

PPL Electric Utilities
Winter Relief Assistance Program
Final Evaluation Report

April 2006

Table of Contents

Executive Summary	E1
Introduction.....	E1
Winter Relief Assistance Program.....	E3
WRAP Procedures and Specifications.....	E7
Contractor Survey	E10
Baseload Observations.....	E13
Full Cost Observations and Inspections.....	E14
Customer Survey.....	E15
Usage Analysis.....	E17
Payment Impacts.....	E19
Recommendations.....	E21
I. Introduction	1
A. Evaluation	1
B. Organization of the Report.....	3
II. Winter Relief Assistance Program	4
A. WRAP Background	4
B. Program Management and Administration.....	5
C. WRAP Needs Assessment.....	6
D. Targeting and Referrals.....	6
E. Eligibility	7
F. Program Enrollment.....	8
G. Job Types	9
H. Contractors.....	10
I. Training.....	10
J. Service Delivery.....	11
K. Energy Education.....	12
L. Program Coordination.....	13

M. Data and Reporting	13
N. Quality Control	14
O. Customer Feedback.....	15
P. Program Performance	15
III. WRAP Procedures and Specifications.....	16
A. Education Procedures.....	16
B. Technical Procedures.....	19
IV. Contractor Survey.....	27
A. Methodology	27
B. Contractor Background Information.....	28
C. PPL Support and Training	32
D. WRAP Service Delivery	35
E. Data Collection and Reporting.....	45
F. Quality Control	46
G. WRAP Overview	51
H. Inspections	52
I. Summary of Findings.....	55
V. Baseload Observations.....	59
A. Visit Introduction	59
B. Home Walkthrough.....	60
C. Measures	61
D. Energy Education.....	63
E. Summary	66
VI. Full Cost Observations and Inspections	67
A. Observations and Inspections	67
B. Observation Results	68
C. Inspection Results.....	70
D. Summary of Full Cost Observation and Inspection Findings.....	72
VII. Customer Survey	73
A. Methodology.....	73

B. Demographics	76
C. Enrollment and Reasons for Participation	80
D. Understanding of WRAP	81
E. Financial Obligations and Bill Payment Difficulties	84
F. Program Measures	85
G. Energy Education and Actions Taken.....	86
H. Program Impact.....	98
I. Satisfaction With Program Services	102
J. Summary of Findings.....	109
VIII. Usage Impacts	113
A. Data Collection and Cleaning	113
B. Energy Impact Analysis Methodology	113
C. WRAP Characteristics	115
D. Electric Impacts	118
E. Sample Attrition Analysis.....	127
IX. Payment Impacts.....	129
A. Methodology.....	129
B. Data Attrition	130
C. Payment Impact Results.....	131
X. Summary of Findings and Recommendations	133
A. Program Management and Administration.....	133
B. Program Specifications and Procedures.....	134
C. Contractor Survey	137
D. Baseload Observations.....	139
E. Full Cost Observations and Inspections.....	140
F. Customer Survey.....	142
G. Usage Analysis.....	144
H. Payment Impacts.....	146
I. Recommendations.....	146

Executive Summary

PPL Electric Utilities (PPL) implemented the Winter Relief Assistance Program (WRAP) in 1984 to help reduce electric bills and improve home comfort for low-income customers. The objectives of the WRAP are to reduce energy usage and bills of low-income customers and to increase low-income customers' ability to pay their electric bills, resulting in reduced arrearages. The program also aims to increase health, safety, and comfort for low-income occupants; create and maintain partnerships with community based organizations and contractors; and make referrals to other low-income assistance programs. PPL's 2002 Universal Services Program evaluation recommended that PPL conduct an evaluation of their WRAP. This evaluation will provide important information and statistics to PPL to help them improve their program, and will also meet BCS reporting requirements.

Introduction

The key objectives of the WRAP evaluation are to:

1. Determine the cost-effectiveness of the WRAP.
2. Develop standard questions so that PPL can measure the same criteria in future evaluations.
3. Comply with the PUC's Final order in conjunction with PPL's 2005 base rate increase for residential customers.

The evaluation of the WRAP is designed to address these objectives by answering the following questions:

1. What are the program goals and are these goals met?
2. What are the administration costs of the program? Could they be lower? How?
3. How effective is the program solicitation process? Is PPL doing everything possible to facilitate the receipt of program services to tenants?
4. Is the current audit mechanism effective? Does the Company adhere to the PUC's payback criteria? Is the Company installing all measures that meet the payback criteria?
5. Is the list of program measures comprehensive? Which measures are most and least effective?
6. Is the education process cost-efficient and effective? Are PPL staff, contractors and customers engaged in the educational process?

7. What is the level of post-inspection and is it appropriate? Does PPL use customer satisfaction surveys as part of the inspection process?
8. Does PPL use advisory panels and/or consult with weatherization experts? If not, why not? If so, are they effective?
9. Does PPL coordinate the WRAP with other weatherization programs? If not, why not? If so, how?
10. Is the Company's self-evaluation accurate and effective? Are there data issues with the annual data that PPL submits to the Pennsylvania State University on behalf of the PUC?
11. What are the energy savings and production goals and are they met? How is job tracking done to ensure that energy services are completed in a timely manner?
12. Does PPL measure the cost-effectiveness of the various agencies and contractors and if so, how? How does PPL address contractor performance issues?
13. Does PPL provide adequate training and support for contractors? Is there a mechanism for contractor feedback?

To answer these questions, we conducted the following evaluation activities.

1. *Evaluation planning and background research:* We revised the evaluation plan, met with PPL WRAP staff and contractors, collected and reviewed all documents related to the WRAP process, and interviewed PPL managers and staff that work on the WRAP. We also collected and analyzed program performance statistics.
2. *Review of specifications and procedures:* We reviewed program protocols to determine whether they can effectively provide energy efficiency services and education to low-income households.
3. *Contractor survey:* We conducted a written survey with contractors who provide work under PPL's WRAP. Contractors were asked to provide information on their understanding of program procedures, implementation of these procedures, and recommendations for the program.
4. *Baseload observations:* We observed delivery of baseload services in each of five service areas.
5. *Full cost observations and inspections:* We observed full cost audits and inspected completed full cost jobs in each of PPL's five service territories.
6. *Customer survey:* We conducted telephone interviews with customers who received WRAP services. The interviews provided information on understanding and satisfaction

with program services, usage reduction education received, and changes in occupant behavior that resulted from the education.

7. *Usage impacts:* We analyzed raw and weather-normalized electric usage before and after program services were received. We determined the extent to which the WRAP reduced the electric usage of program participants by type of service provided and by contractor.
8. *Payment impacts:* We analyzed cash payments and bill coverage rates, total payments (cash plus assistance) and total bill coverage rates, and balances before and after program services were received. We determined the extent to which the WRAP improved the affordability of electric service.

Winter Relief Assistance Program

This section describes the policies and procedures for PPL's WRAP. The findings in this section are based upon reviews of program documents, analysis of program statistics, and interviews with PPL personnel who have responsibilities related to WRAP.

Background

With approval from the Pennsylvania Public Utilities Commission (PUC), PPL developed a weatherization program for electric heating and/or electric water heating customers with income below 150 percent of the federal poverty level in 1984. The program was the first utility-run weatherization program in Pennsylvania. In 1988, the PUC required that all electric and gas utilities in Pennsylvania offer a low-income usage reduction program (LIURP) to customers in their service territories, and WRAP became part of LIURP.

PPL's WRAP annual expenditure goal was raised to \$6,250,000 in accordance with PPL's rate case settlement in 2005. With this budget, PPL expects to serve approximately 3,000 customers annually.

Program Management and Administration

WRAP is managed through the Regulatory Programs and Business Section, which is part of PPL's Customer Services Department. The Customer Relations Specialist is responsible for managing the overall program and for regulatory reporting to the PUC. There are five Customer Programs Directors (CPDs) who oversee the implementation of WRAP, as well as the other Universal Service Programs, in their geographical areas. Each area has a WRAP coordinator who is responsible for customer interactions and data entry.

While PPL requires that WRAP expenditures are within four percent of their expenditure goal, PPL reported that the PUC requires that PPL spend 100 percent of their goal. If PPL under spends in one year, they are required to make up the spending in the next year. If they overspend, they can take the difference out of the next year's budget. PPL spends a great deal of time and effort to ensure that they come within four percent of their expenditure goal.

Targeting and Referrals

PPL offers a reduced payment and arrearage forgiveness agreement as part of its Universal Service programs, known as the OnTrack Program. OnTrack customers are required to receive WRAP, and about sixty percent of WRAP referrals currently come from OnTrack.

WRAP Eligibility

Customers must meet the following requirements to be eligible for WRAP:

- The household income is at or below 200 percent of the federal poverty guidelines
- The primary customer is at least 18 years old
- The customer's home is individually metered and is the primary residence
- The home has not received WRAP in the past seven years
- The customer has lived in the home for at least nine months
- The customer has installed electric heat or uses a minimum of 6,000 kWh per year

Exceptions can be made to the last three requirements with PPL approval. Renters can receive WRAP services, but the landlord is required to provide written consent before the customer is approved for the program.

WRAP Enrollment

Customers must fill out the WRAP application over the phone with a PPL representative or agency caseworker, or fill out the application at home and mail it to PPL to be considered for WRAP. The WRAP coordinator reviews the completed WRAP application to determine if the customer meets the income eligibility criteria for WRAP, makes sure the customer has enough usage history, makes sure the customer's usage is high enough for WRAP, determines the seasonal usage, and determines the job type.

PPL prioritizes outreach by marketing WRAP to customers who have the highest electric usage history, greatest arrearages, and lowest income. However, the CPDs reported that the jobs are generally sent to the contractors on a first come, first serve basis, other than for prioritizing OnTrack High Usage Pilot customers or all OnTrack customers.

WRAP Job Types

There are three types of WRAP services that customers may receive:

1. **Baseload:** Customers with no electric heat will receive this type of service. Measures include CFLs, refrigerator replacement, air conditioner replacement, dryer venting, waterbed replacement, heating filter changing or cleaning, water heater set-back, and other measures that meet the PUC payback criteria.
2. **Low Cost:** In addition to the baseload measures, customers with electric hot water are eligible for water heater replacement, gravity film exchange¹, repairs of plumbing leaks, water pipe insulation, showerheads/aerators, horizontal washing machine pilot, and solar water heating.

¹ Gravity film exchange is a drain water heat recover system designed to reduce hot water usage.

3. Full Cost: Customers with installed electric heat or 3,600 kWh seasonal heating and/or cooling usage are eligible for this type of service. In addition to the baseload and water heating measures, they may receive heating and/or cooling measures, as well as additional follow-up energy education (site or phone). The additional measures for full cost customers include blower-door guided air sealing, insulation, heating repair/retrofit/replacement, cooling system repair and replacement, duct insulation and repair, caulking and weather stripping, and thermostat replacement.

PPL mails an education packet and provides referrals to other programs including state weatherization, gas utility programs, LIHEAP, OnTrack, and CARES for customers with usage below 6,000 annual kWh.

Contractors

PPL uses contractors to install weatherization measures and conduct audits, inspections, and energy education sessions. Contractors often use sub-contractors for specialized work including electrical, plumbing, and heating equipment repair. PPL assigns work to contractors based on customer need, location, skill sets, experience, and ability to handle increased workload.

Training

PPL provides training when there are new WRAP measures or procedures. In the past they have partnered with the state weatherization program to sponsor a contractor training, and they have had consultants observe and participate in installation and inspection work. PPL recently provided an education and communication training. PPL also offers sponsorships to the annual Affordable Comfort Conference and other training courses. PPL offers a training honorarium to contractors for mandatory training that is not conducted on the job site.

Service Delivery

Each WRAP job receives an energy audit to determine which measures should be installed. Contractors decide which measures to install based upon the customer interview, the customer's electric usage history, on-site diagnostics, prioritization of measures, and the PUC payback criteria.

While there is no maximum job limit, spending is defined based on pre-weatherization electric usage. Average program expenditures have increased since the introduction of solar water heating.

Contractors are expected to complete audits within two months. After the audit, contractors can move ahead with measure installation if the measures do not exceed the cost allowance and the measures are on PPL's measure list. Contractors are expected to complete measure installation within three months after the audit.

Energy Education

The goals of energy education are to empower customers to make good energy choices, to involve the customer in the process, and to help the customer understand the electric bill.

All WRAP participants receive at least one on-site energy education visit. Additional energy education is offered to customers with greater opportunities for usage reduction. The three types of energy education that are offered are:

1. Initial education session: The educator conducts the initial energy education session during the audit or the installation of measures for baseload and low cost customers. The educator conducts the initial session before the audit by telephone, during the audit, or during the inspection for full cost customers.
2. Follow-up education session: The educator provides follow-up education at the time of the inspection or within six months after the installation of measures by phone for full cost customers. The session will include a review of the installed measures, discussion of changes in electric use, and additional education on energy saving actions.
3. Remedial education session: PPL provides remedial education by telephone to customers whose usage increases by at least ten percent six months after the installation of measures. The educator attempts to identify reasons for the increased usage and to identify ways to reduce electric usage.²

Program Coordination

PPL does not track the extent to which WRAP service delivery is coordinated with other weatherization programs. The CPDs reported that their contractors often refer customers to other programs, but that coordination is difficult. Barriers to coordination with other programs include long waiting lists for state weatherization and Crisis, long waiting lists and stringent usage requirements for gas usage programs, and some customers with a combination of electric and gas heat do not have high enough usage to qualify for either program.

Data and Reporting

All WRAP jobs are tracked in a special database system called WRAP V. Contractors submit their job information to PPL on paper or on an electric job ticket that can be directly loaded into the WRAP V database. Beginning in early 2006, contractors were expected to use a new electronic web-based job ticket that can be loaded directly into the WRAP V database.

WRAP V contains the dates of WRAP service delivery, the measures that were installed, and the material and labor costs for each measure. The information in WRAP V, coupled with a narrative report, is submitted to the PUC for evaluation every April.

² PPL has not recently conducted the remedial energy education because they have not obtained the weather normalized data from their Information Systems Department. They recently received the data, and will soon begin calling 2005 customers.

Quality Control

PPL requires a site inspection for at least 80 percent of all WRAP jobs that receive at least \$750 in measures, not including appliance replacement costs. PPL usually inspects most full cost jobs, except those where the customer refuses the inspection. Contractors use phone inspections when job costs are below \$750, or when the customer refuses to cooperate with the site inspection.

WRAP Procedures and Specifications

The evaluation included a review of program protocols to determine whether they can effectively provide energy efficiency services and education to low-income households. The review focused on comprehensiveness of the procedures in installing all cost-effective measures, effectiveness of the energy measures and installation procedures, whether the procedures are clearly specified for consistent application, and quality control procedures.

Education Procedures

The following recommendations were made with respect to the education forms and procedures.

- *Education Visit:* The energy education procedures state that the initial session may be conducted before the audit, in conjunction with the audit, in conjunction with the installation of measures, or in conjunction with the inspection. The most effective time for the initial education session is probably during the audit. At this time, the provider will have the opportunity to investigate what is going on in the home, and determine what WRAP can do for the customer. Education can be most effectively provided in conjunction with these activities. We recommend that the procedures require that a certain amount of education be conducted in conjunction with the audit, that the homeowner be present at the time of the audit, and that the procedures strongly suggest that the initial education session is conducted at the time of the WRAP audit.
- *Actions Form:* The Money-Saving Tips form lists actions to save electricity in heating, cooling, water heating, kitchen appliances, laundry appliances, and other areas. It says to “Check those that will help you”. While this is fairly comprehensive and specific list of potential actions to reduce electric use, it encourages customers to check off all that apply, and does not prioritize actions by the potential for energy saving. The form should provide a summary at the bottom that lists the top three to five actions with the highest potential for saving that the customer is willing to take, and estimate monthly dollar savings that may result from each action.
- *Customer Profile Form:* The customer profile form collects information about the customer’s heating habits, cooling habits, and recent or expected changes in electric usage. It may be useful to also include other potential large opportunities for electric savings such as water leaks, use of dehumidifiers, sump pumps, use of second refrigerators or freezers, appliances or lights that are always left on.

Technical Procedures

This assessment of PPL's technical procedures was based on a review of:

- Written program procedures and manuals – specifically the WRAP Standards & Field Guide (September 2004) and the WRAP Contractors Manual (July 2003).
- Data from the program tracking system WRAP V.
- Additional data on measure costs and installation frequencies as provided by PPL staff.

The technical review uncovered some issues that may need to be addressed or clarified.

- *Cost Effectiveness and Measure Screening:* The WRAP design employs decision trees that were developed years ago to determine whether measures should be provided. We recommend that PPL review the underlying cost-effectiveness calculations for the current audit decision trees and update the calculations and decision rules as needed to reflect the best current estimates for costs and savings. PPL can hire a nationally recognized expert to update these specifications every other year. The cost of such an update would likely be under \$5,000.
- *Job Types and Spending Allowances:* We have some concern about including all homes with installed electric heat as full cost jobs even if they have insignificant space conditioning loads, as building shell measures are unlikely to be cost-effective in these homes. However, this concern is mitigated to some degree by the program's use of spending guidelines.
- *Refrigerator and Freezer Replacement:* The refrigerator usage temperature correction apparently adjusts metered usage to an assumed 75°F annual average space temperature. We would recommend default average temperatures of 71°F for living spaces and 65°F for basements. Another potential issue with the refrigerator metering is that the Contractor's Manual contains a data collection form that asks for the temperature but does not appear to use it in any calculation. Additionally, PPL's refrigerator replacement usage thresholds are generally too high, especially for refrigerators between 16 and 24 ft³, and they should be updated.
- *Lighting:* The program specifications state that CFLs are to be installed on lights used three or more hours per day. Given relatively recent sharp declines in the cost of CFLs, this threshold may be worth revisiting. Additionally, given current market prices, the higher cost providers should lower their prices.
- *Water Heater Replacement:* Water heater replacement may only be cost-effective when used to replace a leaky tank. Otherwise, this measure is primarily a home repair or perhaps a safety measure. Given that electric water heater efficiency factor (EF) merely reflects differences in standby losses it seems that water heater wraps and pipe insulation (or thermosiphon check valves) could effectively raise the existing unit's EF to levels close to the new unit at a much lower cost than replacement.

- *Window Air Conditioner Replacement:* The replacement decision should be based on the estimated cooling load from the billing data, the estimated proportion of that cooling load used by the existing unit, and the cost of the replacement. Additionally, the air conditioner section of the Standards & Field Guide includes a very rough unit sizing protocol that will generally lead to oversized units.
- *Ducts:* Research has found very little, if any, savings from sealing ducts in basements. Therefore, basement duct sealing should only focus on safety (return leaks) or comfort (large supply leaks).³
- *Blower Door Guided Air Sealing:* According to tracking system data, fewer than 60 percent of the homes in the full cost program received either a blower door test or blower door guided air sealing. It may be worth investigating why so many homes apparently do not receive this type of air sealing work (or whether the problem is with the tracking system itself).
- *Zonal Pressure Diagnostics:* The treatment protocol includes a 90 percent pressure drop rule of thumb that was developed for application to flat roof row house attics in Philadelphia (the job “passes” if the pressure drop across the ceiling is at least 90 percent of the total pressure drop). For homes with walk-up attics, the 90 percent pressure drop rule may be useful for identifying remaining problems, but should not be used instead of actual visual inspection because well-vented attics will tend to pass the test regardless of the quality of the air barrier.
- *Worst Case Depressurization Protocol:* The testing protocol specifies the position of interior doors as open, but the true worst case will occur when you close interior doors that do not connect to exhaust devices (or, alternately, close any door which makes the depressurization level increase).
- *Reflective Roofs:* This measure is unlikely to be cost-effective in homes with properly insulated attics. Reflective roof coating does provide a significant home repair benefit, but the energy savings alone are not likely to be able to pay for the measure in most cases.
- *Basements:* In general, basements should be considered as inside the conditioned space and therefore duct sealing and insulation have limited energy savings potential and basement ceiling insulation is also not worthwhile.
- *WRAP Standards and Field Guide:* The guide attempts to be specific enough to be useful for practitioners but the level of detail varies substantially between sections, providing perhaps too much detail in some areas while too little detail in others. At the time of the

³ Heat pumps would probably provide better savings and cost-effectiveness compared to gas furnaces because the air handler runs more frequently (due to lower delivery temperatures). However, we are not aware of any studies that show significant savings. Perhaps a somewhat bigger emphasis on "comfort" leaks could be placed in heat pump homes.

next major revision, consideration should be given to creating a more concise overall program field guide appropriate to all staff, along with more detailed guides with specific program standards for each more specialized contracting area such as insulation, air sealing, and HVAC.

Contractor Survey

This section summarizes key findings from the WRAP Contractor Survey.

- *Contractor Background Information:* Sixteen of PPL's 18 contractors responded to this survey. Twelve of these contractors reported that they perform WRAP full cost audits, 12 reported that they perform low cost installation, and 12 reported that they provide education. Eleven contractors reported that they perform baseload audits and 11 reported that they perform full cost installation. Most of these contractors have been providing these services for a long time. The average length of time contractors provided services was more than ten years for all services except inspection, in which some areas have had turnover, and solar, which was recently introduced.

Contractors are likely to also provide services for other weatherization programs. Ten contractors reported that they provide Pennsylvania Weatherization Program services, and a few contractors reported that they provide other gas and electric utility weatherization programs.

Contractors were likely to say that they use subcontractors to provide plumbing, electrical, and HVAC work for WRAP. Contractors were not likely to report that they use subcontractors for managing tasks, administration, education, inspections, audits, and measure installation.

- *PPL Support and Training:* Contractors were likely to report that they have regular contact with a PPL staff member. Twelve contractors said that they communicate with a PPL staff member by telephone or email at least once per week, and seven contractors said that they meet in person with a PPL staff member at least once per month.

Contractors said that each aspect of PPL-provided training – training quality, training focus, level of training, amount of training, and training overall – is good to very good. Contractors gave the lowest rating to the amount of training. However, the only area where more than a few contractors felt training was needed was in zonal testing.

- *Measure Selection Guidelines:* Contractors reported that the WRAP shell allowance, priority lists, available measures, and education guidelines work somewhat well to very well. Contractors reported that most WRAP audit forms were somewhat helpful to very helpful in completing the audit. Contractors rated the Customer's Usage History highest and the Window Audit Form, Door Audit Form, and Thermostat Audit Form lowest of all forms. Overall, eight contractors said that there are too many forms required for WRAP and five contractors said that the number of forms is about right.

Contractors were asked how often they meter various appliances in the home. Nine of fifteen responding contractors reported that their auditors always meter primary refrigerators, four said that their auditors always meter secondary refrigerators, and three said that their contractors always meter freezers. Nearly all contractors reported that their auditors never meter televisions, microwaves, stereos, medical equipment, waterbeds, fish tanks, breakers, and room air conditioner units.

- *Service Delivery:* Contractors were asked whether they face particular obstacles when scheduling customers for service delivery. A large share of contractors reported that they face problems due to outdated client contact information, other difficulties reaching clients, clients who are unavailable to be in the home during service delivery, and clients who are unaware of or who have forgotten about WRAP. Contractors make a mean six attempts to contact the customer by telephone, and an average of two attempts to contact the customer by mail before returning the job to PPL.

Contractors were asked whether they jointly deliver WRAP with the state weatherization program and gas utility programs. Eight of the contractors said that they jointly delivery WRAP with state weatherization, four said they jointly delivery with gas utility programs, and two said that they do joint delivery with county-funded weatherization.

Contractors were likely to report that they were unable to provide WRAP services to customers because the client moved, the client no longer wants WRAP services, work is beyond the scope of WRAP, and there are health and safety concerns in the home. The health and safety issues experienced in the greatest percentage of WRAP jobs are water and mold. Contractors reported that they encountered water problems in a mean of 14 percent of WRAP jobs and mold problems in a mean of 12 percent of WRAP jobs.

- *Audit Procedures:* All contractors who reported that they provide baseload audits said that they always discuss the electric bill with the customer and discuss actions to save with the customer. Contractors were least likely to say that they always provide savings estimates for measures and actions. Six contractors reported that they always provide savings estimates for measures, and five contractors reported that they always provide savings estimates for actions to save during baseload audits. Likewise, contractors were least likely to report that they always provide savings estimates for measures and actions during full cost audits. One contractor said that they never conduct a home walkthrough with the customer during a baseload audit.
- *Data Collection and Reporting:* Eight contractors reported that they use the electronic job ticket. Reasons that contractors offered for not using the electronic job ticket included that the job ticket has not yet been made available or the contractor is not able to use it, and that the current system used by the contractor works better than the electronic job ticket. Contractors who currently use the electronic job ticket said they are satisfied with it overall.

Contractors provided input about moving to the web-based job ticket. Five contractors said that they thought the web-based system would be an improvement over the current

system. Some contractors mentioned potential problems with the web-based job ticket, including that it might require more staff time to enter data and that contractors could face additional expenses, such as high-speed internet service.

- *Quality Control:* Contractors perform quality control on a high percentage of WRAP jobs. Contractors reported that they review data collection forms for a mean of 75 percent of jobs, perform on-site inspection for a mean of 41 percent of jobs, contact customers by telephone for a mean of 40 percent of jobs, and observe work while it is being done for a mean of 32 percent of jobs.

Most contractors reported that they monitor WRAP staff performance using customer complaints and comments, field observations by other staff or managers, inspection of work by other staff or managers, and WRAP Action Sheets. Fewer contractors reported that they use these methods to monitor the performance of subcontractors. Contractors were less likely to report that they conduct on-site observations of subcontractors, compared to WRAP staff.

Contractors were likely to report that they received few action sheets in the year prior to the survey. Six of the 11 contractors who reported that they provide full cost WRAP services said that they received 10 or fewer action sheets, and one contractor received more than 10 action sheets. Contractors were more likely to report that they received action sheets for problems related to weather stripping than for any other problem.

- *WRAP Overview:* Contractors reported that each general program characteristic – program specifications, communication with PPL, data reporting, invoicing, and the program overall – is working somewhat well to very well. Recommendations for improvements to WRAP included providing evaluation reports and savings results to contractors and providing more training for WRAP contractors.
- *Inspections:* Inspectors were asked to provide additional information on the inspection process. When asked about barriers to completing WRAP inspections, responses included that there are customers who are uncooperative in scheduling inspections, there is a lack of follow-up provided to inspectors about action sheets, that customers are unavailable for inspections, there is incomplete audit data, and there is incorrect customer contact information.

Inspectors were asked whether they implement various aspects of inspection procedures. They were most likely to report that they conduct a customer interview, assess the education conducted during the audit, conduct a home walkthrough with the customer, and inspect all installed measures during WRAP inspections. Six inspectors reported that they conduct an initial education session during WRAP inspections, and six said that they conduct a follow-up education session.

Inspectors reported that the most common problems found during inspections were diagnostic testing and customer complaints. Problems related to diagnostic testing are

found in a mean of 27 percent of inspections and customer complaints are found in a mean of 22 percent of inspections.

Inspectors were asked how responsive PPL is to their comments and suggestions. One inspector rated PPL as not at all responsive, two inspectors rated PPL as somewhat responsive, and four inspectors rated PPL as very responsive.

Baseload Observations

APPRISE conducted observations of baseload service delivery provided by five of PPL's WRAP contractors, one in each of PPL's service areas. Each contractor was observed for two customer visits. The baseload observations focused on how well contractors addressed opportunities for baseload electric use reduction, and whether education was effectively provided to the occupant.

- *Visit Introduction:* The observations showed that some of the auditors did a very thorough job of explaining the program and assessing the customers' needs, but some auditors need to improve the content of the information provided to the customer at the introduction of the audit.
- *Home Walkthrough:* One of the contractors did not conduct a walkthrough of the home. He remained in the kitchen throughout the visit except to install CFLs. One other contractor did not do a complete walkthrough. The other three contractors did a thorough walkthrough and addressed all issues in the home.
- *Measures:* Contractors monitored refrigerators in six of the ten homes observed. In two of the cases the refrigerator was new, and in two other cases there were justifiable reasons why the refrigerators were not monitored. There was one instance in which a contractor explored the opportunity for a two-for-one swap, but the customer refused to give up the extra appliance. In two other cases, there was an opportunity that the contractor did not explore.

To determine which lights to replace, two of the contractors went through the home, room by room, and asked how long the lights in each room were used each day. Two of the other contractors only asked the customer which bulbs were used three or more hours per day. The other contractor asked the customer whether any bulbs were used four or more hours per day.

- *Education:* All of the ten baseload observations were considered to include the energy education visit. In most of the cases the contractor engaged the customer as an active participant in the process and found the customer's self-interest in WRAP participation. The contractor also usually reviewed the measures that were installed or ordered, analyzed the customer's electric bill, reviewed the customer's heating and cooling systems and appliances, and encouraged the customer to ask questions. The one

contractor who did not do the walkthrough also did not analyze the customers' electric uses.

Most of the contractors did a good job of finding those customer actions that could have the biggest impact on the electric use. The one exception was the contractor that did not do the walkthrough.

- *Summary:* All of the auditors performed consistently in both of their observed jobs. Two of the auditors did an excellent job. They thoroughly explained WRAP, explained the customer's electric uses and the costs of those uses, worked with the customer to develop actions to reduce electric use, and estimated how much the customer could save through those actions. Two other auditors did a good job.

One of the auditors did not do the job as specified by PPL. He did not walk through the home with the customer to determine the customer's electric uses. He did not provide information to the customer about his/her home, but provided the same actions and cost estimates to both customers from a pre-written sheet.

Full Cost Observations and Inspections

The evaluation included observations and inspections of full cost service delivery provided by five of PPL's WRAP contractors, one in each of PPL's service areas. Each contractor was observed for one customer visit (usually the audit visit), and had the work of another customer's home inspected.⁴

- *Observations and Inspections Conducted:* There were some limitations to this evaluation work. Due to the budget for the evaluation, we did not conduct observations of all aspects of service delivery. Therefore, we did not observe the energy education visit for any of these customers, and in most cases we did not see the actual work performed. For observations, we assessed whether the correct decisions were made based upon the auditors' assessments and recommendations, the results of diagnostic tests conducted during the audit visits or recorded on forms during later visits that were not observed, and the actual work completed as recorded in the paperwork provided by the contractors.
- *Observation Findings:* While none of the observations included what was considered the education visit, the contractors did a good job of communicating with the customers. While two of the visits were installation visits (and the other four were audits), all of the contractors inspected the home and most discussed actions to reduce electric usage with the customers. The contractors did not discuss the costs of the customers' usage and generally did not estimate how much the customer could save by taking certain actions, but presumably these efforts would be undertaken during the education visit.

⁴ One agency had two observations rather than one inspection and one observation.

In general the evaluators were impressed with the work that was conducted. They felt that all of the contractors did a good job and cared about their work.

- *Inspection Findings:* There were missed opportunities found in three of the four homes inspected. The missed opportunities included solar water heating, connections that remained between the house and the garage and the house and the attic, incomplete air sealing, and incomplete insulation work.

Some of the data collection received less than the highest ratings because the evaluator was not able to duplicate the tests in one home, and not all of the forms were used in another home. The measure selection and the appropriateness of installed measures were rated good or very good. Most contractors received the top rating with respect to effort and appropriateness of selected measures.

- *Recommendations from the Full Cost Observations:* The evaluator was generally impressed with the quality and comprehensiveness of work conducted by the contractors that were observed and inspected. The general recommendations that result from this work are summarized below.
 - *One Set of Required Forms:* Many of the contractors used different types of paperwork for the PPL WRAP. This made it difficult to determine whether all of the required paperwork had been completed and it made it difficult to assess and compare jobs. PPL should require contractors to use PPL forms, rather than developing their own forms for the work. They can provide the contractor with a check box for each form that is not applicable, but all forms should be included with every job.
 - *Instructions for Forms:* Some of the contractors were not sure what was required for some of the forms. Because PPL's technical manual is so comprehensive, it is not feasible for the contractors to look in this manual for instructions. Rather, PPL should provide instructions for each form on the back of the form, so that the contractor can easily flip the form over and read the instructions if necessary. Such instructions would improve the probability that all forms were filled out correctly.
 - *Diagnostic Tests:* All applicable diagnostic tests should be required at the audit visit. In some cases blower door and pressure differentials were not conducted during the audit. They should be required so that the auditor can accurately predict what work is needed during the measure installation visit.

Customer Survey

Key findings from the customer survey are summarized below.

- *Survey Respondents Profile:* Households who received WRAP services were likely to have vulnerable members. About 45 percent of households have at least one disabled member and 29 percent have at least one elderly member. These households were also

likely to have a difficult time finding employment that met all of their income needs; fifty-eight percent of respondents reported that the highest level of education reached by any member of their household was high school or less. More than one-third of respondents reported that at least one member of their household had been unemployed and looking for work in the year prior to the survey.

- *Income:* Respondents were asked for the range of their annual household income. Twenty percent of clients have an annual income of \$10,000 or less, 41 percent of clients have an annual income between \$10,001 and \$20,000, and 26 percent of clients have an annual income of \$20,001 or more. Forty-three percent of respondents reported that they earned income from wages, salaries, or self-employment in the 12 months preceding the survey. Twenty-seven percent of respondents reported that they received retirement income.
- *Assistance:* Thirty-three percent of respondents reported that they received public assistance, 33 percent said they received non-cash benefits such as food stamps or subsidized housing, and 45 percent said they received LIHEAP.
- *Understanding of the Program:* Eighty-eight percent of respondents reported that they understand the benefits of WRAP. Thirty-six percent of respondents said that energy education was a benefit of the program, 35 percent said lower electric bills was a benefit, and 18 percent said lower electric use was a benefit.
- *Financial Obligations and Bill Payment Difficulties:* Fifty-nine percent of respondents reported that it was very difficult or somewhat difficult to pay their PPL bill. Fifteen percent of respondents reported that they were unable to use their main source of heat in the year prior to the survey due to a broken heating system, three percent said that their electric service was discontinued, and three percent said that their gas service was discontinued.
- *Measures:* The survey included questions about the measures clients received. As a result of WRAP, 39 percent of respondents received a new refrigerator, 11 percent received a new air conditioner, and nine percent received a new water heater. More than half of respondents, 53 percent, reported that they received air sealing or insulation from the program, seven percent said they received window tinting, and three percent said they received a reflective roof coating.
- *Energy Education and Actions Taken:* Ninety-three percent of respondents said that they were home for the service provider's visit, and 85 percent said they were home for the entire visit.

The survey included questions that addressed whether the provider explained the electric bill and suggested actions that the customer could take to save electricity. Sixty-five percent of respondents said that the service provider explained how electric use is measured. Eighty-three percent of respondents said that the provider recommended actions, 63 percent said the provider gave savings estimates for those actions, and 64

percent said the provider gave them a written plan of actions to save electricity. Eighty percent of respondents said one of the providers left electricity-saving information.

- *Program Impact:* Respondents were asked whether they had reduced their overall electric usage since receiving WRAP services. Nearly three-quarters of respondents said that they had reduced their electric usage. Full cost customers were more likely than baseload customers to report that they had reduced their overall electric usage. More than half of respondents, 55 percent, also said that their PPL bill was lower than it was prior to receiving WRAP services.

Respondents were asked about the impact of WRAP on the comfort of their home. Forty percent of respondents said that the warmth of their home in the winter had improved since receiving WRAP services. Full cost customers and customers with electric heat were most likely to report that the warmth of their home had improved. Thirty-two percent of respondents reported that the temperature of their home in the summer had improved since receiving services.

The survey asked respondents how important WRAP had been in helping them meet their needs. The majority of respondents, 86 percent, said that WRAP was very important or somewhat important. However, nearly half of respondents, 49 percent, said that they need more assistance to pay their PPL bills.

- *Satisfaction with Program Services:* More than 90 percent of respondents reported that they were very satisfied or somewhat satisfied with the measures and services they received from WRAP, including refrigerators, air conditioners, water heaters, air sealing and insulation, reflective roof coating, and window tinting.

Overall, 93 percent of respondents reported that they were very satisfied or somewhat satisfied with WRAP. Full cost customers and customers with electric heat were most likely to report that they were very satisfied or somewhat satisfied with the program.

Usage Analysis

This section analyzes the impact of the WRAP on participants' electric usage. The Usage Analysis was conducted by Blasnik and Associates.

Data Collection and Cleaning

The impact analysis of WRAP employed data from three primary sources: the WRAP tracking system database, monthly electric usage data for program participants from PPL, and weather data from the National Weather Service.

Energy Usage Impact Methodology

We employed a pre/post treatment/comparison design for assessing the electricity savings from WRAP. We analyzed the change in weather-adjusted annual usage for participants for the years before and after treatment and performed the same analysis for a comparison group composed of future year participants. We then calculated net program savings as the

average energy savings for the participants minus the average savings for the comparison group.

This evaluation focused on participants from 2003 (as identified by their inspection date) and chose a comparison group from customers treated in 2004 and later.

WRAP Characteristics

About 60 percent of the WRAP participants also participate in OnTrack bill payment plan. More than 70 percent live in single-family homes. Fewer than half of all participants are renters.

