Appendix A

PPL Electric Utilities Corporation
Consumption Forecast and Peak Load Data
For the period June 1, 2009 through May 31, 2010
Docket No. M-2008-2069887

Introduction

In its order entered on January 16, 2009 at Docket No. M-2008-2069887, the Public Utility Commission ("PUC" or the "Commission") established procedures for the implementation of Act 129 of 2008 ("Act 129" of the "Act"). In Section A of that order, the PUC directed each Electric Distribution Company ("EDC") subject to Act 129 to submit a consumption forecast for the period June 1, 2009 through May 31, 2010, and peak demand data for the period June 1, 2007 through May 31, 2008.

In this filing, PPL Electric Utilities Corporation ("PPL Electric" or the "Company") is submitting the required data. The Company's filing is divided into two sections. Section 1 provides the consumption forecast, and Section 2 provides the peak load data.

Section 1: Consumption Forecast

Set forth below are PPL Electric's consumption forecast for the period June 1, 2009 through May 31, 2010, as well as a full description of its forecasting methodology, weather normalization methodology, supporting data and the major assumptions reflected in the forecast. The result of the forecast is summarized in Table 1:

Table 1
June 1, 2009 to May 31, 2010
Forecasted Billed Sales (MWh)

Residential	14,560,303
Commercial	14,093,904
Industrial	9,275,530
Other	172,435
Company Use	36,762
GenCo	75,434
Total	38,214,368

Consumption Forecast Methodology

PPL Electric uses an econometric model to forecast monthly sales by customer class (residential, commercial, industrial, and other). Each customer class model is comprised of linear regression or trend models. Historical and forecast economic data used in the models are obtained from Moody's Economy.com. Energy efficiency and end-use data is obtained from the Energy Forecaster's Group of Itron (the forecasting software vendor). These data are based on Energy Information Administration (EIA) historical and forecasted end-use and efficiency data. The methodology is identical to the methodology used by the Company and accepted by the Commission in PPL Electric's previous distribution service base rate proceedings. A summary of each model and methodology are as follows:

Residential – The residential forecast is comprised of four models.

Average monthly usage for premises coded as General Residential Service (GRS) customers is modeled using a linear regression model. Historical monthly average use per customer is regressed against variables for cooling, heating, and other use (lighting, cooking, water heating, etc). Forecast drivers include weather, billing days, household size, household income, price, and energy efficiency indexes.

Average monthly usage for premises coded as Electrically Heated Homes (EHH) customers also is modeled using a linear regression model. Historical monthly average use per customer is regressed against variables for cooling, heating, and other use. Forecast drivers include weather, billing days, household size, household income, price, and energy efficiency indexes.

The Residential Customer Forecast is a regression model of PPL Electric's customer counts as a function of the population in its service territory.

Electrically Heated Homes Share is a trend model used to allocate the forecast of residential customers to GRS and EHH.

Commercial – The commercial customer class is forecasted as a whole using a linear regression model. Historical commercial usage is regressed against variables for heating, cooling, and a base usage. Forecast drivers include weather, billing days, population, non-manufacturing output, and energy efficiency indexes.

Industrial – The industrial forecast is segmented into four major sub-categories: food, steel, chemical, and other. All four sub-categories are modeled using a linear regression model.

Historical Industrial-Food usage is regressed against variables for weather, price, and GDP-Manufacturing-Food.

Historical Industrial-Steel usage is regressed against variables for price and GDP-Manufacturing-Primary Metal Industries.

Historical Industrial-Chemical usage is regressed against variables for weather, price, and GDP-Manufacturing-Chemical & Allied Products.

Historical Industrial-Other usage is regressed against variables for weather, price, billing days, and GDP-Manufacturing.

Other – The other forecast is comprised of three models: Public Authority, Railroad, and Borderline.

Public Authority is modeled using a linear regression model. Historical usage is regressed against a variable for population.

Railroad and Borderline are modeled using exponential smoothing models.

GENCO/Company Use – The GENCO and Company Use forecasts are both modeled using seasonal exponential smoothing models. The GENCO forecast is for station net-metered usage at affiliated generating stations owned by PPL Generation. The Company Use forecast is for PPL Electric's facilities, such as service centers.

Institutional Consumption

Act 129 specifies that a minimum of 10% of the required reductions in consumption shall be obtained from units of federal, state and local government, including municipalities, school districts, institutions of higher education and non-profit entities. For PPL Electric, the 2008 consumption for customers in this group totaled 3.4 million kWhs, which is just under 9% of total consumption.

Major Assumptions

Economic Conditions – The forecast is based on a continuation of the recession through the middle of 2009, with a slow recovery beginning during the second half of the year. More normal GDP growth is expected to return in the second half of 2010.

Weather – Normal weather is assumed for the forecast period. PPL Electric uses a 10-year normal Heating Degree Days (HDDs) and Cooling Degree Days (CDDs) to reflect the trend toward warmer winter weather over the past decade.

Prior to 2008, PPL Electric used a 20-year normal, but was consistently over-forecasting sales during the winter months and under-forecasting during the summer months. In order to provide the most accurate monthly forecast, PPL Electric changed to a 10-year normal for the 2008-2012 planning period. A rolling normal is used, and there currently is little difference between the 10- and 20-year rolling normal HDDs, as high HDD years in the 1980s fall out of the rolling 20-year period. However, the rolling normal for CDDs continues to climb. The differences between the 10-year, 20-year, and 30-year normals are shown in Table 2.

Table 2
10-year, 20-year, and 30-year normal Degree Days

	10-year Normal	20-year Normal	% Change 10-yr vs. 20-yr	30-year Normal	% Change 10-yr vs. 30-yr
HDD	5,603	5,596	+0.1%	5,700	-1.7%
CDD	828	813	+1.8%	798	+3.8%

The use of a 10-year normal reduces monthly forecast variances and, on an annual basis, reduces the consumption forecast by less than 0.2% compared to the 30-year normal.

Rate Cap Expiration – The forecast assumes that rate caps for PPL Electric's retail customers expire at the end of 2009, which will result in decreased consumption in 2010.

Energy Efficiency and Conservation (EE&C) Measures – EE&C measures as a result of Act 129 are not included in the forecast.

Consumption Forecast Accuracy

Since 2000, PPL Electric's billed sales forecast accuracy has had a Mean Average Percentage Error (MAPE) of 0.9% on a weather-normalized basis. Table 3 shows the actual and weather adjusted billed sales variance vs. forecast over this time period.

Table 3
Actual Billed Sales and Weather-Adjusted Billed Sales
Variance vs. Forecast

Year	Forecasted Billed Sales (MWh)	Actual Billed Sales (MWh)	Actual Billed Sales vs. Forecast	Weather-Adjusted Billed Sales (MWh)	Weather Adjusted Billed Sales vs. Forecast
2000	33,806,574	33,844,469	0.1%	34,123,298	0.9%
2001	33,817,831	34,576,695	2.2%	34,749,744	2.8%
2002	35,241,722	34,779,292	-1.3%	34,397,979	-2.4%
2003	35,598,244	35,291,594	-0.9%	35,215,173	-1.1%
2004	36,689,129	35,791,611	-2.4%	36,056,721	-1.7%
2005	36,835,033	37,262,218	1.2%	36,458,105	-1.0%
2006	37,295,451	36,715,684	-1.6%	37,192,547	-0.3%
2007	37,497,311	37,839,168	0.9%	37,665,070	0.4%
2008	38,029,900	38,135,600	0.3%	38,328,200	0.8%

Section 2: Peak Load Data

Set forth below is PPL Electric's peak load data. The four and one-half percent reduction in peak demand that must be met by May 31, 2013 is to be measured against the EDC's historical peak load for the period June 1, 2007 through May 31, 2008. The PUC has directed each EDC to provide the top 100 hours for this period, and the top 100 hours for the summer period June 1, 2007 though September 30, 2007. These data are included in Attachment A, and also are submitted in a Microsoft Excel spreadsheet on a compact disk.

PPL Electric calculated the top 100 hours based on the total PPL System Subzone load (as defined by PJM), less the load delivered to the 17 wholesale municipal and FERC customers within the PPL System Subzone. This resultant load is the EDC load associated with PPL Electric's retail customers.

For the period June 1, 2007 through May 31, 2008, PPL Electric's EDC load for the top 100 hours averaged 6,700 MW per hour. For the summer period June 1, 2007 though September 30, 2007, the top 100 hours averaged 6,592 MW per hour. The four and one-half percent reduction required by Act 129 would equal 302 MW using the annual average, and 297 MW using the summer month average.

Appendix B

Average hourly demand in 100 highest peak hours
During the period June 1, 2007 through September 30, 2007

PPL Electric's average hourly demand in its 100 highest peak hours during June 1, 2007 through September 30, 2007 was 6,592 MW.

Appendix C

Approved CSP contract.

PPL Electric awarded a contract to a CSP for the Appliance Recycling Program on June 22, 2009. The contract was filed with the Commission. The contract (with pricing information redacted) is below.

PENNSYLVANIA ACT 129 SERVICES AGREEMENT

BETWEEN

JACO Environmental, Inc.

PPL ELECTRIC UTILITIES CORPORATION

NUMBER 460526

PENNSYLVANIA ACT 129 SERVICES AGREEMENT

NUMBER 460526

THIS PENNSYLVANIA ACT 129 SERVICES AGREEMENT ("Agreement") is entered into on June 18, 2009 (the "Effective Date") by and between PPL Electric Utilities Corporation, a Pennsylvania corporation, with its principal place of business at Two North Ninth Street, Allentown, PA 18101 ("Company") and JACO Environmental, Inc**.** an Oregon Corporation, with its principal place of business at 6908 SW 37th Street, OR 97219 ("Contractor"), as an Agreement whereby Company desires Contractor to provide certain services ("Services") set forth in this Agreement, all as described in the scope of work ("Scope of Work") attached hereto as Exhibit A and a performance-based compensation schedule ("Performance-Based Compensation Schedule") attached hereto as Exhibit B. The Services shall be performed by Contractor as a Conservation Service Provider ("CSP") authorized to perform the Services and has been approved and registered by the Pennsylvania Public Utility Commission ("PUC") to perform such Services pursuant to Pennsylvania Act 129 ("Act 129"). Company and Contractor are each referred to herein as a "Party" and collectively, the "Parties."

NOW, THEREFORE, in consideration of the mutual covenants contained herein, the Parties, intending to be legally bound, hereby agree as follows:

ARTICLE 1 - The Services.

1.1 Scope of Work. The performance of the Services by Contractor shall be subject to the following procedures:

(a) Contractor shall perform the Services pursuant to the Scope of Work attached hereto as Exhibit A detailing the following: (i) Schedule 1: Scope of Work, containing a description of the services to be provided; (ii) Schedule 2: Performance Schedule, containing a schedule for the performance of the Services; (iii) Schedule 3: Management Scope, containing a description of the project management services to be provided, if any; (iv) Schedule 4: Contractor's Key Personnel, containing the names of the key personnel involved; (v) Schedule 5: Company's Key Personnel, containing the names and contact information of the principal representatives of the Company; and (vi) any additional requirements or information that may be relevant to the performance of the Services by Contractor and not otherwise included in this Agreement Additionally, the Performance-Based Compensation Schedule attached hereto as Exhibit B shall provide how Contractor shall be compensated for performance of the Services by Contractor.

(b) Contractor shall not have authorization to proceed with the Services until it has received a written notice to proceed from the Company and the PUC has provided written approval authorizing the Services to be performed, or, by the passage of time, the PUC is deemed to have provided such approval.

1.2 General Statement of Services. Contractor shall furnish the services of all necessary and appropriate personnel for the performance of the Services set forth in the Scope of Work. Company may at any time require the removal from the performance of the Services any member of Contractor's team who has, in the reasonable opinion of Company, acted negligently, inappropriately or incompetently or who is negligent or incompetent. Contractor shall, at its own expense, promptly remove such person from the performance of the Services and replace him or her with a properly qualified, experienced and competent substitute. Company shall be entitled to receive, upon request, full details of the qualifications, and work history of any proposed replacement. The Services shall include all work, equipment and materials that would be customarily performed or provided in connection with the tasks identified in the Scope of Work whether or not each specific item of work, equipment or materials is specifically named in the Scope of Work. In addition, Contractor shall:

(a) with respect to the Scope of Work, appoint an individual who shall be authorized to act on behalf of Contractor and with whom Company may consult at all reasonable times, whose instructions, requests, and decisions shall be binding upon Contractor as to all matters pertaining to the Scope of Work and who shall be responsible for the management and supervision of the Services under such Scope of Work ("Contractor's Representative");

(b) provide such periodic reports on the progress of the Services under the Scope of Work as are specified in the Scope of Work or otherwise requested by Company;

(c) provide Company and its authorized representatives at all reasonable times access to observe the Services and the work of Contractor and any of its Subcontractors (as defined below) at any location where the Services or such work are being performed; and

(d) ensure that all engineering or other Services requiring certification shall be certified by professional engineers or other applicable professionals who are properly licensed and qualified to perform such engineering or other Services under applicable laws and as specifically required by the PUC and Act 129.

No inspection or review or lack of inspection or review by Company or its representatives shall constitute an approval, endorsement or confirmation of any Services, or work of the Contractor or an acknowledgment by Company that the Services satisfy the requirements of this Agreement; nor shall any such inspection or review or lack thereof relieve Contractor of any of its obligations to perform the Services so that it satisfies all the requirements of this Agreement in every respect.

1.3 Changes. Company shall have the right to add to, modify or delete any portion of the Scope of Work, before or after the commencement of the Services related thereto, subject to any necessary approval of the PUC. In the event that Company requests such a change, Contractor shall submit to Company within ten (10) days after receipt of a request for a change, information detailing the effect on the agreed

compensation and the schedule for completion of the Services and on any other aspect of the Services. Upon reaching agreement on the addition, modification or deletion of the portion of the Services, a modified Scope of Work shall be prepared and executed by the Parties. If the Parties cannot agree on a price for the change, the rates set forth in Exhibit B shall apply for the purpose of determining any addition to or reduction of the compensation. Contractor may not make any change to the Scope of Work or Services without the prior written approval of Company. In the event that Contractor believes that it has received a direction from Company that would constitute a change, it shall promptly notify Company and within ten (10) days of receipt of such direction from Company provide the information described above.

