rates for distributed generation and decoupling rate mechanisms for energy efficiency measures. Investigate electricity and natural gas market price trends and fluctuations. Prepare expert testimony and reports for regulatory proceedings.

Center for Energy and Environmental Policy, University of Delaware, Newark, DE. *Research Associate*, 2002 – 2004.

Researched the market potential of distributed resources under different electric distribution rate designs (Report prepared for Conectiv Power Delivery Company). Investigated the potential of the Clean Development Mechanisms (CDM) in Asian developing countries and the Japanese government's policy for CDM. Contributed to a market penetration study for photovoltaic technologies in comparison with the predicted oil production from the oil reservoirs in the Arctic National Wildlife Refuge (Report prepared for Astropower, Inc.). Analyzed the installation of PV and generation-set options for the Assateague Beach Coastal Guard Station at the Assateague Island National Seashore (Maryland) (Report prepared for the US National Park Service).

Delaware Division of Public Advocate, Wilmington, DE. *Research Intern*, 2003.

Researched and wrote reports on states' policies regarding (1) energy efficiency/load management programs in order to identify cost-effective programs for implementation in Delaware; (2) electric standard offer service/default service (rate designs) for those who do not choose alternative suppliers under the deregulation process; (3) electric universal service and system benefit charges for protecting consumers from risks associated with electricity restructuring; and (4) Contributions and Advances-in-Aid-of-Construction for water supply extensions.

Resources for the Future, Washington DC. *Research Intern*, 2002.

Investigated current and planned wind power capacity for the United States. Analyzed the EPA and EIA market models to estimate technical and economic potential of wind power in the United States. Researched the status of renewable energy supply in Japan's electricity sector (Prepared for the Economic and Social Research Institute, Cabinet Office, Government of Japan).

Citizens' Alliance for Saving the Atmosphere and the Earth (CASA), Osaka, Japan. *Volunteer and Researcher*, 1999 – 2001.

Worked as a newsletter writer, editor, and event organizer. Wrote a report on the first experimental biomass energy facility in Japan and the photovoltaic system at Yagi Junior High School in Kyoto, Japan. Participated in a research project to investigate renewable energy potential and policies in Japan. Wrote a report on problems of nuclear power plants affecting communities in Fukui prefecture, Japan.

EDUCATION

Center for Energy and Environmental Policy, University of Delaware, Newark, DE
Master of Arts in Urban Affairs and Public Policy with a concentration in Energy and Environmental Policy, 2003. Master's thesis: *Policies to Support Distributed Resources under Different Electricity Restructuring Models.* Courses in energy economics, energy and environmental policy, electricity policy and planning, political economy of environment, solar electric technology, cost-benefit and decision making analyses, and geographic information system.

Kansai University, Osaka, Japan
Bachelor of Arts in Law with a concentration in Public Administration, 2000.

AWARDS AND SCHOLARSHIPS

- Director's Citation, Department of Urban Affairs and Public Policy, University of Delaware, May 2003.
- NEC scholarship for an environmental education leader-training program funded by one of the leading Japanese computer companies, NEC, November 2000.

ADDITIONAL SKILLS

Software: MS Office, Minitab, Analytica, RETScreen, and REM/Rate™
Language: Japanese, Cantonese, and Spanish

CONFERENCES

- 2013 ACEEE National Conference on Energy Efficiency as a Resource, September 22-24, 2013.
- 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'13), September 11-13, 2013.
- Energy Measure Verification Workshop (sponsored by Massachusetts Department of Energy Resources), September 2013.

- Smart Building: High Performance Homes: A Workshop for building professionals, June 22, 2011.
- NESEA Building Energy 11 Conference, March 8-10, 2011.
- Build Boston 2010 on Residential Design and Construction, November 17, 2010.
- ACI New England Conference 2010, October 6, 2010.
- 2010 ACEEE Summer Study on Energy Efficiency in Buildings, August 18-20, 2010.
- NESEA BuildingEnergy 10 Conference, March 8-10, 2010.
- 5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'09), June 24, 2009.
- 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 21, 2008.
- Tufts University Clean Distributed Energy Workshop, June 8, 2006.
- The 2006 Northeast Energy Efficiency Summit, May 17.
- The 2006 Distributed Generation & Interconnection Conference held by DTE Energy, April 26-28, 2006.
- United Nations Climate Change Conference at its eleventh session / Twenty-third sessions of the Subsidiary Bodies and COP/MOP 1, December 2005.

