B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

Methodology for Quantifying Market-Induced, Non-Programmatic Savings

April 1, 2011

Prepared for
Bonneville Power Administration

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1. Introduction

Overview

In 2009, the Bonneville Power Administration (BPA) contracted with The Cadmus Group Inc. (Cadmus) to assist in estimating non-programmatic savings. Non-programmatic savings are defined as electricity savings that are:

- Cost-effective;
- Above the baseline assumed by the Northwest Power and Conservation Council (the Council) for determining conservation potentials in the 6th Regional Power Plan;
- Not incented through utility-sponsored energy efficiency programs; and
- Not part of net market effects claimed by the Northwest Energy Efficiency Alliance (NEEA).

The work by Cadmus included:

- Quantifying non-programmatic savings for the 2005–2009 program period;
- Projecting probable non-programmatic savings for the 2010–2014 program period, based on the measure-specific savings potentials identified in the 6th Regional Power Plan; and
- Developing and recommending methodologies for calculating actual market-induced, non-programmatic savings in BPA's service area for the 2010–2014 program period, particularly in the residential and commercial sectors.

The results of the analyses of the first two items are summarized in Chapter 2 of this report. Chapters 3, 4, and 5 of this report focus on the last item.

Conservation Planning in the Northwest

On December 5, 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), which authorized the four states of Idaho, Montana, Oregon, and Washington to form the Northwest Power and Conservation Council (Council). The Northwest Power Act directs the Council to prepare a plan to protect, mitigate, and enhance the Columbia River Basin fish and wildlife that have been affected by the construction and operation of hydroelectric dams, while also ensuring that the Pacific Northwest has an adequate, efficient, economical, and reliable electric power supply.

In accordance with these mandates, the Council prepares a regional power supply plan every five years. The plan includes a comprehensive assessment of power supply and conservation options to meet future electricity demand in the region. These conservation supply curves—and the targets derived from them—include all the achievable, cost-effective efficiency measures possible beyond baseline efficiencies and measures accounted for in the load forecast.

The Council published the 6th Regional Power Plan in February 2010. The Plan identified nearly 6000 aMW of cost-effective savings as achievable over a 20-year planning horizon. The Plan further deemed 1,200 aMW of the identified potential to be achievable in a five-year (2010-2014) planning period. BPA supplies approximately 42 percent of the region's wholesale public

power and is committed to ensuring that the public power portion of the conservation targets is achieved. This amounts to approximately or 504 aMW of savings to be deployed by BPA[1] from 2010 to 2014. In addition, utilities in Washington with more than 25,000 retail customers also have conservation targets related to the Council's Power Plan.[2]

Background on Non-Programmatic Savings

The Council's methodology for estimating energy-efficiency potential is based on an assumption of "frozen" efficiency. The baseline represents the market penetration of efficiency measures at the time the Council produces its forecast and develops the conservation supply curves. While the baseline accounts for effects related to codes and standards enacted or scheduled to take effect during the planning period, it does not factor in changes in baseline conditions from new codes and standards, market-induced conservation, utility activities, or other non-programmatic factors.

Moreover, the Council's supply curves are indifferent to how conservation is achieved, who pays for conservation, or why conservation measures are installed. That is, the Council recognizes that savings may be achieved through multiple mechanisms, including utility programs, market transformation initiatives, codes and standards, or independent adoption of energy-efficient products and practices by consumers.

This "multiple-mechanism" approach to acquiring conservation resources makes sense for the Northwest. Historically, conservation in the Northwest has been the product of activities initiated by a number of entities, including BPA, utilities, Energy Trust of Oregon, the Northwest Energy Efficiency Alliance, and the Council, often in joint initiatives. These entities have worked to promote energy efficiency through a variety of mechanisms, including research and development, information and education, support for energy building codes and equipment efficiency standards such as ENERGY STAR® appliances, market transformation, and financial incentives.

These initiatives have, over the past several years, resulted in a robust infrastructure for energy efficiency in the Northwest. This infrastructure has enabled the widespread adoption of energy efficiency technologies and practices in the Northwest and has produced a lasting influence on the regional market for energy efficiency, if not energy in general. It is therefore now difficult—if not impossible—to fully and appropriately attribute the region's achievements in conservation and energy efficiency to the actions taken by any one of these entities. This is especially so since these accomplishments have more often than not been the results of close cooperation and collaboration among the various entities. Moreover, even if practical, attempts at allocating credit may not be a productive exercise. Indeed, focusing on attribution and allocation of credit

[1] Hereafter, all references to claimed savings or targets for BPA imply savings or targets in public power served by BPA.

[2] In 2006, voters in Washington State approved the Clean Energy Initiative 937 (I-937). This initiative requires customer-owned utilities with more than 25,000 retail customers to acquire all cost-effective conservation, using estimates determined by, or using a methodology consistent with, the most recent Power Plan developed by the Council. The Initiative also establishes comparable goals for the state's investor-owned utilities.

may have the unintended consequence of undermining the historical spirit of collaboration in the region, creating an atmosphere in which various entities are motivated to compete, rather than cooperate. Finally, and most importantly, from a regional perspective, any new conservation is a resource that provides the region with a low-cost alternative to developing new power generation and transmission facilities, regardless of the mechanism or combination of mechanism causing its development.

Toward A Workable Solution

In order to properly track and report savings, BPA has defined two primary categories of savings: programmatic and non-programmatic. Programmatic savings consist of those resulting from utility-sponsored incentive programs as well as market transformation savings from the NEEA's initiatives. Non-programmatic savings may originate from three sources:

1. Codes and Standards: Reductions in electricity use due to energy codes and equipment standards that take effect after the establishment of the baseline in the 6th Plan.
2. Baseline Adjustments: Changes made to the baseline by the Regional Technical Forum (RTF) that differs from the 6th Plan.
3. Market-Induced Adoption: Adoption of efficient technologies by non-participants outside of utility programs. Possible drivers of market-induced conservation could include:
    - Tax credits or government spending: State and federal tax credits, as well as spending from the American Recovery and Reinvestment Act.
    - Market transformation: Outside of NEEA's net market effects, utility spending on programs and infrastructure have altered the marketplace for energy efficiency.
    - The "Green" movement: As society places a greater emphasis on green living, energy efficiency has higher visibility and attractiveness for consumers.