1.4 Subcontractors. Contractor shall not subcontract or delegate the performance of any of the Services to any person or company ("Subcontractor") without the prior written consent of Company and subject to any necessary approval of the PUC. In the event that Company gives its consent to the subcontracting of any portion of the Services, the following provisions shall apply:

(a) Notwithstanding any agreement with Subcontractors, Contractor shall be solely responsible for the Services. Contractor shall be as fully responsible for the acts, performance, and omissions of its Subcontractors as it is for its own acts, performance and omissions. Company shall not be deemed to have any contractual obligation or relationship with any Subcontractor.

(b) Each agreement with a Subcontractor ("Subcontract") must provide that it is terminable for convenience, and related termination fees thereunder must be commercially reasonable in light of the value of the services or materials provided at the time when the termination fee applies and in no event shall such termination fees include payment for any costs, losses, damages, injuries or claims of the type disclaimed under Article 9.

(c) Contractor shall promptly pay, in accordance with the terms and conditions set forth in the respective Subcontract, all undisputed amounts to which each Subcontractor is entitled. Contractor shall, by appropriate contracts with each Subcontractor, require each Subcontractor to make timely payments to its laborers, suppliers and subcontractors in a similar manner.

(d) Each subcontractor shall provide that, upon notification to the Subcontractor from Company that this Agreement has been terminated, and Company will thereafter be assuming Contractor's obligations under such Subcontract, such Subcontractor shall continue to perform its responsibilities under such Subcontract for the benefit of Company and shall recognize Company as being vested with all the rights and responsibilities of Contractor under such Subcontract. Notwithstanding the foregoing, it is specifically understood and agreed (and each Subcontract shall clarify) that the Subcontractor shall not have any right to look to Company for the performance of Contractor's obligations under any Subcontract unless and until such Subcontractor has received such notice from Company.

1.5 Company's Obligations.

(a) Company shall designate in each Scope of Work the individual authorized to act as its representative (the "Company's Representative") with respect to the Services and whose instructions, requests and decisions shall be binding upon Company as to all matters pertaining to such Scope of Work.

(b) Company shall from time to time upon request by Contractor supply to Contractor, without charge, such information or data in the possession or control of Company (or which may only be obtained by Company) as is necessary for the proper performance of the Services. Contractor shall make such requests for information or data and applications for decisions or approvals by Company pursuant to the terms of this Agreement or otherwise at such times as shall allow Company a reasonable opportunity to consider and act upon such requests or applications without disrupting or delaying the performance of the Services. Contractor shall use its reasonable judgment with regard to such Company furnished data, but shall have no liability for defects in the Services to the extent attributable to Contractor's reasonable reliance upon or use of such information or data furnished by Company or third parties retained by Company.

1.6 Independent Contractor.

(a) In its performance and completion of the Services and any of its other duties and obligations under this Agreement, Contractor shall at all times be deemed to be an independent contractor and nothing in this Agreement shall at any time be construed so as to create the relationship of employer and employee, principal and agent, partnership or joint venture as between Contractor and Company. Contractor and Company hereby agree that no fiduciary relationship, either express or implied, is created by this Agreement. Contractor shall have the entire charge, control and supervision of its performance of the Services and any of its other duties and obligations under this Agreement, subject to the terms and provisions of this Agreement. Contractor acknowledges that it shall have no authority to bind Company to any contractual or other obligation whatsoever.

(b) Contractor represents and warrants to both Company and the PUC that it operates independently and without any potential conflict or affiliation or common ownership with Company or any other Pennsylvania electric distribution company. If Contractor shall merge with a Pennsylvania electric distribution company during the term of this Agreement then, Contractor shall provide immediate written notice of such merger to Company and this Agreement shall automatically terminate upon the effective date of the merger. Further, Contractor represents and warrants that in addition to previously obtaining all necessary approvals from the PUC to become an authorized CSP, it shall continue to perform its services and to obtain any additional required approvals from the PUC in compliance with all requirements of Act 129 during the term of this Agreement.

Article 2 – Compensation.

2.1 Compensation for Services. As consideration for the satisfactory and timely performance of the Services identified in the Scope of Work, Company shall pay Contractor as follows:

(a) Services are to be provided on a milestone schedule basis, in accordance with the Performance-Based Compensation Schedule as set forth in Exhibit B or on a fixed price (or other) basis as set forth in the Scope of Work. Contractor may not request changes to any rates set forth in the Performance-Based Compensation Schedule more than once per calendar year. Changes to the Performance-Based Compensation Schedule shall not apply to Services under an existing Scope of Work. All such changes are subject to review and approval by Company, and must be documented by modifying the Performance-Based Compensation Schedule. Contractor agrees to review, on an annual basis, the actual cost for marketing services. If it is determined that the actual cost is less per unit than outlined in the fee schedule, the contractor will equally share the difference in the amount with the Company, documenting and adjusting the first invoice of the following year and the final invoice in 2013.

(b) Unless otherwise provided in the Scope of Work, Contractor shall submit to Company within fifteen (15) days after the end of each calendar month, Contractor's invoice for the compensation payable under this Agreement for the Services performed during the preceding month. Each of Contractor's invoices shall set forth in a detailed and clear manner a complete description of the Services covered thereby, the number of hours spent performing such Services, the dates on which such Services were performed and any and all costs or expenses which are, pursuant to the Scope of Work, to be reimbursed by Company. Each such invoice shall be supported by such receipts, invoices, bills, documents, compensation segregations, information and other items as Company may request. Contractor shall place Company's Scope of Work account number assigned to the Scope of Work on all of its invoices.

(c) Contractor shall comply with all promulgated federal, state, regional and local laws, rules and regulations regarding taxes, and is responsible for the payment of all taxes of all kinds now in effect and those becoming effective hereafter, until the Services have been completed, including without limitation, Social Security, state unemployment insurance, withholding taxes, sales and use tax (if applicable), gross receipts, property, value added, franchise and income taxes, and will provide, as requested by Company, satisfactory evidence of such compliance in a format acceptable to Company.

(d) Company agrees to pay Contractor's undisputed invoices (or the undisputed portion(s) thereof) within thirty (30) days following receipt of a correct invoice. If Company in good faith disputes any of the charges on an invoice, it shall advise Contractor in writing of its reasons for such dispute and may withhold payment of the disputed charges until such dispute is resolved. Contractor may suspend performance on thirty (30) days prior written notice if Company fails to pay Contractor any undisputed amount when due. No payment made by Company shall constitute a waiver of any claim or right Company may have at that time or thereafter, including claims regarding unsettled liens, warranty rights and indemnification obligations of Contractor. No

payment made by Company shall be considered or deemed to represent that Company has inspected, or checked the quality or quantity of the Services or that Company knows or has ascertained how or for what purpose Contractor has used sums previously paid, and shall not be deemed or construed as an approval or acceptance of any Services or as a waiver of any claim or right Company may have hereunder. All payments shall be subject to correction or adjustment in subsequent progress reviews and payments.

(e) Company shall pay Contractor for Services properly and timely completed as specifically required in Scope of Work, in accordance with the Performance-Based Compensation Schedule, as set forth in Exhibit B of this Agreement.

2.2 Records and Audit Rights of Company and the PUC.

(a) Contractor and its Subcontractors shall maintain books, records, documents and other information and accounting procedures and practices (hereinafter referred to as "Records") sufficient to determine Contractor's and its Subcontractors performance and compliance with the requirements of this Agreement. Records shall be retained for a minimum of five (5) years after final payment.

(b) Notwithstanding the payment of any amount pursuant to this Article 2, Company and the PUC shall remain entitled to conduct a subsequent audit and review of all amounts paid on a reimbursable basis hereunder and all Records of Contractor and Subcontractor related to such amounts provided that such audit is conducted no later than five (5) years following the completion of the Services under the Scope of Work. If, pursuant to such audit and review, it is determined that a Party has either overpaid or underpaid an amount previously paid hereunder, the amount overpaid or underpaid shall be due and payable by the owing Party. The Party to whom such money is owed must issue an invoice for the amount due within sixty (60) days following completion of the audit and payment will be due within thirty (30) days following receipt of the invoice.

2.3 No Liens.

(a) Contractor shall not directly or indirectly create, incur or assume, or suffer to be created, incurred or assumed by it or any employee, laborer, material man or other supplier of goods or services, any right of retention, claim, lien, charge or encumbrance on any property or interest of Company (each, a "Contractor Lien"). Contractor shall promptly pay or discharge, and discharge of record or provide security reasonably acceptable to Company with respect to, any such Contractor Lien or other charge which, if unpaid, might be or become a Contractor Lien. Contractor shall immediately notify Company of the assertion of any Contractor Lien.

(b) Upon the failure of Contractor to promptly pay, discharge or provide security reasonably acceptable to Company for any Contractor Lien within fifteen (15) days after notice of the existence thereof from any source (or within such lesser period of time as may be necessary to prevent such Contractor Lien from being enforced), Company may pay or discharge such Contractor Lien and, upon the payment

or discharge thereof, shall be entitled to immediately recover from Contractor the amount thereof together with all expenses incurred by Company in connection with such payment or discharge or to set off all such amounts against any such sums owed by Company to Contractor.

ARTICLE 3 – Quality of Services; Contractor's Obligations.

3.1 Contractor Representation. Contractor represents that Contractor's officers, employees, agents and Subcontractors (each a "Contractor Party" and, collectively, the "Contractor Parties") have, or as a condition of being employed or retained will have, the necessary knowledge, skill and expertise to perform the Services required by the Scope of Work as a CSP approved and registered by the PUC pursuant to Act 129. Each Contractor Party is, or will be, before performance of Services is commenced, familiar with all the federal, state and local laws and regulations which govern the performance of the Services provided under the Scope of Work for the Services to be performed by such Contractor Party, including but not limited to all Act 129 and associated PUC requirements. Contractor and each Contractor Party has obtained and holds (or, if not, agrees that it shall obtain and hold) all of the licenses, permits and certificates that are necessary to perform the Services to be performed by the Contractor and such Contractor Party. If, for any reason, any federal, state or local agency revokes or suspends any license, permit or certification of the Contractor or of a Contractor Party utilized in performing the Services, Contractor shall immediately notify Company of such revocation or suspension; and Contractor shall take immediate action to correct or remedy the facts or circumstances, which led to the revocation or suspension of such license, permit or certification, and to obtain a reinstatement of the same.

3.2 Compliance with Laws. Contractor will comply with all federal, state and local laws and regulations governing the performance of the Services, including but not limited to all Act 129 and associated PUC requirements.

3.3 Warranty. Contractor warrants that it shall perform the Services in a timely manner, in accordance with all Act 129 and associated PUC requirements and the description of the Services contained in the Scope of Work (i) with care and diligence, (ii) in accordance with the Professional Standard (as defined herein), and (iii) as expeditiously and economically as is consistent with the interests of Company and with the preceding standards. For purposes of this Agreement, "Professional Standard" shall mean and refer to the practices, methods, standards and performance of the Services in accordance with the degree of judgment and skill that is ordinarily possessed and exercised by (and generally accepted as being appropriate for) nationally recognized professionals of good standing and who are performing work which is of similar scope, nature and complexity as the Services. Contractor's sole liability to Company for any Services that do not conform to Contractor's warranty shall be to reperform at no charge to Company the non-conforming or defective Services, written notice of which must be given by Company to Contractor within the Warranty Period. Contractor's obligation for reperformance of non-conforming Services as set forth in the immediately preceding sentence shall extend for a term commencing at the completion of such Services under a Scope of Work or any reperformance thereof and ending two (2) years later (the

"Warranty Period"). The obligations and representations contained in this Article 3 and all Act 129 and associated PUC requirements are Contractor's sole warranty and guarantee obligations and Company's exclusive remedy in respect of quality of the Services.

THE WARRANTIES SET FORTH IN THIS SECTION 3.3 ARE EXCLUSIVE, AND IN LIEU OF ANY AND ALL OTHER WARRANTIES RELATING TO THE SERVICES, WHETHER STATUTORY, EXPRESS OR IMPLIED, AND CONTRACTOR DISCLAIMS ANY SUCH OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY AND ALL WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE.

3.4 Company and PUC Approvals. Contractor acknowledges and agrees that any review, approval, comment or evaluation by the Company or that may be required by Act 129 and associated PUC requirements of any Services performed by or on behalf of the Contractor shall be solely for the Company's own satisfaction as to the suitability of the Services for the purposes intended therefor by the Company, and may not be relied upon by the Contractor, Subcontractors, Sub-subcontractors or any other third party as a substantive review thereof. The Company and the PUC, in reviewing, approving, commenting on or evaluating any plans, drawings, specifications or other documents, shall have no responsibility or liability for the accuracy or completeness of such documents, for any defects, deficiencies or inadequacies therein or for any failure of such documents to comply with the requirements set forth in this Agreement; the responsibility for all of the foregoing matters being the sole obligation of the Contractor. In no event shall any review, approval, comment or evaluation by the Company or the PUC relieve the Contractor of any liability or responsibility under this Agreement, it being understood that the Company is at all times ultimately relying upon the Contractor's skill, knowledge and professional training and experience.

3.5 Contractor's Key Personnel. Contractor shall provide for inclusion in the Scope of Work a list of the Contractor's key personnel who will be responsible for the performance of the Services. The Contractor's Representative shall be the authorized representative, and shall receive and initiate all communications from and with the Company and be authorized to render binding decisions related to the Services for the Contractor. The Contractor shall not remove any of such key personnel from the Services without the Company's prior written consent, which consent shall not be unreasonably withheld. If, after execution of this Agreement, Company objects to any of Contractor's personnel, the Contractor shall promptly remove such disapproved personnel. If any of the Contractor's key personnel are removed as provided above, any replacement personnel shall have equal or superior experience within the technical discipline and type of project being undertaken, have all appropriate licenses required and be subject to the prior written approval of Company.

3.6 Contractor and Subcontractor Background Reviews. Contractor and any Subcontractors, prior to performing any Services pursuant to this Agreement that include any direct customer contact, shall conduct criminal and identity investigations of all employees providing such Services. A report on each employee shall be maintained for

review by the Parties or the PUC, which shall include a seven (7) year criminal background check as to any felony or misdemeanor convictions, and verification of identity, prior employment, education and any professional training required by Act 129, the PUC or the Company. Company shall have independent rights to conduct its own investigation of any employee with or without cause as it may determine is necessary at any time. The reports on each employee shall be updated every five (5) years or earlier, if requested by the Company, or for cause.