OTHER RELEVENT WORK

- Providing technical support for EPA on energy efficiency matters, including issues pertaining to for its proposed Clean Power Plan to cut carbon pollution from power plants under Section 111(d) of the Clean Air Act
- Assisting New Jersey Division of Rate Counsel with reviewing and commenting on various energy related proposals and documents in New Jersey including utility and the state energy efficiency programs and the state's energy plans. 2009 to present.
- Assisted Nova Scotia Utility and Review Board with a review of an energy efficiency potential study and integrated resource planning for Nova Scotia Power's jurisdiction. 2013
- Assisting the Hawaii Division of Consumer Advocacy in proceedings to develop and review IRPs for three electric companies and to review the state's energy efficiency programs. 2012 to present.
- Assisted the Arkansas Public Service Commission staff with (a) reviewing and assessing utility integrated resource planning and energy efficiency program proposals, and (b) drafting regulatory orders on comprehensive energy efficiency program designs and reporting methods. 2012 to 2013.
- Assumed a general contractor role for renovating an existing multi-family house into an ultra-low energy use house equipped with state-of-art energy efficiency

measures (such as R-7 windows, R-60 roof insulation, a 95% efficient energy recovery ventilation system, cold climate heat pumps) and a 5 kW solar photovoltaic system. December 2012.

- Assisted Nova Scotia Utility and Review Board with developing Community Based Feed-In Tariffs (COMFITs) for five different technologies: small wind projects, medium-sized wind projects, small hydro, small tidal, and biomass CHP projects. April 2011.
- Analyzed existing deep energy retrofit (DER) project data, and analyzed potential energy savings from model partial DER projects (e.g., attic, above-grade wall, windows, basement wall) using REM/Rate building energy software and Synapse's own spreadsheet building energy model being developed for this research project. The result from our analysis were used to project energy savings from and to set incentive levels for partial DER projects as part of National Grid's 2013-2015 efficiency program filing.
- Assisted several states, including Alaska, Colorado, Florida, Maryland, Massachusetts, South Carolina, and Vermont with developing and analyzing their state climate change action plans or state energy plans; evaluated costs and benefits of demand and supply-side policy options, including quantifying expected greenhouse emission reductions. 2007 to 2010.
- Arranged meetings for Union Fenosa/Gas Natural, a Spanish electric and gas company, with Japanese and Korean organizations to study energy efficiency technologies, programs and policies in those countries; Visited Japanese organizations with the delegates of Union Fenosa, provided them technical and translation assistance on energy efficiency in Japan. July 26 to July 31, 2009.

PUBLICATIONS

Stanton, E. A., P. Knight, J. Daniel, B. Fagan, D. Hurley, J. Kallay, G. Keith, E. Malone, P. Peterson, L. Silverstrini, K. Takahashi. 2014. *Feasibility Study for Low Gas Demand Analysis.* Synapse Energy Economics for the Massachusetts Department of Energy Resources.

Takahashi, K., T. Comings, A. Napoleon. 2014. *Maximizing Public Benefit through Energy Efficiency Investments.* Synapse Energy Economics for Sierra Club.

Vitolo, T., J. Fisher, K. Takahashi. 2014. *TVA's Use of Dispatchability Metrics in Its Scorecard.* Synapse Energy Economics for Sierra Club.

Comings, T., S. Fields, K. Takahashi, G. Keith. 2014. *Employment Effects of Clean Energy Investments in Montana.* Synapse Energy Economics for Montana Environmental Information Center and Sierra Club.