About half of the WRAP participants receive a refrigerator and/or freezer replacement with somewhat greater replacements in the low cost program and fewer in the full cost program. Refrigerators and freezers are responsible for about half of the baseload program measure costs. The baseload program also replaced air conditioners in about 18 percent of all homes while the low cost program replaced air conditioners twice as often. The low cost program spends more than twice as much on measures as the baseload program, with most of that difference attributable to water heater replacements and other water heating measures, but also with higher spending on refrigerators, air conditioner replacements, and other appliance repairs/replacements.

About a quarter of full cost participants received significant attic insulation work, while one in six received major window and door work and a comparable proportion received significant blower-door guided air sealing work. The program spent nearly as much on infiltration control without a blower door (e.g., caulking and weatherstripping) as it did on more advanced blower door work.

Electric Impacts

Average annual net savings were estimated at 836 kWh for the baseload program, 500 kWh for the low cost program and 1,767 kWh for the full cost program.

The net savings estimates for the baseload and full cost programs were generally consistent with expectations for this type of program and quite similar to PPL's internal evaluation estimates of 709 kWh for the baseload program and 1,765 kWh for the full cost program. The low cost program savings appear low at just 500 kWh, especially when compared to PPL's internal estimate of 1,090 kWh. One might expect the low cost program to save at least as much as the baseload program since it includes slightly more refrigerator replacements and comparable lighting work and then adds in water heater replacements, other water heating measures, and more air conditioner replacements. Further explorations, described later, have led to the conclusion that this result is not very reliable, which is also reflected in the wide band of uncertainty that covers from -8 kWh to 1008 kWh in savings.

We explored variations in usage and net savings based on a variety of treatment and housing characteristics.

- Houses that received refrigerator replacements saved much more than those that did not, particularly for the baseload program.

- OnTrack participants tended to use a little more and save a little more than other participants (and also had slightly greater installation rates for all major measures).
- Baseload program houses that received air conditioner replacements tended to save about 200 kWh more than those that didn't (given the same refrigerator replacement status).
- Savings were approximately equal for all three housing types in the baseload program, but savings were lowest for apartments in the full cost program (and their usage was lowest).

Measure Saving Analysis

We employed multiple regression analysis to estimate savings associated with multiple measures at once by modeling observed savings as a function of program treatments and other factors. We developed separate regression models for the baseload and full cost programs with dichotomous (yes/no) variables to represent whether major measures had been installed.

We assessed the relative cost-effectiveness of each measure using the regression model savings and the average treatment costs to develop an estimated cost per annual kWh saved. For comparison purposes, the overall cost per kWh savings was \$0.94 for the baseload program, \$2.80 for the low cost program, and \$1.27/kWh for the full cost program. The low cost would be at \$1.27/kWh if the savings were actually 1,100 kWh instead of the 500 kWh found in the main billing analysis.

Refrigerator replacement in the baseload program and blower door guided air sealing in the full cost program were the most cost-effective measures. Air conditioner replacements and major window and door work were the least cost-effective measures with measured savings results.

The lack of statistically significant savings for water heater replacement is cause for concern. The theoretical justification for the measure is not very strong given that the vast majority of the difference in rated efficiencies between new and existing units is due to tank and pipe losses that can mostly be mitigated through tank and pipe insulation.

Overall, the analysis suggests that WRAP should re-assess the air conditioner replacement targeting strategy, water heater replacement as an efficiency measure, and potentially excessive window and door spending on some jobs. Refrigerator replacements, insulation and blower door guided air sealing should be pursued and perhaps expanded if further opportunities can be identified.

Payment Impacts

This section examines the impact of the WRAP on customer bills and coverage rates. The purpose of this analysis was to determine whether WRAP reduces bills to the point that customers can meet their payment obligations.

Methodology

WRAP customers who received a final inspection in 2003 were included as potential members of the study group. We used 2004 WRAP recipients as the comparison group for this evaluation. We used data for these participants for the two years preceding WRAP service delivery, to compare their change in bill coverage in the years prior to service delivery to the treatment group's change in bill coverage after enrolling. Because we analyze the bills and payments for this group before the customers received program services, changes in bills and behavior should be related to factors that are exogenous to the program.

We examined pre and post-participation statistics. The difference between the pre and post-treatment statistics for the treatment group is considered the gross change. This is the actual change in behaviors and outcomes for those participants who were served by the program. Some of these changes may be due to the program, and some of these changes are due to other exogenous factors, but this is the customer's actual experience. The net change is the difference between the change for the treatment group and the change for the comparison group, and represents the actual impact of the program, controlling for other exogenous changes.

Payment Impact Results

Below we summarize the results from the payment impact analysis.

- *Total bill:* Customers who received program treatments had a small gross reduction in their total bill of \$21 and a larger net reduction of \$118.
- *Cash payments:* Cash payments increased by \$39 as compared to the comparison group.
- *LIHEAP payments:* The program recipients experienced a small decline in the amount of LIHEAP cash and crisis assistance received.
- *OnTrack Credits:* OnTrack participants had a significant gross increase in the average amount of OnTrack credits received, an increase of \$72. However, the comparison group had a larger increase in OnTrack credits, resulting in a net decline for the treatment group of \$49.
- *Total payments:* Customers increased their total payments by \$54. However, compared to the comparison group, there was a net decline in total payments of \$58.
- *Cash coverage rates:* The treatment group had a 4 percentage point gross increase and a 13 percentage point net increase in cash coverage rates.
- *Total coverage rates:* The treatment group increased their total coverage rates from 93 percent in the year prior to service delivery to 100 percent in the year following service delivery, an 8 percentage point gross increase. The net increase in total coverage rates was 12 percentage points.

This analysis showed that WRAP enabled customers to reduce their bills and to significantly increase their bill payment coverage rates, achieving its goal of providing more affordable bills for low-income customers.

Recommendations

Recommendations are summarized below, divided by whether they refer to WRAP management and administration, forms, procedures, services and measure selection, contractors, inspections, or training.

Management and Administration

1. Focus less attention on spending 100 percent of the WRAP budget. (The budget would be less time consuming for PPL if they were not required to separately track the solar water heating expenditures.)
2. Encourage coordination between WRAP and state weatherization and/or gas utility weatherization programs. When the next WRAP job ticket and database enhancement is completed, consider adding a field for the contractor to note whether the job was coordinated.
3. Require contractors to use the web-based job ticket.
4. Encourage CPDs to observe each of their contractors in the field at least once each year.
5. Conduct occasional field observation on baseload jobs, and follow-up with more observations for contractors who don't meet expectations.
6. Create a more concise standards and field guide at the next scheduled update. Create separate and more detailed guides that discuss specific program standards for more specialized contracting areas.
7. If more than six months elapse before a customer application is sent to the contractor, re-contact the customer to confirm program interest and contact information prior to sending the job to the contractor.

Forms

1. Develop one set of forms that is required for all WRAP jobs (perhaps one set for baseload jobs and one set for full cost jobs.)
2. Revisit the audit forms and determine whether they can be consolidated.
3. Update the energy cost sheet for changes in electric prices.
4. Provide a summary at the bottom of the Money-Saving Tips form with the top three to five actions with the greatest potential for saving and estimate the monthly dollar savings that may result from each action.
5. Enhance the Customer Profile Form so that it includes other opportunities for electric usage reduction including water leaks, use of dehumidifiers, sump pumps, use of second refrigerators or freezers, appliances or lights that are always left on.

Procedures

1. Require diagnostic testing at the audit visit.

Services and Measure Selection

1. Update the cost effectiveness calculations for the audit decision trees so they take account of changes in prices, as well as the best estimates for costs and savings.
2. Reconsider the classification of all homes with electric heat as full cost jobs. Reconsider classification of other job types as well.
3. Change the temperature correction for refrigerator usage adjustment and make sure it is used in the usage calculation.
4. Update usage thresholds for refrigerator replacement.
5. Revisit thresholds for CFL replacement.
6. Revisit water heater replacement guidelines and consider water heater wraps and pipe insulation as an alternative.
7. Reassess window and door spending.⁵
8. Expand refrigerator replacements, insulation and blower door guided air sealing if further opportunities can be identified.
9. Base the window air conditioner replacement decision upon the estimated cooling load from the billing data, the estimated proportion of that cooling load used by the existing unit, and the cost of the replacement.
10. Revise the protocol for window air conditioner sizing.
11. Focus basement duct sealing on safety or comfort.
12. Investigate why fewer than 60 percent of full cost jobs receive blower door guided air sealing.⁶
13. Utilize visual inspection for homes with walk-up attics when conducting zonal pressure diagnostics.
14. Close interior doors when conducting the worst case depressurization test.
15. Reconsider the use of reflective roof coating, as it is unlikely to be cost-effective in homes with properly insulated attics.

Contractors

1. Require highest cost providers to lower measure costs.⁷
2. Require all auditors to conduct a thorough home walkthrough and inspection.
3. Require all contractors to use the web-based job ticket, as currently planned.

Inspections

1. At the next time the database is enhanced, consider including a date for action sheet resolution so that inspectors can check to see if action sheets have been addressed.

Training

1. Review WRAP education requirements and expectations with contractors.
2. Reinforce the importance of the walkthrough for baseload jobs with all WRAP contractors.

⁵ PPL reports that this spending was lower in 2004 than in 2003 as they had discussed expenditures on windows and doors with one contractor who had excessive spending in this area.

⁶ PPL reports that this is a data tracking issue that will be addressed with the new web-based job ticket.

⁷ PPL reports that this procedure will be enabled by the new data system.

3. Provide additional training to contractors on the importance of refrigerator 2-for-1 swaps, and train contractors to work with customers to obtain their acceptance of this measure.
4. Review CFL replacement procedures with contractors.

I. Introduction

PPL Electric Utilities (PPL) implemented the Winter Relief Assistance Program (WRAP) in 1984 to help reduce electric bills and improve home comfort for low-income customers. The objectives of WRAP are to reduce energy usage and bills of low-income customers and to increase low-income customers' ability to pay their electric bills, resulting in reduced arrearages. The program also aims to increase health, safety, and comfort for low-income occupants; create and maintain partnerships with community based organizations and contractors; and make referrals to other low-income assistance programs. PPL's 2002 Universal Services Program evaluation recommended that PPL conduct an evaluation of their WRAP. This evaluation will provide important information and statistics to PPL to help them improve their program, and will also meet BCS reporting requirements.

A. *Evaluation*

The key objectives of the WRAP evaluation are to:

1. Determine the cost-effectiveness of the WRAP.
2. Develop standard questions so that PPL can measure the same criteria in future evaluations.
3. Comply with the PUC's Final order in conjunction with PPL's 2005 base rate increase for residential customers.

The evaluation of the WRAP is designed to address these objectives by answering the following questions:

1. What are the program goals and are these goals met?
2. What are the administration costs of the program? Could they be lower? How?
3. How effective is the program solicitation process? Is PPL doing everything possible to facilitate the receipt of program services to tenants?
4. Is the current audit mechanism effective? Does the Company adhere to the PUC's payback criteria? Is the Company installing all measures that meet the payback criteria?
5. Is the list of program measures comprehensive? Which measures are most and least effective?
6. Is the education process cost-efficient and effective? Are PPL staff, contractors and customers engaged in the educational process?

7. What is the level of post-inspection and is it appropriate? Does PPL use customer satisfaction surveys as part of the inspection process?
8. Does PPL use advisory panels and/or consult with weatherization experts? If not, why not? If so, are they effective?
9. Does PPL coordinate the WRAP with other weatherization programs? If not, why not? If so, how?
10. Is the Company's self-evaluation accurate and effective? Are there data issues with the annual data that PPL submits to the Pennsylvania State University on behalf of the PUC?
11. What are the energy savings and production goals and are they met? How is job tracking done to ensure that energy services are completed in a timely manner?
12. Does PPL measure the cost-effectiveness of the various agencies and contractors and if so, how? How does PPL address contractor performance issues?
13. Does PPL provide adequate training and support for contractors? Is there a mechanism for contractor feedback?

To answer these questions, the evaluation consisted of the following activities.

1. *Evaluation planning and background research:* We revised the evaluation plan, met with PPL WRAP contractors, collected and reviewed all documents related to the WRAP process, and interviewed PPL managers and staff that work on the WRAP. We also collected and analyzed program performance statistics.
2. *Review of specifications and procedures:* We reviewed program protocols to determine whether they can effectively provide energy efficiency services and education to low-income households.
3. *Contractor survey:* We conducted a written survey with the contractors who provide work under PPL's WRAP.
4. *Baseload observations:* We observed delivery of baseload services in each of five service areas.
5. *Full cost observations and inspections:* We observed one full cost audit and inspected one completed full cost job in each of PPL's five service territories.
6. *Customer survey:* We conducted telephone interviews with customers who received WRAP services.
7. *Usage impacts:* We analyzed raw and weather-normalized electric usage before and after program services were received.

8. *Payment impacts:* We analyzed cash payments and bill coverage rates, total payments (cash plus assistance) and total bill coverage rates, and balances before and after program services were received.

B. Organization of the Report

Nine sections follow this introduction.

- 1) *Section II – Winter Relief Assistance Program:* Provides a detailed description of the Winter Relief Assistance Program.
- 2) *Section III – WRAP Procedures and Specifications:* Provides a review of WRAP education and technical protocols, focusing on comprehensiveness, effectiveness, and communication.
- 3) *Section IV – Contractor Survey Results:* Provides a summary of the findings from the survey of WRAP contractors.
- 4) *Section V – Baseload Observation Results:* Provides a summary of the findings from the baseload observations, including the opportunities for electric use reduction that were addressed, and the implementation and effectiveness of education procedures.
- 5) *Section VI – Full Cost Observations:* Provides a summary of the findings from the full cost observations, including contractors’ adherence to program protocols, quality of work provided, quality of interaction with the occupants, and opportunities for improvements.
- 6) *Section VII - Customer Survey Results:* Provides a summary of the findings from the survey of WRAP recipients.
- 7) *Section VIII – Usage Impacts:* Furnishes a summary of the impact that WRAP has had on the electric usage of program participants.
- 8) *Section XIV – Payment Impacts:* Furnishes a summary of the impact that WRAP has had on the payment behavior of program participants.
- 9) *Section VII – Summary of Findings and Recommendations:* Provides a summary of the findings and recommendations from all of the evaluation activities.

APPRISE prepared this report under contract to PPL. PPL facilitated this research by furnishing program data to APPRISE. Any errors or omissions in this report are the responsibility of APPRISE. Further, the statements, findings, conclusions, and recommendations are solely those of analysts from APPRISE and do not necessarily reflect the views of PPL.

II. Winter Relief Assistance Program

PPL Electric Utilities (PPL) implemented the Winter Relief Assistance Program (WRAP) in 1984 to help reduce electric bills and improve home comfort for low-income customers. The objectives of the WRAP are to reduce energy usage and bills of low-income customers and to increase low-income customers' ability to pay their electric bills, resulting in reduced arrearages. The program also aims to increase health, safety, and comfort for low-income occupants; create and maintain partnerships with community based organizations and contractors; and make referrals to other low-income assistance programs. This section describes the policies and procedures for PPL's WRAP. The findings in this section are based upon reviews of program documents, analysis of program statistics, and interviews with PPL personnel who have responsibilities related to WRAP.

A. WRAP Background

The Pennsylvania Public Utility Commission (PUC) ordered PPL to develop a weatherization program for electric heating and/or electric water heating customers with income below 150 percent of the federal poverty level in 1984. The program was implemented with a \$2 million annual budget, and offered insulation, storm windows, caulking and weather-stripping, and water heating measures. It was the first utility run weatherization program in Pennsylvania.

In 1988, the PUC required that all electric and gas utilities in Pennsylvania offer a low-income usage reduction program (LIURP) to customers in their service territories, and WRAP became part of LIURP. PPL increased WRAP funding to \$3 million annually and added energy education to the program services. Program services were enhanced again in 1992, 1995, and 1998 with blower door testing, air infiltration measures, education and CFLs for baseload customers, and refrigerator replacement.

The PUC increased PPL's WRAP annual expenditure goal to \$5,700,000 with the implementation of universal service in 1999, and to \$6,250,000 in accordance with PPL's rate case settlement in 2005. With this budget, PPL expects to serve approximately 3,047 customers annually.⁸ Actual service delivery expenditures and customers served for 2003 through 2005 are shown in the table below.⁹

Table 1
WRAP Expenditures and Customers Served
2003 – 2005

	2003	2004	2005
WRAP Expenditures	\$5,970,554	\$5,765,336	\$6,328,715

⁸ PPL does not have an annual WRAP production goal, just an expenditure target.

⁹ Average costs increased because of the solar water heating and the OnTrack High Usage Pilot.

	2003	2004	2005
Customers Served	2,948	2,356	2,422
Average Expenditure	\$2,025	\$2,447	\$2,613

WRAP objectives, established by the PUC are to:

1. Reduce the energy usage and electric bills of low-income customers.
2. Increase the ability to pay/decrease arrearages of low-income customers.

Secondary objectives include:

1. Improve comfort for low-income customers.
2. Promote safer living conditions of low-income customers through the reduction of secondary heating devices.
3. Maintain/establish partnerships with social service agencies, community based organizations (CBOs), and local contractors to ensure maximum and timely assistance.
4. Make tailored referrals to Company and other assistance programs such as OnTrack, Operation HELP, LIHEAP, and other weatherization programs.

B. Program Management and Administration

WRAP is managed through PPL's Customer Services Department. The Customer Relations Specialist is responsible for managing the overall program and for regulatory reporting to the PUC. She is responsible for dividing the WRAP budget between PPL's five geographical areas. She is also responsible for solar water heating services, including assigning jobs to contractors and overseeing the budget.

There are five Customer Programs Directors (CPDs) who oversee the implementation of WRAP, as well as the other Universal Service Programs, in their geographical areas. PPL's service territory is divided into the Allentown, Hazleton, Scranton, Harrisburg/Montoursville, and Lancaster areas, each with a CPD. The CPDs are responsible for allocating a contract amount to each of the contractors in their region, negotiating contracts with the contractors, overseeing the work of the contractors, approving exceptions, approving invoices, monitoring the budget, and supervising staff. CPDs review their contractors' prices each year. CPDs do not usually inspect the work of the contractors, except when there is a problem. Each CPD has a WRAP coordinator who is responsible for customer interactions and data entry.

PPL does not have an advisory panel for WRAP. However, the contractors are involved in the evolution of the program and provide suggestions for program improvements and pilot

measures. PPL has utilized consultants to develop field standards, determine areas where training is needed, and conduct supplemental training.

While PPL requires that WRAP expenditures are within four percent of their expenditure goal, PPL reported that the PUC requires that PPL spend 100 percent of their goal. If PPL under spends in one year, they are required to make up the spending in the next year. If they overspend, they can take the difference out of the next year's budget.

PPL spends a great deal of time and effort to ensure that they come within four percent of their expenditure goal. They review expenditure reports on a monthly basis at the beginning of the year, on a weekly basis by October, and every other day beginning in November. They log every invoice into Excel to make sure that the budget is on target. Tracking the solar water heating expenses separately has added more time to this process.

C. WRAP Needs Assessment

PPL used the 2000 Census to estimate that there are approximately 240,000 customers with income below 200 percent of the Federal Poverty Level in their service territory. They further estimate that approximately 143,000 of these customers have high enough usage to be eligible for WRAP, and have not received WRAP in the past seven years. However, they assert that there are fewer eligible customers because some of these customers do not have a PPL account, have homes that are in such poor condition that services cannot be safely provided, or refuse to apply for WRAP because they do not want to receive social programs or because they are satisfied with their bills and comfort.

D. Targeting and Referrals

PPL offers a reduced payment and arrearage forgiveness agreement as part of its Universal Service programs, known as the OnTrack Program. OnTrack customers are required to receive WRAP, and about sixty percent of WRAP referrals currently come from OnTrack.

Customers are usually referred for WRAP services in four ways:

1. Customer Contact Center (CCC) referrals – Customer Service Representatives and Collection Assistants are trained to refer payment-troubled customers or customers experiencing hardships to WRAP. The WRAP support person in the appropriate area follows up with a letter and/or phone call.
2. OnTrack Agency referrals – Customers who apply for OnTrack are required to apply for WRAP if they meet the usage criteria. The customer completes the WRAP application while at the agency or the agency sends a referral to the appropriate area in PPL for follow-up.
3. Advertising – Customers call a designated call center in response to WRAP outreach or advertising. The representative usually completes the application with the customer over

the phone. PPL also uses call centers to do outbound calling for customers at or below 150 percent of poverty level with high electric usage.

4. Direct referrals – The customer or a caseworker calls the WRAP toll-free number. A PPL employee responds to inquiries and completes the application with the customer over the phone.

Depending on the availability of funding and the customers' response, PPL will use some or all of the following efforts to promote WRAP.

- Presentations and special mailings to agencies that administer PPL's other universal service programs.
- Presentations and special mailings to agencies, senior citizen groups, and low-income audiences.
- Presentations to employee groups such as Customer Service Representatives (CSRs), Collection Assistants, Customer Contact Representatives, and Servicemen.
- Telephone contact of payment-troubled customers and/or customers who live in low-income neighborhoods.
- PPL bill inserts (minimum once per year).
- Newspaper, magazine, radio, and TV advertising.

E. Eligibility

Customers must meet the following requirements to be eligible for WRAP:

- The household income is at or below 200 percent of the Federal Poverty Guidelines.
- The primary customer is at least 18 years old.
- The customer's home is individually metered.
- The customer's home is a primary home.
- The home has not received WRAP in the past seven years.
- The customer has lived in the home for at least nine months.
- The customer has installed electric heat or uses a minimum of 6,000 kWh per year.

Exceptions can be made to the last three requirements with PPL approval. For example, customers may receive services although it has not yet been seven years since they last received WRAP if usage is still high, the program has new measures that can be installed in the customer's home, or in a real hardship situation where a referral is made by an agency caseworker.

Renters can receive WRAP services, but the landlord is required to provide written consent before the customer is approved for the program. The WRAP coordinator will send an authorization form to the landlord to receive approval for program services. If the landlord does not respond within 30 days, the coordinator sends another letter. CPDs report that PPL is successful in obtaining landlord approval in more than 75 percent of the cases where the customer is a renter. However, obtaining the approval is sometimes a time-consuming

process that requires several phone calls and letters. The CPDs reported that the customer will receive an energy education packet, but no energy conservation measures, if landlord approval is not received.¹⁰

F. Program Enrollment

Customers must fill out the WRAP application over the phone with a PPL representative or agency caseworker, or fill out the application at home and mail it to PPL to be considered for WRAP. WRAP coordinators review completed applications and check that the data are complete. If information is missing from an application, they will call the customer, and then send a letter if they cannot get in touch with the customer by phone. If required fields on the application are not completed, such as income, PPL will not proceed with the job.

The WRAP coordinator reviews the completed WRAP application to determine if the customer meets the income eligibility criteria for WRAP, makes sure the customer has enough usage history, makes sure the customer's usage is high enough for WRAP, determines the seasonal usage, and determines the job type. All jobs begin as baseload or full cost jobs. The WRAP coordinator then sends the customer an eligibility letter, or a letter that explains why the customer is ineligible for the program.

The WRAP coordinator enters the data from the customer's application into the WRAP database. The coordinator then sends the job to a contractor, or places the job on a waiting list depending on the contractor workload and funding for the area. Jobs are not usually sent out for audit immediately unless the contractor is looking for that type of work. Jobs generally are sent out for audit in about six months.

The WRAP coordinator mails the customer's information to the contractor, including the application, a blank audit form with the top portion filled in, and the customer's usage history. About five years ago, PPL provided contractors with the opportunity to directly access their system to obtain a customer's usage history. Access to the system was very slow, so only a few of the contractors obtain data in this manner. For the most part the contractors receive the usage data from the WRAP coordinator.

PPL states that they give priority to customers who have the highest electric usage history, greatest arrearages, and lowest income. However, the CPDs reported that the jobs are generally sent to the contractors on a first come, first serve basis, other than perhaps for prioritizing OnTrack High Usage Pilot customers or all OnTrack customers.

Customers may not receive WRAP services if they drop out of OnTrack and do not want to receive WRAP, they move, they become ill, they have health and safety issues in their home that prevent services from being provided, or the work required in the home is beyond the scope of WRAP. Contractors make several attempts to contact the customers before they

¹⁰ The landlord is not required to contribute to the cost of program services.

send the jobs back to PPL. Estimates vary by CPD, but on average they serve about 80 to 90 percent of customers who complete applications.

G. Job Types

Customers must have at least 6,000 annual kWh or installed electric heat to receive program services. These customers will all receive at least one home energy education visit and an energy audit. There are three types of WRAP services that customers may receive:

1. **Baseload:** Customers with no electric heat will receive this type of service. Measures include CFLs, refrigerator replacement, air conditioner replacement, dryer venting, waterbed replacement, heating filter changing or cleaning, water heater set-back, and other measures that meet the PUC payback criteria.
2. **Low Cost:** In addition to the baseload measures, customers with electric hot water are eligible for water heater replacement, GFX, repairs of plumbing leaks, water pipe insulation, showerheads/aerators, horizontal washing machine pilot, and solar water heating.¹¹
3. **Full Cost:** Customers with installed electric heat or 3,600 kWh seasonal heating and/or cooling usage are eligible for this type of service. In addition to the baseload and water heating measures, they may receive heating and/or cooling measures, as well as additional follow-up energy education (site or phone). The additional measures for full cost customers include blower-door guided air sealing, insulation, heating repair/retrofit/replacement, cooling system repair and replacement, duct insulation and repair, caulking and weather stripping, and thermostat replacement.

PPL has piloted several WRAP measures to test whether the addition of such measures can improve the cost effectiveness of the program. These pilots have included:

- Horizontal-axis washing machines
- Cooling measures – insulation, air sealing, duct insulation, window fans, central air conditioner repair/replacement, tinted windows, roof coating.
- Solar water heating
- Photovoltaic
- OnTrack High Usage

PPL mails an education packet and provides referrals to other programs including state weatherization, gas utility programs, LIHEAP, OnTrack, and CARES for customers with usage below 6,000 annual kWh.

¹¹ PPL does not require a payback for the solar water heating.

H. Contractors

PPL uses contractors to install weatherization measures and conduct audits, inspections, and energy education sessions. Contractors often use sub-contractors for specialized work including electrical, plumbing, and heating equipment repair. PPL assigns work to contractors based on customer need, location, skill sets, experience, and ability to handle increased workload.

Most of PPL's contractors have been working on WRAP since 1987. They don't have a formalized process for hiring new contractors because it happens so rarely. They may hire a new contractor if one of the contractors has outstanding jobs that are not being worked or if there is a type of job that a contractor does not want to do.

One of the changes that PPL would like to make to WRAP is to standardize the services that are offered throughout PPL's service territory. They currently have some contractors who do not provide certain WRAP measures.

The weatherization contractors purchase the majority of tools and equipment used for WRAP. However, there are situations when PPL purchases equipment for contractor use to implement new and pilot technologies, or to support a sudden increase in workflow.

In 2004-2006, PPL reserved \$40,000 per year for the purchase of contractor equipment, including an infrared camera, diagnostic and monitoring equipment, carbon monoxide testing equipment, and upgrade of PPL-owned computers and printers.

I. Training

PPL provides training when there are new WRAP measures or procedures. In the past they have partnered with the state weatherization program to sponsor a contractor training, and they have had consultants observe and participate in installation and inspection work. PPL recently provided an education and communication training. PPL also offers sponsorships to the annual Affordable Comfort Conference and other training courses. PPL offers a training honorarium to contractors for mandatory training that is not conducted on the job site.

All WRAP partners, including subcontractors, are always allowed to attend WRAP training sessions. WRAP contractors have provided training to their subcontractors.

J. Service Delivery

Contractors are not required to collect income documentation to verify customers' eligibility for WRAP. However, PPL asks contractors to let them know if the customer does not appear to be low income.¹²

Each WRAP job receives an energy audit to determine which measures should be installed. Contractors decide which measures to install based upon the customer interview, the customer's electric usage history, on-site diagnostics, prioritization of measures, and the PUC payback criteria.

The following criteria are used for determining spending and measure selection:

1. **Baseload:** PPL has no limit on the amount of money spent on baseload measures in a home. However, measures must meet the PUC's payback criteria. PPL approves exceptions on a case-by-case basis.¹³
2. **Low Cost:** If a baseload customer has an electric water heater and has the potential for major water heating measures, PPL may upgrade the WRAP job to low cost at the time of the audit. PPL has no limit on the amount of money spent on low cost measures. With the exception of water heater replacement as a "repair" measure, low cost measures must adhere to PUC payback criteria.
3. **Full Cost:** The PUC LIURP guidelines suggest a seven or twelve-year payback for most measures. In 2002, PPL implemented an aggregate payback formula based on the customer's electric usage. PPL assigns a "shell allowance" for each full cost job that serves as a spending guideline for full cost measures. In addition to the shell allowance, contractors can perform the following work on full cost jobs:
 - **Incidental Repairs** – Contractors can make small incidental repairs needed for the installation of other weatherization measures. As a general guideline, the suggested spending allowance for incidental repairs is 20 percent of the shell allowance.
 - **Comfort Repairs** – Contractors can repair, replace or add (rare) electric heating equipment in homes where there is inadequate heat to maintain comfort. These cases will usually result in an increase in electric usage. As a result, PPL may not analyze them in the pre- to post-usage evaluation of WRAP.
 - **Health & Safety** – Contractors are required to conduct combustion safety testing before applying air sealing or insulation to a home. Contractors may spend up to \$250 in diagnostic health and safety measures. If the cost of required health and

¹² PPL does not have a requirement to gather income documentation from customers. They send a letter requesting income documentation if the customer is not elderly and they do not have the documentation on file, but this is not a standard procedure. Most of the customers come from OnTrack, so they know they are income eligible.

¹³ Exceptions are approved by the CPD or the WRAP coordinator on a case-by-case basis. Exceptions may be approved in hardship cases or to finish a recommended measure.

safety measures exceeds this allowance, contractors are asked to use other funding sources such as the state weatherization program, gas utility funding, or CRISES funding. If these funding sources are not available, PPL may provide the needed funding for the health and safety repairs.

While there is no maximum job limit, spending is defined based on pre-weatherization electric usage. Average program expenditures have increased since the introduction of solar water heating.

Contractors are expected to complete audits within two months. After the audit, contractors can move ahead with measure installation if the measures do not exceed the cost allowance and the measures are on PPL's measure list. If the measures exceed the cost allowance and the contractor does not adequately document the reason, the CPD or the WRAP coordinator will call the contractor. Contractors are expected to complete measure installation within three months after the audit, for a total job time of five months.

After they complete service delivery, contractors send job tickets and paperwork to the WRAP coordinators and invoices to PPL's Financial Department. The job ticket shows the work that was done and the materials that were used. The WRAP coordinators review the paperwork and do the necessary data entry. They must approve the invoices before they can be paid by the Financial Department.

K. Energy Education

The goals of energy education are to empower customers to make good energy choices, to involve the customers in the process, and to help the customers understand the electric bill.

PPL asks customers who apply for WRAP to sign a Customer Partnership Agreement/Consent Form which authorizes PPL to do work on the customer's home and which states that the customer will actively participate in WRAP. Customers who refuse to sign the partnership agreement may still receive WRAP services, as required by the PUC.

All WRAP participants receive at least one on-site energy education visit. Additional energy education is offered to customers with greater opportunities for usage reduction. The three types of energy education that are offered are:

1. Initial education session: The educator conducts the initial energy education session during the audit or the installation of measures for baseload and low cost customers. The educator conducts the initial session before the audit by telephone, during the audit, or during the inspection for full cost customers.
2. Follow-up education session: The educator provides follow-up education at the time of the inspection or within six months after the installation of measures by phone for full cost customers. The session will include a review of the installed measures, discussion of changes in electric use, and additional education on energy saving actions.

3. Remedial education session: PPL provides remedial education by telephone to customers whose usage increases by at least 10 percent six months after the installation of measures. The educator attempts to identify reasons for the increased usage and to identify ways to reduce electric usage.¹⁴

L. Program Coordination

PPL does not track the extent to which WRAP service delivery is coordinated with other weatherization programs. The CPDs reported that their contractors often refer customers to other programs, but that coordination does not happen very often. One CPD reported that most of her contractors provide work under the state weatherization program, and that they have been successful in coordinating the programs.

Barriers to coordination with other programs include long waiting lists for state weatherization and Crisis, long waiting lists and stringent usage requirements for gas usage programs, and some customers with a combination of electric and gas heat do not have high enough usage to qualify for either program.

M. Data and Reporting

All WRAP jobs are tracked in a special database system called WRAP V. Contractors submit their job information to PPL on paper or on an electric job ticket that can be directly loaded into the WRAP V database. Beginning in early 2006, contractors will be expected to use a new electronic web-based job ticket than can be loaded directly into the WRAP V database.

WRAP V contains the dates of WRAP service delivery, the measures that were installed, and the material and labor costs for each measure. The information in WRAP V, coupled with a narrative report, is submitted to the PUC for evaluation every April.

PPL is required to submit the following reports to the PUC on an annual basis:

1. LIURP Status Report – February 28
2. USP Report (LIURP Section) – April 1
3. LIURP Report – April 30
4. LIURP Narrative Report – April 30

Information in the reports includes, but is not limited to:

1. Number of homes weatherized by job type
2. Annual expenditures
3. Annual household income and source of income

¹⁴ PPL has not recently conducted the remedial energy education because they have not obtained the weather normalized data from their Information Systems department. They recently received the data, and will soon begin calling 2005 customers.

4. Number of household members by USP age categories
5. Payment status when applying for WRAP
6. Cost per job
7. Name of WRAP contractor(s) for each job
8. Measures installed and their associated material and labor costs
9. Costs for administration, field support, inspection, and energy education
10. Twelve months pre and-post electric usage and billing amounts
11. Customers who are on OnTrack (CAP) or receive fuel assistance during the pre and post-periods
12. Outreach efforts
13. Customer satisfaction information
14. Program goals and future enhancements

The Company analyzes trends and patterns of electric savings' results in the narrative report. The information for the reports comes from the WRAP V database and reporting system, Company accounting reports, and customer postcards and phone calls.

N. Quality Control

PPL requires a site inspection for at least 80 percent of all WRAP jobs that receive at least \$750 of measures, not including appliance replacement costs. PPL usually inspects most full cost jobs, except those where the customer refuses the inspection. Contractors use phone inspections when job costs are below \$750, or when the customer refuses to cooperate with the site inspection.

The inspectors do not conduct diagnostic testing during the inspection. They review the job folder, confirm that invoiced measures are installed to PPL's standards, check whether priority measures are installed, and determine customer satisfaction.

The inspector records any customer concerns or problems on an inspection action sheet. The contractor has 30 days to respond to action sheets. In most cases this requires a return to the customer's home. Estimates of the frequency of action sheets vary by CPD, from a low of one percent to a high of 35 percent. A few CPDs reported that their contractors receive action sheets on about ten percent of WRAP jobs.

PPL conducts annual performance reviews with their WRAP contractors. They evaluate the contractors on their job turnaround time, work quality, cost-effectiveness, and customer satisfaction. They also discuss the contractor's savings statistics. The performance review provides contractors with the opportunity to express any problems and concerns and to make suggestions for program improvement.

PPL may request additional meetings and/or training for contractors that do not meet WRAP requirements. If performance does not improve, PPL may terminate the WRAP contract.

O. Customer Feedback

PPL does not receive much feedback from customers on the WRAP services. They occasionally hear from customers who did not receive something they expected from the program. PPL has not recently conducted a customer satisfaction survey that focuses on WRAP, but they sometimes receive comments on WRAP in a general customer satisfaction survey that they do. The contractor leaves a customer comment card at the inspection, but the cards are rarely completed.

P. Program Performance

PPL's internal savings estimates found savings of only one percent in 1995. PPL estimates that their savings are currently about seven percent for baseload and eight to nine percent for electric heating and water heating.¹⁵ Several years ago the PUC had stated usage reduction goals of ten percent for electric heat, ten percent for baseload, and eight percent for water heat. PPL's standard is to reduce all customers' usage by ten percent through the provision of WRAP.

¹⁵ PPL does not use a control group when estimating program savings.

III. WRAP Procedures and Specifications

The evaluation included a review of program protocols to determine whether they can effectively provide energy efficiency services and education to low-income households. The review focused on comprehensiveness of the procedures in installing all cost-effective measures, effectiveness of the energy measures and installation procedures, whether the procedures are clearly specified for consistent application, and quality control procedures.

A. *Education Procedures*

In this section we discuss the education procedures that were reviewed and provide recommendations for minor changes to these procedures.

1. **WRAP Education Specifications**

This section describes the WRAP education specifications that were reviewed.

WRAP PROCEDURES: Energy Education – Overall

This document describes eligibility for home energy education, follow-up education, and remedial energy education. It describes the responsibilities of PPL and the responsibilities of the energy educator. The document provides a good overview of the responsibilities of each party.

WRAP PROCEDURES: Energy Education – Initial Energy Education Session

This document describes the goals for the initial energy education session, when the education session should be offered, and the number and types of contact attempts that should be made. It then outlines the steps, possible outcomes, procedures, forms, and optional materials for the education process. This document does a good job of summarizing the steps involved in the initial education session and documenting the required forms.

WRAP PROCEDURES: Energy Education – Follow-Up Session

This document outlines the goals for the follow-up education session, when the follow-up education session should be offered, and the number and types of contact attempts that should be made. It then outlines the procedures, lists the required forms, and describes optional educational and promotional items that may be used. This document does a good job of summarizing the steps involved in the follow-up education session and documenting the required forms.