3.7 Contractor and Subcontractor Cooperation. Contractor and its Subcontractors agree to fully cooperate with Company and the PUC's audit of Services provided by Contractor and enforcement of all requirements for performance of the Services pursuant to Act 129 and associated PUC requirements.

ARTICLE 4 – Insurance.

4.1 Required Coverages. During the performance of Services, Contractor and all subcontractors shall maintain insurance policies as follows:

(a) Workers' Compensation in accordance with the statutory requirements of the state having jurisdiction over Contractor's employees who are engaged in the Services, with Employer's Liability with a limit of $1,000,000 each accident;

(b) Commercial General Bodily Injury and Property Damage Liability insurance with limits of $5,000,000 per occurrence and in the aggregate, and Automobile Liability insurance including owned, non-owned, or hired vehicles, with a combined single limit of $5,000,000 for bodily injury and property damage liability. Such policies shall include Contractual Liability coverage and Broad Form Property Damage coverage. Contractor agrees to name Company as an additional insured on such policies, but only to the extent of Contractor's negligence under this Agreement and only to the extent of the insurance limits specified herein.

(c) Professional Liability insurance with limits of $1,000,000 per occurrence and in the aggregate covering Contractor against all sums which Contractor may become legally obligated to pay on account of any professional liability arising out of the performance of this Agreement.

(d) Contractor may satisfy any of the above required limits with a combination of both primary and excess insurance policies. Contractor agrees to provide Company with certificates of insurance evidencing the above described coverage prior to the start of any Services, and annually thereafter, if required by Company. Such certificates shall provide that the applicable insurance policies have been endorsed to provide a minimum of thirty (30) days advance notice to Company in the event of cancellation or non-renewal.

ARTICLE 5 – Indemnification.

For purposes of this article only, "Company Parties" shall mean Company, its directors, officers, agents and employees, successors, assignees, subsidiaries and affiliates, and each of them; "Contractor Parties" shall mean Contractor, its directors, officers, agents and employees, as well as any Subcontractors of Contractor, at any tier, and the Subcontractor's directors, officers, agents and employees, and each of them; and "Claims" shall mean claims, demands, suits or causes of action. Contractor's obligations under this article shall not be limited to Contractor's insurance coverage.

(a) General Indemnity. Contractor shall indemnify Company Parties for any and all loss or liability, including the costs of settlements, judgments, damages and direct expenses including reasonable attorneys fees, (including reasonable attorney's fees incurred in establishing a right to indemnity hereunder), from Claims, at law or in equity, whether based on statute or regulation or on theories of contract, tort, strict liability, or otherwise, which are brought by or on behalf of persons other than Company Parties or Contractor for injuries or damages to persons or property arising from or in any manner relating to acts or omissions of Contractor Parties under this Contract and for any liability arising out of Contractor performing its obligations as a CSP pursuant to Act 129 and as required by Company and the PUC, whether arising from or relating to acts or omissions solely of Contractor Parties or arising from or relating to acts or omissions of both Contractor Parties and Company Parties. Contractor shall defend at its own expense, with counsel acceptable to Company, any suit or action brought against Company Parties based upon such Claims. Contractor shall also indemnify Company Parties for any and all loss or liability for fines, fees or penalties for violations of any statutes, regulations, rule ordinances, codes or standards applicable to the Services, including all Act 129 and associated PUC requirements, arising from or relating to acts or omissions of Contractor Parties, whether arising from or relating to the acts or omissions solely of Contractor Parties or arising from or relating to acts or omissions of both Contractor Parties and Company Parties. Contractor's obligations under this section shall be reduced to the extent of the fault or negligence of Company Parties.

(b) Statutory Indemnity. With respect to Claims brought against Company Parties by or on behalf of Contractor Parties' employees, or other third parties, arising from or in any manner relating to injuries to or death of Contractor Parties' employees, including but not limited to Claims based upon allegations of negligence of Company Parties, Contractor shall indemnify Company Parties for any and all loss or liability resulting therefrom, including the costs of settlements, judgments, damages and direct expenses including reasonable attorney's fees (including reasonable attorney's fees incurred in establishing a right to indemnity hereunder). It is understood and agreed that the indemnity provided for in this section is applicable to claims to which Contractor has or may have immunity under the Pennsylvania Worker's Compensation Act or similar provisions in other jurisdictions. Contractor agrees and acknowledges that by undertaking to indemnify Company Parties under this section, Contractor is expressly undertaking indemnification liability by written contract pursuant to Section 303 (b) of the Pennsylvania Worker's Compensation Act, 77 PS Section 481 (b) or similar provisions in other jurisdictions.

ARTICLE 6 – Intellectual Property.

6.1 Work Product.

(a) Company shall own all Work Product (as defined below) upon payment therefore. All Work Product shall be considered work made for hire by Contractor and owned by Company. Company acknowledges, however, that the Work Product provided to it by Contractor is not intended or represented to be suitable for reuse by Company or others for any work or project other than the Services for which such Work Product was provided. Any such reuse or any modification of Work Product, by Company or others, without special written consent or adaptation by Contractor shall be at Company's sole risk and without liability or legal exposure to Contractor.

(b) If any of the Work Product may not, by operation of law, be considered work made for hire by Contractor for Company (or if ownership of all right, title and interest of the intellectual property rights therein shall not otherwise vest exclusively in Company), Contractor agrees to assign, and upon creation thereof automatically assigns, without further consideration, the ownership of all U.S. and international copyrights and patentable inventions, directly applicable to the Work Product therein to Company, its successors and assigns.

(c) Contractor shall perform, upon the reasonable request of Company, during or after the term of this Agreement, such further acts as may be necessary or desirable to transfer, perfect, and defend Company's ownership of the Work Product. When requested, Contractor shall: (i) execute, acknowledge and deliver any requested affidavits and documents of assignment and conveyance; (ii) obtain and aid in the enforcement of copyrights (and, if applicable, patents) with respect to the Work Product in any countries; and (iii) provide testimony in connection with any proceeding affecting the right, title, or interest of Company in any Work Product. Company shall reimburse all costs and expenses reasonably incurred by Contractor at Company's request in connection with the foregoing.

(d) For purposes hereof, "Work Product" shall mean all intellectual property rights, including all U.S. and international copyrights, patentable inventions, discoveries and improvements, in any documentation to be delivered to Company by Contractor under the Scope of Work. Contractor hereby irrevocably relinquishes for the benefit of Company and its assigns any moral rights in the Work Product recognized by applicable law.

(e) Nothing contained in this Section 6.1 shall be construed as limiting or depriving Contractor of its right to use its basic knowledge and skill to design or carry out other projects or work for itself or others, whether or not such projects are similar to the work to be performed under this Agreement. Rights to Contractor's existing intellectual property developed, utilized or modified in the performance of the Services, but not developed initially as part of the Work Product, shall remain the property of Contractor. Contractor shall have the right to retain and use copies of drawings, documents and engineering or other data furnished or to be furnished by Contractor and

the information contained therein subject to the confidentiality provisions of Article 7 hereof. Company shall not acquire any rights under this Agreement to any of Contractor's or any of its Subcontractors' proprietary computer software that may be used in connection with the Services.

6.2 Intellectual Property Indemnity. Contractor agrees to indemnify, defend and hold harmless the Company Indemnified Persons from and against any and all Claims arising out of or related to any claim that any Work Product infringes, dilutes or violates the intellectual property rights or any other proprietary rights of any third party.

6.3 Names. Contractor shall not use the Company's or any of the Company's Affiliates' trade names, trademarks, logos or other designations for any reason without the Company's express prior written consent and in compliance with all Act 129 and associated PUC requirements.

ARTICLE 7 – Confidentiality; Non-Solicitation.

7.1 Non-Disclosure of Confidential Information.

(a) For purposes of this Agreement, "Confidential Information" shall mean information or material proprietary or otherwise confidential to Company (whether or not owned or developed by Company) and designated as Confidential Information by Company in writing at the time of disclosure. Confidential Information includes, but is not limited to, the following types of information and other information of a similar nature (whether or not reduced to writing): trade secrets, project plans, territory information, discoveries, ideas concepts, software in various stages of development, designs, drawings, specifications, algorithms, formulae, techniques, models, data, source code, object code, documentation, diagrams, flow charts, research, development, processes, procedures, "know-how", marketing techniques and materials, marketing and development plans, customer names and other information related to customers, price lists, business plans, strategies, pricing policies, reports, environmental information, and financial information. Confidential Information does not include: (i) information generally available to the public at the time of or after disclosure (other than as a result of Contractor's violation of clause (c) below), or in Contractor's possession prior to disclosure hereunder; (ii) information independently developed by Contractor; or (iii) information required by law to be disclosed. If Contractor has been advised by counsel that it is legally obligated to disclose Confidential Information, it shall notify Company of the demand for information and shall provide reasonable cooperation to Company with respect to efforts to limit the disclosure of such Confidential Information.

(b) All Confidential Information shall belong exclusively to Company and Contractor agrees to turn over or certify the destruction of all original documents and copies of such materials in the Contractor's control to Company upon Company's request, provided that Contractor may maintain one archival copy of such information.

(c) Contractor agrees to hold in confidence and not to directly or indirectly reveal, report, publish, use, copy, disclose or transfer any of the Confidential

Information to any person or entity, or utilize any of the Confidential Information for any purpose, except as may be necessary in the course of Contractor's performance of the Services. Contractor agrees to exercise diligent efforts to preserve the confidentiality of all Confidential Information. Contractor acknowledges that its nondisclosure obligations under this Section 7.1(c) apply equally to any documents prepared by Contractor, including notes, data, reference materials, sketches, drawings, information, memoranda, reports, recommendations, analyses, documentation and records, that in any way incorporate or reflect any of the Confidential Information. The restrictions of this Section 7.1(c) shall be in effect for two (2) years from the date Confidential Information was first revealed to Contractor.

(d) Because of the unique nature of the Confidential Information, Contractor agrees that Company will suffer irreparable harm in the event that the undersigned fails to comply with any of its obligations hereunder and that monetary damages may be inadequate to compensate Company for such breach. Accordingly, Contractor agrees that Company will, in addition to any other remedies available to it at law or in equity, be entitled to injunctive relief to enforce the non-disclosure terms of this Section 7.1.

(e) It is understood and agreed that the disclosure by Company to Contractor of any Confidential Information is solely for Contractor's use in connection with this Agreement and that such disclosure shall in no way provide Contractor any ownership rights or licenses under any U.S. and international patents or copyrights or other intellectual property rights in such Confidential Information, and nothing contained in this Agreement shall be construed as implying that Company has granted, or that Contractor has accepted, any such rights or licenses in connection with said Confidential Information.

7.2 Non-Solicitation of Company Employees. Contractor acknowledges and understands the value of Company's employees and Company's interests in retaining its employees and that significant time and effort is expended in developing the talent, ability and "know-how" of Company's work force. Accordingly, Contractor promises that during the term of this Agreement, and for a period of one (1) year following the termination of this Agreement, Contractor will not induce or try to induce any employee of Company to leave Company or any of its Affiliates to work for another person or company that does or may be expected to compete with Company or any of its parent, subsidiaries or Affiliates or in any other way interfere with Company's business relations with any of Company's employees, including those employees of Company's Affiliates.

ARTICLE 8 - Force Majeure.

8.1 Force Majeure Defined. For purposes of this Agreement "Force Majeure" means any event or condition that prevents a Party from performing an obligation under this Agreement, is beyond the reasonable control of such Party, was not a result of such Party's fault or negligence, and which could not, by the exercise of due diligence, have been prevented by such Party, including but not limited to:

(a) acts of God, earthquakes, tremors, landslides, floods, hurricanes, lightning, tornadoes or other natural phenomena or calamities;

(b) civil disturbances, wars (declared or undeclared), hostilities, guerilla activities, terrorist acts, riots, insurrections, acts of sabotage or vandalism, blockades, embargoes or epidemics; or

(c) orders of any governmental authority, except for directives or requirements of the PUC pursuant to Act 129.

8.2 Excused Performance. A Party shall be excused from performance and shall not be considered to be in default with respect to any obligation hereunder, except the obligation to pay money in a timely manner for Services actually performed or other liabilities actually incurred, if and to the extent that its failure of, or delay in, performance is due to an event of Force Majeure, provided, that:

(a) Written notice describing the Force Majeure event is given as soon as is reasonably practicable but in no event later than two (2) business days after the Party claiming that a Force Majeure event has occurred first becomes aware of, or with the exercise of due care and diligence should have come to the attention of such Party, the occurrence or commencement of such event;

(b) The suspension of performance is of no greater scope and of no longer duration than is reasonably required by the Force Majeure event and recovery therefrom;

(c) No obligations of the affected Party which arose before the occurrence causing the suspension of performance that remain unaffected by the Force Majeure event are excused as a result of the occurrence of the Force Majeure event;

(d) The affected Party uses reasonable efforts to overcome or mitigate the effects of the occurrence of the Force Majeure event;

(e) When the affected Party is able to resume performance of its obligations under this Agreement, such Party shall give the other Party written notice to that effect and shall promptly resume performance hereunder; and

(f) Company shall not be required to pay standby time caused by, or resulting from, a Force Majeure event.

ARTICLE 9 - Term of Agreement and Termination.

9.1 Term. This Agreement will commence on the Effective Date and will continue until July 31, 2013.

9.2 Termination.

(a) Either Party may terminate this Agreement for its convenience on thirty (30) days prior written notice to the other Party at any time that there are no outstanding Services to be performed as set forth in the Scope of Work.

(b) Company may at any time for its convenience terminate Contractor's performance of all or a portion of its Services under the Scope of Work, by giving thirty (30) days prior written notice to Contractor.

(i) Upon receipt of notice of termination of the Scope of Work for Company's convenience, Contractor shall not place any further orders or place any contracts for services or goods or materials for the performance of the Services, promptly take all practicable steps to bring to an end the performance of the Services under the terminated Scope of Work in an orderly manner and with all reasonable speed and economy, and cause to be delivered to Company all Work Product not yet delivered, whether or not in completed form.