Keith, G., S. Jackson, J. Daniel, K. Takahashi. 2014. *Idaho's Electricity Sources: Current Sources and Future Potential.* Synapse Energy Economics for the Idaho Conservation League.

Malone, E. T. Woolf, K. Takahashi, S. Fields. 2013. "Appendix D: Energy Efficiency Cost-Effectiveness Tests." *Readying Michigan to Make Good Energy Decisions: Energy Efficiency*. Synapse Energy Economics for the Council of Michigan Foundations.

Takahashi, K. et al. 2013. *Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in U.S. Cities*. Proceeding of the 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'13), September 12, 2013.

Comings, T., K. Takahashi, G. Keith. 2013. *Employment Effects of Investing in Select Electricity Resources in Washington State.* Synapse Energy Economics for Sierra Club.

Woolf, T., E. Malone, J. Kallay, K. Takahashi. 2013. *Energy Efficiency Cost-Effectiveness Screening in the Northeast and Mid-Atlantic States.* Synapse Energy Economics for Northeast Energy Efficiency Partnerships, Inc. (NEEP).

Stanton, E. A., T. Comings, K. Takahashi, P. Knight, T. Vitolo, E. Hausman. 2013. *Economic Impacts of the NRDC Carbon Standard.* Synapse Energy Economics for the Natural Resources Defense Council (NRDC).

Woolf, T., W. Steinhurst, E. Malone, K. Takahashi. 2012. *Energy Efficiency Cost-Effectiveness Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs.* Synapse Energy Economics for Regulatory Assistance Project and Vermont Housing Conservation Board.

Woolf, T., M. Whited, T. Vitolo, K. Takahashi, D. White. 2012. *Indian Point Energy Center Replacement Analysis: A Plan for Replacing the Nuclear Plant with Clean, Sustainable, Energy Resources.* Synapse Energy Economics for National Resources Defense Council and Riverkeeper.

Keith, G., T. Woolf, K. Takahashi. 2012. *A Clean Electricity Vision for Long Island: Supplying 100% of Long Island's Electricity Needs with Renewable Power.* Synapse Energy Economics for Renewable Energy Long Island.

Fisher, J., K. Takahashi. 2012. *TVA Coal in Crisis: Using Energy Efficiency to Replace TVA's Highly Non-Economic Coal Units*. Synapse Energy Economics for Sierra Club.

Woolf, T., E. Malone, K. Takahashi, W. Steinhurst. 2012. *Best Practices in Energy Efficiency Program Screening: How to Ensure that the Value of Energy Efficiency is Properly Accounted For*. Synapse Energy Economics for National Home Performance Council.

Takahashi, K., W. Steinhurst. 2012. A Preliminary Analysis of Energy Impacts from Partial Deep Energy Retrofit Projects in National Grid's Jurisdiction. Synapse Energy Economics for National Grid, USA.

Synapse Energy Economics. 2012. *Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in US Cities.* Prepared for a HVAC manufacture company.

Hornby, R., D. White, T. Vitolo, T. Comings, K. Takahashi. 2012. *Potential Impacts of a Renewable and Energy Efficiency Portfolio Standard in Kentucky*. Synapse Energy Economics for Mountain Association for Community Economic Development and The Kentucky Sustainable Energy Alliance.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2011. *Toward a Sustainable Future for the US Power Sector: Beyond Business as Usual 2011.* Synapse Energy Economics for Civil Society Institute.

Synapse Energy Economics. 2011. *Electricity Scenario Analysis for the Vermont Comprehensive Energy Plan 2011.* Prepared for Vermont Department of Public Service.

Bourgeois, T., D. Hall, W. Steinhurst, K. Takahashi. 2011. *Deployment of Distributed Generation for Grid Support and Distribution System Infrastructure: A Summary Analysis of DG Benefits and Case Studies.* Pace Energy and Climate Center and Synapse Energy Economics for New York State Energy Research and Development Authority (NYSERDA).

Peterson, P., V. Sabodash, K. Takahashi. 2010. *Demand Side Resource Potential: A Review of Global Energy Partners' Report for Midwest ISO.* Synapse Energy Economics for Project for Sustainable FERC Energy Policy.