2. WRAP Education Forms

Money-Saving Tips

This form lists actions to save electricity in heating, cooling, water heating, kitchen appliances, laundry appliances, and other areas. It says to “Check those that will help you”

While this is fairly comprehensive and specific list of potential actions to reduce electric use, it encourages customers to check off all that apply, and does not prioritize actions by the potential for energy saving.

Customer Profile

This form collects information about the customer’s heating habits, cooling habits, and recent or expected changes in electric usage.

It may be useful to also include other potential large opportunities for electric savings such as water leaks, use of dehumidifiers, sump pumps, use of second refrigerators or freezers, appliances or lights that are always left on.

Actions to Save

This form lists four actions that are potential areas for large reductions in electric use:

- Turn down heat before bed and before leaving home
- Turn down heat in unused rooms and close doors
- Don’t increase temperature more than one degree every half hour if you have a heat pump.
- Limit hot water use (with space to specify how)

The form also provides space to write in four additional actions. Next to each action is an estimate of the current cost of usage, the new estimated cost of usage, and the estimated savings. At the bottom of the form, there is a total dollar amount that the customer states he/she will attempt to save, and space for a customer signature and date.

It appears that this form is an attempt to summarize and estimate savings from the top actions checked on the Money-Saving Tips form. A completely open-ended form with blanks for each action may be easier to work with. Then customers would only have the actions that are applicable to him/her listed on the form.

Electric Bill Worksheet

This form lists the appliances, and lights by category and provides spaces to fill in the number in use, the hours used per month, the Watts, the estimated kWh per month, and the estimated cost per month. There is also a space for recommendations. There are

instructions on the bottom on how to calculate monthly cost using watts and hours per day that the appliance is used.

This form does a good job of summarizing usage, however it may be easier and helpful to list lights by room rather than by type – incandescent, fluorescent, outdoor floodlight, and other.

WRAP – Your Electric Bill

This form collects information on the customer’s electric bill, other home energy costs, and total home energy costs. It also separates out the electric costs into appliance costs, summer costs, winter costs, and heating costs. Monthly costs for heating, air conditioning, hot water, and key appliances are summarized.

This repeats some of the information collected on the Electric Bill Worksheet. The procedures do not state that this form is to be used, so it is not clear whether it is to be used in place of the Electric Bill Worksheet in full cost audits.

Reinforcement Questionnaire

This form is to be used during the follow-up education visit. This form collects information on changes in electric usage since the first session date. It also collects information on changes in energy habits that have been made, goals recalled from the previous visit, changes in electric bills, change in comfort and other potential changes to reduce electric usage.

This form should include the actions that the customer had agreed to take to reduce usage, should determine whether the customer followed through on each action, and should determine whether the customer can implement the action if he/she has not already done so.

3. Summary of Education Procedure Recommendations

- The initial energy education procedures state that the initial session may be conducted before the audit, in conjunction with the audit, in conjunction with the installation of measures, or in conjunction with the inspection. The most effective time for the initial education session is probably during the audit. At this time, the provider will have the opportunity to investigate what is going on in the home, and determine what WRAP can do for the customer. Education can be most effectively provided in conjunction with these activities. We recommend that the procedures require that some education be conducted in conjunction with the audit, that the homeowner be present at the time of the audit, and that the procedures strongly suggest that the initial education session is conducted at the time of the WRAP audit.

- Provide a summary list at the bottom of the Money-Saving Tips form that lists the top 3-5 actions with the highest potential for saving that the customer is willing to take, and estimate monthly dollar savings that may result from each action.
- Increase the comprehensiveness of the customer profile form.

B. Technical Procedures

This section provides comments and recommendations on the technical approach to program treatments in the PPL WRAP program. This assessment is based on a review of:

- Written program procedures and manuals – specifically the WRAP Standards & Field Guide (Sep 2004) and the WRAP Contractors Manual (July 2003);
- Data from the program tracking system WRAP V; and,
- Additional data on measure costs and installation frequencies as provided by PPL staff.

PPL's WRAP provides a very broad range of program treatments that go beyond what many similar programs provide throughout the nation. Some of the more innovative and/or unusual measures in WRAP include:

- Window air conditioner replacements
- Electric water heater replacements
- GFX hot water heat recovery systems
- A horizontal axis clothes washer pilot
- Reflective window films and roof coatings

The program design also addresses issues such as dryer venting, zonal pressure diagnostics, electric baseboard heater thermostat replacement, duct sealing, and heat pump/AC efficiency. The WRAP Standards and Field Guide also covers health and safety issues in considerable detail -- including combustion appliance safety testing that includes worst-case depressurization (somewhat unusual for an electric utility).

The breadth and depth of WRAP's program design as described in the program documentation is impressive and clearly the result of an on-going effort to maximize program impacts. Nevertheless, our technical review has uncovered some issues that may need to be addressed or clarified in terms of specific technical procedures.

1. Cost Effectiveness and Measure Screening

One major underlying issue in any program is how the program design maximizes the installation of all cost-effective measures while avoiding the installation of measures that are not cost-effective (except for those needed to address health & safety). The Pennsylvania LIURP regulations require that program measures should provide a simple payback of either 7 or 12 years, depending on the type of measure. Measures that qualify for a 12-year payback include building shell insulation and the replacement

of heating systems, cooling systems, water heaters, refrigerators, and freezers. The cost effectiveness of a specific measure can be assessed based on the cost of the measure, the electric savings it can be expected to produce, and the price per kWh.

The WRAP documentation does not provide any specific guidelines for assessing the energy savings expected from any measure or its cost-effectiveness. Instead of attempting to assess the cost-effectiveness of each measure at each home, the program design employs decision trees that were developed years ago using measure screening calculations that were based on estimated measure costs, energy savings, and utility rates. This overall approach can be quite sensible for most measures, although the calculations should be updated periodically to reflect changes in measure costs, utility rates and savings estimation algorithms. For measures where the costs vary widely, the simple yes/no decision tree may not be ideal, but an improved decision tree can be used that provides the maximum price worth paying for a specific measure – e.g., add R-19 insulation if it costs less than \$0.75/ft². For measures where the savings vary widely, the decision tree can be based on expected savings – e.g., replace 19 ft³ refrigerator if estimated annual savings are greater than 650 kWh (this is essentially what WRAP does with refrigerators). However, for measures where both savings and cost varies widely (e.g., refrigerators in WRAP), simple decision rules can compromise cost-effectiveness and either site-specific cost-effectiveness calculations are needed or else a more complicated (e.g., two dimensional) decision tree should be developed.

We recommend that PPL review the underlying cost-effectiveness calculations for the current audit decision trees and update the calculations and decision rules as needed to reflect the best current estimates for costs and savings. The decision process for each measure should reflect any significant variations in expected savings or costs. PPL can hire a nationally recognized expert to update these specifications every other year. The cost of such an update would likely be under \$5,000.

2. Job Types and Spending Allowances

WRAP has three types of jobs: baseload, low cost, and full cost. Baseload jobs include customers without electric heat and with at least 6,000 kWh of annual electric usage (essentially eliminating low-use homes). Low cost jobs are baseload jobs that have electric hot water and a potential for hot water savings. Full cost jobs include homes with installed electric heat as well as homes with at least 3,600 kWh/year in winter or summer seasonal usage (and at least 6,000 kWh in total usage). The main differences in treatment approach are that low cost jobs can receive water heating measures and full cost jobs can receive building shell measures (e.g., insulation and air sealing) and HVAC efficiency measures.

The approach of providing separate program components based on major end uses is especially sensible for separating out heating vs. non-heating jobs since the auditing and contractor skills needed are much different for jobs that address the building shell and HVAC equipment compared to those that just address baseload and water heating loads.

The minimum usage threshold for baseload jobs is also very sensible and should help the program avoid expending resources on homes with modest savings potential. We do have some concern about including all homes with installed electric heat as full cost jobs even if they have insignificant space conditioning loads since building shell measures are unlikely to be cost-effective in these homes. However, this concern is mitigated to some degree by the program's use of spending guidelines.

For full cost jobs, a shell measure budget allowance is calculated based on the seasonal usage as $\$200 + \$0.155 \times \text{seasonal kWh}$. This guideline provides an allowance of about \$1000 for homes with small heating loads (~5,000 kWh/yr), \$1750 for homes with average heating loads (~10,000 kWh), and about \$3,300 for homes with high heating loads (~20,000 kWh). Full cost jobs also have a repair budget allowance equal to 20 percent of the shell allowance and a \$250 allowance for health and safety measures. A spending guideline approach should enhance cost-effectiveness as long as there is some flexibility allowed. Based on the current guideline formula, we calculate a simple payback of about ten to 12 years if 20 percent heating savings can be achieved by spending the guideline amount.

3. Refrigerator and Freezer Replacement

Refrigerator replacement is a major measure in WRAP -- about 40 percent of WRAP homes received a refrigerator replacement in 2004 (down from about 48 percent in 2003). We identified some concerns with both the auditing protocol and the replacement decision rules.

The Program Standards & Field Guide describes the refrigerator auditing procedure as screening out units manufactured since 1993 (when Federal standards dramatically increased refrigerator efficiency) and then metering older units for one or two hours to assess usage. Metered usage is adjusted to an annual usage estimate by adjusting for metering time and for temperature during metering. This approach is quite sensible and can make fairly accurate replacement decisions, even for the one-hour metering. However, the temperature correction apparently adjusts metered usage to an assumed 75°F annual average space temperature. This estimate is probably about 3°F to 5°F too high for most kitchens, biasing the metered usage upward by about 10 percent on average. The bias is likely much larger (about 25 percent) for any metered units located in basements. We would recommend default average temperatures of 71°F for living spaces and 65°F for basements.

Another potential issue with the refrigerator metering is that the Contractor's Manual contains a data collection form that asks for the temperature but does not appear to use it in any calculation.

The refrigerator replacement decision tree has four minimum usage thresholds that vary with the size of the refrigerator. The values were calculated more than five years ago based on estimated average replacement costs, new unit usage, and utility rates at the time. We performed a preliminary analysis of the thresholds using current data from

PPL for replacement unit costs and rates and looked up the rated usage of some of the replacement unit models. We used the PUC 12-year payback criteria to determine thresholds. The results of this analysis are summarized in the table below.

Table III-1
Refrigerator Replacement Usage Thresholds
(kWh/day)

Size	Existing Threshold	Updated Threshold
<= 15ft ³	3.00	2.1 – 3.1
16-19 ft ³	4.16	2.4 – 3.1
20-24 ft ³	4.47	2.6 – 3.6
>=25 ft ³	5.42	4.5 – 5.4

Overall, the numbers in the table show that existing usage thresholds are generally too high, especially for refrigerators between 16 and 24 ft³. The updated thresholds are shown as ranges that vary due to variations in replacement unit costs between contractors. We found that the replacement costs for a given size unit typically varied by about \$300 (about 50 percent). This difference is so large that the replacement thresholds may need to vary between contractors to avoid setting the level too high for lower cost providers and/or too low for higher cost providers. Alternatively, it may be worthwhile trying to reduce the costs of higher cost providers to reduce this range and save program resources. The specification of Energy Star replacement units may also be worth revisiting given their modest incremental savings over typical new units.

Based on large datasets of existing low-income household refrigerator usage (from other programs) we estimate that perhaps 20 to 30 percent of all refrigerators could be cost-effectively replaced but are missed due to outdated usage thresholds. We recommend updating these thresholds.

4. Lighting

The program specifications state that CFLs are to be installed on lights used three or more hours per day. Given relatively recent sharp declines in the cost of CFLs, this threshold may be worth revisiting. The range of costs for CFL installations varies substantially between contractors -- ranging from about \$11 to \$26 per bulb. Preliminary calculations indicate that a threshold as low as 1 hour/day should be cost-effective with the lower cost providers, while 2 hours/day or even slightly more may be needed for the higher cost providers. Given current market prices, the higher cost providers should lower their prices.

5. Water Heater Replacement

The program specifications call for replacing electric water heaters with new models when the existing unit is leaky or corroded or when the unit was manufactured prior to 1993 and the household has annual estimated water heating usage of more than 3,000 kWh/yr (a moderate level) or more than half the baseload usage is attributable to hot water loads, or a large unit could be downsized. Overall, the program replaced electric water heaters in more than 10 percent of the homes, with more than half of the low cost jobs receiving water heater replacements. We have several concerns with this measure and the decision rules:

- It should not matter what percentage of baseload usage is attributable to water heating, since the program should be designed to save kWh, not percentages. There is no reason to replace a water heater in a home because their non water heating baseload usage is low.
- Although it may seem counterintuitive, there is no reason to target water heater replacement to households with high water heating loads. The difference in efficiency between electric water heaters with high vs. low energy factors is essentially a reduction in standby losses. The recovery efficiency is approximately 99 percent for all electric water heaters, so the incremental cost of a gallon of hot water is approximately the same for all units.
- Given that electric water heater EF merely reflects differences in standby losses it seems that water heater wraps and pipe insulation (or thermosiphon check valves) could effectively raise the existing unit's EF to levels close to the new unit at a much lower cost than replacement.
- There has been research that suggests that the rating test for electric water heaters may overstate the efficiency of units with high energy factors, reducing the savings available from unit replacement.
- The water heating sizing protocol described in the Standards and Field Guide sizes a water heater based on current occupancy and usage patterns instead of sizing it based on the home. Because home occupancy changes over time, this approach to sizing may be a mistake. For example, if one elderly person lives alone in a five-bedroom home and needs a new water heater, should it be sized for the small load of one person, or the likely load of a house that size? If sized to the former, then the unit will be undersized for likely future occupancy. In addition, the energy savings from downsizing a new unit are fairly small since the sizing only increases electric usage through standby losses, which are quite small on new high efficiency units.

Given these factors, it appears that water heater replacements may be less cost-effective than was assumed when the measure was adopted. Water heater replacement may only be cost-effective when used to replace a leaky tank. Otherwise, this measure is primarily a home repair or perhaps a safety measure.

6. Window Air Conditioner Replacement

Window air conditioner replacements are another innovative measure in WRAP. Approximately 10 percent of all participants received replacement window air conditioners. For some reason, the replacement rate in the low cost program is more than double the rate in the other two programs. A unit qualifies for replacement if the existing unit has a rated EER of 6 or less or the unit is “in bad condition”. The electric usage must also show some summer loads with a general guideline of a 30 percent increase over baseload usage (higher if multiple units are considered). The new unit must be Energy Star rated.

One concern with the replacement decision is that the kWh usage of the existing unit is not explicitly taken into account. The percentage increase in whole house usage in the summer is as much a function of the baseload usage as it is the cooling usage and therefore is not the critical number to use in the decision process. The savings from the measure depends on the actual kWh used by the existing unit and the EERs of the existing and new units. For example, if a new EER-11 unit costs \$500 and the existing unit has an EER of 6, then the air conditioner being replaced should use at least 1,078 kWh/yr in order to meet a 12 year payback ($\$500 / (12 * .085 * (1/6 - 1/11) / (1/6))$). Therefore, if the home has just one window air conditioner then the cooling load should be at least 1,078 kWh. If there are two window air conditioners that are used equally, then the total cooling load should be at least 2,156 kWh/yr. If cost-effectiveness is a priority, then the replacement decision should be based on the estimated cooling load from the billing data, the estimated proportion of that cooling load used by the existing unit, and the cost of the replacement. The allocation of cooling kWh between window units will be somewhat arbitrary in homes with multiple units, but even a rough estimate will be better than not assessing the usage at all.

In addition to the concern with cost-effectiveness, the air conditioner section of the Standards & Field Guide includes a very rough unit sizing protocol that will generally lead to oversized units. Given how many low-income households tend to try to cool large areas with window units, this oversizing may be acceptable so long as it doesn't involve upsizing from the existing unit.

7. Ducts

The WRAP duct sealing and duct insulation protocols appear quite sound and the guidance provided in the Contractor's Manual is generally consistent with best practice. One concern is how basements may be classified. The Standards & Field Guide seems to allow basements to be easily classified as either inside or outside the conditioned space, while the Contractor's Manual appears to put most basements inside the conditioned space. We agree with this latter interpretation. Research projects have

found very little, if any, savings from sealing ducts in basements. Therefore, basement duct sealing should only focus on safety (return leaks) or comfort (large supply leaks).¹⁶

For homes with ducts in attics, garages, and crawlspaces, the protocols suggest using a pressure pan to identify and fix this leakage. This approach works fairly well but has some drawbacks. If many homes have exterior ducts, it may be worth considering a more advanced approach to measuring the level of duct leakage and assessing progress. But if it is a relatively infrequent measure, then it may not be worth the extra work in program design, training, and inspection to add to the existing protocol.

8. Blower Door Guided Air Sealing

It is not clear from the protocols when blower door guided air sealing is or is not required, except for cases where the building is deemed too tight to seal further. According to tracking system data, fewer than 60 percent of the homes in the full cost program received either a blower door test or blower door guided air sealing. It may be worth investigating why so many homes apparently do not receive this type of air sealing work (or whether the problem is with the tracking system itself).

9. Zonal Pressure Diagnostics

The treatment protocols include the use of advanced blower door techniques, specifically zonal pressure diagnostics. ZPDs can be useful in assessing air leakage in homes and targeting air sealing work. The specific protocol described in the WRAP documentation include a 90 percent pressure drop rule of thumb that was developed for application to flat roof rowhouse attics in Philadelphia (the job “passes” if the pressure drop across the ceiling is at least 90 percent of the total pressure drop). That approach is very sensible for homes with attics that are very difficult to access. For homes with walk-up attics, the 90 percent pressure drop rule may be useful for identifying remaining problems, but should not be used instead of actual visual inspection because well-vented attics will tend to pass the test regardless of the quality of the air barrier.

10. Worst Case Depressurization Protocol

WRAP includes an advanced safety test known as worst case depressurization testing for homes with combustion appliances. The use of such a state-of-the-art approach is unusual in utility programs, especially electric utility programs that often ignore potential safety hazards with gas appliances, and PPL should be commended for it. We did find one modest flaw in the testing protocol – the position of interior doors is specified as open, but the true worst case will occur when you close interior doors that

¹⁶ Heat pumps would probably provide better savings and cost-effectiveness compared to gas furnaces because the air handler runs more frequently (due to lower delivery temperatures). However, we are not aware of any studies that show significant savings. Perhaps a somewhat bigger emphasis on "comfort" leaks could be placed in heat pump homes.

do not connect to exhaust devices (or, alternately, close any door which makes the depressurization level increase).

11. Reflective Roofs

The reflective roof pilot is an innovative component of WRAP. However, this measure is unlikely to be cost-effective in homes with properly insulated attics. If there are some homes where attic insulation is missing or minimal and some factor prevents its installation, then reflective roof coating may be able to provide cost-effective savings (assuming installed costs are reasonable). Reflective roof coating does provide a significant home repair benefit, but the energy savings alone are not likely to be able to pay for the measure in most cases.

12. Basements

As mentioned in the duct section, the protocols may need to be clarified concerning the treatment of basements. In general, basements should be considered as inside the conditioned space and therefore duct sealing and insulation have limited energy savings potential and basement ceiling insulation is also not worthwhile. The primary potential exception would be basements that are always flooded and are more like tall crawlspaces than basements.

13. Comments on WRAP Standards and Field Guide

The WRAP Standards & Field Guide is a substantial 248-page document that contains a vast array of useful information on WRAP and methods for saving energy. The Guide is an ambitious effort and was primarily assembled from other documents and guides with sections edited and added as needed to make it applicable to WRAP. It is more appropriately called a Field Guide because it does not contain a detailed set of program standards.

The guide attempts to be specific enough to be useful for practitioners but the level of detail varies substantially between sections, providing perhaps too much detail in some areas while too little detail in others. It is not always clear what the proper balance should be given the widely varying audience in terms of their existing expertise and their role in the program. For example, an educator or auditor does not need the same level of detailed information on air conditioner diagnostics as an HVAC contractor. In the case of the HVAC contractor, the guide is not detailed enough, but for someone who will not work directly on the systems it is most likely too detailed. This criticism is not meant to suggest that the guide needs to be rewritten, but perhaps at the time of the next major revision consideration should be given to the development of a more concise overall program field guide appropriate to all staff along with more detailed guides with specific program standards for each more specialized contracting area such as insulation, air sealing, and HVAC.

IV. Contractor Survey

The purpose of the contractor survey was to determine the extent to which contractors comply with WRAP protocols, to assess problems that contractors experience in Program administration and implementation, and to understand how WRAP can be improved.

The contractor survey addressed the following issues:

- Contractor staff requirements and training
- PPL support and training
- Measure selection guidelines
- Obstacles to providing WRAP services
- Audit procedures
- Data collection and reporting
- Quality control
- General Program ratings
- Inspection procedures and problems found at time of inspection

Sixteen of PPL's 18 contractors provided responses to the survey.

A. Methodology

The contractor survey targeted the eighteen primary WRAP contractors who currently provide WRAP services. Subcontractors were not included in the survey. APPRISE mailed the survey to the contractors via Priority Mail on January 10, 2006. Each contractor was sent a hard copy of the survey and asked to return the survey by January 31, 2006. Most contractors returned the surveys on time, although a few had to be contacted via phone and email after the due date. The last surveys were returned to APPRISE in mid February.

Table IV-1 shows that two contractors did not provide responses to the survey. The remainder of the contractors provided responses to the survey. Therefore, 16 contractors are included in the analysis.

Table IV-1
Completed Contractor Surveys

	Number of Contractors
Complete	16
No response	2

B. Contractor Background Information

Services Performed

The contractor survey asked the contractors to provide information about the PPL WRAP services they provide. Table IV-2 shows that the largest number of contractors, 12, said that they provide low cost installation, full cost audit, and education services.

Table IV-2
WRAP Services Provided

	Number of Contractors	Mean Number of Years WRAP Service Provided
Baseload audit	11	10 ¹
Low cost installation	12	12 ²
Full cost audit	12	14 ²
Full cost installation	11	15 ¹
Solar water heating installation	6	3
Education	12	13
Inspection	7	8

¹10 Respondents. ²11 Respondents.

The contractor survey asked the contractors to provide information about services they perform for other weatherization programs in Pennsylvania. Table IV-3 shows that 10 contractors reported that they perform services for the Pennsylvania Weatherization Program. The mean number of years that contractors provided these services is 24 years.

Table IV-3
Services Performed for Other Weatherization Programs

	Number of Contractors	Mean Number of Years Performing Services
PA Weatherization	10	24 ¹
Gas Utility Weatherization Programs		
UGI LIURP	3	16 ²
PG Energy LIURP	2	9
Columbia Gas Warm Choice	2	15
PA Gas and Water Weatherization	1	20
PPL Gas Utilities Weatherization	1	10
Electric Utility Weatherization Programs		
MetEd LIURP	3	14
Penelec LIURP	2	20 ³

	Number of Contractors	Mean Number of Years Performing Services
PECO LIURP	1	-- ⁴

¹ 9 Respondents. ² 2 Respondents. ³ 1 Respondents. ⁴ 0 Respondents.

Staff and Subcontractors

Table IV-4 shows that seven contractors reported that they have between one and five staff members who work on WRAP, four contractors said that they have between six and ten staff members who work on WRAP, and two contractors said that they have between 11 and 15 WRAP staff members. One contractor reported that the organization has more than 20 staff members who work on WRAP.

**Table IV-4
WRAP Contractor Staff**

Number of Staff Members	Number of Contractors
1 – 5	7
6 – 10	4
11 – 15	2
16 - 20	0
Greater than 20	1
Don't know / No answer	2

Contractors were asked whether they use staff members to perform tasks related to providing WRAP services, and how many staff members are used to perform that task. Table IV-5 shows that contractors were most likely to say that staff members in their organization performed management, administration, audits, measure installation, and education for WRAP.

Contractors were also asked whether they use subcontractors to perform the same tasks related to providing WRAP services. Contractors were most likely to report that they use subcontractors to perform tasks related to plumbing, HVAC work, and electrical work.

**Table IV-5
WRAP Services Performed by Staff and Subcontractors**

	Number of Contractors That Use Staff	Mean Number of Staff Members Used	Number of Contractors That Use Subcontractors
Managing	14	1.3 ¹	0
Administration	14	1.7 ¹	0
Audits	13	1.6 ²	3

	Number of Contractors That Use Staff	Mean Number of Staff Members Used	Number of Contractors That Use Subcontractors
Measure installation	13	5.0 ²	3
Education	12	2.1 ³	1
Inspections	7	1.4 ⁴	2
Plumbing	7	2.9 ⁴	9
HVAC work	6	2.0 ⁵	10
Electrical work	9	2.6 ⁶	8
Other	2	8.0 ⁷	0

¹ 14 Respondents. ² 13 Respondents. ³ 12 Respondents. ⁴ 7 Respondents. ⁵ 6 Respondents. ⁶ 8 Respondents. ⁷ 2 Respondents.

Contractors were asked about the education level required for new staff members who work on WRAP. Table IV-6 shows that nine contractors said that staff are required to have a high school diploma or the equivalent, one contractor said staff are required to have an Associate's Degree, and four contractors said that there is no specific education requirement.

Table IV-6
Education Requirements for WRAP Staff

	Number of Contractors
High school diploma / GED	9
Associate's degree	1
No specified requirement	4
Don't know / No answer	2

Contractors were asked about the amount of experience that is required for new staff members who work on WRAP. Table IV-7 shows that the six contractors, the largest share, said that there is no specific experience requirement for new WRAP staff. One contractor said that new staff are required to have at least six months of experience, one contractor said six months to one year, three contractors said one year to two years, and one contractor said new staff are required to have more than 2 years of experience.

Contractors were asked if there were any other requirements for staff members who work on WRAP. Other requirements mentioned for WRAP staff included carpentry or building experience, driver's license, physical fitness, understanding of house structure and mechanical systems, people skills, and the ability to work with the WRAP population.

Table IV-7
Experience Requirements for WRAP Staff

	Number of Contractors
At least 6 months	1

	Number of Contractors
6 months – 1 year	1
1 year – 2 years	3
More than 2 years	1
No specified requirement	6
Don't know / No answer	4

Table IV-8 displays training provided by contractors prior to allowing new staff to perform WRAP work. Twelve contractors said that staff members observe other service delivery staff, and 10 contractors said that new staff members are observed while delivering services. Eight contractors said that they provide classroom training and six contractors said that new staff members attend Affordable Comfort prior to providing WRAP services.

**Table IV-8
Contractor-Provided Training**

	Number of Contractors
Observing other service delivery staff	12
Being observed while delivering services	10
Classroom training	8
Affordable Comfort	6
PA Weatherization classes	3
Weatherization Training Center classes	2
Periodic testing on standards and best practices	1
Don't know / No answer	3

Contractors were asked about the methods they use to verify the skills of WRAP staff. Table IV-9 shows that 11 contractors use field observations of WRAP service delivery, seven contractors use a practical exam, seven require a professional certification, five use a written exam, and five inspect WRAP jobs to verify the skills of staff members who provide WRAP services.

Contractors were asked whether they experienced any staffing problems. Problems mentioned by contractors included high staff turnover due to low wages, limited benefits, fluctuations in workload, and low staff motivation due to lack of timely feedback from PPL.

**Table IV-9
Procedures Used to Ensure Staff Skills**

	Number of Contractors
Field observation of WRAP jobs	11
Practical exam	7
Professional certification	7
Written exam	5
Inspection of WRAP jobs	5
Passing Weatherization Training Center classes	1
Web-based training	1
Don't know / No answer	3

C. PPL Support and Training

This section of the memo examines the level of support provided by PPL, as reported by WRAP contractors. Table IV-10 shows that the largest share of contractors, 12, reported that they communicate with a PPL WRAP staff member at least once per week.

**Table IV-10
Telephone or Email Communication
Between Contractor and PPL WRAP Staff**

	Number of Contractors
Daily	5
Weekly	7
Monthly	2
As needed	1
Don't know / No answer	1

Table IV-11 shows that four contractors reported that they meet with PPL WRAP staff in person more than once per month, three contractors said that they do so once per month, five contractors said that they do so quarterly, and two said that they do so semi-annually. One contractor said that they meet with WRAP staff in person as needed.

**Table IV-11
In-Person Communication
Between Contractor and PPL WRAP Staff**

	Number of Contractors
Weekly	1

	Number of Contractors
Semi-monthly	3
Monthly	3
Quarterly	5
Semi-annually	2
Annually	0
As needed	1
Don't know / No answer	1

Contractors were asked to rate aspects of the WRAP training provided by PPL using the scale shown in Table IV-12A.

Table IV-12A
PPL-Provided Training - Rating Scale

	Rating Scale
1	Poor
2	Fair
3	Good
4	Very Good
5	Excellent

Contractors were asked to rate aspects of WRAP training provided by PPL. Table IV-12B shows that contractors gave each aspect of PPL-provided training a mean rating between 3.2 and 3.8, suggesting that each aspect is good to very good. Contractors gave the lowest rating to the amount of training, with a mean rating of 3.2.

Table IV-12B
Rating PPL-Provided Training

	# Who Provided Rating	Number of Contractors Who Provided Each Rating			Mean Rating
		1-2	3	4-5	
Training Quality	15	1	4	10	3.7
Training Focus	14	1	4	9	3.6
Level of Training	14	1	4	9	3.8
Amount of Training	14	2	7	5	3.2
Training – Overall Rating	14	1	3	10	3.6

Contractors were asked to rate the importance of additional PPL-provided WRAP training using the scale shown in Table IV-13A.¹⁷

Table IV-13A
Additional Training Needs - Rating Scale

	Rating Scale
1	Not Important
3	Somewhat Important
5	Very Important

Table IV-13B shows that on average contractors gave each additional training area a rating of 1.4 or less, meaning that they think training in each of these areas is not important. There were a few contractors who felt that training in each of the areas was important. Contractors were most likely to state that training in the area of zonal testing was important.

Table IV-13B
Additional Training Needs

	Number of Contractors Who Provided Each Rating				Mean Rating
	Not Needed	1-2	3	4-5	
General baseload audit	12	0	2	2	0.9
General full cost audit	11	1	1	3	1.1
Blower door testing	13	0	1	2	0.7
Zonal testing	10	0	1	5	1.4
Combustion testing	10	0	3	3	1.3
Priority lists	12	1	0	3	0.9
Measure selection	12	1	1	2	0.8
Shell allowance guidelines	10	2	1	3	1.2
Air sealing	14	0	0	2	0.5
Insulation	14	0	1	1	0.5
Training for new installers	15	0	0	1	0.3
Infrared	15	0	1	0	0.2

¹⁷ Contractors who said that training was not needed in a particular area were assigned a rating of zero for that training area.

D. WRAP Service Delivery

Measure Selection Guidelines

Contractors were asked to rate how well WRAP guidelines work in meeting the needs of the clients that they serve using the scale shown in Table IV-14A.

Table IV-14A
WRAP Guidelines - Rating Scale

	Rating Scale
1	Not at all Well
3	Somewhat Well
5	Very Well

Table IV-14B shows that contractors who provided a rating gave the shell allowance, priority lists, available measures, and education guidelines a mean rating of about 4, meaning that those WRAP guidelines are working somewhat well to very well. Contractors were most likely to say that the education guidelines worked very well and were least likely to say that the shell allowance worked very well.

Table IV-14B
Rating WRAP Guidelines

	Number of Contractors Who Provided Each Rating				Mean Rating
	Do Not Use	1-2	3	4-5	
Shell allowance	2	1	4	9	4.1 ¹
Priority lists	2	1	3	10	4.0 ¹
Available measures	0	0	5	11	3.9
Education guidelines	0	0	2	14	4.3

¹ 14 Respondents.

Contractors were asked to rate the helpfulness of PPL audit forms using the scale shown in Table IV-15A.

Table IV-15A
PPL Audit Forms for WRAP - Rating Scale

	Rating Scale
1	Not at all Helpful
3	Somewhat Helpful
5	Very Helpful

Table IV-15B shows that contractors rated the Customer's Usage History highest, with a mean rating of 4.9, meaning the form is very helpful. Contractors gave the Refrigerator Data Form, Core Assessment Form, Water Heater Checklist, Customer Profile Form, Your Electric Bill Form, Actions to Save Form, and Blower Door Test Form a mean rating of about 4, meaning that those forms are somewhat helpful to very helpful. Contractors rated the Window Audit Form, Door Audit Form, and Thermostat Audit Form lowest, with a mean rating of 2.5.

Table IV-15B
Rating PPL Audit Forms for WRAP

	Number of Contractors Who Provided Each Rating				Mean Rating
	Do Not Use	1-2	3	4-5	
Customer's usage history	0	0	0	16	4.9
Refrigerator Data form	1	3	1	11	4.0 ¹
Core Assessment form	1	1	2	12	3.9 ¹
Water Heater Checklist	0	2	4	10	3.9
Customer Profile form	0	0	5	11	4.1
Your Electric Bill form	1	1	6	8	3.9 ¹
Money Saving Tips form	0	2	7	7	3.5
Actions to Save form	1	2	5	8	3.7 ¹
Blower Door Test form	1	1	5	9	3.8 ¹
Combustion Equipment Safety Tests form	1	4	3	8	3.4 ¹
Duct Testing, Repair, and Sealing form	1	6	3	6	3.0 ¹
Infiltration Checklist	1	3	4	8	3.5 ¹
Window Audit form	3	5	6	2	2.5 ²
Door Audit form	3	5	6	2	2.5 ²
Thermostat Audit form	3	4	7	2	2.8 ²

¹ 15 Respondents. ² 13 Respondents.

Contractors were asked whether the number of forms required for WRAP is too many, too few, or about right. Table IV-16 shows that eight contractors said that there are too many forms required for WRAP and five contractors said that the number of forms required is about right.

Table IV-16
Number of Forms Required

	Number of Contractors
Too many	8
Too few	0

	Number of Contractors
About right	5
Don't know / No answer	3

Contractors were asked whether their WRAP auditors always, sometimes, or never meter particular appliances. Table IV-17 shows that nine contractors reported that their auditors always meter primary refrigerators, four said that their auditors always meter secondary refrigerators, and three said that their contractors always meter freezers. Nearly all contractors reported that their auditors never meter televisions, microwaves, stereos, medical equipment, waterbeds, fish tanks, breakers, and room air conditioner units.

**Table IV-17
Metering Appliances**

	# Who Provided Response	Number of Contractors Who Meter Appliance:		
		Always	Sometimes	Never
Refrigerator – primary	15	9	5	1
Refrigerator – secondary	15	4	9	2
Freezer	14	3	9	2
Television	15	0	1	14
Microwave	15	0	0	15
Space heater	15	1	4	10
Stereo	15	0	0	15
Medical equipment	15	0	1	14
Waterbed	16	0	2	14
Fish tank	16	0	2	14
Breakers	16	0	1	15
Room air conditioner units	16	0	1	15

Service Delivery

Contractors were asked whether they obtain customer usage data from the PPL computer system. Table IV-18 shows that three of the 16 contractors reported that they obtain customer usage data directly from the PPL computer system.

**Table IV-18
Obtain Usage Data from PPL Computer System**

	Number of Contractors
Yes	3
No	13

Contractors who said that they do not obtain customer usage data directly from the PPL computer system were asked why they do not do so. Table IV-19 shows that seven contractors said that access to the computer system has not been made available, four contractors said that usage data is provided with the work order, and one contractor said that usage data is available by fax.

Table IV-19
Reasons for Not Obtaining Usage Data from PPL Computer System

	Number of Contractors
Access has not been made available	7
Usage data provided with work order	4
Usage data available by fax	1
Don't know / No answer	1
Not Asked	3

Contractors who reported that they do not obtain customer usage data directly from the PPL computer system were asked whether they are able to obtain usage data in a timely manner. Table IV-20 shows that 10 contractors said that they are able to obtain usage data in a timely manner.

Table IV-20
Data Delivery is Timely

	Number of Contractors
Yes	10
No	0
Don't know / No answer	3
Not Asked	3

Contractors were asked to rank the following WRAP customer groups based on the priority they give to each group for WRAP services, where one represents the highest priority and four represents the lowest priority:

- OnTrack, High Usage Pilot
- OnTrack
- High Usage
- Arrearages

Four contractors reported that they do not prioritize customers. Seven contractors said that they give highest priority to OnTrack High Usage Pilot customers, four contractors said that they give highest priority to customers with high usage, and one contractor said that they

give highest priority to OnTrack customers. Three contractors said that they give a second level of priority to customers with arrearages.

Table IV-21
Prioritizing WRAP Customers

	Number of Contractors Who Provided Each Ranking					
	1	2	3	4	Do Not Use	Do Not Prioritize Customers
OnTrack, High Usage Pilot	7	1	2	0	2	4
OnTrack	1	7	3	0	1	4
High Usage	4	7	0	0	1	4
Arrearages	0	3	1	3	5	4

Contractors were asked whether they face particular obstacles when scheduling customers for WRAP service delivery and, if yes, in what percentage of WRAP jobs they face each obstacle. Table IV-22 shows that contractors received outdated client contact information in 13 percent of WRAP jobs, and experienced some other difficulty in reaching the client in another 13 percent of WRAP jobs.