(ii) Contractor shall be entitled to payment for all for Services performed prior to the date of termination, plus the reasonable costs of complying with Section 9.2(b)(i) that have been reasonably and properly incurred, provided that the sum of all payments made on account of the Services which have been terminated, shall not exceed any fixed price or projected price applicable to such Services. Contractor's sole and exclusive remedy for such termination shall be the payment by Company of the amounts required to be paid pursuant to this Section 9.2(b)(ii).

(c) Company may terminate this Agreement and/or the Scope of Work for cause if (i) Company determines that Contractor has failed to perform its duties hereunder and has failed to cure such default within ten (10) days written notice of such failure; (ii) Contractor becomes insolvent or bankrupt or (iii) Contractor or any Contractor Party commits a breach of Section 3.2 or Article 7 of this Agreement Upon receipt of notice of termination of this Agreement or the Scope of Work for Contractor's default, Contractor shall have the obligations set forth in Section 9.2(b)(i). Contractor shall be entitled to payment for all for Services properly performed prior to the date of termination but for no further amounts.

(d) Contractor may terminate this Agreement and/or the Scope of Work in the event that Company has failed to pay any amount due under this Agreement and has not cured such failure to pay within thirty (30) days following written notice of such default. Termination of this Agreement under this Section 9.2(d) shall be without prejudice to Contractor's remedies against Company for such default, subject to the limitations in Article 10 of this Agreement.

(e) Company may terminate this Agreement and/or the Scope of Work upon written notice from the PUC that the Services being performed by Contractor are no longer required or if the PUC terminates such Services, with or without cause.

(f) Notwithstanding the other termination clauses set forth in Article 9 of this Agreement, and as set forth in clause 1.6(b), if Contractor shall merge with a Pennsylvania electric distribution company during the term of this Agreement then, Contractor shall provide immediate written notice of such merger to Company and this Agreement shall automatically terminate upon the effective date of the merger.

9.3 Suspension. Company may at any time for any reason at Company's sole discretion suspend the performance of any part of the Services.

9.4 Survival. The Parties agree that the provisions of Sections 2.2, 2.3, 3.3, 4.2 and 12.2 and Articles 4, 5, 6 and 10 shall survive termination or expiration of the Scope of Work and this Agreement.

ARTICLE 10 - Disclaimer of Consequential Damages.

NOTWITHSTANDING ANY OTHER PROVISION TO THE CONTRARY IN THIS AGREEMENT OR THE SCOPE OF WORK, NEITHER COMPANY NOR CONTRACTOR SHALL BE LIABLE TO THE OTHER PARTY, WHETHER BASED ON CONTRACT, TORT, NEGLIGENCE, STRICT LIABILITY, WARRANTY, INDEMNITY, ERROR AND OMISSION OR ANY OTHER CAUSE WHATSOEVER, FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL, INDIRECT, PUNITIVE OR EXEMPLARY DAMAGES OR FOR LOSS OF PROFITS OR REVENUE, LOSS OF OPPORTUNITY OR LOSS OF USE.

ARTICLE 11 - Assignment.

Neither Party shall have the right to assign this Agreement or any rights hereunder, in whole or part, without the prior written consent of the other Party; provided, however, that without the prior consent of Contractor, Company shall have the right to assign this Contract to an Affiliate of Company. Any assignment made in violation of the terms of this Agreement shall be void. Further, Company shall have the right to assign this Agreement and the performance of Services by Contractor if it is required by the PUC pursuant to its rights and obligations set forth in Act 129.

Contractor does hereby assign to Company any and all rights and interests it has or may obtain arising out of or related to all energy savings and environmental attributes of the energy savings realized by the removal of appliances or through other acts of Contractor through performance of the Services by Contractor pursuant to this Agreement.

ARTICLE 12 – Governing Law.

12.1 Governing Law. This Agreement and the respective rights and obligations of the Parties hereto shall be governed by and construed in accordance with the laws of the Commonwealth of Pennsylvania, without regard to its conflicts of laws provisions.

ARTICLE 13 – Miscellaneous.

13.1 Notices. Each notice, request, demand, statement or other communication allowed or required by this Agreement shall be in writing and shall be considered as

delivered when received by the other Party by certified U.S. mail, reputable overnight courier, or by facsimile addressed to the other Party at its address indicated below or at such other address as a Party may provided in a written notice to the other Party, provided that in the case of facsimile communication, the recipient confirms by return facsimile upon receipt:

If to Company:
PPL Electric Utilities Corporation
Two North Ninth Street
Allentown, PA 18101
Attention: Mary Thompson Grassi
Telephone: 610.774.4755
Facsimile: 610.774.2881

Invoices only:
PPL EINV
PO Box 25223
Lehigh Valley, PA 18002-5223
Attention: Mary Thompson Grassi

If to Contractor:
JACO Environmental, Inc.
7115 Larimer Road
Everett, WA 98208
Attention: Mike Jacobsen
Telephone: 1-425-508-3524
Facsimile: 1-425-423-7873

13.2 Successors and Assigns. Contractor may not assign, convey or transfer this Agreement, or any part thereof, or delegate its duties hereunder, without the Company's prior written consent. This Agreement shall be binding upon and shall inure to the benefit of the Parties hereto and their successors and permitted assigns.

13.3 Headings. The headings of the Sections contained in this Agreement are inserted for convenience only and shall not affect the meaning or interpretation of this Agreement or any provision hereof.

13.4 Severability. If any provision of this Agreement is held to be invalid or unenforceable, then, to the extent that such invalidity or unenforceability shall not deprive either Party of any material benefit intended to be provided by this Agreement, the remaining provisions of this Agreement shall remain in full force and effect and shall be binding upon the Parties hereto.

13.5 Amendments and Waiver. No change, amendment or modification of this Agreement or any Scope of Work shall be valid or binding upon the Parties unless in writing and duly executed by both Parties. No delay or omission in the exercise of any right under this Agreement shall impair any such right or shall be taken, construed or considered as a waiver or relinquishment thereof, but any such right may be exercised from time to time and as often as may be deemed expedient. In the event that any

provision hereof shall be breached and thereafter waived, such waiver shall be limited to the particular breach so waived and shall not be deemed to waive any other breach hereof. The rights and remedies provided by this Agreement shall be in addition to those rights and remedies available in both law and equity.

13.6 Entire Agreement. This Agreement and the exhibits hereto embody the entire agreement and understanding of the Parties hereto with respect to the subject matter hereof and supersede all prior and contemporaneous agreements and understandings, oral or written, relating to said subject matter.

13.7 Counterparts. This Agreement may be executed in any number of counterparts, each of which when so executed and delivered shall be deemed an original and all of which shall together constitute one and the same agreement.

13.8 Standards of Conduct & Integrity for Suppliers. Contractor and its employee(s), Subcontractor(s) and consultants shall comply with Company's Standards of Conduct and Integrity for Suppliers booklet, which is part of this Contract as if attached hereto and is incorporated herein by reference. Contractor is responsible for obtaining this booklet and understanding its provisions. If Contractor requires a copy of this booklet, contact the Company's Representative.

13.9 Professional Services and Privacy Requirements. Contractor and its employee(s), Subcontractors and consultants shall perform the Services set forth in this Agreement with strict adherence to the highest ethical standards and the conduct of the Services in the highest professional manner with regard to the privacy and rights of all third parties, including but not limited to the PUC and any customers of the Company for which Services are being performed pursuant to this Agreement.

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their duly authorized officers as of the date first written above.

PPL ELECTRIC UTILITIES CORPORATION	**JACO ENVIRONMENTAL, INC.**
By:_____	By:_____
Name: _____	Name:_____
Title:_____	Title:_____
Date: _____	Date: _____

EXHIBIT A

SCOPE OF WORK
Pursuant to Pennsylvania Act 129 Services Agreement dated June 18 2009

This Scope of Work is governed by the terms and conditions set forth in the Pennsylvania Act 129 Services Agreement dated June 18, 2009 (the "Agreement"). In the event of a conflict or inconsistency between the Agreement and the Scope of Work, the Agreement shall take precedence.

Contractor: JACO, Inc.

Contract No.:460526

Attachments to this Scope of Work include:

Schedule 1: Services to be Provided

Schedule 2: Performance Schedule

Schedule 3: Management Scope

Schedule 4: Contractor's Key Personnel

Schedule 5: Company's Key Personnel

Company's Representative: _____

Contractor's Representative: _____

Execution Date: _____

Commencement Date: _____

End Date: _____

Additional Instructions: None

EXHIBIT A

SCOPE OF WORK (cont'd.)
Pursuant to Pennsylvania Act 129 Services Agreement dated June 18, 2009

Signed: _____	**Signed:** _____
PPL ELECTRIC UTILITIES CORPORATION	**JACO ENVIRONMENTAL, INC.**
By:_____	By:_____
Name: _____	Name:_____
Title:_____	Title:_____
Date: _____	Date: _____

Schedule 1: Services to be Provided

JACO Environmental, Inc. (hereafter JACO) will provide a turn key refrigerator, freezer and room air conditioner recycling program (hereafter the Program) for PPL Electric Utilities Corporation's (hereafter PPL Electric Utilities) residential and small commercial customers. Refrigerator/freezers and air conditioners will be picked up at residential customers homes. Room air conditioners may be picked up at residential customers' homes and at small commercial customer's place of business. Room air conditioners may also be collected at turn-in events. JACO will participate in these events by collecting from the site and properly recycling, room air conditioners turned in at those events.

1. Marketing and Advertising

JACO shall develop a marketing plan for review and approval by PPL Electric Utilities to ensure the goals of the Program are met.

The marketing and advertising tasks for the Program include, but are not necessarily limited to the following:

- Develop an overreaching marketing plan using a multimedia approach. Submit the plan to PPL Electric Utilities on or before August 3, 2009.
- Develop program brochure and other promotional materials that outline the Program's features, benefits, eligibility requirements, and financial incentives.
- Provide, for review and approval by PPL Electric Utilities, a detailed list of refrigerators, freezers and room air conditioners that meet the recycling requirements for this program.
- In conjunction with PPL Electric Utilities staff, identify and recruit trade allies, marketing partners, and other marketing channels.
- Distribute program materials to trade allies, marketing partners, and to other marketing channels and customers in a timely manner.
- Note: PPL Electric Utilities may provide bill inserts, limited newspaper advertising, links or a dedicated page on www.pplelectric.com, or other marketing resources to assist JACO's marketing plan.

Room Air Conditioning turn in events: PPL Electric Utilities may choose to sponsor turn in events with community partners. If such events take place, JACO agrees to:

- Work in collaboration with PPL Electric Utilities to design materials to advertise such events.
- Collect window air conditioner(s) units and properly recycling them.

- Provide the customers with rebate application.

- To JACO's best ability, verify the person turning in an air conditioner is a customer either by asking to see a copy of the customer's bill or a customer driver's license.

- Process mail in rebate forms and mail rebate cheques to customers within four (4) weeks of each event.

2. Operations

JACO will be responsible for all day-to-day operations of the Program. This includes but is not limited to the following:

Call Center:

- Provide customer service to program participants and potential participants. This includes a toll-free contact number, web order placement, integrated voice response/voicemail, live operators, and other means for participants and potential participants to contact JACO with questions about the program, rebate status, problems, etc.

- The toll-free contact number, with Call Center operators identifying the program as the PPL Electric Utilities Appliance Recycling program, needs to be available to take calls by 11/1/09.

- The Call Center will operate Monday through Friday 8 AM EST - 7 PM EST and Saturday 10 AM EST - 5 PM EST.

- Provide Call Center operators who are able to facilitate calls in English and Spanish and to arrange for calls in other languages to be facilitated via a language line.

- Offer a voicemail complete menu of option with selections in both English and Spanish.

- Develop scripted dialogues to use in pre-qualifying customers. The scripts will be reviewed with PPL Electric Utilities having final approval before use. If scripts need adjustment at any time during the life of the Program, JACO will adjust scripts accordingly and submit to PPL Electric Utilities for review and approval.

- Ensure that sufficient supervisory staff is available at all times to handle any customer complaints.
- Maintain a grade of service of 80 percent of the calls from PPL EU customers answered within 20 seconds.

- Provide a monthly report on Call Center activity including volume of calls and grade of service.

Call Center operators will:

- Verify that the caller is a customer; verify appliance eligibility, based upon the approved list of appliances. (e.g., cubic foot size requirements, operating condition), and answer questions about the program.

- Schedule a specific pickup date within 14 calendar days of the call.

- Call customer back with a specific (i.e., four hour) time window to reconfirm pick up no less than two (2) days before the collection appointment.

Scheduling

JACO will:

- Schedule and execute appliance collection, ensuring that customers are offered options for Saturday and weekday morning/afternoon/evening collection.

- Ensure pick-ups are within time frame committed to by JACO.

- Oversee route planning to optimize travel expenses.

- Verify that all appliances are in working order and decommissioned on site.
-
- Transport appliances to recycling facility.

- Oversee recycling of all possible components and appropriately dispose of remaining materials.

- Track appliances through the entire process.

- Mail rebate cheques to customers within four (4) weeks of picking up an appliance.

- Provide access to current program data with summaries through password-protected dashboard; provide monthly quarterly and annual reports to PPL Electric Utilities.

Room Air Conditioner turn in events:

As outlined in Section 1, PPL Electric Utilities may choose to sponsor air conditioning turn in events. If such events are planned, JACO will:

- Oversee recycling of all possible components of the turned in air conditioners and appropriately disposal of remaining materials.

- Track air conditioners through the entire process.

- Provide on-site rebate for an Energy Star™ replacement air conditioner.

- Provide event specific report within 30 days following an event.

3. Recycling Facility

Providing economic development within PPL Electric Utilities is of importance to the Company. To that end, it is expected that JACO will open and have operational a recycling facility within PPL Electric Utilities territory within the first quarter of 2010. JACO will:

- Identify a suitable location for a recycling facility and confirm that the location is within PPL Electric Utilities territory; and,

- Obtain all necessary permits to open and operate such facility.

- Open the facility. PPL Electric Utilities will work with JACO to hold a press event and release a press statement about the facility to boost the program in 2010 and at other times agreed by JACO and PPL Electric Utilities. JACO will participate with PPL Electric Utilities in these activities.

4. Collection and Transportation of Appliances

JACO will collect appliance(s) from customers' homes and small business locations and transport the appliance(s) as well as collect and transport room air conditioners from turn in events to a recycling facility established by JACO. Related activities include, but are not limited to the following:

- Hire, screen, and train drivers and collection staff. JACO is responsible to perform criminal and other background checks for all of its employees and subcontractors who will enter a customer's premises or otherwise have personal contact with PPL Electric Utilities' customers.