The composition of the regional conservation potential and the role of different sources of non-programmatic savings are illustrated in Figure 1.[3]

[3] Note this figure is for illustrative purposes only and not meant to be interpreted quantitatively.

Figure 1. Sources of Savings

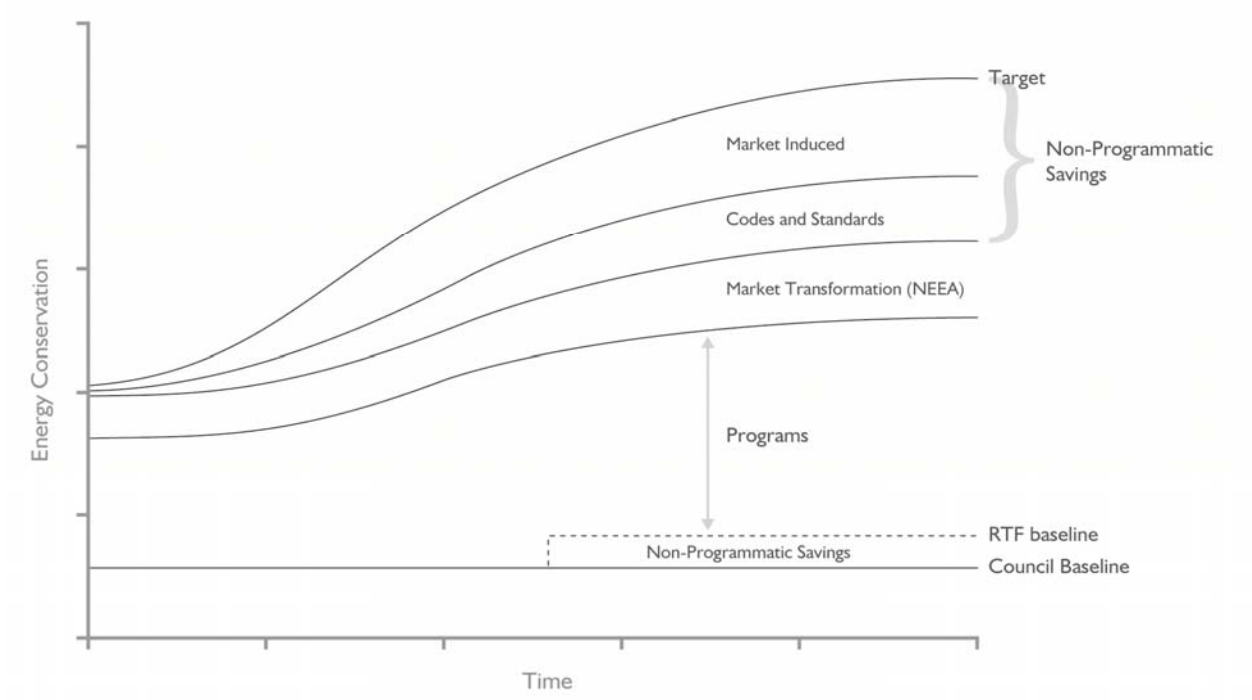
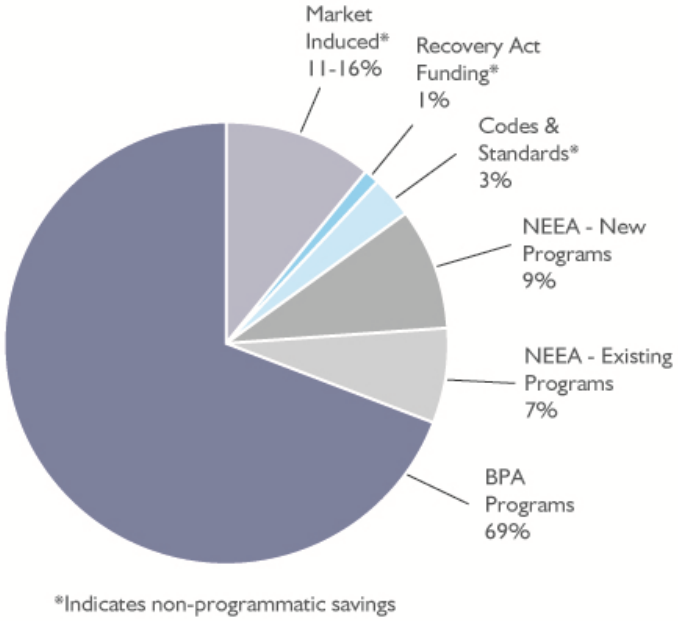


Figure 2 shows the expected contributions of programmatic and non-programmatic savings to BPA's share of regional savings for the 2010–2014 program period. An asterisk denotes non-programmatic categories. Specific non-programmatic savings categories are discussed in more detail below.

Figure 2. Sources of Savings for BPA Residential and Commercial Targets, 2010–2014



Codes and Standards

When the Council sets the baseline for calculating long-term conservation potential, it takes into account the effects of any "known" energy code and standard. These include codes or standards adopted since the previous Power Plan. However, the likely effects of potential new codes or standards are not included or considered when the baseline is established. Given that it usually takes a long time for any code or standard to be adopted and implemented and most of these revisions affect new and replacement stock (and in the five-year time horizon of any Power Plan, stock additions and turnover rates are fairly small), the near-term impacts of new code and standard upgrades are small. However, these impacts are likely to be substantial over the 20-year horizon of the 6th Plan. The Council estimates that 46 percent of the total 20-year savings potential could be subject to codes and standards.[4]