Contractors who reported that they faced these obstacles were asked whether there were any actions PPL could take to alleviate these problems. Contractors said that PPL could help alleviate the problem of customers being unaware of WRAP or having forgotten about the program, which occurs in a mean of nine percent of WRAP jobs, by sending a letter to the customer prior to the contractor contact, or by shortening the length of time between the customer WRAP application and the delivery of WRAP services.

Table IV-22
Obstacles to Scheduling WRAP Service Delivery

	Number of Contractors		Mean % of WRAP Jobs
	Had Problem	Did Not Have Problem	
Outdated client contact information	10	6	13%
Other difficulty reaching client	14	2	13%
Client unavailable to be in home for service delivery during hours staff is available	12	4	8%
Client's reluctance to have auditor enter home	5	11	1%
Client unaware of / forgot about WRAP	9	7	9%
Client has moved	1	15	1%

Contractors were asked how many attempts they make to contact the customer by telephone and mail before they return a job to PPL. Table IV-23 shows that the mean number of telephone attempts used is six and the mean number of mail attempts is two.

Table IV-23
Attempts to Contact Customer

	Number of Contractors Using Contact Method	Number of Attempts		
		Minimum	Maximum	Mean
Telephone	16	2	15	6
Mail	16	1	10	2

Table IV-24 displays the length of time contractors reported that they keep a WRAP job before returning it to PPL because they were unable to contact the customer. Three contractors reported that they keep jobs for two weeks to less than one month, eight contractors said that they keep jobs between one month and less than two months, and five contractors said that they keep jobs for two months or more.

Table IV-24
Length of Time Prior to Returning WRAP Job to PPL

	Number of Contractors
Fewer than 2 weeks	0
2 weeks - <1 month	3
1 month - <2 months	8
2 months or more	5

Contractors were asked whether they deliver WRAP services jointly with Pennsylvania Weatherization services or gas utility program services. Table IV-25 shows that eight contractors reported that they jointly deliver WRAP and Pennsylvania Weatherization services, and four contractors reported that they jointly deliver WRAP and gas utility program services. Two contractors reported that they jointly deliver WRAP and county-funded weatherization services.

Contractors reported that they jointly deliver Pennsylvania Weatherization services with WRAP in a mean 16 percent of WRAP jobs, and that they jointly deliver gas utility program services with WRAP in a mean seven percent of WRAP jobs.

**Table IV-25
Joint Delivery of WRAP Services**

	Number of Contractors Who Jointly Deliver Services	Percent of WRAP Jobs Jointly Delivered		
		Minimum	Maximum	Mean
PA Weatherization	8	0%	100%	16%
Gas Utility Program	4	0%	100%	7%
County-funded Weatherization	2	0%	10%	1%

According to PPL guidelines, OnTrack participants must agree to receive WRAP services. Contractors were asked whether they tell OnTrack customers that they are required to participate in WRAP. Table IV-26 shows that 14 of the 16 contractors reported that they inform OnTrack customers of this requirement.

**Table IV-26
Inform OnTrack Customers About WRAP Requirement**

	Number of Contractors
Yes	14
No	1
Don't know / No answer	1

Table IV-27 displays whether contractors reported that they provide WRAP services in the evenings and on weekends. Eight contractors said that they provide evening services and seven contractors said that they provide weekend services.

**Table IV-27
Provide Evening and Weekend WRAP Services**

	Number of Contractors Who Provide Services	
	Evenings	Weekends
Yes	8	7
No	7	8
Don't know / No answer	1	1

Contractors were asked whether they are unable to serve WRAP customers for particular reasons and in what percentage of WRAP jobs they experience those problems. Table IV-28 shows that contractors reported that they are unable to complete five percent of WRAP jobs because the customer has moved, four percent of WRAP jobs because of health and safety concerns, and three percent of jobs because the work needed is beyond the scope of WRAP.

Contractors were also asked whether they face any additional obstacles when serving tenants. Two contractors said that some landlords provide an additional obstacle because they require additional documentation from WRAP and may refuse certain measures.

Table IV-28
Contractor is Not Able to Provide WRAP Services to Customer

	Number of Contractors Who Reported Problem	Percent of WRAP Jobs With Problem		
		Minimum	Maximum	Mean
Client is no longer an OnTrack participant	2	0%	15%	1%
Client moved	14	0%	15%	5%
Client no longer wants WRAP services	11	0%	15%	2%
Health and safety concerns	12	0%	20%	4%
Work is beyond the scope of WRAP	12	0%	10%	3%
Unable to schedule WRAP audit	3	0%	5%	1%

The survey asked contractors whether they experienced particular health and safety related issues in the homes of WRAP clients. Table IV-29 shows that all 15 contractors who responded to this question said that they saw mold and water problems. Contractors reported that they encountered water problems in a mean of 14 percent of WRAP jobs and mold problems in a mean of 12 percent of WRAP jobs. Most contractors also said that the health and safety problems encountered were combustion problems, heating problems, roof in need of replacement, and pests.

Table IV-29
Health and Safety Issues

	Number of Contractors Who Reported Problem	Percent of WRAP Jobs with Problem		
		Minimum	Maximum	Mean ¹
Combustion problem	12	0%	20%	5%
Cracked heat exchanger	11	0%	5%	2%
Other heating problem	14	0%	35%	9%
Mold	15	1%	50%	12%
Water	15	1%	60%	14%
Roof needs replacement	14	0%	30%	7%
Pests	13	0%	40%	7%
Animal waste	2	0%	10%	1%
Duct distribution	1	0%	15%	1%
Electrical issues	1	0%	10%	1%
Sewer problems	1	0%	2%	<1%

	Number of Contractors Who Reported Problem	Percent of WRAP Jobs with Problem		
		Minimum	Maximum	Mean ¹
Very poor housekeeping	2	0%	25%	3%

¹ 15 Respondents.

Contractors were asked in what percentage of WRAP jobs they request to exceed the health and safety allowance, the repair allowance, and the seasonal allowance. Table IV-30 displays the responses to these questions. Contractors reported that they request to exceed the health and safety allowance in an average of three percent of WRAP jobs, to exceed the repair allowance in eight percent of WRAP jobs, and to exceed the seasonal allowance in eight percent of WRAP jobs.

Contractors who reported that they request to exceed one or more of these allowances were asked what percentage of these requests are approved by PPL. Table IV-30 shows that the majority of requests to exceed all three allowances are granted by PPL.

Table IV-30
Requests to Exceed Allowances

	Number of Contractors Who Requested to Exceed Allowance	Mean % of WRAP Jobs in Which Request Made	Mean % of Requests Granted by PPL
Health and safety allowance	9	3% ¹	87%
Repair allowance	10	8% ¹	90%
Seasonal allowance	10	8% ¹	92%

¹ 13 Respondents.

Audit Procedures

Table IV-31 presents the mean number of hours spent for full cost audits, and baseload audits with and without significant cooling usage. The mean time for baseload audits without significant cooling usage is 1.6 hours, compared to a mean of 2.1 hours for baseload audits with significant cooling usage. The mean audit time for full cost audits is 3.2 hours, with a range of 0.6 hours to 10 hours across contractors.

Table IV-31
Length of Audits

	Number of Contractors Who Perform Audit	Audit Time (Hours)		
		Minimum	Maximum	Mean
Baseload audit without significant cooling usage	11	0.5	3	1.6
Baseload audit with significant cooling usage	10	1.0	3	2.1
Full cost audit	12	0.6	10	3.2

Table IV-32A displays whether contractors perform various procedures always, sometimes, or never during baseload audits. All eleven contractors who provided a response reported that they always discuss the electric bill and discuss actions to save electricity with the customer. Contractors were least likely to report that they always provide savings estimates for measures and that they always provide savings estimates for actions to save during baseload audits. One contractor reported that they never conduct a walkthrough of the home with the customer during the baseload audit.

Table IV-32A
Audit Procedures for Baseload Audits

	Number of Contractors Baseload Audits		
	Always	Sometimes	Never
Describe WRAP	10	1	0
Discuss electric bill with customer	11	0	0
Discuss health and safety issues with customer	10	1	0
Discuss comfort issues with customer	10	1	0
Conduct walkthrough of home with customer	8	2	1
Discuss actions to save electricity with customer	11	0	0
Provide savings estimates to customer for measures	6	5	0
Provide savings estimates to customer for actions	5	6	0

Table IV-32B displays whether contractors perform WRAP procedures always, sometimes, or never during full cost audits. Contractors were most likely to report that they always conduct a home walkthrough with the customer and that they always discuss actions to save with the customer. Eleven of the twelve contractors who responded to this question said that they always perform these procedures during the full cost audit. Contractors were least likely to report that they always provide savings estimates for measures and that they always provide savings estimates for actions to save during full cost audits.

Table IV-32B
Audit Procedures for Full Cost Audits

	Number of Contractors Full Cost Audits		
	Always	Sometimes	Never
Describe WRAP	10	2	0
Discuss electric bill with customer	10	2	0
Discuss health and safety issues with customer	9	3	0
Discuss comfort issues with customer	10	2	0
Conduct walkthrough of home with customer	11	1	0

	Number of Contractors Full Cost Audits		
	Always	Sometimes	Never
Discuss actions to save electricity with customer	11	1	0
Provide savings estimates to customer for measures	7	5	0
Provide savings estimates to customer for actions	7	5	0

E. Data Collection and Reporting

This section of the memo examines WRAP data collection procedures and contractor satisfaction with those procedures. Contractors were asked whether they use PPL's electronic job ticket. Table IV-33 shows that eight of the 16 contractors reported that they use the electronic job ticket.

Contractors who said that they do not use the electronic job ticket were asked why they do not use it. Reasons that contractors offered for not using the electronic job ticket included that the job ticket has not yet been made available or the contractor is not able to use it, and that the current system used by the contractor works better than the electronic job ticket.

**Table IV-33
Use Electronic Job Ticket**

	Number of Contractors
Yes	8
No	7
Don't know / No answer	1

Contractors who currently use the electronic job ticket were asked to rate their satisfaction with the electronic job ticket using the scale shown in Table IV-34A.

**Table IV-34A
PPL Audit Forms for WRAP - Rating Scale**

	Rating Scale
1	Very Dissatisfied
3	Neutral
5	Very Satisfied

Table IV-34B shows that contractors who use the electronic job ticket gave the electronic job ticket a mean rating of 4.1, meaning that they are satisfied with the electronic job ticket overall.

Table IV-34B
Rating Electronic Job Ticket

	# Who Provided Rating	Number of Contractors Who Provided Each Rating				Mean Rating
		Do Not Use	1-2	3	4-5	
Electronic Job Ticket	15	7	0	0	8	4.1 ¹

¹ 8 Respondents.

Contractors were asked to discuss their thoughts related to moving to the web-based job ticket. Five contractors said that they thought the web-based system would be an improvement over the current system. Some contractors mentioned potential problems with the web-based job ticket, including that it might require more staff time to enter data and that contractors could face additional expenses, such as high-speed internet service.

Contractors were also asked whether they experienced any issues related to invoicing procedures. Some contractors said that there are too many steps involved in the invoicing process and that they would prefer to submit invoices entirely electronically.

Contractors were asked to provide any suggestions for improvements to the data reporting procedures for WRAP. Recommendations suggested by contractors included reducing the repetition of data collection forms, revising the data collection forms to assist auditors with the selection of measures, and regularly gathering data that can be used for evaluation and reporting purposes.

F. Quality Control

This section of the memo examines quality control procedures used by WRAP contractors. Contractors were asked whether they use the following quality control methods for WRAP jobs and what percentage of jobs receive each type of quality control:

- Review data collection forms
- Contact customers by telephone
- Perform on-site inspection
- Observe work while it is being done

Table IV-35 displays the responses to these questions. Contractors reported that they review data collection forms for the majority of WRAP jobs, a mean of 75 percent of jobs. Contractors said that the mean percentage of WRAP jobs for which they perform on-site inspection is 41 percent, the mean percentage for which they contact customers by telephone is 40 percent, and the mean percentage for which they observe work while it is being done is 32 percent.

Table IV-35
Quality Control Methods

	Number of Contractors Who Use Method	Percent of WRAP Jobs		
		Minimum	Maximum	Mean ¹
Review data collection forms	11	0%	100%	75%
Contact customers by telephone	10	0%	100%	40%
Perform on-site inspection	12	0%	100%	41%
Observe work while it is being done	12	0%	100%	32%

¹14 Respondents.

Contractors were asked what methods they use to monitor the performance of their WRAP staff and subcontractors. Table IV-36 shows that 13 contractors reported that they use customer complaints and comments to monitor WRAP staff performance, 11 contractors use field observations by staff or other managers to monitor WRAP staff, 10 contractors use inspections of WRAP work by other staff or managers, and 10 contractors use WRAP Action Sheets to monitor the performance of WRAP staff.

Eight contractors reported that they use customer complaints and comments to monitor the performance of WRAP subcontractors, seven contractors use WRAP Action Sheets, six contractors use field observations by staff or other managers to monitor WRAP staff, and six contractors use inspections of WRAP work by other staff or managers to monitor WRAP subcontractor performance.

Table IV-36
Monitoring Staff and Subcontractor Performance

	Number of Contractors Who Use Method to Monitor Performance	
	Staff	Subcontractors
Customer complaints and comments	13	8
Field observations by other staff or managers	11	6
Inspection of work by other staff or managers	10	6
WRAP Action Sheets	10	7
Calls to / discussions with customers	2	2
Review of digital pictures of installations	1	0
Feedback from subcontractor staff	0	1

Table IV-37 shows the frequency with which contractors conduct on-site observations of WRAP staff and subcontractors. Half of the contractors reported that they conduct on-site observation of WRAP staff more than once per month, two contractors said they do so monthly, and another two contractors said they do so quarterly. One contractor said that they do not conduct on-site observations of WRAP staff.

Four contractors reported that they conduct on-site observation of WRAP subcontractors more than once per month, two contractors said they do so monthly, another two contractors said they do so quarterly, and one contractor said they do so annually. Three contractors said that they do not conduct on-site observations of WRAP subcontractors.

Table IV-37
Frequency of On-Site Observation

	Number of Contractors Who Reported Frequency of On-Site Observation	
	Staff	Subcontractors
More than once per month	8	4
Monthly	2	2
Quarterly	2	2
Semi-Annually	0	0
Annually	0	1
Never	1	3
Don't know / No answer	3	4

Contractors were asked how often they conduct reviews of their WRAP field staff. Table IV-38 shows that one contractor said that they review their field staff daily, one contractor said they do so monthly, five contractors said they do so quarterly, one contractor said they do so semi-annually, and five contractors said they do so annually.

Table IV-38
Frequency of Field Staff Reviews

	Number of Contractors
Daily	1
Monthly	1
Quarterly	5
Semi-Annually	1
Annually	5
Don't know / No answer	3

Contractors were asked how they train staff when they find problems through quality control procedures. Table IV-39 shows that 10 contractors reported that they require WRAP staff members to observe other service delivery staff when problems are found with their work, and 10 contractors said they observe staff members service delivery when problems are found. Eight contractors said they provide classroom training, and five contractors said they send staff members to Affordable Comfort when problems are found with their work.

**Table IV-39
Training Response to Quality Control Findings**

	Number of Contractors
Observing other service delivery staff	10
Being observed while delivering services	10
Classroom training	8
Affordable Comfort	5
On-site training	2
Individualized training, as needed	2
PA Weatherization Training Center classes	1
Staff meetings	1
Don't know / No answer	3

Table IV-40A displays the total number of action sheets that contractors reported that they received in the year prior to the survey. Three contractors reported that they received between one and five action sheets, two contractors said they received between six and 10 action sheets, and one contractor said that they received more than 10 action sheets. One contractor reported that they did not receive any action sheets in the year prior to the survey, and five contractors said that they do not receive actions sheets because they do not do full cost work.

**Table IV-40A
Action Sheets Received**

	Number of Contractors
0	1
1 – 5	3
6 – 10	2
More than 10	1
Don't know / No answer	4
No full cost work	5

Contractors were asked how many action sheets they received in the year prior to the survey for specific issues. Table IV-40B shows that contractors were most likely to report that they received at least one action sheet for weather stripping problems. Six contractors said that they received between one and five action sheets for weather stripping problems, and four contractors said they received between six and 10 action sheets for this issue. The next most common reasons for action sheets were customer complaints and thermostats.

**Table IV-40B
Action Sheets Received**

	Number of Contractors Who Reported Full Cost Work						
	0	1 – 5	6 – 10	11 – 15	16 – 20	More than 20	No Answer
Invoicing mistake	7	2	0	0	1	0	1
Weather stripping	0	6	4	0	0	0	1
Insulation	6	2	1	0	1	0	1
Air sealing	8	1	1	0	0	0	1
Thermostats	5	3	1	1	0	0	1
Dryer venting	6	3	0	0	1	0	1
Customer complaint	5	4	0	1	0	0	1
Moisture	0	1	0	0	0	0	10
Attic hatch material	0	0	0	0	1	0	10
Uninstalled air conditioners	0	0	1	0	0	0	10

Contractors were asked whether they use subcontractors for WRAP audits, measure installation, plumbing, HVAC work, electrical work, and other work for WRAP jobs. Table IV-41 shows that 10 contractors reported that they use subcontractors for HVAC work, eight contractors said they do so for plumbing, six said they do so for electrical work, four said they do so for audits, and two said they do so for measure installation. Contractors who said that they use subcontractors were asked what percentage of that type of work for WRAP jobs is completed by subcontractors. Contractors reported that about half of HVAC work for WRAP is completed by subcontractors.

Contractors who reported that they use subcontractors were asked whether they inspect each type of work completed by subcontractors and, if yes, what percentage of each type of work is inspected. Table IV-41 shows that contractors reported that they inspect more than half of plumbing, HVAC, and electrical work completed by subcontractors.

**Table IV-41
Subcontractor Work**

	Number of Contractors Who Use Subcontractors	Mean % of Work Done by Subcontractors	Number of Contractors Who Inspect Subcontractor Work	Mean % of Work Inspected
Audits	4	17%	3	20%
Measure installation	2	10%	2	30%
Plumbing	8	41%	7	53%
HVAC work	10	51%	8	56%
Electrical work	6	23%	6	67%
Other	0	--	0	--

G. WRAP Overview

This section of the memo examines contractors' overall satisfaction of WRAP. Contractors were asked to rate how well various WRAP components are working using the scale shown in Table IV-42A.

Table IV-42A
General Program Ratings - Rating Scale

	Rating Scale
1	Not at all Well
3	Somewhat Well
5	Very Well

Table IV-42B displays contractors' ratings of the following WRAP characteristics:

- Program specifications and procedures
- Communication with PPL
- Data reporting
- Invoicing
- WRAP, overall

Contractors gave each program characteristic a rating of about four, meaning that each aspect of the Program is working somewhat well to very well.

Table IV-42B
General Program Ratings

	# Who Provided Rating	Number of Contractors Who Provided Each Rating			Mean Rating
		1-2	3	4-5	
Program specifications and procedures	15	0	3	12	4.1
Communication with PPL	15	0	3	12	4.3
Data reporting	15	0	5	10	3.9
Invoicing	15	0	4	11	4.1
Overall	15	0	3	12	3.9

Table IV-43 displays contractors' recommendations for improvements to WRAP. Recommendations for improvement included providing evaluation reports and savings results to contractors and providing more training for WRAP contractors. Seven contractors did not have any recommendations for improvements to the program.

**Table IV-43
Recommendations for WRAP Improvement**

	Number of Contractors
Provide evaluation reports / savings results to contractors	2
Provide more training for WRAP contractors	2
Improve procedures for addressing customer issues after completion of WRAP services	1
Simplify paperwork	1
Shorten delivery time of new forms and procedures	1
Make WRAP implementation more consistent across areas	1
Increase budget per job	1
No recommendations given	7

H. Inspections

This section examines WRAP inspection procedures and problems found during inspections. Seven contractors provided responses to the survey questions related to inspections.

Inspectors were asked whether they face any barriers in completing inspections. Table IV-44 shows that barriers mentioned by contractors included customers who are uncooperative in scheduling inspections, the lack of follow-up received on action sheets, customers who are unavailable for inspections, incomplete audit data, and incorrect customer contact information.

**Table IV-44
Barriers to Completing Inspections**

	Number of Contractors
Customer uncooperative in scheduling inspection	3
Inspector does not receive follow-up on action sheets	2
Customer unavailable for inspection	1
Incomplete audit data provided by auditor / installer	1
Incorrect customer contact information provided	1
None	2

Inspectors were asked about the procedures they follow when conducting a WRAP inspection. Table IV-45 shows that contractors were most likely to report that they conduct a customer interview, assess education conducted during the audit, conduct a home walkthrough with the customer, and inspect all installed measures. Six of the seven contractors said that they complete each of these procedures during the WRAP inspection.

Inspectors were less likely to say that they conduct diagnostic testing or install measures that should have been identified during the audit.

**Table IV-45
Inspection Procedures**

	Number of Contractors
Customer interview	6
Assess education conducted during audit	6
Conduct home walkthrough with customer	6
Inspect all installed measures	6
Move CFL's if customer not satisfied with placement	5
Determine missed opportunities	5
Install CFL's that should have been identified during audit	4
Conduct diagnostic testing	3
Install CFL's that were left with customer	3
Install other minor measures that should have been identified during audit	3

Inspectors were asked whether they conduct an initial education session or a follow-up education session while conducting the inspection. Table IV-46 shows that six contractors said that they conduct an initial education session, and six contractors said that they conduct a follow-up education session.

**Table IV-46
Education During Inspection**

	Number of Contractors
Initial education session	6
Follow-up education session	6

Inspectors were asked to indicate the percentage of WRAP jobs where various problems are identified. Table 47 shows that problems related to diagnostic testing and customer complaints are found in a higher percentage of inspections than any other problem. Problems related to diagnostic testing are found in a mean of 27 percent of inspections and customer complaints are found in a mean of 22 percent of inspections.

Contractors who said that they identified a particular problem were asked to indicate the percentage of inspections in which no fix was required and in which they remedied the problem by fixing the problem themselves or sending an action sheet. Table IV-47 shows that inspectors reported that they fix all problems with education and non-metered refrigerators themselves.

Table IV-47
Addressing Problems Found During Inspections

	Mean % of Inspections Where Problem is Found	Mean % of Inspections		
		Inspector Fixed Problem	Action Sheet Sent	No Fix Needed
Invoicing mistake	7%	17% ¹	47% ¹	36% ¹
Weather stripping	6%	7% ²	85% ²	8% ²
Insulation	6%	0% ²	83% ²	17% ²
Air sealing	13%	0% ³	79% ³	21% ³
Diagnostic testing	27%	16% ⁴	55% ⁴	29% ⁴
Thermostats	5%	0% ¹	75% ¹	25% ¹
Dryer venting	15%	39% ¹	61% ¹	0% ¹
Education	11%	100% ⁴	0% ⁴	0% ⁴
Customer complaint	22%	24% ²	61% ²	15% ²
Non-metered refrigerator	4%	100% ⁵	0% ⁵	0% ⁵

¹ 4 Respondents. ² 6 Respondents. ³ 5 Respondents. ⁴ 3 Respondents. ⁵ 1 Respondent.

Contractors who perform WRAP inspections were asked whether they receive responses to action sheets that they send from PPL or from the installer. Table IV-48 shows that three contractors reported that they receive responses to action sheets from PPL and two contractors said that they receive responses from the installer.

Table IV-48
Response to Action Sheets

	Number of Contractors
Receive response from PPL	3
Receive response from installer	2

Contractors who perform WRAP inspections were asked to rate PPL's responsiveness to their comments and suggestions using the scale shown in Table IV-49A.

Table IV-49A
PPL Responsiveness - Rating Scale

	Rating Scale
1	Not at all responsive
3	Somewhat responsive
5	Very responsive

Table IV-49B shows that contractors who perform inspections gave PPL responsiveness a mean rating of 3.7, meaning that they thought PPL is somewhat responsive to their comments and suggestions.

Table IV-49B
PPL Responsiveness

	Number of Contractors Who Provided Each Rating			Mean Rating
	1-2	3	4-5	
PPL Responsiveness	1	2	4	3.7

Contractors were asked whether they had identified any problems that suggest that WRAP procedures should be changed. Two contractors said that there are varying understandings of policies, procedures, and acceptable quality of work among PPL employees and contractors, one contractor said that WRAP needs a better mechanism for updating procedures, and one contractor said that an increasing number of jobs involving attic insulation have been identified as health and safety issues.

I. Summary of Findings

This section summarizes key findings from the WRAP Contractor Survey.

- *Contractor Background Information:* Sixteen of PPL's 18 contractors responded to this survey. Twelve of these contractors reported that they perform WRAP full cost audits, 12 reported that they perform low cost installation, and 12 reported that they provide education. Eleven contractors reported that they perform baseload audits and 11 reported that they perform full cost installation. Most of these contractors have been providing these services for a long time. The average length of time contractors provided services was more than ten years for all services except inspection, in which some areas have had turnover, and solar, which was recently introduced.

Contractors are likely to also provide services for other weatherization programs. Ten contractors reported that they provide Pennsylvania Weatherization Program services, and a few contractors reported that they provide other gas and electric utility weatherization programs.

Contractors were likely to say that they use subcontractors to provide plumbing, electrical, and HVAC work for WRAP. Contractors were not likely to report that they use subcontractors for managing tasks, administration, education, inspections, audits, and measure installation.

- *PPL Support and Training:* Contractors were likely to report that they have regular contact with a PPL staff member. Twelve contractors said that they communicate with a

PPL staff member by telephone or email at least once per week, and seven contractors said that they meet in person with a PPL staff member at least once per month.

Contractors said that each aspect of PPL-provided training – training quality, training focus, level of training, amount of training, and training overall – is good to very good. Contractors gave the lowest rating to the amount of training. However, the only area where more than a few contractors felt training was needed was in zonal testing.

- *Measure Selection Guidelines:* Contractors reported that the WRAP shell allowance, priority lists, available measures, and education guidelines work somewhat well to very well. Contractors reported that most WRAP audit forms were somewhat helpful to very helpful in completing the audit. Contractors rated the Customer's Usage History highest, reporting that it is very helpful. Contractors rated the Window Audit Form, Door Audit Form, and Thermostat Audit Form lowest of all forms, reporting that they are less than somewhat helpful. Overall, eight contractors said that there are too many forms required for WRAP and five contractors said that the number of forms is about right.

Contractors were asked how often they meter various appliances in the home. Nine of fifteen responding contractors reported that their auditors always meter primary refrigerators, four said that their auditors always meter secondary refrigerators, and three said that their contractors always meter freezers. Nearly all contractors reported that their auditors never meter televisions, microwaves, stereos, medical equipment, waterbeds, fish tanks, breakers, and room air conditioner units.

- *Service Delivery:* Contractors were asked whether they face particular obstacles when scheduling customers for service delivery. A large share of contractors reported that they face problems due to outdated client contact information, other difficulties reaching clients, clients who are unavailable to be in the home during service delivery, and clients who are unaware of or who have forgotten about WRAP. Contractors make a mean six attempts to contact the customer by telephone, and an average of two attempts to contact the customer by mail before returning the job to PPL.

Contractors were asked whether they jointly deliver WRAP with the state weatherization program and gas utility programs. Eight of the contractors said that they jointly delivery WRAP with state weatherization, four said they jointly delivery with gas utility programs, and two said that they do joint delivery with county-funded weatherization.

Contractors were likely to report that they were unable to provide WRAP services to customers because the client moved, the client no longer wants WRAP services, work is beyond the scope of WRAP, and there are health and safety concerns in the home. The health and safety issues experienced in the greatest percentage of WRAP jobs are water and mold. Contractors reported that they encountered water problems in a mean of 14 percent of WRAP jobs and mold problems in a mean of 12 percent of WRAP jobs.

- *Audit Procedures:* All contractors who reported that they provide baseload audits said that they always discuss the electric bill with the customer and discuss actions to save with the customer. Contractors were least likely to say that they always provide savings estimates for measures and actions. Six contractors reported that they always provide savings estimates for measures, and five contractors reported that they always provide savings estimates for actions to save during baseload audits. Likewise, contractors were least likely to report that they always provide savings estimates for measures and actions during full cost audits. One contractor said that they never conduct a home walkthrough with the customer during a baseload audit.
- *Data Collection and Reporting:* Eight contractors reported that they use the electronic job ticket. Reasons that contractors offered for not using the electronic job ticket included that the job ticket has not yet been made available or the contractor is not able to use it, and that the current system used by the contractor works better than the electronic job ticket. Contractors who currently use the electronic job ticket said they are satisfied with it overall.

Contractors provided input about moving to the web-based job ticket. Five contractors said that they thought the web-based system would be an improvement over the current system. Some contractors mentioned potential problems with the web-based job ticket, including that it might require more staff time to enter data and that contractors could face additional expenses, such as high-speed internet service.

- *Quality Control:* Contractors perform quality control on a high percentage of WRAP jobs. Contractors reported that they review data collection forms for a mean of 75 percent of jobs, perform on-site inspection for a mean of 41 percent of jobs, contact customers by telephone for a mean of 40 percent of jobs, and observe work while it is being done for a mean of 32 percent of jobs.

Most contractors reported that they monitor WRAP staff performance using customer complaints and comments, field observations by other staff or managers, inspection of work by other staff or managers, and WRAP Action Sheets. Fewer contractors reported that they use these methods to monitor the performance of subcontractors. Contractors were less likely to report that they conduct on-site observations of subcontractors, compared to WRAP staff. Eight contractors reported that they conduct on-site observations of WRAP staff more than once per month, compared to four contractors who said they did so for subcontractors.

Contractors were likely to report that they received few action sheets in the year prior to the survey. Six of the 11 contractors who reported that they provide full cost WRAP services said that they received 10 or fewer action sheets, and one contractor received more than 10 action sheets. Contractors were more likely to report that they received action sheets for problems related to weather stripping than for any other problem.

- *WRAP Overview:* Contractors reported that each general program characteristic – program specifications, communication with PPL, data reporting, invoicing, and the

program overall – is working somewhat well to very well. Recommendations for improvements to WRAP included providing evaluation reports and savings results to contractors and providing more training for WRAP contractors.

- *Inspections:* Inspectors were asked to provide additional information on the inspection process. When asked about barriers to completing WRAP inspections, responses included that there are customers who are uncooperative in scheduling inspections, there is a lack of follow-up provided to inspectors about action sheets, that customers are unavailable for inspections, there is incomplete audit data, and there is incorrect customer contact information.

Inspectors were asked whether they implement various aspects of inspection procedures. They were most likely to report that they conduct a customer interview, assess the education conducted during the audit, conduct a home walkthrough with the customer, and inspect all installed measures during WRAP inspections. Six contractors reported that they conduct an initial education session during WRAP inspections, and six contractors said that they conduct a follow-up education session.

Inspectors reported that the most common problems found during inspections were diagnostic testing and customer complaints. Problems related to diagnostic testing are found in a mean of 27 percent of inspections and customer complaints are found in a mean of 22 percent of inspections.

Inspectors were asked how responsive PPL is to their comments and suggestions. One inspector rated PPL as not at all responsive, two inspectors rated PPL as somewhat responsive, and four inspectors rated PPL as very responsive.

V. Baseload Observations

APPRISE conducted observations of baseload service delivery provided by five of PPL's WRAP contractors, one in each of PPL's service areas. Each contractor was observed for two customer visits. The baseload observations focused on how well contractors addressed opportunities for baseload electric use reduction, and whether education was effectively provided to the occupant.

A. Visit Introduction

Table V-1 displays an assessment of the audit introduction. This table shows that all of the customers expected the visit from the auditor. Three of the auditors explained WRAP to the customers and two of the auditors did not (each in both of their visits). The auditors reviewed electric usage and discussed health and safety issues in four of ten the visits, and discussed comfort issues and whether there were any problems with energy usage in three of the visits.

This analysis shows that some of the auditors need to improve the content of the information provided to the customer at the introduction of the audit. The auditors should provide a thorough explanation of the purpose and steps of WRAP at the audit introduction. They should review the customer's electric usage to provide information to the customer and ask the customer to explain anything unusual in the usage history. They should determine whether there are any issues that the customer is concerned about related to health and safety, comfort, or energy usage prior to beginning the home walkthrough.

**Table V-1
Visit Introduction**

	Number of Observations		Comments
	Yes	No	
Customer expected visit	10		
Explained WRAP	6	4	
Reviewed electric usage	4	6	Two of the auditors who did not do this in the introduction covered it later in the visit.
Discussed health and safety issues	4	6	Two of the auditors who did not do this in the introduction covered it later in the visit.
Discussed comfort issues	3	7	Two of the auditors who did not do this in the introduction covered it later in the visit.
Discussed whether there were any problems with energy usage	3	7	One of the auditors who did not do this in the introduction covered it later in the visit.

B. Home Walkthrough

Table V-2 presents information on the home walkthrough portion of the visit. One of the contractors did not conduct a walkthrough of the home. He remained in the kitchen throughout the visit except to install CFLs. When asked, he stated that this is the way he does the work, as there is not much that can be done in baseload jobs. One other contractor did not do a complete walkthrough. The other three contractors did a thorough walkthrough and addressed all issues in the home.

Other than the one contractor who did not conduct a home walkthrough, the contractors generally did a good job on this aspect of the visit. Some of the key aspects that they covered included:

- *Electric uses:* The contractors discussed the key electric uses with the customers.
- *Costs of electric uses:* Two of the five contractors discussed the costs of these uses during the walkthrough. Four of the five contractors discussed the costs of these uses at a later point in the visit.
- *Actions to reduce uses:* Contractors discussed how the customers could reduce their electric uses during the walkthrough in seven of the ten observations. Another observation included this discussion at a later point in the visit.
- *Potential customer savings:* Contractors discussed how much the customers could save by taking these actions in five of the ten observations. In another three observations, the contractors discussed potential savings at a later point in the visit.
- *Commitment to take actions:* Contractors obtained customer commitments to take actions to reduce electric use during the walkthrough in six of the ten observations. In another two observations, the contractors obtained these commitments at a later point in the visit.

On average, the home walkthroughs took approximately 40 minutes, and about 25 minutes of that time was spent on education.

Table V-2
Home Walkthrough

	Number of Observations			Comments
	Yes	No	NA	
Inspected every room	6	4		One auditor did not conduct a walkthrough in either of the homes where he was observed.
Used systematic method for inspecting	6	4		
Discussed electric uses with customer	8		2	

	Number of Observations			Comments
	Yes	No	NA	
Estimated costs of electric uses	4	4	2	Four of the observations did not include this during the walkthrough, but did include it later in the visit.
Reinforced costs later in the visit	8		2	
Discussed actions to reduce uses	7	1	2	One of the observations did not include this during the walkthrough, but did include it later in the visit.
Estimated how much the customer could save by taking actions	5	3	2	Three of the observations did not include this during the walkthrough, but did include it later in the visit.
Asked customer if he/she was willing to take actions	7	1	2	One of the observations did not include this during the walkthrough, but did include it later in the visit.
Obtained commitment from customer to take actions	6	2	2	Two of the observations did not include this during the walkthrough, but did include it later in the visit.
	Min	Max	Average	
Length of walkthrough (minutes)	13	79	41	The two auditors without a walkthrough are not included in the average.
Part of walkthrough spent on education (minutes)	18	45	26	The two auditors without a walkthrough are not included in the average.

C. Measures

Table V-3 displays information on whether the customers' refrigerators were monitored, whether replacements were ordered, and whether the contractors explored opportunities for two-for-one swaps. Contractors monitored refrigerators in six of the ten homes observed. In two of the cases, the refrigerator was new, in one case the contractor could not move the refrigerator without damaging the customer's floor, and in one of the cases the customer's refrigerator was broken and the contractor had received prior approval to provide a new refrigerator. There was one instance in which a contractor explored the opportunity for a two-for-one swap, but the customer refused to give up the extra appliance. In two other cases, there was an opportunity that the contractor did not explore.

**Table V-3
Refrigerator Replacement**

	Number of Observations			Comments
	Yes	No	NA	
Monitored refrigerator	6	2	2	In one home the auditor could not move the refrigerator without damaging floor. In another home the refrigerator was broken but the auditor had obtained

	Number of Observations			Comments
	Yes	No	NA	
				permission to replace it.
Replacement refrigerator	4	5	1	
Explores opportunity for 2 for 1 swap	1	2	7	

Table V-4 explores whether the contractors followed protocols for replacing incandescent bulbs with compact fluorescent bulbs. PPL protocols state that contractors should replace bulbs that are used three or more hours per day. One effective approach that the evaluators have observed is for the contractor to go through the home, room by room, and ask how long the lights in each room are used each day. This assists the customer to think about when he/she is in the room and when the lights are used. This approach was used by two of the four contractors, in four of the ten homes that were observed. Two of the other contractors only asked the customer which bulbs were used three or more hours per day. The other contractor asked the customer whether any bulbs were used four or more hours per day.

There were two homes where the customers did not have any incandescent bulbs that were used three or more hours per day, and no CFLs were provided. In the other eight observations, the contractors installed the bulbs and made sure that the customer was satisfied with the illumination.

One of the practices that the evaluators have observed in other programs was that contractors left extra bulbs for the customer to install at a later time. This is generally not in accordance with program protocols, and is not recommended, because research has shown that customers only install about half of these bulbs that are left uninstalled. Additionally, customers may not install the bulbs in cost-effective locations. However, in these observations, there were no instances in which contractors left extra bulbs for the customer to install at a later time.