Keith, G., B. Biewald, E. Hausman, K. Takahashi, T. Vitolo, T. Comings, P. Knight. 2010. *Beyond Business as Usual: Investigating a Future Without Coal and Nuclear Power in the US.* Synapse Energy Economics for Civil Society Institute.

Napoleon, A., W. Steinhurst, M. Chang, K. Takahashi, R. Fagan. 2010. *Assessing the Multiple Benefits of Clean Energy: A Resource for States.* US Environmental Protection Agency with research and editorial support from Stratus Consulting, Synapse Energy Economics, Summit Blue, Energy and Environmental Economics, Inc., Demand Research LLC, Abt Associates, Inc., and ICF International.

James, C., K. Takahashi, W. Steinhurst. 2009. *North Dakota Energy Efficiency Potential Study Report.* Synapse Energy Economics for Plains Justice.

James, C., K. Takahashi, W. Steinhurst. 2009. *South Dakota Energy Efficiency Potential Study Report.* Synapse Energy Economics for Plains Justice.

James, C., J. Fisher, K. Takahashi, B. Warfield. 2009. *No Need to Wait: Using Energy Efficiency and Offsets to Meet Early Electric Sector Greenhouse Gas Targets*. Synapse Energy Economics for Environmental Defense Fund.

Takahashi, K., D. Nichols. 2009. *The Costs of Increasing Electricity Savings through Utility Efficiency Programs: Evidence from US Experience*. Proceeding of the 5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'09), June 24, 2009.

Hurley, D., K. Takahashi, B. Biewald, J. Kallay, R. Maslowski. 2008. *Cost and Benefits of Electric Utility Energy Efficiency in Massachusetts*. Synapse Energy Economics for Northeast Energy Efficiency Council.

Takahashi, K., D. Nichols. 2008. *The Sustainability and Costs of Increasing Efficiency Impacts: Evidence from Experience to Date*. Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 20, 2008.

Hornby, R., C. Salamone, S. Perry, D. White, K. Takahashi. 2008. *Advanced Metering Infrastructure-Implications for Residential Customers in New Jersey.* Synapse Energy Economics for New Jersey Division of the Ratepayer Advocate.

Hornby, R., C. James, K. Takahashi, D. White. 2008. *Increasing Demand Response in Maine.* Synapse Energy Economics for the Maine Public Utilities Commission.

Hausman, E., R. Fagan, D. White, K. Takahashi, A. Napoleon. 2007. *LMP Electricity Markets: Market Operations, Market Power, and Value for Consumer.* Synapse Energy Economics for the American Public Power Association.

Zalcman, F.,K. Takahashi, G. Keith, W. Steinhurst. 2006. *A Comprehensive Process Evaluation of Early Experience under New York's Pilot Program for Integration of Distributed Generation in Utility System Planning.* Synapse Energy Economics and Pace Law School Energy Project for New York State Energy Research and Development Authority (NYSERDA).

Chernick, P., J. Wallach, W. Steinhurst, T. Woolf, A. Sommer, and K. Takahashi. 2006. *Integrated Portfolio Management in a Restructured Supply Market.* Resource Insight, Inc. and Synapse Energy Economics for Ohio Consumers' Counsel.

Steinhurst, W., A. Napoleon, K. Takahashi. 2006. *Energy in the Northern Forest Region: A Situation Analysis.* Synapse Energy Economics for Northern Forest Center and The North Country Council.

Synapse Energy Economics. *Ensuring Delaware's Energy Future: A Response to Executive Order Number 82.* Technical assistance for Delaware Cabinet Committee on Energy.

Hausman, E., K. Takahashi, D. Schlissel, B. Biewald. 2006. *The Proposed Broadwater LNG Import Terminal - An Analysis and Assessment of Alternatives.* Prepared for Connecticut Fund for the Environment and Save the Sound.

Synapse Energy Economics. 2006. *The Glebe Mountain Wind Energy Project: Assessment of Project Benefits for Vermont and the New England Region.* Prepared for Glebe Mountain Wind Energy, LLC.