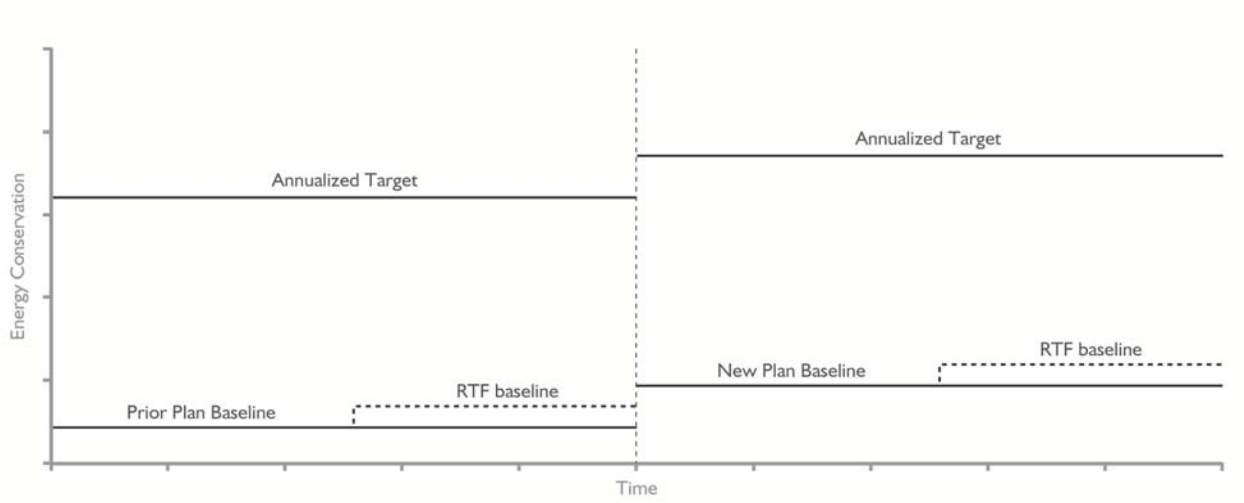
Based on research by Cadmus, BPA assumes three percent of the savings targeted for development between 2010 and 2014 in the 6th Plan will likely be achieved through codes and standards, as shown in Figure 2. At the end of the 6th Plan period, it will be necessary to estimate the actual, ex-post savings from codes and standards changes that were realized between 2010 and 2014. Since code and standard savings have an effect on savings targets of NEEA, as well as on BPA's share of non-programmatic savings, BPA is currently working with NEEA and the Council to develop a robust methodology for estimating these impacts.

Baseline Adjustments

The RTF reviews calculation of savings for conservation measures with stipulated or deemed values and makes recommendations to BPA on an ongoing basis during the plan period. These reviews often result in revisions to deemed savings values based on adjustments to the baseline established in the Power Plan. Revisions to the baseline are often prompted by the results of new research and new market data on average efficiency levels. While the RTF uses the Council's methodology to determine the baseline for deemed measures, the new baseline is determined at a different time than the Plan baseline is. Revisions to the baseline clearly impact the savings that may be claimed per unit of measure through programmatic activity and BPA's reimbursement. The effects of baseline revisions on BPA's saving targets are illustrated in Figure 3.

[4] Presentation to Pacific Northwest Utilities Conference Committee "The Potential Role of Codes and Standards in Efficiency Acquisition," April 2, 2010.

Figure 3. Illustration of Power Plan and RTF Baselines



As can be seen in Figure 3, the adjustment to the baseline does not affect the baseline assumed in the Plan, as it continues to be the baseline for calculation of savings targets. However, the per measure programmatic savings may decrease based on the new RTF baseline. Therefore, a deemed measure may produce both programmatic and non-programmatic savings. Figure 4 provides an example of this for clothes washers. The RTF recently made an upward adjustment to the baseline for this measure, assumed in the 6th Power Plan. As a result, although the target continues to be based on approximately 108 kWh of savings per washer, programs offering this measure will claim approximately 80 percent of the deemed savings for each washer they incent and claim the 20 percent balance as non-programmatic savings.

Figure 4. Clothes Washer Savings

To quantify the non-programmatic savings associated with this baseline shift, BPA will need to assess program achievements and then calculate the additional savings based on the difference between the RTF and 6th Plan baselines. This analysis is based entirely on program achievements, rather than on market activity outside of programs.

Market-Induced Adoption

Market-induced effects refer to the non-programmatic adoption of energy-efficient technologies and practices, motivated by higher energy prices, macro-economic conditions or shifts in cultural norms (e.g. "green movement") other than those above. These savings reflect the adoption of energy-efficient technologies in the marketplace, excluding those associated with codes and standards or utility program incentives. Theoretically, market-induced savings apply to all energy-efficient products and services. In general, estimates of savings for these measures may be obtained by quantifying the total saturation of a measure, and subtracting number of units incented through utility programs and the initial, assumed saturation (the Council's baseline).

The remainder of this report summarizes suggested approaches by sector and measure to quantify market-induced, non-programmatic savings. Chapter 2 summarizes the estimated non-programmatic savings for the 2005–2009 and 2010–2014 planning periods. Chapter 3 provides the overall methodology approach, and Chapters 4 and 5 provide specific information on residential and commercial measures or measure categories. Estimation of other components of non-programmatic savings is documented in detail in for 2005-2009 as Appendix A and 2010-2014 in Appendix B.

2. Quantifying Market-Induced Savings

In consultation with Cadmus, BPA developed estimates of market-induced savings that occurred in the previous planning period (2005-2009) and that are likely to occur within the current (2010-2014) planning period. The analysis focused on savings from conservation measures in two categories, compact fluorescent light bulbs (CFLs) and non-residential lighting. These measures were selected primarily because of their significant savings potential and the availability of reliable data that could support the analysis.

2005–2009 Market-Induced Savings

For the 2005–2009 planning period, BPA's target was 280 aMW, or 56 aMW annually. Of this, BPA determined non-programmatic electricity savings would account for 20 aMW (4 aMW per year), based on a percent of target by measure category that may be captured through non-programmatic channels. This figure was not differentiated by codes and standards or market-induced savings. Based on that analysis, the programmatic target was reduced to 52 aMW per year. Further details are provided in Appendix A.