- Ensure all personnel have photo identification provided by JACO.

- Provide well-maintained, insured collection vehicles, tools, and equipment necessary for safe and efficient removal and transportation of appliance(s).

- Remove appliance(s) from customer's home. To the greatest extent possible, protect customer's walls, floors, doors, furniture, etc. from damage during removal of appliance(s).

- Remove appliances from small business locations. To the greatest extent possible, protect customer's walls, floors, doors, furniture, etc. from damage during removal of room air conditioner(s).

- If requested by PPL Electric Utilities, provide customer with brochures, prepared by PPL Electric Utilities, about other energy efficiency programs or opportunities.

- Decommission/disable the appliance before transporting.

- Record the quantity and type of appliances collected.

- Secure customer acknowledgement of collection.

- Transport appliances to JACO's processing and recycling facility.

- Enter customer, pick-up, appliance, and other information into a tracking database.

4. Recycling and Disposal

JACO shall completely, safely, and legally recycle all possible appliance components. PPL Electric Utilities requires all appliances be recycled in a manner that maximizes the amount of material that is reclaimed and reused. Recycling and disposal activities include, but are not necessarily limited to, the following:

- Ensure the recycling facility is in compliance with all federal, state and local hazardous-waste management and recycling regulations, including the federal Clean Air Act and Heath and Safety Code (HSC).

- Recover reclaim, and/or destroy all chlorofluorocarbon (CFC), hydro chlorofluorocarbon (HFC-134a), and non-CFC refrigerants in compliance with all applicable hazardous-waste regulations. Facilities with independent certification of 95% CFC/HFC capture are preferred.

- Recover and destroy all CFC-11 and HCFC 141b blowing agents in the polyurethane foam insulation of the refrigerators and freezers in a manner that complies with all applicable hazardous-waste regulations. Facilities with independent certification of 95% CFC/HCFC capture are preferred.

- Remove, label, and store, in compliance with all applicable regulations, all materials requiring special handling, such as capacitors containing polychlorinated biphenyls (PCBs), mercury-containing switches, and used oils prior to shipment to licensed facilities for disposal or recycling.

- Recycle all glass, metals and plastics

- Process foam to remove blowing agents and recycle it or use deliver foam to waste-to-energy or hazmat facilities for high temperature incineration, which destroys the CFC-11.

- Properly dispose of any remaining materials that cannot be recycled, reclaimed or reused and which do not require special handling under hazardous waste regulations.

- Maintain documentation to verify appliances were recycled and disposed of properly.

Recycling processes must also meet the requirements for the EPA's RAD program.

5. Program Quality Assurance, Verification, Evaluation, Reporting

JACO will keep PPL Electric Utilities informed of the Program's progress. Communication is expected to include informal (i.e., phone calls and e-mails) and formal reporting. JACO is responsible for maintaining adequate quality assurance, auditing, and verification to ensure information, tracking, payment, customer privacy, and other processes are conducted in accordance with the Program's and other legal requirements. Activities include, but are not limited to, the following:

- Maintain a database to store and track interactions with the customers, as well as detailed information regarding the appliances collected.

- In concert with PPL Electric Utilities, develop an interface with PPL Electric Utilities customer information systems, PPL Electric Utilities Act 129 Measurement Evaluation and Verification Conservation Service Provider system, and other systems to track customer participation.

- Submit monthly reports summarizing Program activities and results, including data from invoices and the following:
    - Number of customers and units collected and/or rejected and recycled.
    - Status of Program compared with projections and a variance report that explains the reasons for major deviations.

- Forecast of number of customers and appliances, by month, to the end of the contract.
- Financial summary including number of rebates processed, in process, rejected, etc.
- Unit information (Refrigerator or stand alone freezer, age, size, defrost type, air conditioner, etc.)
- Deemed energy savings.
- Estimated environmental benefits of the Program (estimated pounds of CFCs/HCFCs/HFCs, PCBs, mercury, oil, and metals removed for disposal or recycling).
- List of all customer complaints or disputes, their status, and how they were resolved. Customer's name and account number must be included on the list.

- Submit annual reports summarizing accumulated monthly Program activities, results, and trends. The report must include a hard copy as well as all relevant electronic database information.

- If JACO uses the EPA RAD program, reporting processes must also meet the EPA requirements.

6. Invoicing

JACO is expected to reach the program goals set forth in Exhibit B, Schedule 2: Performance Schedule. JACO will bill monthly on a per unit basis based on the actual number of units recycled. Quarterly, PPL Electric Utilities and JACO will review progress on the program to ensure that annual targeted goals are met.

JACO will:

- Submit monthly invoices within ten (ten) business days of the end to the previous month, documenting services provided, such as:
  - Customer name, address, a PPL Electric Utilities account number.
  - Number of appliances collected or rejected, by zip code
  - Documentation that appliances met Program criteria (size, age, working order, etc.).
  - Reasons for rejection of appliance.
  - Number and type of Appliances recycled.
  - For refrigerators/freezers, appliance model/style (single-door, top freezers, side-by-side, and bottom freezer refrigerators, upright and chest freezers), defrost type, presence of icemaker, capacity (in cubic feet), estimated vintage, amperage/BTU's, and location in the facility from which it was removed.
  - For room air conditioner(s), model number, size, number turned in by each customer.
  - Date, status and amount of incentive payments made to customers.

Schedule 2: Performance Schedule

Measure		Year 1 2/1/2010 - 5/31/10	Year 2 6/1/2010 - 5/31/2011	Year 3 6/1/2011 - 5/31/2012	Year 4 6/1/2012 - 5/31/13	total
Refrigerator and Freezers		5100	20,400	20,400	20,400	66,300
Room AC		255	1020	1020	1020	3315
Total Volumes		5355	21,420	21,420	21,420	69,615

Schedule 3: Management Scope

Details of management of the project are included in Services to be Provided.

Schedule 4: Contractor's Key Personnel

Contractor Representative:
Sam Sirkin
JACO Environmental, Inc.
6908 SW 37th Street
Portland, OR 97219
Tel. 503.293.8059

Michael Dunham, Executive Oversight
JACO Environmental, Inc.
6908 SW 37th Street
Portland, OR 97219
Tel. 503.293.8059

Mike Jacobsen, Operations and Finance
JACO Environmental, Inc.
6908 SW 37th Street
Portland, OR 97219
Tel. 503.293.8059

Roy Fernandez, Jr., President
Collection and Transportation Services
Appliance Distribution
915 North B Street
Sacramento, CA 95811
Tel. 916.497.0274

Penny Ash , Executive Account Manager Hazmat
17425 NE Union Hill Road
Redman, WA 98052
Tel. 707.360.5272

Jennifer Castleberry, Managing Supervisor
Runyon Saltzman & Einhorn
One capitol Mall #400
Sacramento, CA 95814
Tel. 916.446.9900

Greater Allentown Area facility manager --- To be determined

Schedule 5: Company's Key Personnel

Mr. David G. DeCampli, President
PPL Electric Utilities
2 North 9th Street, GENN5
Allentown, PA 18101
Tel. 610.774.4247

Mr. Robert M. Geneczko, Vice President Customer Services
PPL Electric Utilities
Lehigh Service Center, LEHSC
827 Hausman Road
Allentown, PA 18104
Tel. 484.634.3248

Mr. Thomas C. Stathos, Director, Customer Strategy
PPL Electric Utilities
2 North 9th Street, GENN5
Allentown, PA 18101
Tel. 610. 774.3760

Mr. Joseph M. Mezlo, Manager, Customer Programs and Communication
PPL Electric Utilities
2 North 9th Street, GENN5
Allentown, PA 18101
Tel. 610.774.5814

Mr. Peter D. Cleff, Program Manager, Act 129
PPL Electric Utilities
2 North 9th Street, GENN5
Allentown, PA 18101
Tel. 610.774.4530

Ms. Mary E. Thompson Grassi, Customer Program Specialist
PPL Electric Utilities
2 North 9th Street, GENN5
Allentown, PA 18101
Tel. 610.774.4755

EXHIBIT B

PERFORMANCE-BASED COMPENSATION SCHEDULE

2009 RATES
Rates are valid through June 30, 2013*.

Per unit price		
Refrigerator and Freezers		Redacted
Room AC		Redacted

* With the exception as outlined in Section 2.1 (a) regarding marketing expenses.

Appendix D

Calculation of annual program savings and costs

Tables are provided in section 7.3 that show a program-by-program calculation of savings and costs for each program year, broken out for each program. Please refer to Table 135 in the Plan for portfolio-specific assignment of EE&C costs (per Table 6A in the PUC template). Table 136 provides Allocation of common costs to applicable customer sector (per Table 6B in the PUC template). Table 137 provides a summary of portfolio EE&C costs (per Table 6C in the PUC template).

Section 8 of the Plan provides a complete overview of program costs and benefits. Cost effectiveness calculations by program and by program year are provided in the Plan in Section 8.2. Please refer to Table 138 for TRC Benefits By Program Per Year for each sector (per Tables 7A through 7E in the PUC template)

Appendix E

Calculation Methods and Assumptions

The methodologies used to estimate and allocate costs are described in Section 8 of the Plan. Given below are the assumed measure savings by program.

APPLIANCE RECYCLING PROGRAM

Appliance Recycling Measure

I. Room AC - Window/Wall Unit
II. Refrigerator
III. Freezer

Room AC

Deemed Savings = 58 kWh annually

Source:

1 2008 Iowa Recycling Program impact estimates and adjusted by CDD for Scranton
2 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81
3 Savings are net of a new unit

Refrigerator and Freezer

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

RESIDENTIAL ENERGY ASSESSMENT & WEATHERIZATION PROGRAM

Infiltration Measures

I. Weather Stripping and Door Sweeps
II. SH+RAC Weather Stripping and Door Sweeps
III. SH+CAC Weather Stripping and Door Sweeps

Weather Stripping and Door Sweeps

Annual kWh = Enduse Deemed Savings (See Table Below)

Weather Stripping and Door Sweeps Measures by Enduse	Deemed Savings [kWh]
Air Source Heat Pump (ASHP)	614
Room Heat (RH)	323
Central Space Heat (SH)	633

Source:
1 2008 Iowa Weatherization Program impact estimates and adjusted by CDD for Scranton
2 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

SH+RAC Weather Stripping and Door Sweeps

Annual kWh = SH + RAC

SH = Central Space Heat Annual deemed savings kWh (See the Table Presented in Weather Stripping and Door Sweeps for Central Heat)

RAC = Room Air Conditioning Annual deemed savings kWh (See the Table Presented in Weather Stripping and Door Sweeps for Room Air Conditioners)

SH+CAC Weather Stripping and Door Sweeps

Annual kWh = SH + CAC

SH = Central Space Heat Annual deemed savings kWh (See the Table Presented in Weather Stripping and Door Sweeps for Central Heat)

CAC = Central Air Conditioning Annual deemed savings kWh (See the Table Presented in Weather Stripping and Door Sweeps for Central Air Conditioners)

Duct Sealing

Annual kWh = Enduse Deemed Savings (See Table Below)

Duct Sealing Measures by Enduse	Deemed Savings [kWh]
Central Air Conditioning (CAC)	116
Air Source Heat Pump (ASHP)	895
Central Space Heat (SH)	882

Source:
1 2008 Iowa Weatherization Program impact estimates and adjusted by CDD for Scranton
2 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Insulation Shell Measures

I. Wall Insulation (R-11)
II. SH+RAC Wall Insulation (R-11)
III. SH+CAC Wall Insulation (R-11)
IV. Ceiling Insulation (R-38)
V. SH+RAC Ceiling Insulation (R-38)
VI. SH+CAC Ceiling Insulation (R-38)

Wall Insulation (R-11)

Room Air Conditioner Impact Savings

$$\text{Room AC kWh}_{\text{Cooling}} = \frac{A \times CDD \times 24 \times F_{\text{Room AC}}}{SEER \times 1{,}000} \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right] = \text{Annual kWh}_{\text{Cooling}} \times F_{\text{Room AC}}$$

Central Air Conditioner Impact Savings

$$\text{Annual kWh}_{\text{Cooling}} = \frac{A \times CDD \times 24}{SEER \times 1{,}000} \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right]$$

Electric Resistance Room Heat Impact Savings

$$\text{Room Heat kWh}_{\text{Heating}} = \frac{A \times HDD \times 24 \times F_{\text{Room Heat}}}{3{,}412} \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right] = \text{Annual kWh}_{\text{Heating}} \times F_{\text{Room Heat}}$$

Electric Resistance Central Heat Impact Savings

$$\text{Annual kWh}_{\text{Heating}} = \frac{A \times HDD \times 24}{3{,}412} \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right]$$

Air Source Heat Pump Impact Savings

$$\text{Annual kWh}_{\text{HeatPump}} = \left[\frac{A \times HDD \times 24}{HSPF \times 1{,}000} + \frac{A \times CDD \times 24}{SEER \times 1{,}000}\right] \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right]$$

A = Area of attic insulated, in Square Feet
HDD = 6,234 = Heating Degree Days
CDD = 611 = Cooling Degree Days
$F_{\text{Room AC}}$ = 0.58333 = Adjustment factor for Room AC
$F_{\text{Room Heat}}$ = 0.77080 = Adjustment factor for Room Heat
R_i = Initial Baseline R-value
R_f = Final R-value
R = 3.63 = R-value of structural components
SEER = Seasonal Energy Efficiency Ratio of air conditioner
HSPF = Heating Seasonal Performance Factor for heat pump
COP = Coefficient of Performance for heat pump
3,412 = BTU/kWh
1000 = W/kW
24 = Hours per day

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

SH+RAC Wall Insulation (R-11)

Annual kWh = SH + RAC

SH = Central Space Heat Annual savings kWh (See the Table Presented in Wall Insulation (R-11) for Central Heat)
RAC = Room Air Conditioning Annual deemed savings kWh (See the Table Presented in Wall Insulation (R-11) for Room ACs)
Use the Equations Presented in Wall Insulation (R-11) for Room Air Conditioners and Central Heat

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

SH+CAC Wall Insulation (R-11)