Hausman, E., K. Takahashi, B. Biewald. 2006. *The Deerfield Wind Project: Assessment of the Need for Power and the Economic and Environmental Attributes of the Project.* Synapse Energy Economics for Deerfield Wind, LLC.

Fagan, R., A. Napoleon, A. Rochelle, A. Sommer, W. Steinhurst, D. White, K. Takahashi. 2006. *Mohave Alternatives and Complements Study: Assessment of Carbon Sequestration Feasibility and Markets.* Sargent & Lundy and Synapse Energy Economics, Inc. for Southern California Edison.

Johnston, L., K. Takahashi, F. Weston, and C. Murray. 2005. *Rate Structures for Customers with Onsite Generation: Practice and Innovation.* Synapse Energy Economics and Regulatory Assistance Projects for National Renewable Energy Laboratory.

Woolf, T., K. Takahashi, G. Keith, A. Rochelle, P. Lyons. 2005. *Feasibility Study of Alternative Energy and Advanced Energy Efficiency Technologies for Low-Income Housing in Massachusetts.* Synapse Energy

Economics for Low-Income Energy Affordability Network (LEAN) and Action for Boston Community Development, and Action Inc.

Steinhurst, W., R. McIntyre, B. Biewald, C. Chen, K. Takahashi. 2005. *Economic Impacts and Potential Air Emission Reductions from Renewable Generation & Efficiency Programs in New England.* Prepared for Regulatory Assistance Project.

Keith. G., B. Biewald, K. Takahashi. 2004. *The Searsburg/Readsboro Wind Project: An Analysis of Project Economics and An Analysis of Need*. Synapse Energy Economics for enXco Inc.

Takahashi, K. 2003. "The Clean Development Mechanism and Energy Efficiency Upgrades in Developing Countries: The Case of the Residential Sector in Selected Asian Countries." Proceedings of the 3rd International Conference on Energy Efficiency in Domestic Appliances and Lighting, October 1-3, 2003.

TESTIMONY PREPARATION AND ASSISTANCE

Assisted in the preparation of the following testimony: Tim Woolf, testifying before the Colorado Public Utilities Commission (Docket No. 13A-0686EG) regarding setting energy efficiency goals for the Public Service Company of Colorado's demand-side management plan. On behalf of Sierra Club. October 16, 2013.

Assisted in the preparation of the following testimony: Tim Woolf, testifying before the Florida Public Service Commission (Docket No. 130199-EI – No. 130205-EI) regarding setting goals for increasing the efficiency of energy consumption and increasing the development of demand-side renewable energy systems in Florida utilities. On behalf of Sierra Club. May 19, 2014.

Assisted in the preparation of the following testimony: Tim Woolf, testifying before the Kentucky Public Service Commission (Case No. 2012-00578) regarding Kentucky Power Company's economics analysis of the proposed purchase of the Mitchell Generating Station. On behalf of Sierra Club. April 1, 2013.

Assisted in the preparation of the following testimony: Robert Fagan, testifying before the State of New Jersey Board of Public Utilities (Docket No. GO11070399) regarding Elizabethtown Gas Company's Proposed Energy Efficiency Program. On behalf of New Jersey Division of the Ratepayer Advocate. December 16, 2011.

Assisted in the preparation of the following testimony: David Nichols, testifying before the State of New Jersey Board of Public Utilities (BPU DOCKET No. GR10030225) regarding New Jersey Natural Gas Company's Proposed Energy Efficiency Program. On behalf of New Jersey Division of the Ratepayer Advocate. July 9, 2010.

Assisted in the preparation of the following testimony: David Nichols, testifying before the Pennsylvania Public Utility Commission (Docket Nos. R-2009-2139884 and P-2009-2097639) regarding Philadelphia Gas Works' Proposed Energy Efficiency Plan. On behalf of Pennsylvania Office of Consumer Advocate. March 26, 2010.