To verify these savings were realized, Cadmus estimated the market-induced, non-programmatic savings for CFLs and non-residential lighting. The results of the analysis, summarized in Table 1, indicated market-induced savings of 26 aMW for CFLs and 13 aMW from non-residential lighting. As can be seen in Table 1, the estimated market-induced savings from the two measures constituted were significant, representing 21 and 30 percent of the total programmatic savings (BPA program and NEEA savings) for these measures during the same period.

Table 1. 2005–2009 BPA's Market-Induced Share of Savings by Measure Category

Measure Category	5-Year Market-Induced Savings (aMW)	5-Year BPA Program and NEEA Savings (aMW)	Market-Induced Fraction
CFL	26	97	21%
Non-Residential Lighting	13	30	30%

2010–2014 Market-Induced Savings

During the 2010–2014 planning period, market-induced savings are projected to be between 38 aMW and 53 aMW, with approximately three-quarters of the savings in the residential sector and the remainder in the commercial sector.

To derive these estimates, BPA and Cadmus assigned a probability of occurrence of non-programmatic savings to each measure bundle (e.g., residential weatherization, commercial grocery refrigeration) using a nominal scale with five categories: none, very low, low, medium, and high (see Table 2). The probabilities are assumed to range between zero and 25 percent, with levels representing values reflecting available estimates from sources including ENERGY STAR market shares[5], industry experience, and a review of published process evaluations and

[5] http://www.energystar.gov/ia/partners/downloads/2009_USD_Summary.pdf

studies on freeridership.[6] On average, non-programmatic savings are expected to fall around 10 percent. Each measure category was assigned a probability, based on the data available from the 2005–2009 program period, as well as the sources listed above. For example, residential lighting and consumer electronics both received a "high" rating based on market characterization studies and penetration of ENERGY STAR-qualified units in the marketplace.

Table 2. Likelihood of Non-Programmatic Savings

Category	Non-Programmatic Percent of Savings
None	0%
Very Low	2.5%
Low	7.5%
Medium	15%
High	25%

BPA and Cadmus also prioritized measure bundles according to their five-year economic potential, and determined that all measures which cumulatively account for less than five percent of the total five-year potential were too small to justify the costs of data collection and analysis. These measures were therefore excluded from the non-programmatic savings analysis. All Distribution System Efficiency Initiative (DSEI), industrial, and agriculture measures were assumed to have no non-programmatic savings (a "none" rating). DSEI was excluded because, by definition, it is an efficiency measure implemented by a utility, not an end-user. Although there may be a small amount of non-programmatic savings in the industrial and agricultural sectors, quantifying and verifying these savings would likely be complex and costly.

Table 3 shows the BPA target, based on the 6th Plan potential,[7] as well as the distribution of savings across measure categories for both low and high scenarios. These scenarios reflect the uncertainty inherent in estimating the likelihood of market-induced savings. In fact, the final market-induced savings may be below the low scenario estimates. This analysis is not intended to provide a precise estimate of non-programmatic savings; rather, it is meant to inform the program planning process and guide marketing efforts. The savings estimates are what might be considered reasonable approximations of market-induced savings. They will be revisited and adjusted annually, if possible, and the anticipated impact from market-induced and other non-programmatic sources will be adjusted as necessary. Further details are provided in Chapters 4 and 5.

[6] Examples include: California statewide lighting evaluation (Cadmus), NEEA 80Plus MPER (Cadmus), Nevada Power Process Evaluation (Paragon Consulting), ComED potential study (Cadmus).

[7] 6th Plan potential based on Council supply curves.

Table 3. BPA Five-Year Target for Market-Induced Non-Programmatic Savings

Sector	Measure Category	BPA 5-year Target (aMW)	BPA 5-year Market-Induced Savings Estimate (aMW)		Market-Induced Savings as Percent of Potential	
			Low	High	Low	High
Residential	CFLs	102.5	15.1	25.6	15%	25%
	Showerheads	33.4	2.5	5.0	8%	15%
	Consumer Electronics	25.6	4.2	4.8	16%	19%
	Appliances	9.5	1.0	1.0	10%	10%
	Envelope Measures	35.2	2.6	2.6	8%	8%
	HVAC Systems	46.0	1.4	1.4	3%	3%
	Water Heaters	12.6	0.9	1.2	7%	10%
	Residential Total	264.8	27.6	41.6	10%	16%
Commercial	Lighting	40.1	8.4	9.0	20%	22%
	Computers/Network PC Management	8.5	3.2	3.5	19%	22%
	Refrigeration	16.0	0.6	0.6	8%	8%
	Commercial Total	64.6	12.2	13.2	18%	20%
Overall Total		329.4	39.8	54.8	12%	17%

3. Overview of Methodology

This chapter provides an overview of potential data sources, calculation methodologies, timelines, and regional representativeness issues common to all measures with market-induced non-programmatic savings. Subsequent chapters present detailed methodologies by sector and by measure or measure category.

Data Sources for Total Market

Market-induced savings may be directly estimated from data on saturation of energy-efficient products at the total market level. There are two main sources for these data:

1. Sales data for energy-efficient equipment sold in the region; and
2. Regional market studies such as the Residential Building Stock Assessment (RBSA) and the Commercial Building Stock Assessment (CBSA)

Sales Data

Two types of sales data are publicly available for estimating market-induced savings: point-of-sales (POS) and shipment data. Both provide reasonable estimates of total numbers of energy-efficient products sold. Some market data on energy-efficient products are also available from other sources, such as the Consortium for Energy Efficiency (CEE). Surveys of contractors have also been used in the past to obtain market data, but the results have been mixed.

Point-of-Sales

POS data come directly from retailers and are usually obtained through a third-party contractor who develops relationships with the retailers to obtain sales data. Ideally, this process will involve key retailers with large market shares, thus minimizing the need to extrapolate sales data to account for retailers not providing data.