Annual kWh = SH + CAC

SH = Central Space Heat Annual savings kWh (See the Table Presented in Wall Insulation (R-11) for Central Heat)
CAC = Central Air Conditioning Annual deemed savings kWh (See the Table Presented in Wall Insulation (R-11) for Central ACs)
Use the Equations Presented in Wall Insulation (R-11) for Central Air Conditioners and Central Heat

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Ceiling Insulation (R-38)

Room Air Conditioner Impact Savings

$$\text{Room AC kWh}_{\text{Cooling}} = \frac{A \times CDD \times 24 \times F_{\text{Room AC}}}{SEER \times 1{,}000} \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right] = \text{Annual kWh}_{\text{Cooling}} \times F_{\text{Room AC}}$$

Central Air Conditioner Impact Savings

$$\text{Annual kWh}_{\text{Cooling}} = \frac{A \times CDD \times 24}{SEER \times 1{,}000} \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right]$$

Electric Resistance Room Heat Impact Savings

$$\text{Room Heat kWh}_{\text{Heating}} = \frac{A \times HDD \times 24 \times F_{\text{Room Heat}}}{3{,}412} \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right] = \text{Annual kWh}_{\text{Heating}} \times F_{\text{Room Heat}}$$

Electric Resistance Central Heat Impact Savings

$$\text{Annual kWh}_{\text{Heating}} = \frac{A \times HDD \times 24}{3{,}412} \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right]$$

Air Source Heat Pump Impact Savings

$$\text{Annual kWh}_{\text{HeatPump}} = \left[\frac{A \times HDD \times 24}{HSPF \times 1{,}000} + \frac{A \times CDD \times 24_c}{SEER \times 1{,}000}\right] \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right]$$

A = Area of attic insulated, in Square Feet
HDD = 6,234 = Heating Degree Days
CDD = 611 = Cooling Degree Days
$F_{\text{Room AC}}$ = 0.58140 = Adjustment factor
$F_{\text{Room Heat}}$ = 0.51093 = Adjustment factor
R_i = Initial Baseline R-value
R_f = Final R-value

R = 3.63 = R-value of structural components
SEER = Seasonal Energy Efficiency Ratio of air conditioner
EER = Energy Efficiency Rating of air conditioner
HSPF = Heating Seasonal Performance Factor for heat pump
COP = Coefficient of Performance for heat pump
3,412 = BTU/kWh
1000 = W/kW
24 = Hours per day

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

SH+RAC Ceiling Insulation (R-38)

Annual kWh = SH + RAC

SH = Central Space Heat Annual savings kWh (See the Table Presented in Ceiling Insulation (R-38) for Central Heat)
RAC = Room Air Conditioning Annual deemed savings kWh (See the Table Presented in Ceiling Insulation (R-38) for Room ACs)
Use the Equations Presented in Ceiling Insulation (R-38) for Room Air Conditioners and Central Heat

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

SH+CAC Ceiling Insulation (R-38)

Annual kWh = SH + CAC

SH = Central Space Heat Annual savings kWh (See the Table Presented in Ceiling Insulation (R-38) for Central Heat)
CAC = Central Air Conditioning Annual deemed savings kWh (See the Table Presented in Ceiling Insulation (R-38) for Central ACs)
Use the Equations Presented in Ceiling Insulation (R-38) for Central Air Conditioners and Central Heat

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Lighting Measures

I. Compact Florescent Lights (CFL)

Compact Florescent Lights (CFL)

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009
2 The impact assumptions are the same for single family, low income housing, and buy down program

SmartStrip

Annual kWh = Smartstrip x 244 kWh

Smartstrip = Number of installed units
244 = Annual kWh savings per installed unit

Source:
1 Nine California University Test Results of the Smart Strip 3-31-08

Water Heating Measures

I. Faucet Aerator
II. Hot Water Pipe Insulation
III. Water Heater Setback

Faucet Aerator

Annual kWh = Faucet Aerator x 45 kWh

Faucet Aerator = Number of installed units
45 = Annual kWh savings per installed unit

Source:
1 Aerators change flow rate from 2.5 GPM to 1.5 GPM

Hot Water Pipe Insulation

Annual kWh = Linear Foot x 10.9

Linear Foot = Linear Feet of Insulated Hot Water Pipe, estimate 10 ft
10.9 = Annual kWh Savings per linear foot

Source:
1 DOE - EERE: Wrapping 7 feet of R-4 on Hot Water Piping and 3 feet of R-4 on the Cold Water Piping near the Hot Water Heater.
2 DOE - EERE: http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13060

Water Heater Setback

Annual kWh = Enduse Deemed Savings (See Table Below)

Water Heater Measure	Deemed Savings [kWh]
Water Heater Setback	61

Source:
1 Based on Cadmus analysis using Energy-10 building simulations assuming decrease in temperature from 135^{o}F to 120^{o}F

EFFICIENT EQUIPMENT INCENTIVE PROGRAM
(for the Residential Sector)

HVAC Measures

I. Central Air Conditioning Efficiency Upgrade
II. Air Source Heat Pump Efficiency Upgrade
III. Room Air Conditioner - ENERGY STAR
IV. Programmable Thermostat
V. RTS Fuel Switching

Central Air Conditioning Efficiency Upgrade

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 Baseline Equipment = SEER 13
2 Capacity in cooling BTUH = 36,000
3 Central AC Efficient Equipment = SEER 14.5, SEER 15, SEER 16
4 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Air Source Heat Pump Efficiency Upgrade

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 Baseline Equipment = SEER 13 and HSPF = 7.7
2 Capacity in cooling BTUH = 36,000
3 ASHP Efficient Equipment = SEER 14.5 / HSPF 8.5, SEER 15 / HSPF 8.6, SEER 16 / HSPF 8.8
4 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Room Air Conditioner - ENERGY STAR

Annual kWh = Number Room AC x Deemed Savings kWh

Number Room AC = Number of ENERGY STAR installed Room AC units
Deemed Savings kWh = Annual savings per unit (refer to TRM)
Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 ENERGY STAR Room AC Calculator: Scranton 59 kWh (621 hours)
2 Based on 10,000 BTUH Room AC unit
3 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Programmable Thermostat

Annual kWh = Enduse Deemed Savings (See Table Below)

Measure by Enduse	Deemed Savings [kWh]
Central Air Conditioning	82
Air Source Heat Pump	754

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81
2 RLW Study - "Validating the Impact of Programmable Thermostats" January 2007. Average enduse savings percent of 6.8%.

RTS Fuel Switching

RTS (Residential Thermal Storage) Removal and Replacement with Central Gas Furnace

Annual kWh = 10,000 kWh

Source:
1 Internal Utility Data

Alternative Hot Water Heaters

I. Heat Pump Hot Water Heater

Heat Pump Hot Water Heater

Annual kWh = Deemed Savings (See Table Below)

Alternative Hot Water Heaters Measure	Deemed Savings [kWh]
Heat Pump Hot Water Heater	1884

Source:
1 Heat Pump Hot Water Heater EF = 2.9
2 Emerging Technologies & Practices: 2004 ACEEE http://www.aceee.org/pubs/a042_w3.pdf

ENERGY STAR Measures

I. ENERGY STAR Dishwasher
II. ENERGY STAR Clothes Washer
III. ENERGY STAR Refrigerator
IV. ENERGY STAR Light Fixtures
V. ENERGY STAR Dehumidifier

ENERGY STAR Dishwasher

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 ENERGY STAR Dishwasher: 105 kWh
2 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009
3 Weighted to account for mix of gas and electric hot water heat

ENERGY STAR Clothes Washer

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 ENERGY STAR Clothes Washer: Tier 2 = 135 kWh
2 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009
3 Weighted to account for mix of gas and electric hot water heat

ENERGY STAR Refrigerator

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 Model Type: Top Mount Freezer without Through-the-Door Ice, deemed savings = 80 kWh
2 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY STAR Light Fixtures

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY STAR Dehumidifier

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 ENERGY STAR Dehumidifier at 35 - 45 pints/day: 213 kWh
2 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

LOW INCOME WRAP

Low-Income Program Measures

Measure Name	Program Name
CFL	Energy Assessment
Faucet Aerator	Audit
Water Heater Setback	Audit
Hot Water Pipe Insulation	Audit
Reduced Flow Showerheads	E-Power Wise
EWH: Water Heater Replacement	WRAP
CAC Infiltration	WRAP
AC/Fan: Insulation	WRAP
Electric Comprehensive	WRAP
ESH/CAC: ENERGY STAR Windows	WRAP
ENERGY STAR Light Fixtures: Indoor and Outdoor	WRAP
ENERGY STAR Refrigerator	WRAP
ENERGY STAR Room AC	WRAP

Audit

Refer to the Residential Audit Program Section

E-Power Wise low-Income

I. Reduced Flow Showerheads

Reduced Flow Showerheads

Annual kWh = Showerhead x 101 kWh

Showerhead = Number of installed units
101 = Annual kWh savings per installed unit

Source:
1 Showerheads change flow rate from 4.0 GPM to 2.5 GPM

WRAP

I. EWH: WH Replacement
II. CAC Infiltration
III. AC/Fan: Insulation
IV. Electric Comprehensive
V. ESH/CAC: ENERGY STAR Windows
VI. ENERGY STAR Light Fixtures: Indoor and Outdoor
VII. ENERGY STAR Refrigerator
VIII. ENERGY STAR Room AC

Electric Water Heater, Central Air Conditioning, and AC Fan

Annual kWh = Deemed Savings (See Table Below)

WRAP Measures	Deemed Savings [kWh]
EWH: WH Replacement	287
CAC Infiltration	71
AC/Fan: Insulation	240

Source:
1 Low-Income Program Analysis

ENERGY STAR Windows

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

WRAP Measures	Deemed Savings [kWh]
ESH/CAC: ENERGY STAR Windows	1700

Source:
1 2500 sqft Home Assumptions: 15% Window to Wall Area, 2 Floors, 10ft Height per Floor, Square Footprint, Window Area= 25 sf
2 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY STAR Refrigerator

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 Model Type: Top Mount Freezer without Through-the-Door Ice, deemed savings = 80 kWh
2 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY STAR Indoor/Outdoor Lighting

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 Refer to "ENERGY STAR Outdoor Fixture" in PA Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY STAR Room AC

Annual kWh = Number Room AC x Deemed Savings kWh

Number Room AC = Number of ENERGY STAR installed Room AC units
Deemed Savings kWh = Annual savings per unit (refer to TRM)
Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:
1 ENERGY STAR Room AC Calculator: Scranton 59 kWh (621 hours)
2 Based on 10,000 BTUH Room AC unit
3 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY STAR NEW HOMES PROGRAM

Miscellaneous Measures

I. Insulation Up-Grades, Efficient Windows, Air Sealing, Efficient HVAC Equipment and Duct Sealing

Miscellaneous Measures

Annual kWh = 2,700 kWh per Building

Source:

1 ENERGY STAR Home Performance Program assumes 15% reduction in consumption compared to code.
2 Assumes a new electrically heated home baseline consumption is 18,000 kWh

RENEWABLE ENERGY PROGRAM
(for the residential sector)

Renewable Measures

I. PV
II. GSHP

I. PV

Annual kWh = CF * kW * 8760
kWh = 3,553 kWh
kW = 3 kW system
CF = 13.5% = Capacity Factor
8760 = Hours/year

Source:

1 Baseline Equipment = SEER 13 and HSPF = 7.7
2 Capacity in cooling BTUH = 36,000

II. Ground Source Heat Pump (GSHP) Efficiency Upgrade

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:

1 Baseline Equipment = SEER 13 and HSPF = 7.7
2 Capacity in cooling BTUH = 36,000
3 GSHP Efficient Equipment: EER = 14.1 / COP = 3.3
4 Assumes Ground Source HP (closed loop) instead of Ground Water HP (open loop)
5 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY STAR NEW HOMES PROGRAM

Miscellaneous Measures

I. Insulation Up-Grades, Efficient Windows, Air Sealing, Efficient HVAC Equipment and Duct Sealing

Miscellaneous Measures

Annual kWh = 2,700 kWh per Building

Source:

1 ENERGY STAR Home Performance Program assumes 15% reduction in consumption compared to code.
2 Assumes a new electrically heated home baseline consumption is 18,000 kWh

RENEWABLE ENERGY PROGRAM
(for the residential sector)

Renewable Measures

I. PV
II. GSHP

PV

Annual kWh = CF * kW * 8760
kWh = 3,553 kWh
kW = 3 kW system
CF = 13.5% = Capacity Factor
8760 = Hours/year

Source:

1 Baseline Equipment = SEER 13 and HSPF = 7.7
2 Capacity in cooling BTUH = 36,000

Ground Source Heat Pump (GSHP) Efficiency Upgrade

Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

Source:

1 Baseline Equipment = SEER 13 and HSPF = 7.7
2 Capacity in cooling BTUH = 36,000
3 GSHP Efficient Equipment: EER = 14.1 / COP = 3.3
4 Assumes Ground Source HP (closed loop) instead of Ground Water HP (open loop)
5 Refer to Pennsylvania Alternative Energy Portfolio Standard Technical Reference Manual (TRM), 2009

ENERGY EFFICIENCY BEHAVIOR & EDUCATION

Consumer Energy Education

Annual kWh = Savings * Load * Participants
Annual kWh = 181 kWh
Savings = 2%
Load = 9,050 kWh
Participants = 10% of total population

Source:

1. Assessment of Long-Term, System-Wide Potential for Demand-Side and Other Supplemental Rsources, Prepared for PacifiCorp, 2007, Quantec
2. Based on educational savings from program planners including: Flex Your Power, Energy Center of Wisconsin, San Diego Green Action Program, NYSERDA, BC Hydro

EFFICIENT EQUIPMENT INCENTIVE PROGRAM
(for the Commercial & Industrial and Government & Non-Profit sectors)

Lighting Equipment

I. Lighting Measures
II. Exterior Lighting Measures

Lighting Measures

Savings per Unit

$$\text{Annual kWh} = \frac{(W_{base} - W_{eff})}{1{,}000} \times \text{OPHRS}$$

Wbase = Wattage of baseline fixture, from Lighting Measure table below
Weff = Wattage of energy efficient fixture, from Lighting Measure table below
OPHRS = Annual fixture operating hours, from Operating Hours table below
1,000 = W / kW conversion factor