Assisted in the preparation the following testimony: William Steinhurst, testifying before the Florida Public Service Commission (DOCKET NO. 080407-EG, DOCKET NO. 080408-EG, DOCKET NO. 080409-EG, DOCKET NO. 080410-EG, DOCKET NO. 080411-EG, DOCKET NO. 080412-EG, DOCKET NO. 080413-EG) regarding Florida Demand Side Management Policy and Planning. On behalf of Natural Resources Defense Council (NRDC) and Southern Alliance for Clean Energy. July 6, 2009.

Assisted in the preparation of the following testimony: Chris James, testifying before Iowa Utilities Board (DOCKET NO. EEP-08-01) regarding Interstate Power and Light Company's Proposed Energy Efficiency Program. On behalf of Community Coalition and Plains Justice. August 29, 2008.

Assisted in the preparation of the following testimony: Bruce Biewald and David Nichols, testifying before the Nova Scotia Utility and Review Board (Case No. M00208) regarding Nova Scotia Power Inc's Demand Side Management Plan. Oh behalf of The Utility and Review Board Staff f. March 17, 2008.

Assisted in the preparation of the following testimony: Timothy Woolf, testifying before the Public Utilities Commission of Nevada (Docket No. 06-06051) regarding the review of the Nevada Power Company's Demand Side Management Plan in the 2006 Integrated Resource Plan. On behalf of Nevada Bureau of Consumer Protection. September 13, 2006.

Assisted in the preparation of the following testimony: Amy Roschelle, testifying before the Public Utilities Commission of California (Application A.04-06-024) regarding the review of Pacific Gas and Electric's Application to Establish a Demonstration Climate Protection Program and Tariff Option. On behalf of The Utility Reform Network (TURN). May 5, 2006.

Assisted in the preparation of the following testimony: Timothy Woolf, testifying before the Public Service Commission of Nevada (Docket No. 05-10021) regarding the Sierra Pacific Power Company's Gas Demand-Side Management Plan. On behalf of Nevada Bureau of Consumer Protection. February 22, 2006.

PRESENTATIONS

Takahashi, K. 2014. "Expected U.S. Climate and Environmental Policy: The Future of Coal Power and Clean Energy." Presentation at the Citizen's Alliance for Saving the Atmosphere and the Earth (CASA) seminar in Osaka, Japan on July 10, 2014.

Takahashi, K. and J. Fisher. 2013. "Greening TVA: Leveraging Energy Efficiency to Replace TVA's Highly Uneconomic Coal Units." Presentation at the 2013 ACEEE National Conference on Energy Efficiency as a Resource, September 23, 2013.

Takahashi, K. 2013. "Economic and Environmental Analysis of Residential Heating and Cooling Systems: A Study of Heat Pump Performance in U.S. Cities." Presentation at the 7th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'13), September 12, 2013.

Takahashi K. 2011. "Jiyuka-dakedenai-america-no-denryokuseisaku-no-saishin-doukou (Recent Trends in U.S. Electric Power Regulation and Policy)." Presentation at CASA and Hinodeya Eco-life Research

Institute in Osaka, Japan Workshop to discuss (1) US electricity regulation, (2) the impact of the Fukushima nuclear event on the US nuclear power industry, and (3) energy efficiency policies and programs in the US, November 21, 2011.

Takahashi, K. 2010. "Review of Utility-Owned Distributed Generation Models for New York." Presentation at the Northeast CHP Initiative Meeting, April 13, 2010.

Takahashi, K. and D. Nichols. 2009. "The Costs of Increasing Electricity Savings through Utility Efficiency Programs: Evidence from US Experience." Presentation at the 5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'09), June 24, 2009.

Takahashi, K. 2008. "The Sustainability and Costs of Increasing Efficiency Impacts: Evidence from Experience to Date." Presentation at the 2008 ACEEE Summer Study on Energy Efficiency in Buildings, August 21, 2008.

Takahashi, K. 2005. Discussant at the World Bank Expert Workshop on CDM methodologies and Technical Issues Associated with Power Generation and Power Saving Activities, December 3, 2005.

Resume dated November 2014