As building these relationships takes time and resources, data availability and quality should be considered before investing in this option. These data are more reliable if a few large retailers account for a majority of the market. For example, a few do-it-yourself retailers, such as Home Depot, may account for up to 80 percent of the home appliance sales in local markets. If these retailers provide sales data, the estimate of total sales will largely be based on actual data, with minimal extrapolation, and will provide a reasonable approximation of total sales. If, however, data are derived from many smaller retailers, extrapolation is required and developing relationships with numerous independent entities can be difficult. In such situations, shipment data is a preferred option.

Regional and national market research firms such as Fluid Market Strategies (Fluid) and the NPD Group also have experience with collecting sales data. Some energy-efficiency industry associations such as the CEE — also track POS data. BPA may leverage these sources to obtain the needed sales data.

Shipment Data

Shipment data show the number of units shipped into a specific state or region. Sources of shipment data include manufacturer or trade-ally associations, ENERGY STAR, and, for

imports, the U.S. Census Bureau.[8] Unlike POS data, shipment data tend to be available at the aggregate regional and state levels. They are not tracked and are not available at the sub-region or retailer levels (i.e., stores). These data will therefore have to be adjusted to correspond to BPA service area and its share of the market. Shipment data do not typically account for inventory turnover, though this may be a negligible issue, as inventory generally turns over at a constant rate. That is, it would be safe to assume that shipments in a given year represent actual sales. It is also important to note that reporting timelines for these data are usually delayed by one year. For example, ENERGY STAR shipment data are generally reported about one year after the reported year's end.

Data Quality

Data quality may vary depending on the source, level of extrapolation, and geographic resolution. Regional data on total energy-efficient units sold are currently tracked for only a few measure categories; thus, any data obtained will be an improvement over current knowledge.

An additional concern, however, is data validity, particularly for POS data. If a third-party contractor can only obtain actual sales for 2 percent of the market and must extrapolate the remainder, the estimate's uncertainty is high. Ideal POS estimates would meet 90 percent confidence and 10 percent precision by measure and retail channel; such accuracy is, however, not likely for most measures. The contractor collecting current regional CFL sales data estimates that 60 percent of sales are based on actual POS data, while 40 percent are extrapolated. This level of extrapolation has been accepted in the region.

Shipment data do not require as much extrapolation; however, these data are likely only available at the state level and thus a more refined geographic distribution is not possible and may skew actual savings within BPA territory. For example, sales may skew to urban locations over rural, and this information will not be captured with shipment data.

Regional Market Studies

Regional market studies such as RBSA and CBSA collect data on structural characteristics, energy system specifications, and energy-using equipment in residential and commercial buildings. Conducted at regular intervals, the data from these surveys may be used to estimate changes in saturation of energy-efficient equipment and appliances, as long as they use consistent data collection methods and protocols.

Residential Building Stock Assessment

RBSA is a Northwest residential building characterization study being launched by NEEA. The study will collect information on:

- Heating and cooling equipment types and efficiencies;
- Water heating equipment types and efficiencies;
- Appliance and cooking equipment types;
- Saturation of ENERGY STAR-rated models;

[8] http://www.census.gov/manufacturing/m3/

- Home electronic equipment saturations; and
- Building envelope characteristics.

The RBSA sample will include a statistically significant representation of BPA's service area at the five sub-regional levels. NEEA will visit more than 1,200 homes in the region. Data will be collected in 2011, providing baseline measure saturations. In 2014, follow-up surveys and/or site visits should be conducted for a subsample of RBSA to obtain data on changes in measure saturations. The studies could be longitudinal, with 2010 homes contacted again in 2014 to determine changes made in their homes between studies.

Commercial Building Stock Assessment

Similar to the RBSA, the CBSA is a study that characterizes Northwest commercial buildings through site visits. The study has collected information on energy consumption, envelope characteristics, lighting, HVAC equipment, refrigeration systems, and plug load and cooking equipment. NEEA conducted the most recent CBSA in 2008–2009 and the previous study was completed in 2003. The data from the recent study provide baseline saturations for commercial measures. For estimating non-programmatic savings, the primary data of interest are lighting power densities by building type and saturation of efficient refrigeration equipment.

Survey Methods

These surveys may be conducted as longitudinal studies of the same samples over time or by developing fresh, regional samples. Conducting a longitudinal study (as the CBSA has done) would significantly reduce the time and cost required to obtain data, compared to selecting a new random sample of buildings. As part of the RBSA update in 2014, customers may be asked whether they replaced their water heaters during the proceeding five-year period; asked for specific information on the new unit (e.g., manufacturer and model number); and asked whether they participated in a utility- or state-sponsored rebate program. If possible, the customer list should be prescreened to remove known program participants. The disadvantage of this approach is sample attrition. For example, it is very likely that one-quarter of the participants in the current RBSA sample will have moved by the time the survey is updated in five years.

Data Quality

Site visits typically do not provide complete information for all measures. For example, it is difficult for residential auditors to obtain information on the efficiency of home electronics, although it is relatively easy for them to obtain the makes and models of appliances to later determine ENERGY STAR status. The site-visit samples must also be large enough to provide reliable and representative information on particular measures; individual sections in the following chapters reference required sample sizes.

Savings Calculations

Key data needed to estimate market-induced savings include:

- Total units sold or installed;
- Per-unit savings;
- Programmatic (both public and investor-owned utility) savings; and

- Other overlapping, non-programmatic savings.

Total measure savings is calculated as the product of the number of units and the savings per unit. The per unit savings will be based on the Council's 6th Plan values, where the numbers given are all at busbar.

Timeline

As 2010 is the first year of the current program period, it is important for BPA to collect baseline data as soon as possible. Baseline data are available or are currently being collected for the following measures:

- Residential lighting (CFLs): NEEA Alliance Cost-Effective (ACE) model using contractor-supplied POS data.
- Residential insulation: collected in current RBSA.
- Residential showerheads: collected in current RBSA.
- Commercial lighting: 2008 CBSA data.