Table V-4
CFLs

	Number of Observations			Comments
	Yes	No	NA	
Discussed all lights in the home	4	6		Two auditors just asked if there were any lights used 3 or more hours per day. One discussed replacing lights that were used more than 4 hours per day.
Discussed all outside lights	7	32		Auditor did not have needed replacement
Discussed installation of CFLs in all lights used 3+ hours/day	7	2	1	One customer said none used more than 3 hours per day.
Installed CFLs	8		2	
Asked customer if he/she satisfied with lighting	8		2	

	Number of Observations			Comments
	Yes	No	NA	
Left extra bulbs for customer		10		

Table V-5 explores whether other measures were recommended or installed by the contractor. The measures that were provided or recommended included new air conditioners, window film, attic insulation, white roof coating, GFX, reduction in hot water temperature, dryer venting, cleaning air conditioning filters, removing a dehumidifier, drying rack, shower aerator, and a waterbed mattress cover. The contractor turned down the hot water temperature in one home, but in most of the homes the hot water temperature was already set in the correct range.

**Table V-5
Other Measures Recommended**

	Number of Observations				Comments
	Yes	No	Maybe	NA	
New air conditioner	2	6		2	
Window film	2	6		2	
Attic insulation		6	2	2	
White roof coating		7	1	2	
GFX	1	5		4	
Turned down hot water temperature	1	1		8	5 were already set to 125 or below, 3 did not have electric water heat
Dryer venting	2	4		4	
Clean HVAC filters	2	6		2	
Drying Rack	1	5		4	
Shower aerator	1	3		6	Flow was higher than the one that was replaced
Removed dehumidifier	1	1		8	
Waterbed mattress cover	1			9	

D. Energy Education

Table V-6 describes the aspects that were included in the energy education aspect of the visit. All of the ten observations were considered to include the energy education visit. In most of the cases the contractor engaged the customer as an active participant in the process and found the customer's self-interest in WRAP participation. The contractor also usually reviewed the measures that were installed or ordered, analyzed the customer's electric bill, reviewed the customer's heating and cooling systems and appliances, and encouraged the customer to ask questions. The one contractor who did not do the walkthrough also did not

analyze the customers' electric uses. Instead, he provided the customer with a copy of a "Your Electric Bill" form that was already filled out with uses that did not apply to the customer. He provided the same exact form in both of the observations.

Of the other possible programs that customers may be eligible for, contractors were most likely to discuss the state weatherization program and LIHEAP. The contractors did not let the customers know that PPL would continue to monitor their electric usage. Most of the customers cooperated with the education process.

**Table V-6
Energy Education**

	Number of Observations			Comments
	Yes	No	NA	
Energy education visit	10			
Engaged customer as active participant	9	1		
Found customer's self interest in WRAP	7	3		
Reviewed measures	7	2	1	None installed or recommended in one case.
Analyzed the customer's electric bill	8	2		
Reviewed the customer's heating and cooling systems	8	2		
Reviewed the customer's appliances	8	2		
Encouraged the customer to ask questions	8	2		
Discussed other programs:				One auditor did not discuss any other programs.
OnTrack	2	8		
LIHEAP	5	5		
Operation HELP		10		
PA Wx	9	1		
Told customer that PPL will continue to evaluate his/her electric use		10		
Customer cooperated with education process	8	2		

Table V-7 examines the education that was provided about potential actions to reduce electric usage. Most of the contractors did a good job of finding those actions that could have the biggest impact on the customer's electric use. The one exception was the contractor that did not do the walkthrough. Rather than finding those actions that applied to the particular customer's home, he handed the customer an "Actions to Save" form that was already filled out with actions that did not apply to that customer. He provided the same exact form in both of the observations.

**Table V-7
Education and Customer Actions**

	Number of Observations			Comments
	Yes	No	NA	
Hot Water				
Reduce water temperature	6		4	
Wash clothes in cold water	3	3	4	
Turn off hot water on vacations		6	4	
Reduce shower water usage	4	2	4	
Heating				
Use of space heaters	5		5	
Cooling				
Keep shades closed during the day, open at night	1	9		
Close doors and windows when AC is on		8	2	
Turn down AC temperature	2	6	2	
Use fans to improve comfort	3	7		
Clean AC filter/coils	3	5	2	
Kitchen Appliances				
Use smallest available cooking appliance	1	9		
Limit time coffee maker is on	1	9		
Use energy saving switch on refrigerator	2	8		
Run dishwasher for full loads		8	2	
Clothes Dryer				
Dry clothes outside when possible	1	5	4	
Clean lint	3	3	4	
Use correct drying cycle	1	5	4	
Avoid over drying	1	5	4	
Lighting				
Use natural light	1	9		
Use low watt night light	2	3	5	
Use motion detector for outside light		5	5	Auditor did not have CFL replacement for flood light and did not recommend motion detector.

E. Summary

Table V-8 provides some summary information on the visits. The average length of the visits was just about two hours. The visits ranged from 70 minutes to 180 minutes, although the longest visit was not a baseload job.

All of the auditors performed consistently in both of the observed jobs. Two of the auditors did an excellent job. They thoroughly explained WRAP, explained the customer's electric uses and the costs of those uses, worked with the customer to develop actions to reduce electric use, and estimated how much the customer could save through those actions.

One of the auditors did not do the job as specified by PPL. He did not walk through the home with the customer to determine the customer's electric uses. He did not provide information to the customer about his/her home, but provided the same actions and cost estimate to both customers from a pre-written sheet. He explained to the evaluation observer that this is the way that he does the baseload jobs.

**Table V-8
Visit Summary**

	Length of Visit			
	Min	Max	Average	
Length of visit (minutes)	70	180	119	
	Rating			
	Excellent	Good	Fair	Not Acceptable
Overall rating	4	2	2	2

VI. Full Cost Observations and Inspections

The evaluation included observations and inspections of full cost service delivery provided by five of PPL's WRAP contractors, one in each of PPL's service areas. Each contractor was observed for one customer visit (usually the audit visit), and had the work of another customer's home inspected.¹⁸ The observations focused on how well contractors addressed opportunities for electric use reduction, whether the correct measures were selected, and the extent to which energy education was provided. The inspections focused on accuracy of data collection, appropriateness of measure selection, and quality of installation work.

A. Observations and Inspections

There were some limitations to this evaluation work. Due to the budget for the evaluation, we did not conduct observations of all aspects of service delivery. Therefore, we did not observe the energy education visit for any of these customers, and in most cases we did not see the actual work performed. For observations, we assessed whether the correct decisions were made based upon the auditors' assessments and recommendations, the results of diagnostic tests conducted during the audit visits or recorded on forms during later visits that were not observed, and the actual work completed as recorded in the paperwork provided by the contractors. We faced the additional limitation that in some cases the customer was not home, and in one of the inspections, the customer had moved out of the residence some time prior to the inspection.

Table VI-1 describes the six observations that were conducted. Four of the six visits were audits and the other two were installation visits. The audit visits lasted from 1.5 to three hours and the installation visits lasted six and seven hours.

**Table VI-1
Observations Conducted**

Contractor	Visit	Length of Visit	Notes
CACLV	Audit	1.5 hours	This visit was difficult to assess because the recommended work had not yet been done due to customer health concerns.
SEDA	Audit	2.5 hours	Mobile home.
Rovegno's	Installation, inspection	6 hours	The customer was not home for most of the visit. There was a previous audit visit.
ECC	Audit	1.5 hours	No testing completed at this visit. Testing to be done at the installation visit.
WCRA	Audit	3 hours	Some of the testing to be done at the installation visit.
WCRA	Installation	7 hours	Installation work was performed during this visit. The work was not completed so another visit was scheduled to finish the work and the testing.

¹⁸ WCRA had two observations rather than one inspection and one observation.

Table VI-2 describes the four inspections that were conducted. In two of the homes, the customer was not home for the inspection, and in another home, the customer had moved out of the home and the house was no longer lived in so the refrigerator and lamps had been removed and the furnace and water heater were shut off. In the fourth home, the evaluator was not able to duplicate the contractor's results.

**Table VI-2
Inspections Conducted**

Contractor	Notes
CACLV	The evaluator was not able to duplicate the contractor's test results.
SEDA	The house was no longer lived in, so the homeowner was not present for questions. The refrigerator, lamps were gone. The furnace and water heater were shut off.
Rovegno's	The customer was not home for the inspection. Hardship case – they were told to do all that they could for the customer and spent nearly \$7500 on the home.
ECC	The customer was not home for the inspection.

B. Observation Results

While none of the observations included what was considered the education visit, the contractors did a good job of communicating with the customers. Table VI-3 describes the visit introduction. This table shows that while one of the customers was not present for the visit, most of the contractors explained WRAP, reviewed electric usage, and discussed health and safety, comfort, and energy use issues with the customers.

**Table VI-3
Visit Introduction**

	Number of Observations		Comments
	Yes	No	
Customer expected visit	6	0	One of the customers was not present for most of the visit.
Explained WRAP	4	2	
Reviewed electric usage	4	2	
Discussed health and safety issues	6	0	
Discussed comfort issues	6	0	
Discussed whether there were any problems with energy usage	5	1	

Table VI-4 describes some of the education that was undertaken during the home walkthrough. While two of the visits were installation visits (and the other four were audits), all of the contractors inspected the home and most discussed actions to reduce electric usage with the customers. The contractors did not discuss the costs of the customers' usage and generally did not estimate how much the customer could save by taking certain actions, but presumably these efforts would be undertaken during the education visit.

**Table VI-4
Home Walkthrough**

	Number of Observations		Comments
	Yes	No	
Inspected every room	6	0	
Used systematic method for inspecting	6	0	
Discussed electric uses with customer	5	1	This was not done for the installation visit.
Estimated costs of electric uses	0	6	
Reinforced costs later in the visit	1	5	
Discussed actions to reduce uses	5	1	This was not done for the installation visit
Estimated how much the customer could save by taking actions	1	5	
Asked customer if he/she was willing to take actions	5	1	
Obtained commitment from customer to take actions	5	1	

Table VI-5 shows that a blower door test was conducted in five of the six observations and pressure diagnostics were conducted in one of the observations. These tests should always be conducted during the audit to help the auditor determine which measures are needed, where the work should be performed, and the estimated cost for the measures.

**Table VI-5
Diagnostic and Safety Testing Conducted**

	Number of Observations			Comments
	Yes	No	NA	
Blower door testing	5	1		
Pressure diagnostics	1	4	1	One of the observations was at a mobile home.

Table VI-6 provides an overview of the evaluator’s assessment of the work conducted during the observations. This table shows that the majority of the contractors received a “very good” rating for both their technical and their communication skills.

**Table VI-6
Overview**

	Number of Observations	
	Very Good	Good
Technical Skills	4	2

	Number of Observations	
	Very Good	Good
Communication Skills	4	2

In general the evaluators were impressed with the work that was conducted. They felt that all of the contractors did a good job and cared about their work. Some of the general comments included:

- They were on the right track with the work that was observed. They were not afraid of working hard.
- What he did was correct, but he should have done more.
- He looked at all the right things and asked the homeowner to clarify things that were not obvious.
- He inspected the entire home and included the homeowner in the audit.
- He did not fill out all the forms and he did not do any testing.
- He was very friendly and he carefully explained everything to the customer.
- He did everything according to the protocol.

C. *Inspection Results*

This section summarizes the findings from the inspections. Table VI-7 displays the guidelines and expenditures for the homes that were inspected. Total expenditures ranged from nearly \$3,000 to nearly \$8,000 for one hardship case where the contractor was told to do everything possible to reduce usage. Two of the four homes had health and safety expenditures and one of the four had repairs.

**Table VI-7
Guidelines and Expenditures**

	Inspection			
	1	2	3	4
Shell guideline	\$5,553	\$1,372	\$1,192	\$1,617
Total Expenditure	\$6,699	?	\$7,707	\$2,902
Health and Safety Expenditure	\$120	?	\$0	\$283
Repair Expenditure	\$0	?	\$1145	\$0

Table VI-8 displays the missed opportunities that were found in the inspections. There were missed opportunities found in three of the four homes inspected. The missed opportunities included solar hot water, connections that remained between the house and the garage and the house and the attic, incomplete air sealing, and incomplete insulation work.

**Table VI-7
Missed Opportunities**

Inspection 1	Solar hot water.
	House was still connected to garage and attic after work was completed.
Inspection 2	Should have removed dropped ceiling and installed sheetrock for an air barrier.
Inspection 3	None.
Inspection 4	Should have insulated entire attic. This would have been difficult, given the amount of space in the attic, but it was possible.

Table VI-8 provides an overview of the work that was inspected. Some of the data collection received less than the highest ratings because the evaluator was not able to duplicate the tests in one home, and not all of the forms were used in another home. The measure selection and the appropriateness of installed measures were rated good or very good.

Additionally, the contractors' effort, work quality, work appropriateness, and overall rating are displayed in the table below. This table shows that most contractors received the top rating with respect to effort and appropriateness of measures.

**Table VI-8
Overview**

	Number of Observations			Comments
	Very Good	Good	Fair	
Accuracy of data collection	1	1	2	Evaluator was unable to duplicate some of the test results in one home. Not all of the forms were used in another.
Measure selection	1	3		The attic was sealed shut in one home, so the work done there could not be inspected.
Appropriateness of installed measures	2	2		One of the inspections was a hardship case and the contractor was told to do anything they could to reduce energy use.
	Number of Observations			Comments
	Exceptional	Good	Satisfactory	
Effort	3	1		Hard to assess in one home because the customer had moved and the home was not occupied. In another home the evaluator's tests did not match the contractor's results.
Quality	1	2	1	
Appropriateness	3	1		
Overall Rating	1	3		

The evaluator felt that the contractors did a good job overall. Some of the general comments are noted below.

- There was a missed opportunity in one home. The contractor did appropriate air sealing and insulation. While the contractor did make a good effort, the attic still had a connection to the house, and the garage still had a connection to the house. The inspector was not able to duplicate the contractor's test results.
- One of the homes was a hardship case and the contractor was told to do whatever he could do to reduce the customer's usage. As such, the contractor did not fill out all of the forms. The contractor did everything that was appropriate to reduce usage and did not do additional work that was not needed. However, they did not do the testing that is normally required. PPL reported that this was an isolated case that was the result of miscommunication between the contractor and the CPD.

D. Summary of Full Cost Observation and Inspection Findings

The evaluator was generally impressed with the quality and comprehensiveness of work conducted by the contractors that were observed and inspected. The general recommendations that result from this work are summarized below.

1. Many of the contractors used different types of paperwork for the PPL WRAP. This made it difficult to determine whether all of the required paperwork had been completed and it made it difficult to assess and compare jobs. PPL should develop one set of forms that is required for all jobs. They can provide the contractor with a check box for each form that is not applicable, but all forms should be included with every job.
2. Some of the contractors were not sure what was required for some of the forms. Because PPL's technical manual is so long, it is not feasible for the contractors to look in this manual for instructions. Rather, PPL should provide instructions for each form on the back of the form, so that the contractor can easily flip the form over and read the instructions if necessary. Such instructions would improve the probability that all forms were filled out correctly.
3. All applicable diagnostic tests should be required at the audit visit. In some cases blower door and pressure differentials were not conducted during the audit. They should be required so that the auditor can accurately predict what work is need during the measure installation visit.
4. There was one hardship case where the contractor was instructed to do everything necessary to assist the client. Some of the tests were not conducted and the forms were not filled out in this case. Tests should still be required in such cases and contractors should be given guidelines, because services that have minimal payback should not be completed even in severe hardship cases.

VII. Customer Survey

APPRISE conducted a survey with PPL customers who received WRAP services in the first half of 2005. The WRAP customer survey was designed to measure the following:

- Household demographics
- Reasons for participation
- Understanding of the program
- Actions taken to save electricity
- Measures received from the program
- Financial obligations and bill payment difficulties
- Impact of WRAP on electricity usage and bills
- Impact of WRAP on safety and comfort
- Satisfaction with WRAP

This section presents the methodology used to implement the customer survey and summarizes the findings from the 219 completed interviews.

A. *Methodology*

Below we describe the methodology for the customer survey, including procedures for sample selection and survey implementation, and response rates.

1. **Survey Implementation**

An advance letter was sent to all customers who were selected for the survey. This letter notified customers that they would be called to participate in the survey, explained the purpose of the survey, and gave them the option to call into the phone center to complete the survey at their convenience.

APPRISE retained Braun Research to conduct the survey through its call center. Researchers from APPRISE trained Braun's employees on the survey instrument and monitored survey implementation. Braun's manager in charge of the survey instructed interviewers how to use the computerized version of the survey to record customer responses.

Interviewer training consisted of two hour-long sessions – one for daytime and one for evening interviewers. Training included an explanation of WRAP, an introduction to the WRAP customer population, an explanation of field codes included in the survey instrument, an overview of each question, and in-depth discussion of survey questions requiring special attention.

Interviewer monitoring allowed APPRISE researchers to both listen to the way interviewers conducted surveys and see the answers they chose on the computerized data entry form. Braun's manager facilitated open communication between the monitors and interviewers, which allowed the monitors to further instruct interviewers on how to implement the survey and accurately record customer responses.

2. Sample Selection and Response Rates

The survey sample was designed to furnish data on WRAP participants. Customers who received services in the first half of 2005 were selected for the survey because they received services recently enough that they should remember the service delivery, yet enough time had elapsed for them to observe the impact of the services.

Table VII-1 details the number of customers selected to complete the survey, number of completed interviews, cooperation rates, and response rates for each of the three groups. The table presents the following information for the sample:

- **Number selected:** There were 400 WRAP customers selected to complete the survey.
- **Unusable:** There were 101 cases deemed unusable because no one was present in the home during the survey who was able to answer questions related to the household electric bills and WRAP, or because phone numbers were unavailable, disconnected, or incorrect.¹⁹ These households are not included in the denominator of the response rate or the cooperation rate. They are included in the denominator of the completed interview rate.
- **Non-Interviews:** There were 24 cases classified as non-interviews because the qualified respondent refused to complete the interview, or because the respondent asked the interviewer to call back to complete the interview at a later time, but did not complete the interview during the field period. These households are included in the denominator of the cooperation rate, the response rate, and the completed interview rate.
- **Unknown eligibility:** There were 39 cases that were determined to have unknown eligibility to complete the interview, due to answering machines, no answers, and language barriers. These households are not included in the denominator of the cooperation rate. They are included in the denominator of the response rate and the completed interview rate.
- **Not eligible – did not receive WRAP services:** There were eight cases that were deemed not eligible to complete the interview because the respondent did not

¹⁹One hundred cases were deemed unusable because phone numbers were unavailable, disconnected, or incorrect. This may be related to incorrect customer information or to interruptions in telephone service. However, we do not believe that these unusable numbers will bias the results of the survey.

remember receiving WRAP services. These households are not included in the denominator of the response rate or the cooperation rate. They are included in the denominator of the completed interview rate.

- **Not eligible – household moved since receiving WRAP services:** There were nine cases that were deemed not eligible to complete the interview because the respondent reported that the household had moved since WRAP services were provided. These households are not included in the denominator of the response rate or the cooperation rate. They are included in the denominator of the completed interview rate.
- **Completed interviews:** The completed interviews are households that were reached and that answered the full set of survey questions. In total, 219 interviews were completed.
- **Cooperation rate:** The cooperation rate is the percent of eligible households contacted who completed the survey. This is calculated as the number of completed interviews divided by the interviews plus the number of non-interviews (refusals plus non-completed call backs²⁰). Overall, this survey achieved a 90 percent cooperation rate.
- **Response rate:** The response rate is the number of completed interviews divided by the number of completed interviews plus the number of non-interviews (refusals plus non-completed call backs) plus all cases of unknown eligibility (due to answering machines and language barriers). This survey attained a 78 percent response rate.
- **Completed Interview Rate:** The completed interview rate is the percentage of households selected that completed the survey. This survey attained a 55 percent completed interview rate.

**Table VII-1
Sample and Response Rates**

	WRAP Customers
Number selected	400
Unusable	101
Non-Interviews	24
Unknown eligibility	39
Not eligible – does not know about WRAP	8
Not eligible – household moved since receiving WRAP services	9

²⁰ Non-completed callbacks include respondents who asked the interviewer to call back at a later time to complete the interview, but did not complete the interview by the end of the field period.

	WRAP Customers
Completed interviews	219
Cooperation rate	90%
Response rate	78%
Completed interview rate	55%

This next sections present detailed findings from the customer survey. Unless otherwise specified, tables include 219 survey respondents. Percentages may not sum to 100 percent due to rounding.

B. Demographics

This section examines the demographic characteristics of survey respondents. Respondents were asked whether they own or rent their home. Table VII-2 shows that 69 percent of respondents own their homes.

**Table VII-2
Home Ownership**

Do you own or rent your home?	
Own	69%
Rent	31%

Table VII-3 presents the percentage of households by number of total household members. The majority of respondents, 85 percent, have two or more household members.

**Table VII-3
Number of Household Members**

Including yourself, how many people normally live in this household?	
1	16%
2	24%
3	24%
4	15%
5 or more	22%

Table VII-4 shows the percentage of customers that have a disabled member, an elderly member (60 years of age or older), or one or more children (18 years of age and younger). Twenty-nine percent reported that they have one or more household members age 60 or

older, 45 percent have one or more disabled members, and 59 percent have one or more children age 18 or younger.

**Table VII-4
Percent with Vulnerable Household Members**

How many are 60 or older? How many are disabled? How many are 18 or under?	
Elderly (60 or older)	29%
Disabled	45%
Children 18 or under	59%

Respondents were asked whether any member of their household has a medical condition that necessitates additional electric usage. Table VII-5 shows that 22 percent of respondents reported that someone in their household has such a medical condition.

**Table VII-5
Medically Necessary Electricity Usage**

Does anyone in your home have a medical condition that requires additional use of electricity?	
Yes	22%
No	78%
Don't know	1%

Respondents were asked for their marital status. Table VII-6 shows that 42 percent of respondents said they are married, 47 percent said they are single, and 11 percent said they are widowed.

**Table VII-6
Marital Status**

What is your marital status?	
Married	42%
Single	47%
Widow/Widower	11%
Refused	1%

Respondents were asked to report the highest level of education attained by any member of their household. Table VII-7 shows that 58 percent of respondents reported that the highest level of education reached by any member of their household was a high school education or less, 29 percent attended some college or earned an Associates Degree, 12 percent earned a bachelor's degree or higher, and one percent completed vocational training.

**Table VII-7
Education Level**

What is the highest level of education reached by any member of your household?	
Less than high school	11%
High school diploma / GED	47%
Some college / Associates Degree	29%
Bachelor's Degree	10%
Master's Degree or higher	2%
Vocational training	1%
Refused	1%

Table VII-8 displays the respondents' reported annual household income. The majority of respondents, 61 percent, reported an annual income at or below \$20,000. More than three-quarters of respondents reported an annual income at or below \$30,000.

**Table VII-8
Annual Household Income**

What is your household's annual income?	
≤ \$ 10,000	20%
\$10,001 - \$20,000	41%
\$20,001 - \$30,000	16%
\$30,001 - \$40,000	7%
> \$40,000	3%
Don't know	10%
Refused	3%

Respondents were asked to report on several sources of income and benefits received by members of their household:

- Employment income from salaries and wages, or self-employment income from a business or farm
- Retirement income, including Social Security, pensions, and other retirement funds
- Public assistance benefits from TANF, SSI, AFDC, or general assistance or public assistance
- Non-cash benefits, including food stamps or public housing
- Low Income Home Energy Assistance Program (LIHEAP) benefits

Table VII-9 shows that 43 percent of respondents reported that they received wages or self-employment income, 27 percent said they received retirement income, 33 percent said they

received public assistance, 33 percent said they received non-cash benefits, and 45 percent said they received LIHEAP benefits.

**Table VII-9
Types of Income and Benefits Received**

In the past 12 months, did you or any member of your household receive:	
<ul style="list-style-type: none"> • Employment income from wages and salaries or self-employment from a business or farm? • Retirement income from Social Security or pensions and other retirement funds? • Benefits from Temporary Assistance for Needy Families (TANF), Supplemental Security Income (SSI), or general assistance or public assistance? • Food Stamps or live in public/subsidized housing? • Benefits from the Low Income Home Energy Assistance Program (LIHEAP)? 	
Wages or self-employment income	43%
Retirement income	27%
Public assistance	33%
Non-cash benefits	33%
LIHEAP	45%

Table VII-10 shows that about one-third of respondents reported that at least one member of their household was unemployed and looking for work in the 12 months preceding the survey.

**Table VII-10
Employment Status**

In the past 12 months, was any member of your household unemployed and looking for work?	
Yes	34%
No	66%

Table VII-11 displays responses to the survey question, “What is the primary fuel used to heat your home?” Thirty-six percent of respondents reported that they use electricity as their primary heating fuel, 32 percent reported fuel oil, 16 percent reported natural gas, seven percent reported bottled gas (which included LPG and propane), three percent reported coal, another three percent reported kerosene, two percent reported wood, and one percent reported some other fuel.

**Table VII-11
Main Heating Fuel**

What is the primary fuel used to heat your home?	
Electricity	36%
Fuel Oil	32%
Natural Gas	16%
Bottled Gas	7%
Coal	3%
Kerosene	3%
Wood	2%
Some Other Fuel	1%
Don't know	1%

C. Enrollment and Reasons for Participation

This section examines the reasons for participation in WRAP. Table VII-12 displays the ways in which respondents found out about WRAP. Respondents were most likely to say that they heard about the program from a PPL customer service representative, a friend or relative, a community agency, or an electric bill insert. Respondents were also likely to say that they found out about the program through OnTrack or from a social service or government agency. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-12
How Respondent Became Aware of WRAP**

How did you find out about WRAP?	
PPL customer service representative	29%
Friend or relative	21%
Community agency	10%
Bill insert	10%
OnTrack	6%
Social service or government agency	6%
Received letter / was contacted by PPL	2%
Television / radio / newspaper ad	2%
Other weatherization program	1%
Internet	1%
Other	1%
Don't know	15%

Respondents were asked why they wanted to receive WRAP services. Table VII-13 shows that the majority of respondents, 64 percent, said that they wanted to receive WRAP services to reduce their electric bills. Respondents were also likely to say that they wanted to receive services to improve the comfort of their home, to reduce their electric use, or due to difficult financial circumstances or low income. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-13
Reason for Receiving WRAP Services**

Why did you want to receive WRAP services?	
Reduce electric bills	64%
Improve comfort of home	20%
Reduce electric use	9%
Due to difficult financial circumstances or low income	6%
Told to enroll / Not given a choice	3%
Because WRAP is offered / because respondent qualified	3%
Receive new appliances	2%
Reduce arrearages	1%
Other	1%
Don't know	1%

D. Understanding of WRAP

This section examines how well clients understand the benefits provided by WRAP. Respondents were asked, “Do you feel that you have a good understanding of the benefits provided by WRAP?” Table VII-14 shows that 88 percent of respondents said they have a good understanding of the benefits of WRAP.

**Table VII-14
Understanding of the Benefits of WRAP**

Do you feel that you have a good understanding of the benefits provided by WRAP?	
Yes	88%
No	10%
Don't know	2%

Table VII-15A displays answers to the question “What do you feel are the benefits of the Program?” A real testament to the quality of the education provided by the program is that

the most common response to this question was that energy education was a benefit.²¹ Thirty-six percent of respondents said that the benefit of WRAP is to receive energy education, 35 percent said the benefit is to reduce electric bills, 18 percent said the benefit is to reduce electric use, 11 percent said the benefit is to have a safer or more comfortable home, nine percent said the benefit is to receive new appliances, and six percent said the benefit is to receive weatherization services or home improvements. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-15A
Benefits of WRAP - Unprompted

What do you feel are the benefits of the program?	
Energy education	36%
Lower electric bills	35%
Lower electric use	18%
Safer / more comfortable home	11%
New appliances	9%
Weatherization services / improvements to home	6%
Program helps people who need it	4%
Receiving services of contractors / auditors	1%
Ability to maintain electric service	1%
CFL's	1%
OnTrack benefits	1%
None / did not see benefit	1%
Other	2%
Don't know	12%

After the unprompted question about program benefits, respondents were asked specifically whether they felt lower electric bills, lower electric use, energy education, receiving new appliances, and a safer or more comfortable home were benefits of participating in WRAP. Table VII-15B displays the responses to these questions. Eighty-eight percent of respondents agreed that lower electric bills is a benefit of the program, 91 percent agreed lower electric use was a benefit, 95 percent agreed energy education was a benefit, 86 percent agreed receiving new appliances was a benefit, and 92 percent agreed a safer or more comfortable home was a benefit.

²¹ In other surveys we found that customers were much less likely to say that energy education was a benefit of the program.

**Table VII-15B
Benefits of WRAP – Prompted**

Do you feel that lower electric bills are a benefit of the program?	
Do you feel that lower electric use is a benefit of the program?	
Do you feel that energy education is a benefit of the program?	
Do you feel that receiving new appliances is a benefit of the program?	
Do you feel that a safer or more comfortable home is a benefit of the program?	
Lower electric bills	88%
Lower electric use	91%
Energy education	95%
Receiving new appliances	86%
Safer or more comfortable home	92%

Respondents were then asked what they felt was the most important benefit of the program. Table VII-15C shows that the largest share of respondents, 27 percent, said that reducing electric bills was the most important benefit of WRAP. Nineteen percent of respondents said that energy education was the most important benefit, 11 percent said that a safer or more comfortable home was most important, 10 percent said reducing electric use was the most important benefit, and another 10 percent said that receiving new appliances was the most important benefit.

**Table VII-15C
Most Important Benefit of WRAP**

What do you feel is the most important benefit of the program?	
Lower electric bills	27%
Energy education	19%
Safer / more comfortable home	11%
Lower electric use	10%
New appliances	10%
Program helps people who need it	5%
Weatherization services / improvements to home	4%
Services of contractors / auditors	2%
CFL's	1%
None / did not see benefit	1%
Other	1%
Don't know	10%

E. Financial Obligations and Bill Payment Difficulties

Low-income customers may experience increased difficulty in paying their utility bills, and, as a result, may also experience interruptions in utility service. This section of the memo examines the financial difficulties that survey respondents reported.

Respondents were asked how difficult it is to pay their monthly PPL bill. Table VII-16 shows that 23 percent of respondents said it is very difficult to pay their PPL bill and 36 percent said it is somewhat difficult.

**Table VII-16
Difficulty of Electric Bill Payment**

How difficult is it to pay your monthly PPL bill?	
Very difficult	23%
Somewhat difficult	36%
Not too difficult	25%
Not at all difficult	13%
Don't know	2%
Refused	1%

Respondents were asked whether they used their kitchen stove or oven to provide heat in the past year, a dangerous practice that is sometimes used by low-income customers who cannot afford to pay their heating bills or service their heating systems. Table VII-17 shows that 17 percent of respondents reported that they used their kitchen stove or oven to provide heat in the year prior to the survey.

**Table VII-17
Use Kitchen Stove or Oven for Heat**

In the past year, did you use your kitchen stove or oven to provide heat?	
Always	3%
Frequently	3%
Sometimes	11%
Never / No	82%

Respondents were asked whether there was a time that they could not use their main source of heat for one or more of the following reasons:

- Their heating system was broken and they were unable to pay for a repair or replacement
- The utility company discontinued their electric service because they were unable to pay their bill

- The utility company discontinued their gas service because they were unable to pay their bill

Table VII-18 shows that 15 percent of respondents said their heating system was broken and they were unable to pay for its repair or replacement in the year prior to the survey. Three percent said that their electric service was discontinued, and another three percent said that their gas service was discontinued.

Table VII-18
Main Source of Heat Was Not Available

In the past year, was there ever a time when you wanted to use your main source of heat, but could not because:	
Your heating system broke and you were unable to pay for its repair or replacement	15%
The utility company discontinued your electric service because you were unable to pay your bill	3%
The utility company discontinued your gas service because you were unable to pay your bill	3%

Respondents who said that their gas service had been discontinued were asked if they used more electricity to heat their homes when they lost their natural gas service. Table VII-19 shows that 29 percent of respondents whose gas service was discontinued said they used more electricity to heat their homes due to that discontinuation.

Table VII-19
Used More Electricity When Gas Heat Was Not Available

When you lost your natural gas service, did you use more electricity to heat your home?¹	
Yes	29%
No	71%

¹7 respondents.

F. Program Measures

This section of the memo examines measures that respondents received from WRAP. Table VII-20 shows that 39 percent of respondents said they received a new refrigerator, 11 percent said they received an air conditioner, and nine percent said they received a water heater.

**Table VII-20
Received Appliances as a Result of WRAP**

Did you receive a new refrigerator as a result of the program? Did you receive a new air conditioner as a result of the program? Did you receive a new water heater as a result of the program?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Refrigerator	39%	41%	37%	39%	39%
Air Conditioner	11%	14%	7%	6%	16%
Water Heater	9%	6%	12%	12%	6%

TableVII-21 shows that more than half of respondents, 53 percent, said that a WRAP provider installed air sealing or insulation. Three percent of respondents said they received a reflective roof coating as a result of the program, and seven percent said they received window tinting. Full cost customers and those with electric heat were most likely to report that they received air sealing or insulation. Full cost customers were more likely than baseload customers to report that they received window tinting.

**Table VII-21
Received Work on Home as a Result of WRAP**

Did any of the providers seal gaps in your home or add to your home's insulation? Did any of the providers apply a reflective roof coating to the roof of your home? Did any of the providers apply window tinting to any of the windows in your home?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Seal gaps or add to insulation	53%	19%	86%	71%	34%
Apply reflective roof coating	3%	1%	5%	5%	1%
Apply window tinting	7%	2%	12%	7%	7%

G. Energy Education and Actions Taken

This section examines the energy education provided by WRAP service providers and customer actions to save electricity. Table VII-22 shows that 93 percent of respondents said they were home at the time of the service provider's visit, and 85 percent said they were home for the entire visit.

**Table VII-22
Respondent at Home for Service Provider's Visit**

Were you home at the time of the service provider's visit? Were you home for the entire visit?	
Home for visit	93%
Home for entire visit	85%

Respondents were asked whether the WRAP service provider explained how electric use is measured. Table VII-23 shows that about two-thirds of respondents, 65 percent, reported that one of the service providers explained how electric use is measured.

**Table VII-23
Provider Explained How Electric Use is Measured**

Did any of the providers explain how your electric use is measured?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Yes	65%	66%	65%	67%	63%
No	23%	21%	25%	21%	25%
Don't know	11%	13%	10%	11%	12%
Refused	1%	0%	1%	1%	0%

Respondents were asked whether any of the WRAP service providers did the following:

- Recommended actions that the customer could take to save electricity
- Told the customer how much money he/she could expect to save by taking the recommended actions
- Gave the customer a written plan of actions that he/she could take to save electricity
- Left the customer with information about how to reduce the amount of electricity he/she uses

Table VII-24 displays the responses to these questions. Eighty-three percent of respondents said that one of the providers recommended actions, 63 percent said the provider gave savings estimates for those actions, and 64 percent said the provider gave them a written plan of actions to save electricity. Eighty percent of respondents said one of the providers left electricity-saving information.

**Table VII-24
Actions to Save**

Did any of the providers recommend some actions that you could take to save electricity? Did any of the providers tell you how much money you could expect to save by taking the electricity-saving actions that he or she recommended? Did any of the providers give you a written plan of actions that you could take to save electricity? Did any of the providers leave you with information about how to reduce the amount of electricity you use?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Provider recommended actions	83%	81%	84%	86%	79%
Provider gave savings estimates for actions	63%	67%	58%	65%	59%
Provider gave written plan of actions to save electricity	64%	68%	60%	68%	60%
Provider left electricity-saving information	80%	83%	78%	80%	81%

Respondents who received a new refrigerator from the program were asked whether any of the WRAP service providers gave them an estimate of how much they could save by replacing their old refrigerator with a new one. Table VII-25 shows that 64 percent of respondents who received a new refrigerator said that one of the providers gave them a savings estimate for replacing their refrigerator with a new one.

**Table VII-25
Provider Gave Savings Estimate for Replacing Refrigerator**

Did any of the providers give you an estimate of how much you might be able to save by replacing your old refrigerator with a new one?¹	
Yes	64%
No	20%
Don't know	17%

¹85 respondents.

Table VII-26 shows that more than two-thirds of respondents who received a new air conditioner, 65 percent, said that one of the providers gave them a savings estimate for replacing their air conditioner with a new one.

**Table VII-26
Provider Gave Savings Estimate for Replacing Air Conditioner**

Did any of the providers give you an estimate of how much you might be able to save by replacing your air conditioner with a new one?¹	
Yes	65%
No	13%
Don't know	22%

¹23 respondents.

The survey addressed specific electric uses that respondents may have reduced as a result of receiving WRAP services. Table VII-27 displays the percent of respondents who reduced particular electric uses. Seventy-two percent of respondents reported that they reduced the amount of electricity used by their lights. Likewise, of the 98 respondents who said that they have a dishwasher, 72 percent said that they reduced this use. Sixty-eight percent of the 117 respondents who said they have electric heat reported that they reduced this use, and 62 percent of the 146 respondents who said that they have an electric hot water heater reported that they reduced this use.