MeasureName	Nominal Lamp Watts	# Lamps	EE Fix Watt (Weff)	BaseFix Watts (Wbase)	Baseline Type	Deemed kWh Savings
Compact Fluorescent Lamps	11	1	13	40	Incandescent	117
Compact Fluorescent Lamps	15	1	17	60	Incandescent	187
Compact Fluorescent Lamps	20	1	22	75	Incandescent	230
Compact Fluorescent Lamps	27	1	29	100	Incandescent	309
Compact Fluorescent Lamps	40	1	42	150	Incandescent	470
Compact Fluorescent Lamps	65	1	67	200	Incandescent	578
Compact Fluorescent Pin-Base Fixtures13 W CFL Double-Biax + Ballast	13	1	15	40	Incandescent	109
Compact Fluorescent Pin-Base Fixtures18 W CFL Double-Biax + Ballast	18	1	20	60	Incandescent	174
Compact Fluorescent Pin-Base Fixtures26 W CFL Double-Biax + Ballast	26	1	28	75	Incandescent	204
Compact Fluorescent Pin-Base Fixtures32 W CFL Triple-Biax + Ballast	32	1	34	100	Incandescent	287
Compact Fluorescent Pin-Base Fixtures42 W CFL Triple-Biax + Ballast	42	1	44	150	Incandescent	461
LED Exit Lighting	5	1	5	26	CFL	184
LED Exit Lighting	5	1	5	40	Incandescent	307
Delamping And Install Reflectors 2-Lamp 4 ft. T8 + New Reflector	32	2	55	115	T12	261
Energy Efficient High Bay Lighting, T5HO (4 Lamps, 240 W per fixture)	54	4	234	454	Metal Halide	957
Energy Efficient High Bay Lighting, T8HO (6 Lamps, [240 W] estimated per	54	6	351	454	Metal Halide	448
4 ft. T8 2-Lamp Fixture	32	2	55	73	T12	78
4 ft. T8 3-Lamp Fixture	32	3	79	105	T12	113
4 ft. T8 4-Lamp Fixture	32	4	110	146	T12	157
8 ft. T8 2-Lamp Fixture	59	2	118	158	T12	174

Source:
1 2007 Table of Standard Fixture Wattages based on Deemed wattage from California's Title 24 Regulations
2 EE Fix Watts = Energy Efficiency Fixture Wattages (Weff); BaseFix Watts = Baseline Fixture Wattage (Wbase); Total fixture wattage (lamp and balla
3 Averages of various manufacturers' laboratory tests (ANSI)
4 For Deemed Savings kWh assumed average of small retail and office in Scranton
5 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Annual Operating Hours (OPHRS) Interior by Climate Zone

Building Type	Scranton
Large Office	3,913
Large Retail	6,257
Large School	2,707
Large Other	4,348
Health (Hospital)	5,249
Small Office	3,387
Small Retail	5,310
Small School	3,108
Small Other	3,387
Industrial	5,697
Lodging (Continuous)	8,278

Source:

1 Annual Operating Hours based on Draft Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Exterior Lighting Measures

$$\text{Annual kWh} = \frac{(W_{base} - W_{eff})}{1{,}000} \times \text{OPHRS}$$

Wbase = Wattage of baseline fixture, from Lighting Measure table below
Weff = Wattage of energy efficient fixture, from Lighting Measure table below
OPHRS = 3000 Hours = Annual exterior fixture operating hours
1,000 = W / kW conversion factor

MeasureName	BaselineType	Weff	Wbase	Exterior OPHRS	Deemed kWh Savings
Exterior CFL - 23 Watts	Incandescent	23	75	3000	156
Exterior High Pressure Sodium (70 W HPS Lamp)	Mercury Vapo	70	175	3000	315
Exterior Pulse Start Metal Halide with Electronic Pulse Start Ballas	Mercury Vapo	250	1000	3000	2250

Source:

1 Assume 8 hours per night operation
2 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Lighting Controls

I. Daylighting Controls - Dimming-Continuous, Fluorescent Fixtures
II. Occupancy Sensors
III. Time Clocks And Timers (Lighting)

Daylighting Controls - Dimming-Continuous, Fluorescent Fixtures

Savings per Unit

$$\text{Annual kWh} = \frac{W_{controls}}{1000} \times 25\% \times OPHRS \times (1 - IF)$$

$W_{controls}$ = Total wattage controlled by day lighting
OPHRS = 2600 = Annual Daylight Hours
25% = Percent of savings by day lighting controls
IF = 5% = Interactive Factor. This represents the secondary demand and energy savings in reduced HVAC consumption resulting from decreased indoor lighting wattage.
1,000 = W / kW conversion factor

Source:

1 Saving range from 10% to 50% based on EERE and California Title 24 Building Energy Efficiency documents
2 Astronomical Applications Department of the U.S. Naval Observatory: http://aa.usno.navy.mil/data/docs/RS_OneYear.php
3 Assume 2 hours of each day does not impact day lighting controls. The average annual day hours in PA (minus 2 hours)=10 hours.
4 Annual Daylight Hours = 5 days x 10 hours x 52 weeks = 2600 hours
5 Interactive Factor – This applies to C&I interior lighting only. Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009
6 Assumed savings per 2 lamp T8 fixture (32 W lamp)

Occupancy Sensors

Refer to Refer to Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Source:

1 Deemed savings based on 3 fixtures controlled. Assumed savings per 2 lamp T8 fixture (32 W lamp).
2 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Time Clocks And Timers (Lighting)

Savings per Unit

$$\text{Annual kWh} = \frac{W_{controls}}{1000} \times (OPHRS_{total} - OPHRS_{timeclockhours})$$

$W_{controls}$ = Total wattage controlled by timeclock
$OPHRS_{total}$ = Total annual operating hours of lamps before timer controls installed
$OPHRS_{timeclockhours}$=Annual hours spent in On mode of lamps controlled with timer controls. Default value: OPHRStimeclockhours=2600 hrs
1,000 = kW per W conversion factor

Source:

1 Assumed savings per 2 lamp T8 fixture (32 W lamp)
2 Interactive Factor – This applies to C&I interior lighting only. Based on PA Alternative Energy Portfolio Standard, TRM, 2009

Lighting Designs

I. High Efficiency Fixture/Design
II. Daylighting Controls, Super T8's, Dimming Controls
III. Integrated Lighting, Classrooms and Other Buildings

High Efficiency Fixture/Design

Refer to Refer to Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Source:

1 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009
2 LPD reduction of 20%

Daylighting Controls, Super T8's, Dimming Controls

Refer to Refer to Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Source:

1 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009
2 LPD reduction of 50% or greater in daylight areas

Integrated Lighting, Classrooms and Other Buildings

Annual kWh = 1.02 x SQFT

1.02 = kWh savings per sqft of integrated lighting designed area
SQFT = square feet of integrated lighting designed area

Source:

1 Based on integrating Daylighting Controls, Super T8's, Dimming Controls, etc to achieve 0.5 W/sqft
2 Operating hours and lighting assumptions based education building type

ENERGY STAR Office Equipment

I. Computer - ENERGY STAR Features Enabled
II. Monitor - ENERGY STAR Features Enabled
III. Copier - ENERGY STAR Features Enabled
IV. Fax - ENERGY STAR Features Enabled
V. Printer - ENERGY STAR Features Enabled
VI. Scanner - ENERGY STAR Features Enabled
VII. Water Cooler (Hot/Cold Function)

Office Equipment Measures

$$\text{Annual kWh} = \text{DeemedSavings} \times \text{NumberUnits}$$

Deemed Savings = Annual kWh Savings (refer to table below)
NumberUnits = Number of units installed

MeasureName	Deemed kWh Savings
Computer	326
Monitors	194
Copiers	1,125
Fax	113
Printers	147
Scanners	71
Water Cooler (Hot/Cold Function)	361

Source:

1 Based on ENERGY STAR specifications, web-calculators, and qualified manufactured data
2 Computer and Monitor measures were adjusted to account for a higher "active mode", 40 hours per
3 Copiers based on an average baseline consumption of 4500 kWh with ENERGY STAR requirements of at least 25% savings improvement
4 ENERGY STAR sources include: LBNL 2007, LBNL 2006, EPA 2006, Industry data 2008, and Industry Data 2007
5 Water Cooler savings based on hot and cold water equipment. Note cold water only units save 47.5 kWh.

ENERGY STAR Food Service Equipment

I. Vending Machine - ENERGY STAR
II. Steam Cookers - ENERGY STAR Electric
III. Commercial Reach-In Refrigerator - ENERGY STAR
IV. High-Efficiency Ice Maker - ENERGY STAR

Vending Machine - ENERGY STAR Features Enabled

ENERGY STAR Refrigerated Beverage Vending Machines Key Product Criteria
New and Rebuilt Machines — effective July 1, 2007
Y = 0.45 [8.66 + (0.009 x C)]
Where:
Y = 24 hr energy consumption (kWh/day) after the machine has stabilized
C = Vendible can capacity
Table below summarizes savings calculation by can capacity

Equipment	Can Capacity	Calculation kWh Savings	Deemed kWh Savings
ENERGY STAR Vending Machines	< 500	Annual kWh = ((0.70 - 0.45) x (8.66+(0.009xC)))*365	1099
ENERGY STAR Vending Machines	500	Annual kWh = ((0.82 - 0.45) x (8.66+(0.009xC)))*365	1754
ENERGY STAR Vending Machines	600	Annual kWh = ((0.69 - 0.45) x (8.66+(0.009xC)))*365	1242
ENERGY STAR Vending Machines	700	Annual kWh = ((0.77 - 0.45) x (8.66+(0.009xC)))*365	1741
ENERGY STAR Vending Machines	800 +	Annual kWh = ((0.57 - 0.45) x (8.66+(0.009xC)))*365	713

C= Vendible can capacity
365 = days/year
0.45 = ENERGY STAR efficiency factor
0.70, 0.82, 0.69, 0.77, & 0.57 = Standard efficiency factor
8.66 = ENERGY STAR Key Product Criteria
0.009 = ENERGY STAR Key Product Criteria

Source:
1 ENERGY STAR Refrigerated Beverage Vending Machines Products List
2 ENERGY STAR Case Study:http://www.energystar.gov/ia/products/vending_machines/UB_Case_study.pdf
3 ENERGY STAR Refrigerated Beverage Vending Machines, July 2008:http://www.energystar.gov/index.cfm?c=vending_machines.pr_vending_machines
4 PPL program savings based on 500 can capacity unit

Steam Cookers - ENERGY STAR Electric

Savings per Unit

$$\text{Annual kWh} = \left(IER_{eff} \times \frac{CE_{eff}}{100} \times F_{idle} \times F_{conv} \times \frac{1}{CE_{basic}} \right) \times \frac{1,685}{1,000}$$

IER_{eff} = Idle Energy Rate of efficient steam cooker, W [Range: 100 to 700]
CE_{eff} = Cooking Efficiency of efficient steam cooker [Range: 0.50 to 0.75]
F_{idle} = 3.111 = Conversion factor comparing total energy use to idle energy use for an efficient uni
F_{conv} = 1.7006 = Conversion factor comparing total energy savings and baseline use
CE_{basic} = 0.35 = Cooking Efficiency of conventional steam cooker
1,685 = HRSidle = Hours of idle-state operation per year
1,000 = W / kW conversion factor

Source:
1 Algorithm inferred from ENERGY STAR Electric Steam Cooker Calculator
2 PPL deemed savings based on 205 W unit at 50% efficiency

Commercial Reach-In Refrigerator - ENERGY STAR Features Enabled
Savings per Unit

Annual kWh = $V_{cubicfeet, refrig}$ x 27.2

$V_{cubicfeet, refrig}$ = Refrigerator volume in cubic feet
27.2 = Refrigerator calculated value kWh/cubicfoot

Source:
1 ENERGY STAR Commercial Solid Door Refrigerators & Freezers, July 2008
2 ENERGY STAR calculator sheet of cubic volumes of each unit type and kWh usage, kWh/cubicfoot
3 ENERGY STAR Product List for Commercial Reach-In Refrigerators

High-Efficiency Ice Maker - ENERGY STAR
Savings per Unit

Annual kWh = Harvest Rate x kWh per lb

Harvest Rate = Equipment ice harvest capacity per day (lbs ice/day)
kWh per lb = Annual kWh savings per lb

Equipment	Harvest Rate (lbs ice/day)	Annual Savings (kWh)	kWh per lb
Ice Making Head (IMH)	706	1598	2.3
Remote Condensing Unit	1027	3777	3.7
Self Contained Unit (SCU)	137	561	4.1

Source:
1 Algorithm inferred from ENERGY STAR Ice Maker Calculator
2 PPL deemed savings based on Ice Making Head (IMH) assumptions
3 ENERGY STAR sources include: ARI Certified Product Directory, Certified Automatic Commercial Ice Makers: 810, EPA 2003, and LBNL 2007

Auxiliary Ventilation and Pumps Measures
I. Variable Speed Drive
II. HVAC Motors - Premium-Efficiency

Variable Speed Drive

$$\text{Annual kWh} = \left(\frac{\text{HP}}{\text{EFF}_{\text{motor}}}\right) \times 0.746 \times \text{LF} \times \text{SF} \times \text{EFF}_{\text{VSD}} \times \text{OPHRS}$$

EFF_{motor} = Efficiency rating of motor being controlled by VSD, Range: 50.0% to 98.0% (0.50 to 0.98)
EFF_{VSD} = Efficiency rating of variable speed drive, Range: 90.0% to 99.0% (0.90 to 0.99)
HP = Horsepower of new high efficiency motor
LF = 0.75 = Loading Factor
SF = 0.40 = Saving Factor
OPHRS = Annual operating hours
0.746 = Conversion Factor [kW/hp]

Source:
1 Saving Factor based on Department of Energy Office of Industrial Technologies study
2 Ernest Orlando Lawrence Berkeley National Laboratory: EMERGING ENERGY-EFFICIENT INDUSTRIAL TECHNOLOGIES Oct 2000 LBNL 46990
3 Full-load efficiencies based on NEMA EPACT Energy-Efficient motors

HVAC Motors - Premium-Efficiency

Refer to Refer to Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Source:

1 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009
2 Full-load efficiencies based on NEMA EPACT Energy-Efficient motors
3 Ernest Orlando Lawrence Berkeley National Laboratory: EMERGING ENERGY-EFFICIENT INDUSTRIAL TECHNOLOGIES Oct 2000 LBNL 46990