For all other measures, BPA must begin collecting data to track non-programmatic savings. In addition, BPA must also approach investor-owned utilities (IOUs) to negotiate a program savings reporting protocol.

Where sales data are the source for total units sold, BPA will likely need to track data on a yearly basis. While data could be collected in 2010 and 2014, and interpolated between the two years, Cadmus believes tracking data yearly will provide more accurate market-induced non-programmatic savings estimates and data continuity. This is particularly the case for POS data, as contractors maintain ongoing relationships with retailers over the program cycle.

For measures relying on RBSA or CBSA studies, BPA should initiate the "post" period data collection activities at the end of 2013 for data collection during 2014.

Regional Representation

Many methodologies described in the following chapters rely on data sources reported at a regional or state level. As such, it is necessary to apply assumptions to determine the extent of market-induced savings in BPA's service area.

BPA Share

Overall, BPA accounts for 42 percent of the Northwest's regional electricity sales, and 44 percent of the residential and 38 percent of the commercial regional sales. Its service territory combines rural areas (e.g., eastern Oregon and Washington) and urban areas (e.g., the Seattle and Snohomish area), in a manner similar to the overall region's urban/rural composition. Based on these observations, BPA's market-induced savings can generally be assumed to be equal to its regional sales share (44 and 38 percent, for the residential and commercial sectors, respectively) or state sales shares, where state or regional data are available.

In some cases, the BPA's savings may be better represented by portion of housing units. Since customers in BPA's territory tend to have a higher saturation of electric space and water heating than the regional average, the share of load may over- or under-represent the potential for a

specific end use. For example, the number of dishwashers sold in BPA territory is more closely related to percent of houses than percent of load in the region or state. An even more refined approach would be to include saturations of measures within homes in BPA territory. Saturation data will be acquired through RBSA and thus can be used to inform the proper share.

This approach can be particularly useful for measures where service territory leakage may be a significant factor. For example, rural customers may routinely travel to urban areas to purchase "big-ticket" items, such as appliances or electronics. In such cases, POS data would overstate savings for urban utilities and understate them for rural utilities. This issue can be addressed by apportioning the estimated state-level market-induced savings by state load shares, or, if appropriate, by portion of housing units within the state.

Zip Code or Service Territory

For greater disaggregation of POS data, it may be possible to acquire sales information at the zip code or territory level. The ability to do this will largely depend on contractors' ability to negotiate appropriate non-disclosure agreements with retailers and manufacturers. If zip code sales data were available, BPA's market-induced savings share could be calculated by filtering data to include only those in BPA's territory.[9] At the zip code level, however, any leakage between BPA and IOU territory sales must also be accounted for (e.g., parallel to the example of rural customers driving to urban areas to purchase big-ticket items). However, acquiring these data increases costs, and, given the concern of leakage across zip codes, focusing on state-level data is likely the best option.

Data Adjustments

For all measures, market data must be adjusted for all program-funded measures in order to avoid double-counting of savings. In addition, any savings from changes to codes and standards as well as Recovery Act savings need to be cross-checked. Where data are specific to BPA's service area (e.g., RBSA measures; sales data at the territory level), only BPA program savings need to be debited from total savings. For measures where only regional or state data are available, IOU program savings will need to be removed. In most cases, as sales data will be reported at the state level, BPA will need to work with IOUs to obtain program impacts for the 2010–2014 program period. For these measures, the programmatic savings adjustment should be calculated annually to facilitate tracking of total savings.

Summary of Data Recommendations

A summary of recommended sources for market data needed to calculate market-induced savings, the likely level of geographic granularity, any necessary adjustments, and timeframe are shown in Table 4.

[9] As part of the RBSA, an accurate map of zip codes served by BPA customer utilities is being developed.

Table 4. Summary of Recommendations

Measure Category	Recommended Data Source for Market Data	Likely Level of Data Granularity	Adjustments to Market Data Required	Timeline for Data Collection
RESIDENTIAL				
CFLs	POS Sales Data	State	IOU/BPA Program	Annual
Showerheads	Shipment Data	Regional	IOU/BPA Program	Annual
Consumer Electronics	POS Sales Data	State	IOU/BPA Program	Annual
Appliances	Shipment Data	Regional	IOU/BPA Program, Recovery Act	Annual
Envelope Measures	RBSA, Shipment Data	BPA Territory, Regional	IOU/BPA Program, Recovery Act	Annual
HVAC Systems	RBSA	BPA Territory	BPA Program	2010, 2014
Water Heaters	RBSA, Shipment Data	BPA Territory, Regional	IOU/BPA Program, Recovery Act	Annual
COMMERCIAL				
Lighting	CBSA	BPA Territory	BPA Program	2014
Refrigeration	CBSA	BPA Territory	BPA Program	2014
Network PC	Survey	BPA Territory	BPA Program	2010, 2014

4. Residential Sector

Overview

Residential measures (or measure categories in which market-induced adoption is likely to occur) include:

- CFLs;
- Showerheads;
- Consumer electronics (televisions, set-top boxes, and desktop computers and monitors);
- Appliances (clothes washers, dishwashers, refrigerators, freezers, and window AC units);
- Envelope measures (windows, doors, and insulation);
- Water heaters (high-efficiency storage and heat pump water heaters); and
- HVAC systems (ductless heat pumps and high-efficiency heat pumps).

Table 5 summarizes the five-year potential and non-programmatic savings estimates for each measure for 2010-2014, providing additional measure-level detail beyond that displayed in Table 3 (see Chapter 2). CFL, consumer electronics, and showerhead measures comprise the majority of residential non-programmatic savings.