Full cost customers were more likely than baseload customers to report that they reduced their use of electric heat and dehumidifiers. Customers with non-electric heat were more likely than those with electric heat to report that they reduced the amount of electricity used by their electric hot water heater. Seventy-three percent of non-electric heat customers who have electric water heaters said they reduced this use, compared to 55 percent of electric heat customers who have electric water heaters.

Table VII-27
Reduced Use of Appliances
Respondents Who Reported That They Have Appliance

	All Respondents		Baseload		Full Cost		Electric Heat		Non-Electric Heat	
	# Have Appliance	% Reduced Use	# Have Appliance	% Reduced Use	# Have Appliance	% Reduced Use	# Have Appliance	% Reduced Use	# Have Appliance	% Reduced Use
Lights	219	72%	106	70%	113	74%	117	70%	101	74%
Electric dryer	172	55%	88	59%	84	51%	91	50%	80	61%
Air conditioner	155	56%	84	62%	71	49%	73	51%	81	61%
Electric hot water heater	146	62%	56	63%	90	61%	94	55%	52	73%
Electric heat	117	68%	30	53%	87	72%	117	68%	0	--
Dishwasher	98	72%	45	71%	53	74%	54	72%	44	73%
Dehumidifier	46	39%	20	20%	26	54%	29	41%	17	35%

Respondents were asked what actions they had taken to save electricity since receiving WRAP services. Table VII-28 displays the responses to this question. The actions respondents most commonly reported that they had taken were using compact fluorescent

light bulbs (CFL's), turning off unnecessary lights, covering doors or windows or keeping them closed, purchasing new or energy efficient appliances, adding weatherization measures, and washing clothes in cold water.

Baseload customers and non-electric heating customers were most likely to say that they used CFL's. Baseload customers were more likely than full cost customers to report that they turn off unnecessary lighting. Twenty-four percent of baseload customers reported that they took this action, compared to 12 percent of full cost customers. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-28
Actions Taken to Save Electricity**

What electricity-saving actions have you been able to take since the providers came to your home?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Use CFL's	37%	49%	27%	31%	46%
Turn off lighting that is not needed	18%	24%	12%	16%	20%
Cover / keep doors or windows closed	11%	10%	12%	10%	12%
Purchase new / energy efficient appliances	8%	9%	6%	6%	10%
Add insulation, air sealing, or other weatherization measure	6%	5%	7%	8%	4%
Use cold water for washing clothes	6%	5%	7%	8%	4%
Turn off television when not being watched	2%	5%	0%	1%	4%
Turn off computer when not in use	2%	3%	1%	0%	4%
Wash only full loads in clothes washer	2%	3%	2%	2%	3%
Repair / replace windows or doors	2%	3%	2%	3%	1%
Reduced electricity used by hot water heater	2%	1%	3%	2%	2%
Clean / replace air conditioner filters	1%	0%	1%	0%	1%
Clean / replace furnace filters	1%	3%	0%	1%	2%
Heat fewer rooms	1%	1%	1%	1%	1%
Use less electric heat / do not use at all	1%	1%	1%	2%	0%
Stop using one or more appliances	1%	0%	1%	1%	0%
Get rid of waterbed	1%	0%	3%	2%	1%
Use shower / faucet aerators	1%	1%	1%	2%	0%
Raise refrigerator temperature	1%	0%	1%	1%	0%
Reduce use of fans	1%	1%	0%	0%	1%
Reduce use of dishwasher	1%	1%	2%	2%	1%
Reduce number / length of baths or showers	1%	1%	0%	0%	1%
Use alternative heating sources	1%	0%	1%	0%	1%

What electricity-saving actions have you been able to take since the providers came to your home?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Other	5%	6%	4%	3%	7%
No actions taken	7%	5%	9%	7%	7%
Don't know	11%	10%	12%	10%	12%
Refused	1%	0%	3%	2%	1%

Respondents who stated that they reduced their use of hot water as a result of the program were asked what actions they had taken to do so. Table VII-29 shows that the most commonly reported actions taken to reduce hot water usage were using cold water for washing clothes, reducing the length of showers, reducing the number of baths and showers, and not letting the water run. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-29
Actions Taken to Reduce Use of Hot Water**

What have you done as a result of the program to reduce the amount of hot water you use?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	146	56	90	94	52
Use cold water for washing clothes	22%	21%	22%	19%	27%
Reduced length of showers	17%	20%	16%	15%	21%
Reduced number of showers / baths	14%	14%	13%	11%	19%
Don't let water run	12%	13%	11%	12%	12%
Don't run dishwasher as often	8%	7%	8%	9%	6%
Don't wash clothes as often	6%	9%	4%	3%	12%
Turned down water heater temperature	6%	7%	6%	5%	8%
Use cold water instead of hot water	2%	4%	1%	1%	4%
Use low flow showerhead / aerator	1%	2%	1%	1%	2%
Use timer for water heater / reduce time it is on	1%	2%	0%	0%	2%
Got new hot water heater	1%	0%	1%	1%	0%
Wrapped water heater / pipes	1%	0%	1%	1%	0%
Other	2%	0%	3%	2%	2%
Don't know	2%	4%	1%	2%	2%
Not asked	38%	38%	39%	45%	27%

Respondents who reported that they reduced the amount of heat they use as a result of participating in WRAP were asked how they reduced this use. Table VII-30 shows that more than one-third of these respondents, 37 percent, said that they turned down the thermostat setting. Thirteen percent of respondents said that they use heat less, and six percent said they heat fewer rooms. Baseload customers were more likely than full cost customers to report that they reduced their use of electric space heaters as a result of WRAP. Ten percent of baseload customers reported that they took this action, compared to one percent of full cost customers. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-30
Changes in Use of Electric Heat

How have you changed the way you heat as a result of the program?			
	All Respondents	Baseload	Full Cost
Number of Respondents	117	30	87
Turn down thermostat	37%	27%	40%
Use heat less	13%	17%	12%
Heat fewer rooms	6%	0%	8%
Use alternative heat source	4%	7%	3%
Had weatherization work done	4%	0%	6%
Use timer or programmable thermostat	3%	0%	3%
Use heat fewer hours per day	3%	0%	3%
Use space heater less often / not at all	3%	10%	1%
Cleaned furnace filter	3%	7%	2%
Use heat fewer days per year	1%	3%	0%
Repaired or replaced primary heating system	1%	3%	0%
Other	1%	0%	1%
No action / action unrelated to heat use	3%	0%	3%
Don't know	3%	0%	3%
Not asked	33%	47%	28%

Respondents who reported that they reduced the amount of heat they use as a result of participating in WRAP were asked what actions they had taken to keep warm since reducing the amount of heat they use. Table VII-31 shows that the largest share of respondents, 41 percent, said that they use warmer clothes and blankets to keep warm. Ten percent of respondents said that they did not take any actions to keep warm. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-31
Actions Taken in Response to Reduced Use of Electric Heat**

What do you do to keep warm now that you use less heat?	
Number of Respondents	117
Warmer clothes / blankets	41%
Use alternative heat source	5%
Leave house for heated location	2%
Use electric space heaters or blankets	2%
Other	2%
Nothing	10%
Don't know	7%
Not asked	33%

Table VII-32 displays whether respondents reported that they have an electric space heater in their home. One-quarter of respondents said that they have an electric space heater.

**Table VII-32
Electric Space Heater in Home**

Do you have an electric space heater in your home?	
Yes	25%
No	75%
Don't know	1%

Respondents who reported that they have an electric space heater were asked whether they use their space heater more, less, or about the same since receiving WRAP services. Table VII-33 shows that half of respondents who reported having a space heater said that they use their space heater less since receiving services, 13 percent said that they use their space heater more, and 37 percent said that they use their space heater about the same amount.

**Table VII-33
Changes in Use of Electric Space Heater**

Do you use your electric space heater more, less, or about the same since participating in the program?	
Number of Respondents	54
More	13%
Less	50%
About the Same	37%

Respondents who reported that they reduced the amount of air conditioning they use as a result of participating in WRAP were asked how they reduced this use. Table VII-34 shows that 27 percent of respondents said that they use their air conditioner less, and 16 percent said that they turn up the thermostat or use a lower setting on the air conditioner. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-34
Changes in Use of Air Conditioning

How have you changed the way you use your air conditioning as a result of the program?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	155	84	71	73	81
Use air conditioning less	27%	29%	25%	26%	27%
Turn up thermostat / use lower setting on unit	16%	19%	13%	14%	19%
Got new / energy efficient unit	5%	7%	3%	1%	9%
Do not use air conditioner	3%	2%	4%	4%	3%
Use fewer hours per day	3%	4%	1%	1%	3%
Use in fewer rooms	2%	4%	0%	0%	4%
Use fewer days per year	1%	0%	1%	1%	0%
Other	1%	1%	1%	3%	0%
Don't know	2%	1%	3%	3%	1%
Not asked	44%	38%	51%	49%	40%

Respondents who reported that they reduced the amount of air conditioning they use as a result of participating in WRAP were asked what actions they had taken to keep cool since reducing the amount of air conditioning they use. Table VII-35 shows that 21 percent of respondents said that they use fans to keep cool. Some respondents also said that they open windows, take cool baths or showers, or close the blinds and curtains. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-35
Actions Taken in Response to Reduced Use of Air Conditioning

What do you do to keep cool now that you use less air conditioning?	
Number of Respondents	155
Use fans	21%
Open windows	7%
Take cool baths or showers / swim	4%
Close blinds / curtains	4%
Leave home for air conditioned or cooler location	2%

What do you do to keep cool now that you use less air conditioning?	
Number of Respondents	155
Cool drinks	1%
Wear lighter clothing	1%
Stay in air conditioned or cool part of home	1%
Other	1%
Nothing	16%
Don't know	3%
Not asked	44%

Respondents who reported that they reduced the amount of electricity used by their clothes dryer were asked what actions they had taken to reduce this use. Table VII-36 shows that one-fifth of respondents said that they line dry clothes, and 13 percent said that they reduced the number of loads that they dry in the clothes dryer. Other actions that respondents commonly reported that they had taken included cleaning the lint filter, not using the dryer much or at all, drying only full loads, and getting a new or energy efficient clothes dryer. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-36
Actions Taken to Reduce Use of Clothes Dryer**

What have you done as a result of the program to reduce the amount of electricity used by your dryer?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	172	88	84	91	80
Line drying	20%	23%	18%	18%	23%
Reduce number of loads	13%	17%	8%	10%	16%
Clean out lint	6%	5%	7%	4%	8%
Don't use dryer much or at all	6%	8%	4%	4%	8%
Dry only full loads	5%	3%	6%	4%	5%
Got new / energy efficient dryer	5%	3%	6%	6%	4%
Use at a certain time of day	2%	1%	2%	1%	3%
Had work done by WRAP	4%	5%	2%	3%	4%
Vented dryer / fixed vent	5%	0%	1%	1%	0%
Other	1%	1%	1%	1%	1%
Not asked	45%	41%	49%	51%	39%

Respondents who reported that they reduced the amount of electricity used by their dishwasher were asked what actions they had taken to do so. Table VII-37 shows that 31

percent of respondents said that they do not use the dishwasher much or at all, 16 percent said that they use the dishwasher less than they did prior to receiving services, 13 percent said that they use the energy saver or air dry setting, and 12 percent said they wash only full loads. Baseload customers were more likely than full cost customers to report that they use their dishwasher less often than they did prior to receiving WRAP services. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-37
Actions Taken to Reduce Use of Dishwasher

What have you done as a result of the program to reduce the amount of electricity used by your dishwasher?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	98	45	53	54	44
Don't use much or at all	31%	36%	26%	26%	36%
Use less often than before	16%	9%	23%	17%	16%
Use energy saver setting	13%	11%	15%	17%	9%
Wash only full loads	12%	13%	11%	13%	11%
Got new / energy efficient appliance	1%	2%	0%	0%	2%
Other	3%	2%	4%	2%	5%
Nothing	1%	0%	2%	2%	0%
Not asked	28%	29%	26%	28%	27%

Table VII-38 displays actions that respondents reported taking as a result of the program to reduce the electricity used by their lights. Nearly half of respondents, 45 percent, said that they turn lights off when they are not being used, 30 percent said that they use compact fluorescent light bulbs (CFL's), and six percent said that they turn lights off at night. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-38
Actions Taken to Reduce Use of Lights

What have you done as a result of the program to reduce the electricity used by your lights?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Turn off when not in use	45%	46%	44%	44%	48%
Use CFL's	30%	29%	31%	28%	32%
Turn off at night	6%	6%	6%	4%	8%
Use night lights or lower wattage lights	1%	2%	0%	0%	2%

What have you done as a result of the program to reduce the electricity used by your lights?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Use motion detector	1%	0%	1%	1%	0%
Open curtains / use natural light	1%	2%	0%	0%	2%
Use candles	1%	0%	2%	2%	0%
Put lights on timer	1%	1%	0%	0%	1%
Other	1%	0%	3%	3%	0%
Nothing / action unrelated to use of lights	1%	1%	1%	1%	1%
Don't know	1%	2%	1%	1%	2%
Not asked	28%	30%	26%	30%	26%

Table VII-39 displays data about whether respondents leave lights on all night and, if they do, how many they leave on. Table 39 shows that 30 percent of respondents reported that they left lights on all night prior to receiving WRAP services, and 27 percent of respondents reported that they currently leave lights on all night.

Those respondents who said that they did or do leave lights on all night were asked how many lights they leave on all night. The mean number of lights left on decreased from 1.98 to 1.77.

**Table VII-39
Lights on All Night**

Did you leave any lights on all night prior to receiving services from the program? How many lights did you leave on all night prior to receiving services? Do you currently leave lights on all night? How many lights do you currently leave on all night?										
	Prior to Receiving Services					Currently				
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101	219	106	113	117	101
Yes	30%	25%	35%	34%	24%	27%	26%	27%	27%	25%
No	70%	76%	66%	66%	76%	73%	74%	73%	72%	75%
Don't know	0%	0%	0%	0%	0%	1%	0%	1%	1%	0%
Mean number left on	1.98 ¹	2.12 ²	1.89 ³	2.00 ⁴	1.96 ⁵	1.77 ⁶	2.07 ⁷	1.46 ⁷	1.93 ⁸	1.56 ⁹

¹ 64 respondents. ² 26 respondents. ³ 38 respondents. ⁴ 40 respondents. ⁵ 23 respondents. ⁶ 56 respondents. ⁷ 28 respondents. ⁸ 30 respondents. ⁹ 25 respondents.

Respondents were asked, “Is there anything else in your home that we haven’t discussed that you think uses a lot of electricity? If yes, what uses a lot of electricity?” As shown in Table VII-40, 20 percent of respondents said that they had another appliance that uses a lot of electricity. Respondents were likely to say that their stove or oven, television, refrigerator, freezer, fan, microwave, computer, and waterbed use a lot of electricity.

Ten percent of respondents reported that the service provider discussed this use with them, and 13 percent said that they took actions to reduce this use. Respondents who said that they took actions to reduce this use were most likely to say that they use the item less or turn the setting down, turn the item off when not in use, take actions to keep the item running efficiently, or do not use the item at all.

Table VII-40
Other High-Use Appliances

Is there anything else in your house that we haven’t discussed that you think uses a lot of electricity?	
Did any of the providers discuss these electric uses with you?	
What actions, if any, have you taken to reduce these uses?	
Have other high-use appliance(s)	20%
Provider discussed use of other appliance(s)	10%
Took actions to reduce use of other appliance(s)	13%

H. Program Impact

This section examines the impact that WRAP has had on participants’ lives.

Respondents were asked whether they had reduced their overall electric usage as a result of WRAP.²² Table VII-41 shows that 73 percent of respondents said that they reduced their overall electric usage as a result of WRAP. Full cost customers were more likely than baseload customers to report that they reduced their overall electric usage. Seventy-eight percent of full cost customers said that they reduced their overall electric usage, compared to 67 percent of baseload customers.

Respondents who reported that they had not reduced their overall electric usage were asked why they had not reduced their usage. The reasons most commonly given by respondents were the need for more weatherization services and the lack of services received from WRAP.

²² This is a difficult question to ask low-income customers who have been shown to focus on their bill amount, rather than on the amount of electricity used. Therefore, the accuracy of these responses may be subject to question.

**Table VII-41
Reduction in Overall Electric Usage**

Do you feel that your household has reduced its overall electric usage as a result of WRAP?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Yes	73%	67%	78%	76%	68%
No	19%	25%	14%	15%	24%
Don't know	8%	9%	8%	9%	8%

Respondents were asked whether their PPL bill had changed since receiving WRAP services. Table VII-42 shows that 55 percent of respondents said that their bill was lower since receiving services, 11 percent said that their bill was higher, and 24 percent said that their bill was the same. Baseload customers were more likely than full cost customers to report that their bill was higher since receiving WRAP services.

**Table VII-42
Change in PPL Bill**

Would you say that your PPL bill is higher, lower, or has not changed in comparison to what it was before receiving WRAP services?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Higher	11%	14%	7%	9%	12%
Lower	55%	55%	55%	55%	55%
No change	24%	22%	27%	25%	24%
Don't know	11%	9%	12%	11%	10%

Table VIII-43 displays whether respondents experienced a change in the warmth of their home in the winter since receiving WRAP services. More than half of respondents reported that there was no change in the winter temperature of their home, 40 percent said that the warmth of their home had improved, and one percent said that it had worsened. Full cost customers and those with electric heat were most likely to report that the warmth of their home in the winter had improved.

**Table VIII-43
Change in Warmth of Home in the Winter**

Have you noticed a change in the warmth of your home in the winter since receiving WRAP services? Has the winter temperature in your home improved, worsened, or stayed the same since receiving WRAP services?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Improved	40%	21%	58%	52%	27%
Worsened	1%	0%	1%	1%	0%
No / No change	58%	78%	40%	46%	72%
Don't know	1%	1%	1%	1%	1%

Table VII-44 displays whether respondents experienced a change in the summer temperature of their home since receiving WRAP services. More than two-thirds of respondents reported that there was no change in the summer temperature of their home, 32 percent said that the summer temperature of their home had improved, and one percent said that it had worsened. Full cost customers were more likely than baseload customers to report that the summer temperature of their home had improved.

**Table VII-44
Change in Temperature in Home in the Summer**

Have you noticed a change in the temperature of your home in the summer since receiving WRAP services? Has the summer temperature in your home improved, worsened, or stayed the same since receiving WRAP services?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Improved	32%	25%	38%	33%	30%
Worsened	1%	0%	3%	3%	0%
No Change	67%	75%	59%	65%	70%

Table VII-45 displays other changes that respondents reported in the comfort of their home since receiving WRAP services. Changes most commonly mentioned by respondents included a warmer home in the winter and a less drafty home. Full cost customers were more likely than baseload customers to report that there were other changes in the comfort of their home since receiving WRAP services. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-45
Other Changes in the Comfort of Home**

Have you noticed any other changes in the comfort of your home since receiving WRAP services?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Warmer in winter	11%	3%	19%	12%	10%
Less drafty	7%	1%	12%	12%	1%
Cooler in summer	4%	3%	4%	3%	4%
Temperature / home is more comfortable in general	3%	1%	5%	4%	2%
Electric bill / use is lower	2%	3%	1%	2%	2%
Hotter in summer	1%	0%	1%	1%	0%
More drafty	1%	0%	1%	0%	1%
Dehumidifier works better	1%	0%	1%	1%	0%
Water is hotter	1%	0%	1%	1%	0%
Other	2%	3%	1%	3%	1%
No other changes	71%	87%	57%	62%	81%
Don't know	1%	1%	1%	2%	0%

Respondents were asked how important WRAP has been in helping them meet their needs. Table VII-46 shows that 63 percent of respondents said that WRAP was very important, and 23 percent said that it was somewhat important. Customers with electric heat were more likely than those with non-electric heat to report that WRAP was very important in helping them meet their needs.

**Table VII-46
Importance of WRAP**

How important has WRAP been in helping you to meet your needs?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Very important	63%	59%	66%	68%	56%
Somewhat important	23%	27%	20%	18%	30%
Of little importance	8%	8%	8%	7%	9%
Not at all important	2%	4%	1%	3%	2%
Don't know	4%	3%	4%	4%	3%
Refused	1%	0%	1%	1%	0%

Respondents were asked whether they need more assistance to pay their PPL bills. Table VII-47 shows that nearly half of respondents, 49 percent, said that they needed additional assistance to pay their PPL bills.

**Table VII-47
Need Additional Assistance With PPL Bills**

Do you feel that you need additional assistance to pay your PPL bills?	
Yes	49%
No	50%
Don't know	1%
Refused	1%

I. Satisfaction With Program Services

This section examines respondents' satisfaction with WRAP. Table VII-48 displays respondents' satisfaction with measures and services received through WRAP. More than 90 percent of respondents reported that they were very satisfied or somewhat satisfied with each of the measures and services asked about in the survey. The aspect of the program that customers were most likely to be dissatisfied with was the air sealing or insulation they received. Eight percent of customers said that they were somewhat or very dissatisfied with the air sealing or insulation they received.

Six percent of respondents said that they were somewhat dissatisfied or very dissatisfied with the energy education they received from WRAP. These respondents were asked what they would change about the energy education. These respondents were most likely to say that the education should be more understandable, that WRAP should offer more education, and that the service provider should explain all of the appliances and services available through WRAP. Respondents also said that WRAP should hire contractors who are more knowledgeable, and that they should offer more referrals to other programs.

Table VII-48
Satisfaction with Program Measures and Services Provided

How satisfied are you with your new refrigerator? How satisfied are you with your new air conditioner? How satisfied are you with your new water heater? How satisfied were you with the completion of this sealing and insulation work? How satisfied were you with the completion of this roof coating? How satisfied were you with the completion of this window tinting? How satisfied were you with the energy education that you received?							
	Refrigerator	Air Conditioner	Water Heater	Sealing and Insulation	Roof Coating	Window Tinting	Energy Education
Number of Respondents	85	23	20	117	7	15	219
Very satisfied	80%	96%	90%	77%	86%	67%	65%
Somewhat satisfied	14%	0%	5%	15%	14%	33%	28%
Somewhat dissatisfied	6%	4%	5%	5%	0%	0%	4%
Very dissatisfied	0%	0%	0%	3%	0%	0%	2%

Respondents who received new appliances under WRAP were asked how satisfied they were with the delivery of their new appliances. Table VII-49 displays the responses to these questions. Ninety-two percent of respondents who received a new refrigerator, 95 percent of respondents who received a new air conditioner, and 90 percent of those who received a new water heater said that they were very or somewhat satisfied with the delivery of their new appliances.

Table VII-49
Satisfaction with Delivery of Appliances

How satisfied were you with the delivery of your new refrigerator? How satisfied were you with the delivery and installation of your new air conditioner? How satisfied were you with the delivery and installation of your new water heater?			
	Refrigerator	Air Conditioner	Water Heater
Number of Respondents	85	23	20
Very satisfied	77%	78%	90%
Somewhat satisfied	15%	17%	0%
Somewhat dissatisfied	4%	0%	5%
Very dissatisfied	4%	0%	0%
Don't know	1%	4%	5%

Respondents who received air sealing and insulation work, a reflective roof coating, or window tinting were asked whether the service provider left their home in the same condition after completing the work. Table VII-50 shows that 94 percent of respondents

who received sealing and insulation work, 100 percent of those who received a reflective roof coating, and 93 percent of those who received window tinting reported that the provider left their home in the same condition after completing the work.

Table VII-50
Provider Left Home in Same Condition After Completion of Work

Did the provider leave your home in the same condition it was in before the completion of the sealing and insulation work?			
Did the provider leave your home in the same condition it was in before the completion of the roof coating work?			
Did the provider leave your home in the same condition it was in before the completion of the window tinting work?			
	Sealing and Insulation	Roof Coating	Window Tinting
Number of Respondents	117	7	15
Yes	94%	100%	93%
No	6%	0%	7%

Respondents were asked how helpful WRAP energy education was in teaching them about electricity and ways to reduce electric costs. Table VII-51 shows that 57 percent of respondents said that the education was very helpful and 27 percent said that it was somewhat helpful. Full cost customers and those with electric heat were most likely to report that WRAP was very helpful or somewhat helpful in teaching them about electricity use and ways to reduce electric costs.

Table VII-51
Helpfulness of Energy Education

How helpful was WRAP in teaching you about electricity use and ways to reduce electric costs?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Very helpful	57%	49%	64%	66%	47%
Somewhat helpful	27%	27%	27%	22%	32%
Of little help	12%	18%	7%	8%	18%
Not at all helpful	3%	5%	1%	3%	3%
Don't know	1%	1%	1%	1%	1%
Refused	1%	0%	1%	1%	0%

Respondents were asked how knowledgeable the WRAP service provider was. Table VII-52 shows that 83 percent of respondents said that the provider was very knowledgeable, 14 percent said that the provider was somewhat knowledgeable, and one percent said the provider was not knowledgeable at all.

**Table VII-52
Rating of Service Providers**

Do you feel that the provider who came to your home was very knowledgeable about electricity usage, somewhat knowledgeable, or not at all knowledgeable?	
Very knowledgeable	83%
Somewhat knowledgeable	14%
Not at all knowledgeable	1%
Don't know	3%
Refused	1%

Table VII-53 displays respondents' ratings of the timeliness of WRAP service delivery. Sixty-seven percent of respondents said that all of the work that was promised was completed very soon after it was promised, 19 percent said it was completed somewhat soon after, and six percent said it was completed not at all soon after it was promised.

**Table VII-53
Timeliness of Service Delivery**

Was all of the work that you were promised done very soon after it was promised, somewhat soon after, or not at all soon after?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Very soon	67%	59%	74%	74%	59%
Somewhat soon	19%	18%	20%	15%	23%
Not at all soon	6%	8%	4%	7%	5%
Don't know	8%	15%	2%	4%	13%

Respondents who said that they did not receive a refrigerator or an air conditioner were asked if they had expected to receive a new appliance after the service provider completed the audit of their home. Table VII-54 shows that four percent of respondents did not receive a refrigerator but expected one, and five percent of respondents did not receive an air conditioner but expected one.

Table VII-54
Expected But Did Not Receive Refrigerator or Air Conditioner

After the service provider completed the audit of your home, did you expect to receive a new refrigerator from the Program?		
After the service provider completed the audit of your home, did you expect to receive a new air conditioner from the Program?		
	Refrigerator	Air Conditioner
Expected appliance	4%	5%
Did not expect appliance	54%	84%
Don't know	3%	0%
Not asked	39%	11%

Respondents were asked if they received everything they expected to receive from the program. Table VII-55A shows that 80 percent of respondents said that they received everything that they expected to receive.

Table VII-55A
Expected Measures and Services Not Received

Did you receive everything that you expected to receive under the Program?	
Received everything expected	80%
Did not receive everything expected	19%
Don't know	1%

Table VII-55B displays measures and services that respondents said that they did not receive, but expected to receive. Commonly mentioned measures and services that respondents expected to receive included insulation, windows and doors, air sealing, air conditioners, repairs or replacement of heating equipment, and water heater or pipe insulation. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-55B
Expected Measures and Services Not Received

What did you expect to receive that you did not receive?	
Insulation	5%
Windows / doors	5%
Air sealing	3%
Air conditioner	2%
Repair or replace heating equipment	2%
Water heater / pipe insulation	2%

What did you expect to receive that you did not receive?	
Clothes dryer	1%
Hot water heater	1%
Wood stove	1%
Refrigerator	1%
Cleaning of HVAC filters	1%
Solar energy system	1%
Window tinting	1%
Replacement mattress for waterbed	1%
Hot tub repairs	1%
Freezer	1%
Programmable thermostats	1%
Other	1%
Received everything expected	82%

Table VII-56 shows respondents' overall satisfaction with WRAP. Seventy-one percent of respondents said that they were very satisfied with WRAP and 22 percent said that they were somewhat satisfied. Full cost customers and those with electric heat were most likely to report that they were very satisfied with WRAP.

Table VII-56
Program Satisfaction

Overall, how satisfied were you with WRAP?					
	All Respondents	Baseload	Full Cost	Electric Heat	Non-Electric Heat
Number of Respondents	219	106	113	117	101
Very satisfied	71%	64%	78%	76%	65%
Somewhat satisfied	22%	29%	16%	18%	28%
Somewhat dissatisfied	4%	2%	5%	3%	4%
Very dissatisfied	2%	4%	1%	3%	2%
Don't know	1%	1%	0%	0%	1%

Respondents were asked what more PPL could have done to help them reduce their electric bills. Table VII-57 displays the responses to this question. Fifteen percent of respondents said that PPL could have helped them reduce their electric bill by providing weatherization services. Eight percent said that they could have replaced doors or windows, and six percent said that they could have replaced appliances. Answers total more than 100 percent because respondents could provide more than one answer.

**Table VII-57
What Else Could PPL Have Done**

What else could PPL have done to help you reduce your electric use?	
Provide weatherization services	15%
Replace doors or windows	8%
Replace appliances	6%
Offer discounted rate on electric bill	3%
Provide roof coating and/or window tinting	3%
Check more appliances	1%
Enroll customer in OnTrack	1%
Replace heating equipment	1%
Replace hot water heater	1%
Wrap water heater / pipes	1%
Repair roof	1%
Improve education	1%
Offer audits of electricity use	1%
Finish work that is started / promised	1%
Provide solar energy systems	1%
Test home's weatherization needs	1%
Provide new electrical wiring	1%
Provide services more quickly	1%
Allow customers to receive WRAP services more than once	1%
Other	1%
Don't know	24%
Nothing else	39%

Respondents were asked whether they had any recommendations for improvements to WRAP. Table VII-58 shows that four percent of respondents recommended that WRAP improve the explanation of the program and of services provided by the program. Other recommendations included offering more weatherization services, advertising the program more or offering it to more people, providing periodic follow-up with customers, and shortening the time between applying for the program and receiving services. Answers total more than 100 percent because respondents could provide more than one answer.

Table VII-58
Recommendations for Program Improvement

Do you have any recommendations for improvements to the program?	
Improve explanation of program and services available	4%
Offer more weatherization services	3%
Advertise program better / offer to more people	3%
Provide periodic follow-up	3%
Shorten time between applying and receiving services	2%
Offer additional services at reduced cost to customer	1%
Provide more help with doors and windows	1%
Listen to the customer more	1%
Provide a more thorough audit	1%
Finish work that is started / promised	1%
Replace more appliances	1%
Lower electric bills	1%
Give homeowner choice of measures within the budget	1%
Other	2%
No recommendations	77%

J. Summary of Findings

Key findings from the customer survey are summarized below.

- *Survey Respondents Profile:* Households who received WRAP services were likely to have vulnerable members. About 45 percent of households have at least one disabled member and 29 percent have at least one elderly member. These households were also likely to have a difficult time finding employment that met all of their income needs; fifty-eight percent of respondents reported that the highest level of education reached by any member of their household was high school or less. More than one-third of respondents reported that at least one member of their household had been unemployed and looking for work in the year prior to the survey.
- *Income:* Respondents were asked for the range of their annual household income. Twenty percent of clients have an annual income of \$10,000 or less, 41 percent of clients have an annual income between \$10,001 and \$20,000, and 26 percent of clients have an annual income of \$20,001 or more. Forty-three percent of respondents reported that they earned income from wages, salaries, or self-employment in the 12 months preceding the survey. Twenty-seven percent of respondents reported that they received retirement income.

- *Assistance:* Thirty-three percent of respondents reported that they received public assistance, 33 percent said they received non-cash benefits such as food stamps or subsidized housing, and 45 percent said they received LIHEAP.
- *Understanding of the Program:* Eighty-eight percent of respondents reported that they understand the benefits of WRAP. Thirty-six percent of respondents said that energy education was a benefit of the program, 35 percent said lower electric bills was a benefit, and 18 percent said lower electric use was a benefit.
- *Financial Obligations and Bill Payment Difficulties:* Fifty-nine percent of respondents reported that it was very difficult or somewhat difficult to pay their PPL bill. When customers face difficulties paying bills, they may experience interruptions of heating service or use alternative heat sources. Seventeen percent of respondents reported that they used their kitchen stove or oven to provide heat in the year preceding the survey. Fifteen percent of respondents reported that they were unable to use their main source of heat in the year prior to the survey due to a broken heating system, three percent said that their electric service was discontinued, and three percent said that their gas service was discontinued.
- *Measures:* The survey included questions about the measures clients received. As a result of WRAP, 39 percent of respondents received a new refrigerator, 11 percent received a new air conditioner, and nine percent received a new water heater. More than half of respondents, 53 percent, reported that they received air sealing or insulation from the program, seven percent said they received window tinting, and three percent said they received a reflective roof coating.
- *Energy Education and Actions Taken:* Ninety-three percent of respondents said that they were home for the service provider's visit, and 85 percent said they were home for the entire visit.

The survey included questions that addressed whether the provider explained the electric bill and whether he/she suggested actions that the customer could take to save electricity. Sixty-five percent of respondents said that the service provider explained how electric use is measured. Eighty-three percent of respondents said that the provider recommended actions, 63 percent said the provider gave savings estimates for those actions, and 64 percent said the provider gave them a written plan of actions to save electricity. Eighty percent of respondents said one of the providers left electricity-saving information.

Respondents were asked what electricity-saving actions that had taken as a result of receiving WRAP services. The actions respondents most commonly mentioned were using compact fluorescent light bulbs (CFL's), turning off lights when not in use, and covering doors or windows or keeping them closed.

Respondents were more likely to report that they reduced the use of specific appliances when asked directly about those uses. Of the respondents who have each appliance discussed in the survey, 72 percent reported that they reduced the use of lights, 55 percent

reduced use of the electric dryer, 56 percent reduced use of air conditioning, 62 percent reduced use of hot water, 68 percent reduced use of electric heat, 72 percent reduced use of the dishwasher, and 39 percent reduced use of the dehumidifier.

One-quarter of the respondents reported that they have an electric space heater in their home. Half of these respondents said that they use their space heater less since receiving WRAP services.

The survey asked respondents whether they left lights on all night prior to receiving WRAP services and whether they currently leave lights on all night. Thirty percent of respondents said that they left lights on all night prior to receiving services, and 27 percent said that they currently leave lights on all night. The mean number of lights left on all night decreased from 1.98 to 1.77.

- *Program Impact:* Respondents were asked whether they had reduced their overall electric usage since receiving WRAP services. Nearly three-quarters of respondents said that they had reduced their electric usage. Full cost customers were more likely than baseload customers to report that they had reduced their overall electric usage. More than half of respondents, 55 percent, also said that their PPL bill was lower than it was prior to receiving WRAP services.

Respondents were asked about the impact of WRAP on the comfort of their home. Forty percent of respondents said that the warmth of their home in the winter had improved since receiving WRAP services. Full cost customers and customers with electric heat were most likely to report that the warmth of their home had improved. Thirty-two percent of respondents reported that the temperature of their home in the summer had improved since receiving services.

The survey asked respondents how important WRAP had been in helping them meet their needs. The majority of respondents, 86 percent, said that WRAP was very important or somewhat important. However, nearly half of respondents, 49 percent, said that they need more assistance to pay their PPL bills.

- *Satisfaction with Program Services:* More than 90 percent of respondents reported that they were very satisfied or somewhat satisfied with the measures and services they received from WRAP, including refrigerators, air conditioners, water heaters, air sealing and insulation, reflective roof coating, and window tinting.

The satisfaction rate for education was high. Ninety-three percent of respondents said that they were very satisfied or somewhat satisfied with the energy education they received. Eighty-four percent of respondents reported that WRAP was very helpful or somewhat helpful in teaching them about electricity use and ways to reduce electric costs. Additionally, nearly all respondents, 97 percent, said that the WRAP service provider was very knowledgeable or somewhat knowledgeable about electricity usage.

The majority of respondents, 80 percent, received everything that they expected to receive from WRAP. Some respondents said that they did not receive insulation, doors or windows, and air sealing, but expected to receive these services.

Overall, 93 percent of respondents reported that they were very satisfied or somewhat satisfied with WRAP. Full cost customers and customers with electric heat were most likely to report that they were very satisfied or somewhat satisfied with the program. Most respondents, 77 percent, did not have recommendations for improvement to the program. Six percent suggested replacing more appliances, three percent suggested offering a discounted rate on the electric bill, and three percent suggesting providing more roof coating or window tinting.

VIII. Usage Impacts

This section analyzes the impact of the WRAP on participants' electric usage. The Usage Analysis was conducted by Blasnik and Associates.

A. Data Collection and Cleaning

The impact analysis of WRAP employed data from three primary sources: the WRAP tracking system database, monthly electric usage data for program participants from PPL, and weather data from the National Weather Service.

We used the program tracking system data to characterize the demographics, housing characteristics and treatments received by each customer and to identify the treatment dates. We translated the 120 different official PUC measure codes into broader categories of treatments for reporting and analysis purposes. We assigned each customer to one of four weather stations (Allentown, Harrisburg, Wilkes-Barre, and Williamsport) based on their PPL region assigned in the tracking system.

We prepared the usage data for analysis by combining estimated meter readings into actual usage periods and eliminated periods without occupancy (or shut-off). We classified each usage data point into the before and after treatment periods. We defined the treatment period for each home as starting on the date the order for the energy audit was sent to the provider and ending on the installation date of the last measure. This definition blocks out a significant amount of time for some homes. The median treatment period lasted 36 days for baseload jobs, 64 days for low cost jobs, and 90 days for full cost jobs. For PPL's internal evaluations, they consider the treatment period to be the date that the last measure was installed. That definition will lead to some program treatments being installed during the pre-treatment period and should generally understate the true savings.