Refrigeration Measures

I. Compressor VSD Retrofit
II. Floating Head Pressure Control
III. Case Fans with ECM Motors
IV. High-Efficiency Display Cases
V. High-Efficiency Case Fans
VI. High-Efficiency Compressor
VII. High-Efficiency Evaporator Fans - Walk-ins
VIII. Anti-Sweat Heater Controls
IX. Night Covers for Display Cases
X. Strip Curtains for Walk-Ins

General Algorithm

Annual kWh = Number of Units x Unit Savings [kWh/Unit Basis]

Compressor VSD Retrofit

Annual kWh = HP x 856 kWh

HP = Compressor horse power
856 = Annual kWh savings per HP

Source:

1 CIEE Cleanroom Case Studies Applied Materials: Chilled Water Plant Efficiency Upgrade, http://ateam.lbl.gov/cleanroom/doc/Applied_Final.pdf
2 DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00

Floating Head Pressure Control

Annual kWh = Ton x 367 kWh

Ton = Number of refrigeration cooling tons
367 = Annual kWh savings per refrigeration cooling ton

Source:

1 DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00
2 DEER 2005 / CALMAC Report - September 2000 / GSD

Case Fans with ECM Motors

Annual kWh = Case x 55 kWh

Case = Number of refrigerated cases
55 = Annual kWh savings per refrigerated case

Source:

1 DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00
2 DEER 2005 / CALMAC Report - September 2000 / GSD

High-Efficiency Display Cases

Annual kWh = Case x 240 kWh

Case = Number of refrigerated cases
240 = Annual kWh savings per refrigerated case

Source:
1 DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00
2 DEER 2005 / CALMAC Report - September 2000 / GSD
3 SCE program rebate structure
http://www.sce.com/RebatesandSavings/LargeBusiness/Commercial/SupermarketDisplayCaseSheilds/

High-Efficiency Case Fans

Annual kWh = Fan x 220 kWh

Fan = Number of case fans
220 = Annual kWh savings per case fan

Source:
1 DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00
2 DEER 2005 / CALMAC Report - September 2000 / GSD
3 SCE program rebate structure
http://www.sce.com/RebatesandSavings/LargeBusiness/Commercial/SupermarketDisplayCaseSheilds/

High-Efficiency Compressor

Annual kWh = Ton x 1028 kWh

Ton = Number of compressor tons
1028 = Annual kWh savings per compressor ton

Source:
1 DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00
2 DEER 2005 / CALMAC Report - September 2000 / GSD

High-Efficiency Evaporator Fans - Walk-ins

Annual kWh = HP x 221 kWh

HP = Evaporator fan horse power
221 = Annual kWh savings per HP

Source:
1 CEE and DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00
2 DEER 2005 / CALMAC Report - September 2000 / GSD
3 SCE program rebate structure
http://www.sce.com/RebatesandSavings/LargeBusiness/Commercial/SupermarketDisplayCaseSheilds/

Anti-Sweat Heater Controls

Annual kWh = Case Door x 349 kWh

Case Door = Number of refrigerated glass doors
349 = Annual kWh savings per refrigerated glass door

Source:
1 Utility Program 2004 http://www.focusonenergy.com/data/common/pageBuilderFiles/AntiSweatTDS3429.pdf
2 DOE: Energy Savings Potential for Commercial Refrigeration Equipment: Final Report, Arthur D. Little, Inc., June 1996.

Night Covers for Display Cases

Annual kWh = Linear Foot x 62 kWh

Linear Foot = Night cover per linear foot
62 = Annual kWh savings per linear foot

Source:
1 Reflective Night Covers Case Studies: http://www.econofrost.com/free_reports.html#ashrae
2 SCE program rebate structure http://www.sce.com/RebatesandSavings/LargeBusiness/Commercial/SupermarketDisplayCaseSheilds/

Strip Curtains for Walk-Ins

Annual kWh = Linear Foot x 99 kWh

Linear Foot = Night cover per linear foot
99 = Annual kWh savings per linear foot

Source:
1 CEE and DOE: Energy Savings Potential for Commercial Refrigeration Equipment, A.D. Little, June 1996, Ref 46230-00
2 Assume typical 7.5 foot length (90")

Cooling Chiller

I. Cooling Tower-Decrease Approach Temperature
II. Cooling Tower-Two-Speed Fan Motor
III. Pipe Insulation
IV. High-Efficiency Screw Chiller
V. Premium-Efficiency Screw Chiller

Cooling Tower-Decrease Approach Temperature

Annual kWh = Ton x 44 kWh

Ton = Number of cooling chiller tons
44 = Annual kWh savings per cooling chiller ton

Source:
1 2001 DEER http://www.calmac.org/publications/2001%20DEER%20Update%20Study.pdf
2 2005 DEER Database and CALMAC Report - September 2000

Cooling Tower-Two-Speed Fan Motor

Annual kWh = Ton x 77 kWh

Ton = Number of cooling chiller tons
77 = Annual kWh savings per cooling chiller ton

Source:
1 2001 DEER http://www.calmac.org/publications/2001%20DEER%20Update%20Study.pdf
2 2005 DEER Database and CALMAC Report - September 2000

Pipe Insulation

Annual kWh = Linear Foot x 4.65 kWh

Linear Foot = Number of linear feet of pipe insulation cooling chiller tons
4.65 = Annual kWh savings per cooling chiller ton

Source:
1 2005 DEER Database and CALMAC Report - September 2000
2 Based on prototypical cooling chiller assumptions

High-Efficiency Screw Chiller

Refer to Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Source:
1 High Efficiency Chiller kW/ton = 0.62
2 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Premium-Efficiency Screw Chiller

Refer to Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Source:
1 Premium Efficiency Chiller kW/ton = 0.574
2 Based on Pennsylvania Alternative Energy Portfolio Standard, Technical Reference Manual (TRM), 2009

Air Source Heat Pump and Ground Source Heat Pump

I. High-Efficiency ASHP
II. Premium-Efficiency ASHP
III. Ground Source Heat Pump

High-Efficiency ASHP

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Source:
1 High Efficiency ASHP EER=11.0, COP=3.5
2 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Premium-Efficiency ASHP

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Source:
1 Premium Efficiency ASHP EER=11.8, COP=3.8
2 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Ground Source Heat Pump

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Source:
1 EER=20, COP=3.6
2 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

(DX) Packaged Air Conditioner System

I. High-Efficiency DX
II. Premium-Efficiency DX
III. Advanced-Efficiency DX

High-Efficiency DX

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Source:
1 High Efficiency DX EER=11.0
2 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Premium-Efficiency DX

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Source:
1 Premium Efficiency DX EER=11.5
2 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Advanced-Efficiency DX

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Source:
1 Advanced Efficiency DX EER=12.0
2 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Programmable Thermostat

I. Cooling Direct Expansion
II. Air Source Heat Pump
III. Space Heat

Thermostat Measure	Deemed
Cooling Direct Expansion	403
Air Source Heat Pump	1,448
Space Heat	1,830

Source:

1 Savings based on per installed programmable thermostat per building
2 ENERGY STAR Energy Savings with Programmable Thermostats recommendations
3 3% enduse savings percent, based on EPA estimates

Water Heating Measures

I. Faucet Aerators
II. Water Heater Thermostat Setback

Faucet Aerators

Annual kWh = Aerators x 11 kWh

Aerators = Number of faucet aerator installed
11 = Annual kWh savings per aerator

Source:

1 Aerators change flow rate from 2.5 GPM to 1.5 GPM
2 2001 DEER Data Base

Water Heater Thermostat Setback

Annual kWh = Water Heater x 94 kWh

Water Heater = Number of water heaters
94 = Annual kWh savings per water heater

Source:

1 Based on Cadmus analysis using eQuest building simulations assuming decrease in temperature from 135^{o}F to 120^{o}F
2 2001 DEER Data Base

Insulation Shell Measures

I. Insulation Ceiling
II. Insulation Wall

Insulation (Ceiling)

Electric Resistance Impact Savings

$$\text{Annual kWh}_{\text{Heating}} = \frac{A \times HDD \times 24}{3{,}412} \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right]$$

Electric Cooling Impact Savings

$$\text{Annual kWh}_{\text{Cooling}} = \frac{A \times CDD \times 24}{EER \times 1{,}000} \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right]$$

Heat Pump Impact Savings

$$\text{Annual kWh}_{\text{HeatPump}} = \left[\frac{A \times CDD \times 24}{EER \times 1{,}000} + \frac{A \times HDD \times 24}{COP \times 1{,}000}\right] \times \left[\frac{1}{R_i} - \frac{1}{R_f}\right]$$

A = Area of attic insulated, in Square Feet
HDD = 6,234 = Heating Degree Days
CDD = 611 = Cooling Degree Days
R_i = Initial Baseline R-value
R_f = Final R-value

EER = Energy Efficiency Rating of air conditioner
HSPF = Heating Seasonal Performance Factor for heat pump
COP = Coefficient of Performance for heat pump
3,412 = BTU/kWh
1000 = W/kW
24 = Hours per day

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

Insulation (Wall)

Electric Resistance Impact Savings

$$\text{Annual kWh}_{\text{Heating}} = \frac{A \times HDD \times 24}{3{,}412} \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right]$$

Electric Cooling Impact Savings

$$\text{Annual kWh}_{\text{Cooling}} = \frac{A \times CDD \times 24}{EER \times 1{,}000} \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right]$$

Heat Pump Impact Savings

$$\text{Annual kWh}_{\text{HeatPump}} = \left[\frac{A \times CDD \times 24}{EER \times 1{,}000} + \frac{A \times HDD \times 24}{COP \times 1{,}000}\right] \times \left[\frac{1}{R_i + R} - \frac{1}{R_f + R}\right]$$

A = Area of attic insulated, in Square Feet
HDD = 6,234 = Heating Degree Days
CDD = 611 = Cooling Degree Days
R_i = Initial Baseline R-value
R_f = Final R-value
R = 3.63 = R-value of structural components

EER = Energy Efficiency Rating of air conditioner
HSPF = Heating Seasonal Performance Factor for heat pump
COP = Coefficient of Performance for heat pump
3,412 = BTU/kWh
1000 = W/kW
24 = Hours per day

Source:
1 HDD and CDD based on CLIMATOGRAPHY OF THE UNITED STATES NO. 81

ENEGY STAR Residential Refrigerator

See residential measure list

HVAC TUNE-UP PROGRAM

Small Commercial

Based on per Tune-Up

Small Rooftop HVAC Tune-Up Measure	Deemed Savings [kWh]
Basic Package	1686
Refrigerant/Airflow (1 Comp.)	864
Refrigerant/Airflow (2 Comp.)	1457
Thermostat Modification	682
Economizer Adjustment	1674
Thermostat Replacement	3870
Economizer Control Package	1045

Source:

1 Portland Energy Conservation, Inc.

2 California AirCare Plus Program Data and Analysis

CUSTOM INCENTIVE PROGRAM

Commercial and Industrial

Based on per building analysis

Custom Measures	Deemed Savings [kWh]
AC Windows	3194
Controls	39000
Lighting	45000
Energy Analysis	0
Heat Recovery	165000
Refrigeration	40000
Industrial Process - Other Electric	664413
Custom Motors	442942
Industrial Compressed Air	664413
Agriculture (Dairy Farms)	10704
Permanent Operational Changes (Cooling DX)	2331
Permanent Operational Changes (Cooling Chillers)	1972
Permanent Operational Changes (Heat Pump)	17075
Permanent Operational Changes (Heating)	7139

Source:

1 Protypical savings based on utility program data

DATA CENTERS

Based on deemed savings by server by enduse, assume average of 207 servers per data center

Data Center Cooling Measures

Data Center Measures for Cooling Savings	Cooling Side Deemed Savings [kWh]	Applicability Factor
Chiller-Water Side Economizer	1112	23%
Component level cooling	795	15%
Centrifugal Chiller - VSD Remodel for Existing	636	23%
Chiller - High Efficiency	150	15%
Chiller - Premium Efficiency	318	4%
Chiller - Advanced Technology	434	1%

Data Center Lighting

Data Center Measures for Lighting Savings	Lighting Side Deemed Savings [kWh]	Applicability Factor
HE Fixtures/Design	19	68%
Occupancy Sensor Control, Fluorescent	51	68%

Data Center Plug Load

Data Center Measures for Plug Load Savings	Plug Load Side Deemed Savings [kWh]	Applicability Factor
Server Virtualization 4:1	1788	64%
Energy efficient UPS	16	25%
Efficient power supply	52	38%
Power Management Software	620	68%
Energy efficient storage	33	19%
Removal of inefficient server	2384	2%
Massive Array of Idle Disks	119	0.1%

Source:

1 PG&E: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/hi
2 Data Center Misc: http://searchdatacenter.techtarget.com/news/article/0,289142,sid80_gci1215285,00.html
3 Canada CADDET: http://www.oee.nrcan.gc.ca/publications/infosource/pub/ici/caddet/english/r344.cfm?attr=20
4 Engineering Calculation based on 2006 IECC lighting code and existing lighting densities
5 Lighting Control Association: http://www.aboutlightingcontrols.org/education/papers/2007_occ_sensor_study.shtml
6 Intel: http://www.computerwoche.de/fileserver/idgwpcw/files/1434.pdf
7 ENERGY STAR Data Centers: http://www.energystar.gov/ia/partners/prod_development/downloads/EPA_Datacenter_Report_Co
8 LBL: http://hightech.lbl.gov/documents/UPS/Final_UPS_Report.pdf
9 Misc: http://www.80plus.org/docs/collatrl/print/80plus_benefits.pdf

EFFICIENT EQUIPMENT INCENTIVE PROGRAM

Government and Nonprofit Sector

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM 2009

Source:

1 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

RENEWABLE ENERGY PROGRAM

Government and Nonprofit Sector

Ground-Source Heat Pump

Refer to Pennsylvania Alternative Energy Portfolio Standard, TRM 2009

Source:

1 Based on Pennsylvania Alternative Energy Portfolio Standard, TRM, 2009

Photovoltaics

Annual kWh = CF * kW * 8760
kWh = 10,659 kWh
kW = 9 kW system
CF = 13.5% = capacity factor
8760 = hours/year

Source:

1 PV Watts, NREL http://rredc.nrel.gov/solar/codes_algs/PVWATTS/version1/