Table 5. Five-year Target and Market-Induced Savings by Measure Categories

Measure Category	Measure	BPA 5-year Target (aMW)	BPA 5-year Market-Induced Savings Estimate (aMW)
CFLs	Specialty/Standard	102.5	25.6
Showerheads		33.4	5.0
Consumer Electronics	Television	14.2	2.1
	Set-top Box	3.3	0.8
	Computers	8.1	1.9
Appliances	Clothes Washer	6.2	0.5
	Dishwasher	1.2	0.2
	Refrigerator/Freezer	2.1	0.3
	Window AC	0.2	0.02
Envelope Measures	Windows/Doors	15.7	1.2
	Insulation	19.5	1.5
HVAC Systems	Ductless Heat Pump	25.6	0.6
	Heat Pump	20.2	0.7
Water Heaters	High Efficiency WH	5.3	0.7
	Heat Pump WH	7.3	0.5
Total		264.8[10]	41.6

[10] Note that this only represents the BPA portion of the target for measures which are likely to have non-programmatic market-induced savings. The BPA target for the residential sector is 275 aMW.

Each measure or measure category has a unique, suggested approach for quantifying non-programmatic savings, which is described in the following sections. Each section contains the following information:

- Overview of measures, including 6th Plan baseline
- Savings calculation
- Estimating numbers of units
  - Sales data approach
  - RBSA approach
- Savings per unit

CFLs

The total, market-induced savings associated with CFLs (including both standard and specialty bulbs[11]) is estimated at 26 aMW. BPA can claim savings for standard CFLs only in 2010 and 2011, as the 2007 Energy Independence and Security Act (EISA) lighting provisions take effect in 2012. As specialty lighting is exempt from EISA, specialty CFL savings can be claimed throughout the five-year program period.

Currently, NEEA works with a contractor to estimate total regional sales of CFLs. This approach, described in more detail below, is the general approach recommended going forward, assuming data on sales of standard and specialty bulbs are disaggregated. CFL quantities can also be collected through RBSA, but sales data will provide more timely (i.e., annual) information on amounts of non-programmatic savings.

Savings Calculation

Historically, NEEA has tracked savings through the number of CFL bulbs sold across the region, through POS data. NEEA, through its ACE model, apportions total bulbs to utility programs (distributed through the various utility channels, including buy-down, giveaways, or direct install), retire and burnout, and what NEEA considers baseline sales. The remainder (total less utility programs, baseline, and retire/burnout) can be claimed as net market effects. NEEA baseline sales are the non-programmatic sales. The current NEEA baseline estimate is based on a study, commissioned by NEEA, which estimated the number of CFLs being sold in regions without utilities or other local agencies working to promote them.[12] Given EISA, in order for these data to be useful after 2012, these data and NEEA's ACE model will need to account for the proportion of standard versus specialty bulbs sold.

The ACE model analysis is currently conducted at the regional level. For the non-programmatic savings, BPA claims 42 percent towards its targets. Because of non-disclosure agreements, NEEA's contractor can only provide POS data at the state level. NEEA has asked its contractor

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[11] BPA changed its classification of standard bulbs in 2010; it now includes the following in addition to standard twisters: A-lamps, T-2, high wattage (>25 W), and daylight bulbs.

[12] NEEA Residential CFL Baseline Memorandum, to Anu Teja, Karen Horkitz, and Christine Jerko at NEEA, from Tami Rasmussen at Kema Inc., August 15, 2008.

to explore the possibility of modifying these agreements to provide sales at a more granular (e.g., zip code or market territory) level. If this occurs, non-programmatic savings can be determined specifically for BPA's territory, eliminating the need to account for IOU program savings. Cadmus believes leakage between service territories is minimal for CFLs, as light bulbs are low-cost, widely available items. No additional adjustments for the effects of the Recovery Act will be necessary.

Savings per Unit

In the 6th Plan, ENERGY STAR CFLs have a per bulb savings estimate of 27 kWh/year. This value is for "Any Interior or Exterior Application," which is a weighted average of savings based on room type. Since room type is not available through sales data, a more refined estimate cannot be used. Savings for specialty CFLs vary by type, but are estimated for recessed cans (most common application) in the 6th Plan at 47 kWh/year. For a more accurate estimate of savings, the RTF values by bulb type could be used.

Estimating the Number of Units

NEEA's contractor currently receives POS data on CFL sales, of which approximately 60 percent are based on actual data and 40 percent are extrapolated. Given the quantity of retail channels selling CFLs, it is not feasible to collect data from a census of retailers. NEEA's contractor has a census or near-census of do-it-yourself/mass merchant/wholesale retail channels, but extrapolates for small retail channels (such as drug stores, groceries, and small hardware stores). To accurately estimate the total savings, the data collection effort will also have to distinguish between standard and specialty CFLs sold.

Showerheads

This section outlines an approach for tracking non-programmatic savings from low-flow showerheads. Cadmus, which estimates that about 5.0 aMW will result from market-induced adoption, presents necessary data and assumptions to calculate market-induced savings using both sales data and the RBSA; sales data is the recommended approach if data collection is possible. No savings are expected from Recovery Act programs.

Savings Calculation

If sales data are used to calculate market-induced savings, they will ideally be collected at the stock-keeping unit, or SKU, level. For RBSA data, RBSA auditors will document or estimate nameplate gallons per minute (GPM) for the installed unit and measure actual flow rates during site visits.[13]

Calculation Using Sales Data

If sales data are available, total showerhead savings will be calculated using the following formula:

[13] Nameplate GPM will be collected wherever it is visible on the unit.

$$Savings = \sum_i (Quantity\ of\ units\ sold * Savings\ per\ unit)_i - Program - Funded\ Measure\ Savings$$

where i is the showerhead flow-rate rating in gallons-per-minute (GPM). Savings are differentiated whether the low-flow showerhead is used in a primary, secondary, or any shower. Adjustments will be made for programmatic savings from both public- and IOU-funded programs.

Calculation Using RBSA Data

If data from the RBSA are used, total showerhead savings will be calculated using the following formula:

$$Savings = (\#\ of\ high\ efficiency\ showerheads\ installed\ (extrapolated\ to\ region)) \ x\ savings\ per\ unit_i - BPA\ Program\ Funded\ Measure\ Savings$$

where *i* is the showerhead flow-rate rating in GPM.