B. Energy Impact Analysis Methodology

We employed a pre/post treatment/comparison design for assessing the electricity savings from WRAP. We analyzed the change in weather-adjusted annual usage for participants for the years before and after treatment and performed the same analysis for a comparison group composed of future year participants. We then calculated net program savings as the average energy savings for the participants minus the average savings for the comparison group.

The weather adjustment procedure was used to adjust for differences between actual weather in the analysis period and long-term average weather. Although most participants in the baseload and low cost programs do not have electric heat, most have multiple end-uses that vary with some dependence on outdoor temperatures such as air conditioners, refrigerators, electric water heaters, and furnace fans. On the other hand, some end uses like lighting do vary seasonally, but are not temperature dependent. Overall, we decided that weather

adjustment would provide more reliable results than no adjustment due to the greater proportion of seasonal loads likely to be temperature-related.

Even after performing a weather adjustment there are many factors other than WRAP treatments that could lead to changes in average usage among participants. First, there may be trends in overall electricity consumption due to systematic changes in end uses or behaviors such as people adding computers and cell phone chargers. Second, biases can be introduced from the weather-adjustment process due to seasonal loads that are not strictly temperature dependent (e.g., lighting, solar-related cooling loads). The role of the comparison group is to reflect what changes in usage would have been observed for participants if they had not participated in WRAP. If the comparison group is similar to the participants, then net program savings can be estimated accurately.

This evaluation focused on participants from 2003 (as identified by their inspection date) and chose a comparison group from customers treated in 2004 and later. In analyzing the comparison group, we eliminated all usage data from after the start of actual treatment (the date the audit was sent to the contractor) and then split the remaining pre-treatment usage data into pseudo pre and post periods.

Weather Adjustment Details

The analysis was complicated by the fact that the summer of 2002 was extremely hot while 2003 and 2004 were both fairly mild. In Harrisburg, the cooling degree days (base 70°) were 48 percent above normal in 2002 but 11 percent below normal in 2003 and 12 percent below normal in 2004. To the extent that summer usage is not fully temperature dependent, a degree-day adjustment will over-adjust for weather, leading to an apparent increase in normalized usage between 2002 and 2003 or 2004. Summer weather extremes can also affect behavior patterns in potentially unpredictable ways (people change how much and where they air condition in response to weather and bill concerns) and may lead to unusual results. The potential bias from extreme weather should be reflected in the comparison group as well, and the analysis should provide reliable estimates of net savings if the groups are well matched.

The adjustment procedure we used employs fixed degree-day reference temperatures of 60°F for heating and 70°F for cooling. The procedure uses weather data to classify each meter reading period as winter, summer, or baseload. The usage and degree days are summarized in each of these three seasons and create three equations that are then solved for the three usage characteristics: baseload use, winter use per heating degree day, and summer use per cooling degree day. Seasonal loads that are lower than baseload are reclassified as baseload and the degree-day slope for that season is set to zero. The analysis results are adjusted to a typical weather year by multiplying the usage per heating (cooling) degree-day by the appropriate long-term average degree days.

In comparison to more standard regression-type approaches, such as PRISM, the degree day adjustment procedure tends to be less sensitive to outliers or unusual usage patterns and, in practice, often seems to deal with moderate cooling loads better than regression approaches.

The heating and cooling load estimates from the model are actually better described as winter and summer load estimates since many electric end-uses vary seasonally and their seasonal components will be included in the heating and cooling estimates. The smaller the true heating and cooling loads are, the more the estimates will be affected by these seasonal loads.

We employed a series of data screens to assess the reliability of results from the weather adjustment procedure. These screens included:

- The usage data spans at least 270 days, includes at least one period without significant heating or cooling degree days, includes at least 40 percent of a typical year's heating and cooling degree days, and does not require more than 450 days of usage to cover one year (due to estimated readings).
- The total annual usage is estimated between 1,200 kWh and 70,000 kWh.
- The overall change in usage is less than 65 percent and the changes in estimated heating and cooling loads is less than 100 percent or less than 2,000 kWh.

Statistical Analysis of Energy Impacts

Overall average energy savings results from billing data analysis typically provide a useful but limited picture of program accomplishments and few insights into the causes of program performance or changes that may yield improvements. To assess which factors are associated with savings, we summarized impacts among different groups of participants and also employed statistical analyses, including regression modeling, to estimate the impacts of specific measures and explore how housing and demographic characteristics may affect savings. This type of analysis is complicated by the frequency with which low-income households experience significant changes in occupancy, end uses, or other household circumstances from year to year.

C. WRAP Characteristics

Table VIII-1 summarizes key demographic and housing characteristics of 2003 WRAP participants. About 60 percent of the WRAP participants also participate in OnTrack bill payment plan. More than 70 percent live in single-family homes with the largest concentration of mobile homes in the low cost program and the largest concentration of apartments in the full cost program. Fewer than half of all participants are renters. The baseload participants tend to live in older homes compared to the other program participants. We estimate that at least 20 percent of baseload participants have electric hot water (based on spending on hot water measures).

**Table VIII-1
Demographic and Housing Characteristics for 2003 WRAP participants**

	Baseload	Low Cost	Full Cost
OnTrack Bill Plan Participant	62%	62%	58%
# Occupants	3.1	2.9	3.1
Household Income \$/yr (median)	\$14,400	\$14,000	\$13,800
Renter	41%	39%	48%
Year home built (median)	1950	1973	1972
Electric hot water	20%	100%	?
Housing Type:			
- Single Family	78%	72%	71%
- Mobile Home	13%	22%	8%
- Multi Family	10%	5%	21%

Program Treatments

We used the data in WRAP tracking system to identify major measures and tabulate the installation rates and costs by type of measure. The tracking system does not keep track of the number of measures installed but does track measure costs, so the installation rates show the percentage of homes that receive a measure, not the number of measures installed. To create a more accurate assessment of major measures, we used cost cut-offs to define the measures so that ancillary or misclassified costs would not lead us to count, for example, a \$30 cost in the refrigerator replacement category as an actual refrigerator replacement. Table VIII-2 summarizes the key measure installation rates and costs by program for the 2003 WRAP participants. The vast majority of participants received CFL lighting retrofits in each program, so we don't include lighting in the installation rates.

The table shows that about half of the WRAP participants receive a refrigerator and/or freezer replacement with somewhat greater replacements in the low cost program and fewer in the full cost program. Refrigerators and freezers are responsible for about half of the baseload program measure costs. The baseload program also replaced air conditioners in about 18 percent of all homes while the low cost program replaced air conditioners twice as often. The low cost program spends more than twice as much on measures as the baseload program, with most of that difference attributable to water heater replacements and other water heating measures, but also with higher spending on refrigerators, air conditioner replacements, and other appliance repairs/replacements. Water heater and air conditioner replacements are two unusual measures that are provided fairly often in WRAP.

The full cost program spends more on window and door measures than any other measure category with attic insulation and refrigerators/freezer spending a close second and third. About a quarter of full cost participants received significant attic insulation work, while one in six received major window and door work and a comparable proportion received

significant blower-door guided air sealing work. The program spent nearly as much on infiltration control without a blower door (e.g., caulking and weatherstripping) as it did on more advanced blower door work.

**Table VIII-2
Measure Installation Rates and Costs per Job by Program**

	Baseload	Low Cost	Full Cost
Major Measure Installation Rates:			
- Refrigerator/Freezer Replacement (>\$200)	50%	62%	44%
- Water Heater Replacement (>\$250)	1%	59%	10%
- Air Conditioner Replacement (>\$150)	18%	36%	13%
- Attic Insulation (>\$400)	0%	1%	26%
- Other Insulation (>\$400)	0%	1%	8%
- Major Window/Door (>\$500)	0%	0%	16%
- Air Sealing w/ Blower Door (>\$200)	0%	1%	15%
- Major HVAC Work (>\$500)	0%	0%	11%
Baseload Measure Costs:			
- Refrigerator/Freezer Replacement	\$328	\$365	\$268
- Water Heater Replacement	\$6	\$315	\$50
- Air Conditioner Replacement	\$97	\$175	\$81
- Other Appliance Replace/Repair	\$59	\$175	\$51
- Lighting Retrofit	\$65	\$66	\$71
- Other Hot Water Measures	\$8	\$67	\$58
Total Baseload Measures	\$563	\$1,163	\$579
Thermal Measure Costs:			
- Attic Insulation	\$1	\$4	\$255
- Other Insulation	\$1	\$4	\$105
- Window & Door Measures	\$7	\$3	\$295
- Infiltration Work w/ blower door	\$2	\$4	\$119
- Infiltration Work no blower door	\$1	\$2	\$105
- HVAC Work	\$8	\$8	\$186
- Mobile Home weatherization	\$0	\$0	\$62
Total Thermal Measures	\$20	\$24	\$1,127
Other/Misc. Measures	\$15	\$46	\$140
Total Measure Cost	\$597	\$1,233	\$1,845
Education	\$67	\$92	\$94
Audit / Admin / Other	\$115	\$179	\$327
Total Job Cost	\$779	\$1,504	\$2,266

D. Electric Impacts

Table VII-3 summarizes the results of the usage analysis for the three programs. Average net savings are estimated at 836 kWh for the baseload program, 500 kWh for the low cost program and 1,767 kWh for the full cost program.

The net savings estimates for the baseload and full cost programs are generally consistent with expectations for this type of program and quite similar to PPL's internal evaluation estimates of 709 kWh for the baseload program and 1,765 kWh for the full cost program. The low cost program savings appear low at just 500 kWh, especially when compared to PPL's internal estimate of 1,090 kWh. One might expect the low cost program to save at least as much as the baseload program since it includes slightly more refrigerator replacements and comparable lighting work and then adds in water heater replacements, other water heating measures, and more air conditioner replacements. Further explorations, described later, have led to the conclusion that this result is not very reliable, which is also reflected in the wide band of uncertainty that covers from -8 kWh to 1008 kWh in savings.

The comparison groups for the baseload and full cost programs showed 5.8 percent and 5.4 percent increases in weather adjusted usage, making the comparison group adjustments responsible for a large portion of the net savings. These large adjustments caused some concern. In the methodology section we noted that the extremely hot summer in the pre-treatment period and mild summer in the post treatment period may lead to an apparent increase in weather-adjusted usage. We believe that this factor is responsible for most of the increased usage and the comparison group is properly reflecting a weather adjustment bias that also affects the participants. Some of the usage increase shown in the comparison group is also likely to be due to true usage increases related to the increasing penetration of electrical end uses such as computers, cell phone chargers, digital cable boxes, DVD players, video game consoles. This evaluator found a similarly large comparison group adjustment for a different evaluation that covered the same time period.

The comparison group adjustment for the low cost program is much smaller than the other programs and perhaps it is too little, making the savings for that program look smaller than they really are. The low cost program comparison group has just 48 homes and so the adjustment has large uncertainty.

Table VII-3
Electric Savings Results (kWh/yr/unit)

Program	Average Usage & Gross Savings				Net Savings	
	# units	Pre-use	Post-use	Gross Savings	Savings	Savings %
Participants:						
Baseload	659	9,661	9,394	267	836 (±182)	8.7% (±1.9%)
Low Cost	112	10,869	10,633	236	500 (±508)	4.6% (±4.7%)
Full Cost	1,019	17,912	17,129	783	1,767 (±309)	9.9% (±1.7%)

Program	Average Usage & Gross Savings				Net Savings	
	# units	Pre-use	Post-use	Gross Savings	Savings	Savings %
Comparison Groups:						
Baseload	442	9,740	10,309	-569		
Low Cost	48	10,958	11,222	-264		
Full Cost	401	18,230	19,213	-983		

Note: ± figures are 90% confidence intervals on the net savings.

We examined the savings in greater detail by calculating net savings for each of the three estimated components of usage: baseload, winter/heating use, and summer/cooling use. Table VIII-4 shows the results of this analysis.

For the baseload program, the table shows the expected results – most savings occur in the baseload part of usage with small and statistically insignificant changes in the modest winter and summer usage components.

The low cost program shows much larger baseload savings that are offset by a substantial increase in the estimated net winter/heating load and a smaller increase in the summer/cooling load. Nearly all of the winter load increase is due to comparison group savings of 483 kWh in the winter load (not shown). It is not clear why these savings were found or whether it may just be an anomaly of the small sample. If we eliminate cases with pre-treatment heating usage of more than 2,000 kWh, the net savings for the low cost program rise to 1,113 kWh (comparable to the baseload component of savings). Given these findings and the small sample sizes, we believe that the 500 kWh net savings estimate for the low cost program is questionable and that the actual net savings may be closer to 1,100 kWh.

For the full cost program, the overall savings are a little lower than the 2,000 to 3,000 kWh found in some studies of weatherization for all electric homes. The pre-treatment winter usage of just 7,444 kWh shown in the table may help explain the shortfall. This level of usage is fairly low for electric heating and most likely reflects the fact that a significant fraction of participants in this program do not have installed electric heat (about 40 percent according to PPL). The full cost savings are about evenly split between the baseload and winter/heating load components with the winter load savings equal to 11.4 percent of the pre-treatment winter usage.

Table VIII-4
Heating, Cooling, and Baseload Usage and Savings by Program

Load Components	Baseload Program		Low Cost Program		Full Cost Program	
	Pre-use	Net Savings	Pre-use	Net Savings	Pre-use	Net Savings
Baseload	7,629	710 (±197)	8,691	1,177 (±598)	9,508	860 (±295)
Winter / Heating Load	1,239	84 (±106)	1,460	-529 (±358)	7,444	850 (±252)
Summer / Cooling Load	793	42 (±67)	718	-147 (±186)	960	57 (±79)

Load Components	Baseload Program		Low Cost Program		Full Cost Program	
	Pre-use	Net Savings	Pre-use	Net Savings	Pre-use	Net Savings
Total	9.661	836 (± 182)	10,869	500 (± 508)	17,912	1,767 (± 309)

Usage and Savings Variations

Most evaluations of low-income electric usage reduction programs find that usage and savings vary widely across participants. Changes in household occupancy patterns and appliance holdings often create much of this variability and make the analysis of factors associated with savings more difficult, requiring large samples to detect all but the most substantial impacts. The low cost program had too small a sample for performing much analysis but the baseload and full cost programs provided better opportunities.

Pre-treatment usage is often related to energy savings. We explored the relationship between usage and savings to identify usage thresholds associated with higher or lower savings. We found that:

- The 18 percent of baseload program participants with usage above 12,000 kWh/yr had net savings of 1,372 kWh compared to 717 kWh for those with lower usage.
- We did not find lower savings for the 36 percent of baseload program participants using less than 8,000 kWh compared to the 46 percent using between 8,000 kWh and 12,000 kWh.
- For the full cost program, net savings averaged 2,619 kWh for the 34 percent of participants with usage greater than 20,000 kWh/yr compared to 1,325 kWh for participants using less than 20,000 kWh. Savings for the 15 percent of participants using less than 10,000 kWh averaged 865 kWh, but we found no consistent pattern between 10,000 and 20,000 kWh.
- In terms of percent savings, higher and lower users both had about 10 percent savings for the full cost program and 9 percent savings for the baseload program.

We explored variations in usage and net savings based on a variety of treatment and housing characteristics. Some of these comparisons are summarized in Table VIII-5. The table shows that:

- Houses that received refrigerator replacements saved much more than those that did not, particularly for the baseload program.
- OnTrack participants tended to use a little more and save a little more than other participants (and also had slightly greater installation rates for all major measures).
- Baseload program houses that received air conditioner replacements tended to save about 200 kWh more than those that didn't (given the same refrigerator replacement status).

- Savings were approximately equal for all three housing types in the baseload program, but savings were lowest for apartments in the full cost program (and their usage was lowest).

Water heater replacements were difficult to assess because they primarily occurred in low cost homes, which are not shown in the table due to small sample sizes. Results for those homes showed about 200 kWh higher savings for houses that had the water heater replaced and incremental savings of about 1,100 kWh for refrigerator replacements but both of these figures have large uncertainty.

Table VIII-5
Program Savings Break-outs (kWh/yr/unit)

Group	Baseload Program			Full Cost Program		
	#	Pre-use	Net Savings	#	Pre-use	Net Savings
By OnTrack Participation:						
OnTrack	374	10,207	970 (±336)	575	19,332	2,050 (±585)
Not OnTrack	285	8,944	763 (±278)	444	16,074	1,626 (±448)
By Refrigerator Measures:						
Refrigerator/Freezer Replaced	330	9,558	1,226 (±212)	442	16,916	2,074 (±403)
No Refrigerator/Freezer	329	9,765	444 (±210)	577	18,675	1,531 (±411)
Measure Combinations:						
No Fridge, No A/C Replace	280	9,727	411 (±258)	Not shown due to		
Yes Fridge, No A/C	249	9,628	1,188 (±276)	other major measures		
No Fridge, Yes A/C	49	9,981	635 (±523)			
Yes Fridge & Yes A/C	81	9,342	1,342 (±411)			
By Housing Type:						
Single Family Home	523	9,668	823 (±204)	724	19,583	1,877 (±361)
Mobile Home	80	10,083	932 (±529)	75	15,721	1,795 (±1228)
Apartment	56	8,996	843 (±629)	217	13,073	1,159 (±714)

Measure Savings Analysis

The simple comparisons in the table do not establish reliable savings estimates for measures because multiple factors can vary at once between homes. The additional range of measures employed among full cost homes makes it infeasible to estimate net savings for each major measure combination yet comparisons based on one measure at a time (like for the refrigerators) are likely to be biased due to variations in the installations of other measures between groups. To address these issues, we employed multiple regression analysis to estimate savings associated with multiple measures at once by modeling observed savings as a function of program treatments and other factors.

We developed separate regression models for the baseload and full cost programs. Ideally, we would use site-specific projections of savings for each measure or specific measure quantities as explanatory variables in a regression model of savings. For WRAP, we did not have either of these variables but we did have information on spending per measure type at each home. However, measure costs varied widely between providers so they are unlikely to serve as a very good predictor of savings. Instead, we used dichotomous (yes/no) variables to represent whether major measures had been installed. Since nearly every home received lighting retrofits, those savings cannot be estimated separately from other measures. The analysis was further complicated by the significant weather differences and large comparison group adjustment that make the changes in observed usage potentially less predictable than usual.

For the baseload program we found that refrigerator replacement was the only statistically significant treatment variable with estimated savings of 777 kWh per unit when we include air conditioner replacements in the model (and 792 kWh when we do not). These savings are generally consistent with studies of this measure in comparable programs. At this level of savings, refrigerator replacements are responsible for about half of the observed savings in the baseload program. The estimated savings from air conditioner replacement is 172 kWh in the model (comparable to the simple group differences in Table VII-5) but the 90 percent confidence interval spans from -87 kWh to +431 kWh. The 172 kWh seems reasonable for window air conditioner replacement, especially when one considers that the average estimated pre-treatment summer/cooling load was just 895 kWh for the homes that received window air conditioners.

For the full cost program, the analysis found that, in addition to refrigerator replacement, attic insulation and “other” insulation were both statistically significant predictors of savings with estimated impacts of 766 kWh and 887 kWh respectively. Window and door work and blower door guided air sealing were estimated to provide savings of 457 kWh and 378 kWh, but were just barely statistically significant (at 90 percent confidence). The savings from window and door work may also reflect homes that received extensive repair work since we used a threshold of \$500 to identify this measure. We found no relationship between measured savings and air conditioner replacement (12 percent of cases) or water heater replacement (11 percent of cases). The preferred regression model found statistically insignificant negative savings for each measure.

We assessed the relative cost-effectiveness of each measure using the regression model savings and the average treatment costs to develop an estimated cost per annual kWh saved. This figure can be turned into a simple payback period by dividing by the retail rate per kWh. For comparison purposes, the overall cost per kWh savings was \$0.94 for the baseload program, \$2.80 for the low cost program, and \$1.27/kWh for the full cost program. The low cost would be at \$1.27/kWh if the savings were actually 1,100 kWh instead of the 500 kWh found in the main billing analysis.

The regression analysis of measure savings and the cost effectiveness calculations are summarized in Table VIII-6.

The table indicates that refrigerator replacement in the baseload program and blower door guided air sealing in the full cost program are the most cost-effective measures. Air conditioner replacements and major window and door work are the least cost-effective measures with measured savings results.

The lack of statistically significant savings for water heater replacement is cause for concern. The theoretical justification for the measure is not very strong given that the vast majority of the difference in rated efficiencies between new and existing units is due to tank and pipe losses that can mostly be mitigated through tank and pipe insulation.

Overall, the analysis suggests that WRAP should re-assess the air conditioner replacement targeting strategy, water heater replacement as an efficiency measure, and potentially excessive window and door spending on some jobs. Refrigerator replacements, insulation and blower door guided air sealing should be pursued and perhaps expanded if further opportunities can be identified.

**Table VIII-6
Measure Savings Analysis Results**

Measure	Baseload Program			Full Cost Program		
	Savings	\$/install	\$/kWh	Savings	\$/install	\$/kWh
Refrigerator Replacement	777 (± 206)	\$662	\$0.85	532 (± 296)	\$606	\$1.14
Air Conditioner Replacement	172 (± 259)	\$546	\$3.17	0	\$657	?
Water Heater Replacement				0	\$483	?
Attic Insulation (>\$400)				766 (± 338)	\$882	\$1.15
Other Insulation (>\$400)				887 (± 525)	\$999	\$1.13
Windows & Doors (>\$500)				457 (± 404)	\$1,206	\$2.64
Air Sealing w/Blower Door				378 (± 347)	\$288	\$0.76

Savings Results by Provider

Electricity savings differences between providers are of direct interest in assessing program performance and potentially identifying higher and lower performing contractors. However, provider-specific savings estimates have considerable statistical uncertainty and even true differences in average savings may be due to differences in the opportunities available in the local housing stock, not necessarily work quality. Homes with high refrigeration and lighting loads will tend to provide greatest savings opportunities for baseload usage while homes with poor insulation and high infiltration rates will tend to provide the greatest savings in heating loads. Table VIII-7 shows the average net savings by provider for each program component. Providers with fewer than 20 homes in the analysis are not shown.

For the baseload program, SEDA-COG appears to have the highest savings at 2,397 kWh/yr. -- nearly three times the overall average -- but the sample size is small and the uncertainty

bounds are wide. The table also shows that spending averaged \$790 per job but varied widely by provider with SEDA-COG spending the most at \$1,969 per job. The extra spending was primarily on air conditioner replacements and “other appliance” replacements (it is not clear what this category entails). The last column of the table provides an indicator of cost-effectiveness in terms of dollars spent per annual kWh saved. Pure Energy and SLHDA appeared to provide the most cost-effective work at about \$0.50 per kWh, primarily due to low spending while producing about average savings. SLHDA’s savings show large uncertainty.

For the full cost program, SEDA-COG and CACLV appeared to have produced the most kWh savings, although STEP Inc. had the highest percent savings. In terms of cost-effectiveness, WCRA appeared to be most cost-effective, primarily due to very low spending compared to the other providers. Overall, the full cost program cost more per kWh saved than the baseload program, but the measure lifetimes for the treatments are likely longer making inter-program comparisons potentially unfair.

The low cost program had a small sample overall and just one provider, Solair, had more than 20 jobs in the analysis sample. It appears that Solair had higher average savings than the other low cost contractors but the small sample may distort the results and the low cost impact assessment is suspect at best.

Table VIII-7
Energy Savings by Provider (kWh/year/unit)

Provider	# Homes	Pre-use	Net Savings	Net % Savings	Cost \$/unit	\$ / annual kWh
Baseload Program:						
Billiard	75	9,508	825 (±637)	8.7%	\$582	\$0.71
CEO	102	8,932	890 (±474)	10.0%	\$752	\$0.85
Energy Cons Ctr.	27	10,582	680 (±1180)	6.4%	\$1,150	\$1.69
Pure Energy	108	9,296	851 (±466)	9.2%	\$441 ²³	\$0.52
SEDA-COG	22	11,148	2,397 (±1369)	21.5%	\$1,969	\$0.82
SLHDA	56	9,223	760 (±678)	8.2%	\$408	\$0.54
STEP INC	95	10,495	359 (±444)	3.4%	\$839	\$2.34
Solair	107	8,895	822 (±355)	9.2%	\$1,187	\$1.44
WCRA	36	10,139	734 (±982)	7.2%	\$637	\$0.87
Total Baseload	659	9,661	836 (±182)	8.7%	\$790	\$0.94
Low Cost Program:						
Solair	52	10,718	915 (±569)	8.5%	\$1,393	\$1.52
Total Low Cost	112	10,869	~500 (±508)	~4.6%	\$1,400	~\$2.80

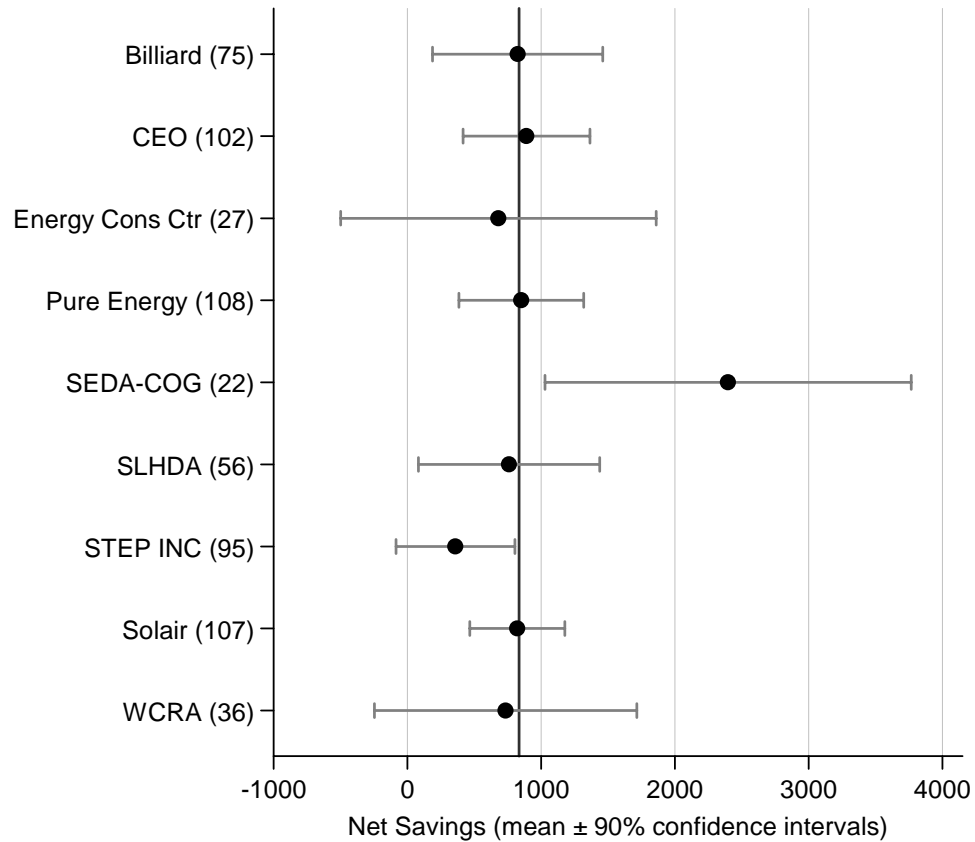
²³ This cost does not include CFLs. CFLs for Pure Energy are purchased by PPL.

Provider	# Homes	Pre-use	Net Savings	Net % Savings	Cost \$/unit	\$ / annual kWh
Full Cost Program:						
CACLV	166	21,434	2,352 (± 722)	11.0%	\$2,695	\$1.15
CEO	129	16,651	899 (± 622)	5.4%	\$1,781	\$1.98
Energy Cons Ctr.	281	17,250	1,766 (± 467)	10.2%	\$1,966	\$1.11
Rovegno	99	18,172	1,528 (± 895)	8.4%	\$3,407	\$2.23
SCA	58	18,469	1,117 (± 1011)	6.0%	\$2,160	\$1.93
SEDA-COG	59	18,632	2,578 (± 1027)	13.8%	\$3,312	\$1.28
STEP INC ²⁴	122	11,466	1,846 (± 720)	16.1%	\$2,048	\$1.11
WCRA	73	22,922	1,499 (± 925)	6.5%	\$1,287	\$0.86
Total Full Cost	1019	17,912	1,767 (± 309)	9.9%	\$2,249	\$1.27

Figure VIII-1 shows the net savings by provider for the baseload program along with uncertainty bounds (± 90 percent confidence intervals) shown by the capped line. The length of each confidence interval reflects the uncertainty due to sample size (shown in parentheses next to each provider's name) and savings variability between homes for each provider. A vertical reference line is shown at the average 836 kWh savings. The figure shows surprisingly consistent savings across providers with most having average savings in the 700-900 kWh range and just two providers with savings that differ significantly from the overall average.

²⁴ Half of these homes are from one multi-unit pilot project.

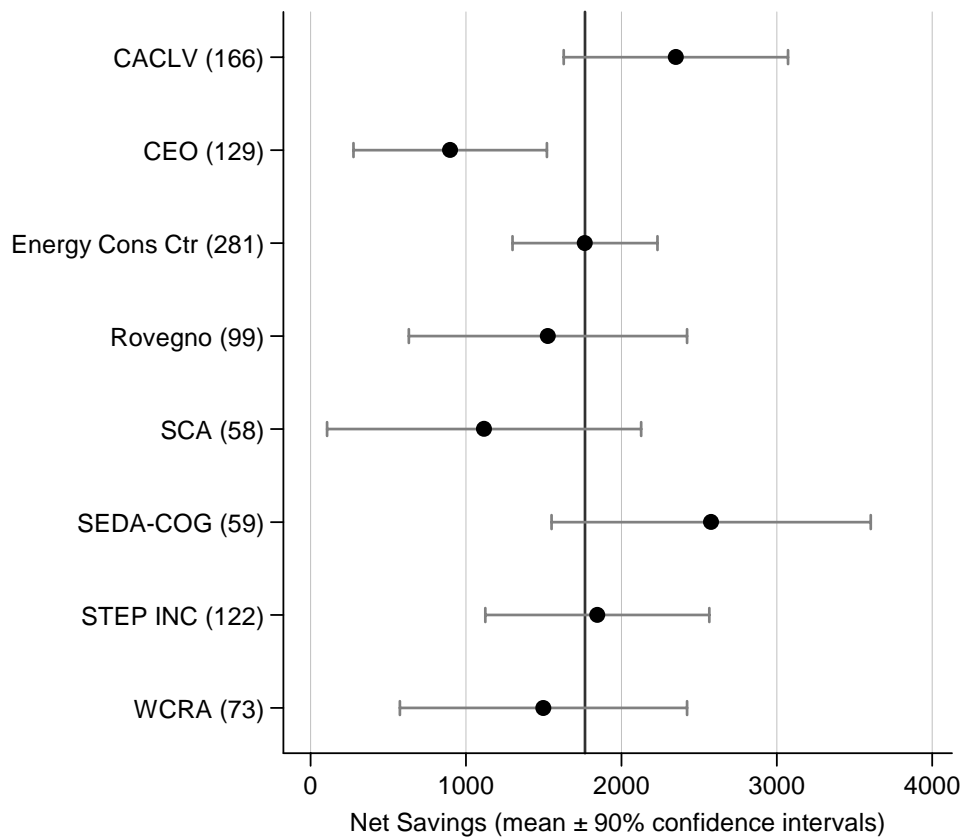
**Figure VIII-1
Net Savings by Provider: Baseload Program**



Note: Black circle shows average net savings, capped line shows ±90% confidence interval

Similar to the previous graph, Figure VIII-2 shows the savings by provider for the full cost program with a vertical line showing the 1,767 kWh overall average savings. The graph shows that the two highest saving providers may not actually produce savings greater than the overall average (i.e., the difference is not statistically significant). CEO does appear to have produced the least savings, but one should remember that savings differences may be due to differences in housing stock opportunities rather than work quality.

Figure VIII-2
Net Savings by Provider: Full Cost Program



E. Sample Attrition Analysis

Table VIII-8 tabulates the sources of data attrition for each program. About 40 percent of the participants could not be included in the analysis. The largest source of attrition, 25 percent of the population, was due to having too little usage data to develop reliable pre or post usage estimates. Some of that attrition is due to customers moving – renters had 31 percent attrition from this factor vs. 21 percent for homeowners. The second largest source of attrition was from large changes in usage, primarily due to changes in estimated heating or cooling loads that exceeded 100 percent and 2000 kWh, implying major changes in air conditioning or space heating behavior. The comparison groups experienced similar attrition that averaged 41 percent.

We compared the analysis sample to the attrition group using available data about measure spending and demographics. We found the common pattern of somewhat greater attrition among renters (and apartments) than single-family homeowners, but the differences were mostly small.

For the baseload program, the analysis sample had slightly more spent per job (\$790 vs. \$762), slightly more single-family homes (79 percent vs. 75 percent), fewer renters (36 percent vs. 47 percent), higher incomes (\$14,700 vs. \$13,745), and fewer OnTrack participants (57 percent vs. 70 percent). The refrigerator replacement rates were identical at 50 percent but the analysis group had more air conditioners replaced (20 percent vs. 14 percent). The small difference in spending and identical refrigerator replacement rates makes it unlikely that the analysis group is significantly biased in terms of energy savings.

For the low cost program, the analysis group had much less spent per job than the attrition group (\$1,400 vs. \$1,643), including a lower refrigerator replacement rate (57 percent vs. 69 percent) and lower air conditioner replacement rate (29 percent vs. 44 percent). The analysis group also had more owners and single family homes but fewer mobile homes (19 percent vs. 27 percent) and far fewer OnTrack participants (51 percent vs. 76 percent). Overall, these differences imply that the analysis sample is biased toward lower savings.

For the full cost program, the analysis and attrition groups are almost indistinguishable. We found comparable spending (\$2249 vs. \$2290) and nearly identical installation rates for all baseload and thermal measures. We also found very similar demographics as both groups had 71 percent single-family homes, there were slightly fewer renters in the analysis (46 percent vs. 50 percent) and slightly fewer OnTrack participants (56 percent vs. 60 percent). Overall, the full cost program analysis group appears quite representative of the participant population.

Table VIII-8
Electric Usage Analysis Sample Attrition by Program

Sample / Attrition Cause	Baseload	Low Cost	Full Cost
Treated Population Units	1,106	196	1,752
-No Usage Data / Unclear treat date	39	6	76
-Insufficient Usage Data (total or seasonal)	287	51	437
-Estimated Usage <1,200 or >70,000	7	0	29
-Change in Usage >65% (or >100% heat/cool)	114	27	191
=Analysis Sample Units	659	112	1,019
Attrition %	40%	43%	42%

IX. Payment Impacts

This section of the report examines the impact of the WRAP on customer bills and coverage rates. The purpose of this analysis is to determine whether the WRAP reduces bills to the point that customers can meet their payment obligations.

A. Methodology

This section describes the methodology for the payment impact analysis.

Study Group

WRAP customers who received a final inspection in 2003 were included as potential members of the study group. Customers who did not have a full year of data prior to the beginning of service delivery or a full year of data following the last service delivery date were not included in the impact analysis. The subject of data attrition is addressed more fully below.

Comparison Group

When measuring the impact of an intervention, it is necessary to recognize other exogenous factors that can impact changes in outcomes. Changes in a client's bills and bill coverage rate, between the year preceding receipt of WRAP and the year following receipt of WRAP, may be affected by many factors other than program services received. Some of these factors include changes in household composition or health of family members, changes in gas prices, changes in weather, and changes in the economy.

The ideal way to control for other factors that may influence payment behavior would be to randomly assign low-income customers to a treatment or control group. The treatment group would be given the opportunity to participate in the program first. The control group would not be given an opportunity to participate in the program until one full year later. This would allow evaluators to determine the impact of the program by subtracting the change in behavior for the control group from the change in behavior for the treatment group. Such random assignment is rarely done in practice because of a desire to include all eligible customers in the benefits of the program or to target a program to those who are most in need.

A comparison group was constructed for the program evaluation to control for exogenous factors. The comparison group was designed to be as similar as possible to the treatment group, those who received services and who we are evaluating, so that the exogenous changes for the comparison group is as similar as possible to those of the treatment group.

We use 2004 WRAP recipients as the comparison group for this evaluation. These participants serve as a good comparison because they are lower income households who

were eligible for the program and chose to participate. We use data for these participants for the two years preceding WRAP service delivery, to compare their change in bill coverage in the years prior to service delivery to the treatment group's change in bill coverage after enrolling. Because we analyze the bills and payments for this group before the customers received program services, changes in bills and behavior should be related to factors that are exogenous to the program.

In this evaluation, we examine pre and post-participation statistics. The difference between the pre and post-treatment statistics for the treatment group is considered the gross change. This is the actual change in behaviors and outcomes for those participants who were served by the program. Some of these changes may be due to the program, and some of these changes are due to other exogenous factors, but this is the customer's actual experience. The net change is the difference between the change for the treatment group and the change for the comparison group, and represents the actual impact of the program, controlling for other exogenous changes.

B. Data Attrition

Customers were divided into the treatment group and the comparison group as described above. However, some of these customers were not included in the analysis in this section because they did not have adequate data available. Table IX-1 displays the original number of customers in each group, the number of customers that had to be excluded from the analysis because they did not have sufficient billing and payment data, and the number of customers in each group that are included in the analysis. Two factors must be weighed when selecting the sample for the analysis. First, when conducting a program evaluation, the goal is always to include as much of the group in the research as possible, so that the estimated results are not biased due to elimination of distinctive subgroups. However, to provide good estimates of program impacts, it is also necessary to restrict the sample to those customers who have a minimum level and quality of data.

Customers were excluded from the final analysis group for the following reasons:

- *Full Year of Pre or Post Billing Data Not Available:* The analyses that are conducted require that customers have a full year of bills for the year prior to service delivery and the year following service delivery. Customers were excluded from the analyses if the pre or post year of billing data that could be constructed contained less than 330 days or more than 390 days.
- *Full Year of Pre or Post Payment Data Not Available:* The analyses also require that customers have a full year of payment data for the year prior to service delivery and the year following service delivery. Customers were excluded from the analyses if the pre or post year of payment data that could be constructed contained less than 330 days or more than 390 days.

Table IX-1 shows that a significant percentage of the customers had to be eliminated from the analysis. However, the percentage of customers included in the analysis exceeds 50 percent for both the treatment and the comparison group, and is an acceptable percentage for the evaluation. This attrition of the studied groups relates to the low socio-economic status of the population researched in this evaluation, as well as their inability to meet their utility expenses.

**Table IX-1
Data Attrition**

	Treatment Group 2003 WRAP Recipients	Comparison Group 2004 WRAP Recipients
All Eligible	3,054	2,382
Full Billing/Payment Data	1,873	1,228
% of Total	61%	52%

C. Payment Impact Results

This section displays the billing and payment statistics for the treatment and the comparison groups. The following variables are analyzed:

- *Total bill:* Customers who received program treatments had a small gross reduction in their total bill of \$21 and a larger net reduction of \$118.
- *Cash payments:* Cash payments increased by \$39 as compared to the comparison group.
- *LIHEAP payments:* The program recipients experienced a small decline in the amount of LIHEAP cash and crisis assistance received.
- *OnTrack Credits:* OnTrack credits are payments made toward PPL customers' bills through the OnTrack payment assistance program. OnTrack participants had a significant gross increase in the average amount of OnTrack credits received, averaging \$72. However, the comparison group had a larger increase in OnTrack credits, resulting in a net decline for the treatment group of \$49.
- *Total payments:* Customers increased their total payments by \$54. However, compared to the comparison group, there was a net decline in total payments of \$58.
- *Cash coverage rates:* The treatment group had a 4 percentage point gross increase and a 13 percentage point net increase in cash coverage rates.
- *Total coverage rates:* The treatment group increased their total coverage rates from 93 percent in the year prior to service delivery to 100 percent in the year following service

delivery, an 8 percentage point gross increase. The net increase in total coverage rates was 12 percentage points.

This analysis showed that WRAP enabled customers to reduce their bills and to significantly increase their bill payment coverage rates, achieving its goal of providing more affordable bills for low-income customers.

Table IX-2
Payment Impacts

	Treatment Group			Comparison Group	Net Change
	Pre	Post	Change	Change	
Number of Customers	1,873			1,228	
Total Bill	\$1,214	\$1,194	-\$21**	\$97**	-\$118**
Cash Payments	\$817	\$824	\$7	-\$32**	\$39*
LIHEAP Payments	\$44	\$39	-\$5*	\$7*	-\$13**
OnTrack Credits	\$218	\$290	\$72**	\$121**	-\$49**
Other Credits	\$45	\$25	-\$20**	\$15**	-\$35**
Total Payments	\$1124	\$1179	\$54**	\$112**	-\$58**
Cash Coverage Rate	70%	73%	4%**	-9%**	13%**
Total Coverage Rate	93%	100%	8%**	-5%	12%*

**Denotes significance at the 99 percent level. *Denotes significance at the 95 percent level.

X. Summary of Findings and Recommendations

This section of the report summarizes the findings and recommendations from all of the evaluation activities. Findings and recommendations are grouped into the categories of program administration and procedures, program impact, customer perspectives, and financial analysis.

A. *Program Management and Administration*

PPL has developed a comprehensive and effective program for assisting their low-income customers to reduce their electric usage. They have several dedicated and experienced staff members, as well as experienced contractors, who work to provide effective services. They have refined and revised their program over the years, and as the program increased in size and comprehensiveness they have piloted and adopted new measures to provide even greater savings for their customers.

We have developed the following recommendations for PPL to provide even more effective services.

1. *Attention to the WRAP Budget:* While PPL requires that WRAP expenditures are within four percent of their expenditure goal, PPL reported that the PUC requires that PPL spend 100 percent of their goal. If PPL under spends in one year, they are required to make up the spending in the next year. If they overspend, they can take the difference out of the next year's budget. PPL spends a great deal of time and effort to ensure that they come within four percent of their expenditure goal. It appears that this effort could be better used on other aspects of the program, as the Bureau of Consumer Services (BCS) states in the 2004 Report on Universal Service Programs and Collections Performance, "As a rule, companies try to spend all of the LIURP funds that are budgeted each year, but this is not always possible. In most cases, unspent funds are carried over from one program year to the next on an ongoing basis."
2. *Prioritize Customers:* PPL states that they give priority to customers who have the highest electric usage history, greatest arrearages, and lowest income. However, the CPDs reported that the jobs are generally sent to the contractors on a first come, first serve basis, other than perhaps for prioritizing OnTrack High Usage Pilot customers or all OnTrack customers. Given the wait time for PPL services, PPL or the contractors should prioritize customers based on these factors.
3. *Program Coordination:* PPL does not track the extent to which WRAP service delivery is coordinated with other weatherization programs. The CPDs reported that their contractors often refer customers to other programs, but that coordination does not happen very often. Barriers to coordination with other programs include long waiting lists for state weatherization and Crisis, long waiting lists and stringent usage requirements for gas usage programs, and some customers with a combination of electric and gas heat do not have high enough usage to qualify for either program.

However, some of the contractors did report that they provide other weatherization programs, and there may be an opportunity to increase the coordination. PPL should try to include tracking of program coordination in their database and provide incentives for contractors to coordinate LIURP with gas utility programs or the state weatherization program.

4. *Web-based job ticket:* Beginning in early 2006, contractors were expected to use a new electronic web-based job ticket than can be loaded directly into the WRAP V database. PPL should continue to provide such technological improvements to their program that will increase efficiency of program management.
5. *Quality Control:* PPL requires a site inspection for at least 80 percent of all WRAP jobs that receive at least \$750 of measures, not including appliance replacement costs. PPL usually inspects most full cost jobs, except those where the customer refuses the inspection. Contractors use phone inspections when job costs are below \$750, or when the customer refuses to cooperate with the site inspection. However, WRAP CPD's infrequently go out in the field and observe work that is conducted, and baseload jobs are not observed or inspected. CPD's should spend some time in the field to be more familiar with contractor procedures and provide additional review of baseload and low cost jobs.

B. Program Specifications and Procedures

We conducted a detailed review of PPL WRAP's education and technical procedures. Recommendations based on this review are listed below.

1. *Initial Education During Audit:* The initial energy education procedures state that the initial session may be conducted before the audit, in conjunction with the audit, in conjunction with the installation of measures, or in conjunction with the inspection. The most effective time for the initial education session is probably during the audit. At this time, the provider will have the opportunity to investigate what is going on in the home, and determine what WRAP can do for the customer. Education can be most effectively provided in conjunction with these activities. We recommend that the procedures require that some education be conducted in conjunction with the audit, that the homeowner be present at the time of the audit, and that the procedures strongly suggest that the initial education session is conducted at the time of the WRAP audit.
2. *Update Energy Costs Sheet:* PPL has an energy costs sheet used in LIURP education that shows the costs of electric uses around the home. This sheet should be updated as the cost of electricity changes.
3. *Money-Saving Tips Form:* The Money-Saving Tips form lists actions to save electricity in heating, cooling, water heating, kitchen appliances, laundry appliances, and other areas. It says to "Check those that will help you". While this is fairly comprehensive and specific list of potential actions to reduce electric use, it encourages customers to

check off all that apply, and does not prioritize actions by the potential for energy saving. The form should provide a summary at the bottom that lists the top three to five actions with the highest potential for saving that the customer is willing to take, and estimate monthly dollar savings that may result from each action.

4. *Customer Profile Form:* The customer profile form collects information about the customer's heating habits, cooling habits, and recent or expected changes in electric usage. It may be useful to also include other potential large opportunities for electric savings such as water leaks, use of dehumidifiers, sump pumps, use of second refrigerators or freezers, appliances or lights that are always left on.
5. *Cost Effectiveness and Measure Screening:* The WRAP design employs decision trees that were developed years ago to determine whether measures should be provided. We recommend that PPL review the underlying cost-effectiveness calculations for the current audit decision trees and update the calculations and decision rules as needed to reflect the best current estimates for costs and savings. The decision process for each measure should reflect any significant variations in expected savings or costs. PPL can hire a nationally recognized expert to update these specifications every other year. The cost of such an update would likely be under \$5,000.
6. *Job Types and Spending Allowances:* We have some concern about including all homes with installed electric heat as Full Cost jobs even if they have insignificant space conditioning loads, as building shell measures are unlikely to be cost-effective in these homes. However, this concern is mitigated to some degree by the program's use of spending guidelines.
7. *Refrigerator and Freezer Temperature Usage Adjustment:* We would recommend default average temperatures for refrigerator usage correction of 71°F for living spaces and 65°F for basements instead of the 75°F that is currently used. The calculation of refrigerator usage should include this adjustment.
8. *Refrigerator Usage Thresholds:* PPL's refrigerator replacement usage thresholds are generally too high, especially for refrigerators between 16 and 24 ft³. We recommend updating these thresholds.
9. *CFL Replacement Criteria:* The program specifications state that CFLs are to be installed on lights used three or more hours per day. Given relatively recent sharp declines in the cost of CFLs, this threshold may be worth revisiting.
10. *Provider CFL Prices:* Given current market prices, the higher cost providers should lower their prices for CFLs.
11. *Water Heater Replacement:* Water heater replacement may only be cost-effective when used to replace a leaky tank. Otherwise, this measure is primarily a home repair or perhaps a safety measure. Given that electric water heater EF merely reflects differences in standby losses it seems that water heater wraps and pipe insulation (or

thermosiphon check valves) could effectively raise the existing unit's EF to levels close to the new unit at a much lower cost than replacement.

12. *Window Air Conditioner Replacement:* The replacement decision should be based on the estimated cooling load from the billing data, the estimated proportion of that cooling load used by the existing unit, and the cost of the replacement.
13. *Window Air Conditioner Sizing:* The air conditioner section of the Standards & Field Guide includes a very rough unit sizing protocol that will generally lead to oversized units. This protocol should be revised.
14. *Ducts:* Research has found very little, if any, savings from sealing ducts in basements. Therefore, basement duct sealing should only focus on safety (return leaks) or comfort (large supply leaks).²⁵
15. *Blower Door Guided Air Sealing:* According to tracking system data, fewer than 60 percent of the homes in the full cost program received either a blower door test or blower door guided air sealing. It may be worth investigating why so many homes apparently do not receive this type of air sealing work (or whether the problem is with the tracking system itself).
16. *Zonal Pressure Diagnostics:* The treatment protocol includes a 90 percent pressure drop rule of thumb that was developed for application to flat roof row house attics in Philadelphia (the job "passes" if the pressure drop across the ceiling is at least 90 percent of the total pressure drop). For homes with walk-up attics, the 90 percent pressure drop rule may be useful for identifying remaining problems, but should not be used instead of actual visual inspection because well-vented attics will tend to pass the test regardless of the quality of the air barrier.
17. *Worst Case Depressurization Protocol:* The testing protocol specifies the position of interior doors as open, but the true worst case will occur when you close interior doors that do not connect to exhaust devices (or, alternately, close any door which makes the depressurization level increase).
18. *Reflective Roofs:* This measure is unlikely to be cost-effective in homes with properly insulated attics. Reflective roof coating does provide a significant home repair benefit, but the energy savings alone are not likely to be able to pay for the measure in most cases.
19. *Basements:* In general, basements should be considered as inside the conditioned space and therefore duct sealing and insulation have limited energy savings potential and basement ceiling insulation is also not worthwhile.

²⁵ Heat pumps would probably provide better savings and cost-effectiveness compared to gas furnaces because the air handler runs more frequently (due to lower delivery temperatures). However, we are not aware of any studies that show significant savings. Perhaps a somewhat bigger emphasis on "comfort" leaks could be placed in heat pump homes.

20. *WRAP Standards and Field Guide*: The guide attempts to be specific enough to be useful for practitioners but the level of detail varies substantially between sections, providing perhaps too much detail in some areas and too little detail in others. In the case of the HVAC contractor, the guide is not detailed enough, but for someone who will not work directly on the systems it is most likely too detailed. This criticism is not meant to suggest that the guide needs to be rewritten, but perhaps at the time of the next major revision consideration should be given to creating a more concise overall program field guide appropriate to all staff along with more detailed guides with specific program standards for each more specialized contracting area such as insulation, air sealing, and HVAC.

C. *Contractor Survey*

We conducted a survey with 16 of PPL's contractors. Key findings and recommendations from this survey are summarized below.

1. *Contractor Background Information*: Most of PPL's contractors have been providing WRAP services for a long time. The average length of time contractors provided services was more than ten years for all services except inspection, in which some areas have had turnover, and solar, which was recently introduced.

Contractors are likely to also provide services for other weatherization programs. Ten contractors reported that they provide Pennsylvania Weatherization Program services, and a few contractors reported that they provide other gas and electric utility weatherization programs.

2. *PPL Support and Training*: Contractors were likely to report that they have regular contact with a PPL staff member. Twelve contractors said that they communicate with a PPL staff member by telephone or email at least once per week, and seven contractors said that they meet in person with a PPL staff member at least once per month.

Contractors said that each aspect of PPL-provided training – training quality, training focus, level of training, amount of training, and training overall – is good to very good. Contractors gave the lowest rating to the amount of training. However, the only area where more than a few contractors perceived a need for training was in zonal testing.

3. *Audit Forms*: Contractors reported that most WRAP audit forms were somewhat helpful to very helpful in completing the audit. Contractors rated the Customer's Usage History highest, reporting that it is very helpful. Contractors rated the Window Audit Form, Door Audit Form, and Thermostat Audit Form lowest of all forms, reporting that they are less than somewhat helpful. Overall, eight contractors said that there are too many forms required for WRAP and five contractors said that the number of forms is about right. We recommend that PPL revisit the forms that are used and determine whether they can be consolidated.

4. *Service Delivery:* Contractors were asked whether they face particular obstacles when scheduling customers for service delivery. A large share of contractors reported that they face problems due to outdated client contact information, other difficulties reaching clients, clients who are unavailable to be in the home during service delivery, and clients who are unaware of or who have forgotten about WRAP. Contractors make a mean six attempts to contact the customer by telephone, and an average of two attempts to contact the customer by mail before returning the job to PPL. We recommend that PPL have customers complete the application closer to the time when they will be served, so that information is up to date and customers are aware of the program.
5. *Joint Service Delivery:* Contractors were asked whether they jointly deliver WRAP with the state weatherization program and gas utility programs. Eight of the contractors said that they jointly delivery WRAP with state weatherization, four said they jointly deliver with gas utility programs, and two said that they do joint delivery with county-funded weatherization. We recommend that PPL keep track of joint service delivery in their database.
6. *Health and Safety Problems:* Contractors were likely to report that they were unable to provide WRAP services to customers because the client moved, the client no longer wants WRAP services, work is beyond the scope of WRAP, and there are health and safety concerns in the home. The health and safety issues experienced in the greatest percentage of WRAP jobs are water and mold. Contractors reported that they encountered water problems in a mean of 14 percent of WRAP jobs and mold problems in a mean of 12 percent of WRAP jobs.
7. *Audit Procedures:* All contractors who reported that they provide baseload audits said that they always discuss the electric bill with the customer and discuss actions to save with the customer. Contractors were least likely to say that they always provide savings estimates for measures and actions. Six contractors reported that they always provide savings estimates for measures, and five contractors reported that they always provide savings estimates for actions to save during baseload audits. Likewise, contractors were least likely to report that they always provide savings estimates for measures and actions during full cost audits. One contractor said that they never conduct a home walkthrough with the customer during a baseload audit. We recommend that PPL require all auditors to conduct a thorough home walkthrough and inspection. This is necessary for safety reasons and for comprehensive baseload service delivery.
8. *Data Collection and Reporting:* Eight contractors reported that they use the electronic job ticket. Reasons that contractors offered for not using the electronic job ticket included that the job ticket has not yet been made available or the contractor is not able to use it, and that the current system used by the contractor works better than the electronic job ticket. Contractors who currently use the electronic job ticket said they are satisfied with it overall. We recommend that PPL require all contractors to use the web-based job ticket, as is currently planned.

9. *WRAP Overview:* Contractors reported that each general program characteristic – program specifications, communication with PPL, data reporting, invoicing, and the program overall – is working somewhat well to very well. Contractor recommendations for improvements to WRAP included providing evaluation reports and savings results to contractors and providing more training for WRAP contractors.
10. *Inspections – Action Sheets:* Inspectors were asked to provide additional information on the inspection process. When asked about barriers to completing WRAP inspections, responses included that there are customers who are uncooperative in scheduling inspections, there is a lack of follow-up provided to inspectors about action sheets, that customers are unavailable for inspections, there is incomplete audit data, and there is incorrect customer contact information. We recommend that PPL formalize a process to respond to action sheets so that inspectors know the resolution of any problems that were found.
11. *Inspections – Work Completed:* Inspectors were asked whether they implement various aspects of inspection procedures. They were most likely to report that they conduct a customer interview, assess the education conducted during the audit, conduct a home walkthrough with the customer, and inspect all installed measures during WRAP inspections. Six contractors reported that they conduct an initial education session during WRAP inspections, and six contractors said that they conduct a follow-up education session.
12. *PPL Responsive to Inspector Comments:* Inspectors were asked how responsive PPL is to their comments and suggestions. One inspector rated PPL as not at all responsive, two inspectors rated PPL as somewhat responsive, and four inspectors rated PPL as very responsive. We recommend that PPL focus on inspector feedback, as they expend significant funding and effort to implement this important process and inspectors can provide the most information on WRAP problems because they spend so much time in the field with WRAP customers.

D. Baseload Observations

APPRISE conducted observations of baseload service delivery provided by five of PPL's WRAP contractors, one in each of PPL's service areas. Key findings and recommendations based on these observations are described below.

1. *Visit Introduction:* This analysis shows that some of the auditors did a very thorough job of explaining the program and assessing the customers' needs, but some auditors need to improve the content of the information provided to the customer at the introduction of the audit. We recommend that PPL review WRAP requirements and expectations with the contractors.
2. *Home Walkthrough:* One of the contractors did not conduct a walkthrough of the home. He remained in the kitchen throughout the visit except to install CFLs. One other

contractor did not do a complete walkthrough. The other three contractors did a thorough walkthrough and addressed all issues in the home. We recommend that PPL reinforce the importance of the walkthrough for baseload jobs with all WRAP contractors.

3. *Refrigerator Replacement:* Contractors monitored refrigerators in six of the ten homes observed. In two of the cases the refrigerator was new, and in two other cases there were justifiable reasons why the refrigerators were not monitored. There was one instance in which a contractor explored the opportunity for a two-for-one swap, but the customer refused to give up the extra appliance. In two other cases, there was an opportunity that the contractor did not explore. We recommend that PPL provide additional training to contractors on the importance of 2-for-1 swaps in refrigerator replacement, and train contractors to work with customers to obtain their acceptance of this measure.
4. *CFL Replacement:* To determine which lights to replace, two of the contractors went through the home, room by room, and asked how long the lights in each room were used each day. This approach was used by two of the four contractors, in four of the ten homes that were observed. Two of the other contractors only asked the customer which bulbs were used three or more hours per day. The other contractor asked the customer whether any bulbs were used four or more hours per day. We recommend that PPL review these procedures with contractors.
5. *Education:* All of the ten observations were considered to include the energy education visit. In most of the cases the contractor engaged the customer as an active participant in the process and found the customer's self-interest in WRAP participation. The contractor also usually reviewed the measures that were installed or ordered, analyzed the customer's electric bill, reviewed the customer's heating and cooling systems and appliances, and encouraged the customer to ask questions. The one contractor who did not do the walkthrough also did not analyze the customers' electric uses. Most of the contractors did a good job of finding those customer actions that could have the biggest impact on the electric use. The one exception was the contractor that did not do the walkthrough. We recommend that PPL review education requirements with the contractors.
6. *Observations:* We recommend that PPL conduct observation of baseload service delivery to ensure that contractors meet their standards for service delivery.

E. Full Cost Observations and Inspections

The evaluation included observations and inspections of full cost service delivery provided by five of PPL's WRAP contractors, one in each of PPL's service areas. Key findings and recommendations based on these observations and inspections are summarized below.

1. *Observations and Inspections Conducted:* There were some limitations to this evaluation work. Due to the budget for the evaluation, we did not conduct observations of all aspects of service delivery. Therefore, we did not observe the energy education visit for any of these customers, and in most cases we did not see the actual work performed. For observations, we assessed whether the correct decisions were made based upon the auditors' assessments and recommendations, the results of diagnostic tests conducted during the audit visits or recorded on forms during later visits that were not observed, and the actual work completed as recorded in the paperwork provided by the contractors.
2. *Observation Findings:* While none of the observations included what was considered the education visit, the contractors did a good job of communicating with the customers. While two of the visits were installation visits (and the other four were audits), all of the contractors inspected the home and most discussed actions to reduce electric usage with the customers. The contractors did not discuss the costs of the customers' usage and generally did not estimate how much the customer could save by taking certain actions, but presumably these efforts would be undertaken during the education visit.
3. *Inspection Findings:* There were missed opportunities found in three of the four homes inspected. The missed opportunities included solar hot water, connections that remained between the house and the garage and the house and the attic, incomplete air sealing, and incomplete insulation work. Some of the data collection received less than the highest ratings because the evaluator was not able to duplicate the tests in one home, and not all of the forms were used in another home. The measure selection and the appropriateness of installed measures were rated good or very good. Most contractors received the top rating with respect to effort and appropriateness of selected measures.
4. *One Set of Required Forms:* Many of the contractors used different types of paperwork for the PPL WRAP. This made it difficult to determine whether all of the required paperwork had been completed and it made it difficult to assess and compare jobs. PPL should develop one set of forms that is required for all jobs. They can provide the contractor with a check box for each form that is not applicable, but all forms should be included with every job.
5. *Instructions for Forms:* Some of the contractors were not sure what was required for some of the forms. Because PPL's technical manual is so long, it is not feasible for the contractors to look in this manual for instructions. Rather, PPL should provide instructions for each form on the back of the form, so that the contractor can easily flip the form over and read the instructions if necessary. Such instructions would improve the probability that all forms were filled out correctly.
6. *Diagnostic Tests:* All applicable diagnostic tests should be required at the audit visit. In some cases blower door and pressure differentials were not conducted during the audit. They should be required so that the auditor can accurately predict what work is needed during the measure installation visit.

7. *Procedures for Hardship Cases:* There was one hardship case where the contractor was instructed to do everything necessary to assist the client. Some of the tests were not conducted and the forms were not filled out in this case. Tests should still be required in such cases and contractors should be given guidelines, because services that do not provide a clear benefit for the client should not be provided.

F. Customer Survey

The evaluation included a survey with 219 WRAP recipients. Key findings and recommendations from the customer survey are summarized below.

1. *Survey Respondents Profile:* Households who received WRAP services were likely to have vulnerable members. About 45 percent of households have at least one disabled member and 29 percent have at least one elderly member. These households were also likely to have a difficult time finding employment that met all of their income needs; fifty-eight percent of respondents reported that the highest level of education reached by any member of their household was high school or less. More than one-third of respondents reported that at least one member of their household had been unemployed and looking for work in the year prior to the survey.
2. *Income:* Respondents were asked for the range of their annual household income. Twenty percent of clients have an annual income of \$10,000 or less, 41 percent of clients have an annual income between \$10,001 and \$20,000, and 26 percent of clients have an annual income of \$20,001 or more. Forty-three percent of respondents reported that they earned income from wages, salaries, or self-employment in the 12 months preceding the survey. Twenty-seven percent of respondents reported that they received retirement income.
3. *Assistance:* Thirty-three percent of respondents reported that they received public assistance, 33 percent said they received non-cash benefits such as food stamps or subsidized housing, and 45 percent said they received LIHEAP.
4. *Understanding of the Program:* Eighty-eight percent of respondents reported that they understand the benefits of WRAP. Thirty-six percent of respondents said that energy education was a benefit of the program, 35 percent said lower electric bills was a benefit, and 18 percent said lower electric use was a benefit.
5. *Financial Obligations and Bill Payment Difficulties:* Fifty-nine percent of respondents reported that it was very difficult or somewhat difficult to pay their PPL bill. Fifteen percent of respondents reported that they were unable to use their main source of heat in the year prior to the survey due to a broken heating system, three percent said that their electric service was discontinued, and three percent said that their gas service was discontinued.
6. *Measures:* The survey included questions about the measures clients received. As a result of WRAP, 39 percent of respondents received a new refrigerator, 11 percent

received a new air conditioner, and nine percent received a new water heater. More than half of respondents, 53 percent, reported that they received air sealing or insulation from the program, seven percent said they received window tinting, and three percent said they received a reflective roof coating.

7. *Energy Education and Actions Taken:* Ninety-three percent of respondents said that they were home for the service provider's visit, and 85 percent said they were home for the entire visit.

The survey included questions that addressed whether the provider explained the electric bill and whether he/she suggested actions that the customer could take to save electricity. Sixty-five percent of respondents said that the service provider explained how electric use is measured. Eighty-three percent of respondents said that the provider recommended actions, 63 percent said the provider gave savings estimates for those actions, and 64 percent said the provider gave them a written plan of actions to save electricity. Eighty percent of respondents said one of the providers left electricity-saving information.

8. *Program Impact:* Respondents were asked whether they had reduced their overall electric usage since receiving WRAP services. Nearly three-quarters of respondents said that they had reduced their electric usage. Full cost customers were more likely than baseload customers to report that they had reduced their overall electric usage. More than half of respondents, 55 percent, also said that their PPL bill was lower than it was prior to receiving WRAP services.

Respondents were asked about the impact of WRAP on the comfort of their home. Forty percent of respondents said that the warmth of their home in the winter had improved since receiving WRAP services. Full cost customers and customers with electric heat were most likely to report that the warmth of their home had improved. Thirty-two percent of respondents reported that the temperature of their home in the summer had improved since receiving services.

The survey asked respondents how important WRAP had been in helping them meet their needs. The majority of respondents, 86 percent, said that WRAP was very important or somewhat important. However, nearly half of respondents, 49 percent, said that they need more assistance to pay their PPL bills.

9. *Satisfaction with Program Services:* More than 90 percent of respondents reported that they were very satisfied or somewhat satisfied with the measures and services they received from WRAP, including refrigerators, air conditioners, water heaters, air sealing and insulation, reflective roof coating, and window tinting.

Overall, 93 percent of respondents reported that they were very satisfied or somewhat satisfied with WRAP. Full cost customers and customers with electric heat were most likely to report that they were very satisfied or somewhat satisfied with the program.

G. Usage Analysis

We conducted an analysis of the measures provided and the change in usage for customers who received WRAP in 2003. Key findings and recommendations from this analysis are summarized below.

1. *WRAP Characteristics:* About 60 percent of the WRAP participants also participate in OnTrack bill payment plan. More than 70 percent live in single family homes. Fewer than half of all participants are renters.

About half of the WRAP participants receive a refrigerator and/or freezer replacement with somewhat greater replacements in the Low Cost program and fewer in the Full Cost program. Refrigerators and freezers are responsible for about half of the Baseload program measure costs. The Baseload program also replaced air conditioners in about 18 percent of all homes while the Low Cost program replaced air conditioners twice as often. The Low Cost program spends more than twice as much on measures as the Baseload program, with most of that difference attributable to water heater replacements and other water heating measures, but also with higher spending on refrigerators, air conditioner replacements, and other appliance repairs/replacements.

About a quarter of Full Cost participants received significant attic insulation work, while one in six received major window and door work and a comparable proportion received significant blower-door guided air sealing work. The program spent nearly as much on infiltration control without a blower door (e.g., caulking and weatherstripping) as it did on more advanced blower door work.

2. *Electric Impacts:* Average net savings are estimated at 836 kWh for the Baseload program, 500 kWh for the Low Cost program and 1,767 kWh for the Full Cost program.

The net savings estimates for the Baseload and Full Cost programs are generally consistent with expectations for this type of program and quite similar to PPL's internal evaluation estimates of 709 kWh for the Baseload program and 1,765 kWh for the Full Cost program. The Low Cost program savings appear low at just 500 kWh, especially when compared to PPL's internal estimate of 1,090 kWh. One might expect the Low Cost program to save at least as much as the Baseload program since it includes slightly more refrigerator replacements and comparable lighting work and then adds in water heater replacements, other water heating measures, and more air conditioner replacements. Further explorations, described later, have led to the conclusion that this result is not very reliable, which is also reflected in the wide band of uncertainty that covers from -8 kWh to 1008 kWh in savings.

We explored variations in usage and net savings based on a variety of treatment and housing characteristics.

- Houses that received refrigerator replacements saved much more than those that did not, particularly for the Baseload program.

- OnTrack participants tended to use a little more and save a little more than other participants (and also had slightly greater installation rates for all major measures).
 - Baseload program houses that received air conditioner replacements tended to save about 200 kWh more than those that didn't (given the same refrigerator replacement status).
 - Savings were approximately equal for all three housing types in the Baseload program, but savings were lowest for apartments in the Full Cost program (and their usage was lowest).
3. *Measure Saving Analysis:* We employed multiple regression analysis to estimate savings associated with multiple measures at once by modeling observed savings as a function of program treatments and other factors. We developed separate regression models for the Baseload and Full Cost programs with dichotomous (yes/no) variables to represent whether major measures had been installed.

We assessed the relative cost-effectiveness of each measure using the regression model savings and the average treatment costs to develop an estimated cost per annual kWh saved. For comparison purposes, the overall cost per kWh savings was \$0.94 for the Baseload program, \$2.80 for the Low Cost program, and \$1.27/kWh for the Full Cost program. The Low Cost would be at \$1.27/kWh if the savings were actually 1,100 kWh instead of the 500 kWh found in the main billing analysis.

Refrigerator replacement in the Baseload program and blower door guided air sealing in the Full Cost program are the most cost-effective measures. Air conditioner replacements and major window and door work are the least cost-effective measures with measured savings results.

The lack of statistically significant savings for water heater replacement is cause for concern. The theoretical justification for the measure is not very strong given that the vast majority of the difference in rated efficiencies between new and existing units is due to tank and pipe losses that can mostly be mitigated through tank and pipe insulation.

Overall, the analysis suggests that WRAP should re-assess the air conditioner replacement targeting strategy, water heater replacement as an efficiency measure, and potentially excessive window and door spending on some jobs. Refrigerator replacements, insulation and blower door guided air sealing should be pursued and perhaps expanded if further opportunities can be identified.

4. *Savings by Provider:* For the Baseload program, SEDA-COG appears to have the highest savings at 2,397 kWh/yr. -- nearly three times the overall average -- but the sample size is small and the uncertainty bounds are wide. The table also shows that spending averaged \$790 per job but varied widely by provider with SEDA-COG spending the most at \$1,969 per job. The extra spending was primarily on air conditioner replacements and "other appliance" replacements (it is not clear what this

category entails). The last column of the table provides an indicator of cost-effectiveness in terms of dollars spent per annual kWh saved. Pure Energy and SLHDA appeared to provide the most cost-effective work at about \$0.50 per kWh, primarily due to low spending while producing about average savings. SLHDA's savings show large uncertainty.

For the Full Cost program, SEDA-COG and CACLV appeared to have produced the most kWh savings, although STEP Inc. had the highest percent savings. In terms of cost-effectiveness, WCRA appeared to be most cost-effective, primarily due to very low spending compared to the other providers.

H. Payment Impacts

We conducted an analysis of the impact of WRAP on customer bills and coverage rates for 2003 WRAP participants. Key findings and recommendations from this analysis are presented below.

1. *Total bill:* Customers who received program treatments had a small gross reduction in their total bill of \$21 and a larger net reduction of \$118.
2. *Cash payments:* Cash payments increased by \$39 as compared to the comparison group.
3. *LIHEAP payments:* The program recipients experienced a small decline in the amount of LIHEAP cash and crisis assistance received.
4. *OnTrack Credits:* OnTrack participants had a significant gross increase in the average amount of OnTrack credits received, average \$72. However, the comparison group had a larger increase in OnTrack credits, resulting in a net decline for the treatment group of \$49.
5. *Total payments:* Customers increased their total payments by \$54. However, compared to the comparison group, there was a net decline in total payments of \$58.
6. *Cash coverage rates:* The treatment group had a 4 percentage point gross increase and a 13 percentage point net increase in cash coverage rates.
7. *Total coverage rates:* The treatment group increased their total coverage rates from 93 percent in the year prior to service delivery to 100 percent in the year following service delivery, an 8 percentage point gross increase. The net increase in total coverage rates was 12 percentage points.

I. Recommendations

Recommendations are summarized below, divided by whether they refer to WRAP management and administration, forms, procedures, services and measure selection, contractors, inspections, and training.

Management and Administration

1. Focus less attention on spending 100 percent of the WRAP budget. (The budget would be less time consuming for PPL if they were not required to separately track the solar water heating expenditures.)
2. Encourage coordination between WRAP and state weatherization and/or gas utility weatherization programs. When the next WRAP job ticket and database enhancement is completed, consider adding a field for the contractor to note whether the job was coordinated.
3. Require contractors to use the web-based job ticket.
4. Encourage CPDs to observe each of their contractors in the field at least once each year.
5. Conduct occasional field observation on baseload jobs, and follow-up with more observations for contractors who don't meet expectations.
6. Create a more concise standards and field guide at the next scheduled update. Create separate and more detailed guides that discuss specific program standards for more specialized contracting areas.
7. If more than six months elapse before a customer application is sent to the contractor, re-contact the customer to confirm program interest and contact information prior to sending the job to the contractor.

Forms

1. Develop one set of forms that is required for all WRAP jobs.
2. Revisit the audit forms and determine whether they can be consolidated.
3. Update energy cost sheet for changes in electric prices.
4. Provide a summary at the bottom of the Money-Saving Tips form with the top three to five actions with the greatest potential for saving and estimate the monthly dollar savings that may result from each action.
5. Enhance the Customer Profile Form so that it includes other opportunities for electric usage reduction including water leaks, use of dehumidifiers, sump pumps, use of second refrigerators or freezers, appliances or lights that are always left on.

Procedures

1. Diagnostic testing should be required at the audit visit.

Services and Measure Selection

1. Update the cost effectiveness calculations for the audit decision tree so they take account of changes in prices, as well as the best estimates for costs and savings.
2. Reconsider the classification of all homes with electric heat as full cost jobs. Reconsider classification of other job types as well.
3. Change the temperature correction for refrigerator usage adjustment and make sure it is used in the usage calculation.
4. Update usage thresholds for refrigerator replacement.
5. Revisit threshold for CFL replacement.
6. Revisit water heater replacement guidelines and consider water heater wraps and pipe insulation as an alternative

7. Reassess window and door spending.²⁶
8. Refrigerator replacements, insulation and blower door guided air sealing should perhaps be expanded if further opportunities can be identified.
9. The window air conditioner replacement decision should be based upon the estimated cooling load from the billing data, the estimated proportion of that cooling load used by the existing unit, and the cost of the replacement.
10. The protocol for window air conditioner sizing should be revised.
11. Basement duct sealing should focus on safety or comfort.
12. Investigate why fewer than 60 percent of full cost jobs receive blower door guided air sealing.²⁷
13. Visual inspection should be used for homes with walk-up attics when conducting zonal pressure diagnostics.
14. Interior doors should be closed when conducting the worst case depressurization test.
15. Reflective roof coating is unlikely to be cost-effective in homes with properly insulated attics.

Contractors

1. Require highest cost providers to lower their measure costs.²⁸
2. Require all auditors to conduct a thorough home walkthrough and inspection.
3. Require all contractors to use the web-based job ticket, as currently planned.

Inspections

1. At the next time the database is enhanced, consider including a date for action sheet resolution so that inspectors can check to see if action sheets have been addressed.

Training

1. Review WRAP education requirements and expectations with contractors.
2. Reinforce the importance of the walkthrough for baseload jobs with all WRAP contractors.
3. Provide additional training to contractors on the importance of refrigerator 2-for-1 swaps, and train contractors to work with customers to obtain their acceptance of this measure.
4. Review CFP replacement procedures with contractors.

²⁶ PPL reports that this spending was lower in 2004 than in 2003 as they had discussed expenditures on windows and doors with one contractor who had excessive spending in this area.

²⁷ PPL reports that this is a data tracking issue that will be addressed with the new web-based job ticket.

²⁸ PPL reports that this procedure will be enabled by the new data system.