Savings per Unit

Savings values depend on the location in the home (primary, secondary, or any bathroom) and are given in **Error! Reference source not found.**. Note that the RTF distinguishes savings dependent on delivery channel: retail or direct-installed, but the 6th Plan does not. Also note that the 6th Plan assumes a small amount of savings in wastewater treatment regardless of water heating fuel type which are included below. The savings in **Error! Reference source not found.** include water heating and wastewater treatment savings. Other water heating savings are insignificant and should not be calculated. The primary and secondary showerhead savings will be used for RBSA data; the any showerhead savings are used for sales data.

Table 6. Savings, Low-Flow Showerheads

Primary SH Savings (kWh/year)	Secondary SH Savings (kWh/year)	Any SH Savings (kWh/year)
140	71	117

Note that the showerhead savings include an adjustment to the nameplate flow rate based on actual flow rates; the federal showerhead standard is 2.5 GPM and the Council's baseline is 2.2 GPM based on actual median flow rates. This may be updated after the 2010 RBSA calculates an updated figure. Additionally, savings are based on the assumption that the customer has a standard electric water heater. For customers with heat pump water heaters, savings would be reduced; the RTF has not yet developed a deemed value for those customers.

Estimating Number of Units

Currently shipment data for showerheads are not readily available and POS data may be difficult to obtain due to the large number of outlets for showerheads such as DIY stores, plumber supply stores, plumbers or over the internet. EPA's nascent Water Sense program (described more below), is likely the best source of data on units sold.

Sales Data

Most showerheads are sold through DIY stores and plumbers/plumbing supply stores. BPA should explore collecting data on showerheads. It may be possible to leverage NEEA's existing relationships with DIY chains and other retail channels selling both CFLs and showerheads. However, few DIY stores currently sell low-flow units. This may change with BPA's retail-based programs' launch in 2010, but, to date, most customers must purchase low-flow showerheads through plumbing supply stores or over the Internet.[14] Therefore, if current relationships are used, it is likely the data will be insufficient to reliably extrapolate showerhead POS data to the region. Shipment data will likely be available, at best, at the state level using EPA data, and BPA's share will be based on its share of electric water heating customers for each state.

Beginning in 2010, EPA started labeling showerheads with a flow rate of 2.0 GPM or less with the "WaterSense" label. The "WaterSense" program operates in a manner similar to ENERGY STAR, in that the program collects data from partners reporting annual numbers of units sold.[15] As this is a new program, there are currently no data for showerheads; however, once this program builds momentum, BPA should be able to leverage the partner data.

Program-funded measures would need to be removed from the total number of showerheads sold. As showerheads are not generally considered a big-ticket item (for which a customer might travel long distances to obtain), POS data accurately represent the location of use. If POS data were available at the territory level, they would allow calculation of the number of units specifically in BPA's territory and its customer utilities. Otherwise, if regional sales data are used, IOU program data will need to be accounted for.

RBSA Data

Numbers of showerhead units could also be obtained through the RBSA. However, one complication concerning showerheads is their GPM ratings are not always visible, and they do not always perform as indicated by the GPM rating. Though RTF-deemed savings are meant to account for this variation, care must be taken to properly categorize the measured flow rate to the nameplate GPM if actual flow rates are not measured.

Statistical significance at an industry level of 90 percent with a margin of error of 10 percent is required specifically for customers with electric water heat. This indicates that at least 67 customers within BPA's territory should have electric water heat, and oversampling may be required if this is not achieved near the close of data collection. However, given that around 1,200 homes will be visited during 2011, it is likely that the required sample of 67 electric water heaters will be achieved.

To obtain non-programmatic savings, data will also need to be collected in 2014. Telephone surveys can be performed, stratifying the sample to include only customers with electric water heat and a standard showerhead in 2010. BPA-program-funded units will need to be removed from the total number of showerheads to estimate non-programmatic savings.

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[14] For example, Portland General Electric states on its website, "Low-flow showerheads can be hard to find locally." (http://www.portlandgeneral.com/residential/energy_savings/efficiency_improvements/low_cost_improvements.aspx)

[15] http://www.epa.gov/watersense/partners/r-report.html

Weatherization Measures

This section outlines the approach to tracking non-programmatic savings from weatherization measures, including windows, doors, and insulation (attic, floor, and wall). Approximately 1.1 aMW in savings are expected to result from windows and doors, and 1.4 aMW are expected to result from insulation. Cadmus presents necessary data and assumptions for calculating non-programmatic savings using sales data for windows and doors, and using RBSA for insulation. Collecting sales data is the only viable approach for doors and windows, as auditors usually cannot determine the U-value or ENERGY STAR rating for these products on site. On the other hand, insulation is more suited to on-site data collection, as it is easier to ascertain insulation's presence as well as total amount of insulation present (measured in units of square feet). Weatherization measures, however, are a significant target area for Recovery Act funds, so BPA will need to net out window and door savings funded by the Recovery Act if those savings are booked through other avenues.[16]

Savings Calculations

Windows and Doors

Using available sales data, total window and door savings will be calculated using the following formula:

$$Savings = \begin{array}{c}(Quantity\ of\ Units\ Sold \times Savings\ per\ Unit) - \\ Program\ Funded\ Measure\ Savings\end{array}$$

Windows meeting a U-factor of 30 or below will be counted as "efficient" units, as both the Council and ENERGY STAR define energy-efficiency thresholds at that level. Regional code falls between U-32 (Washington) and U-35 (Oregon, Idaho, and Montana). Both IOU and public power program-funded measures would need to be removed from the total number of sold or observed window or door units to avoid double counting.

Wall and Floor Insulation

Cadmus recommends using RBSA data for calculating savings associated with insulation measures. Auditors can reliably record the presence or absence of wall and floor insulation, but determining the actual insulation R-value proves difficult and less reliable. If the auditors are able to accurately assess the amount of insulation (more likely for floor than wall), then the weighted average value could be used instead. Barring that, Cadmus recommends performing a non-programmatic savings calculation for wall and floor insulation, counting savings via saturation of insulated homes during the five-year program period with assuming a value of R0 for the base level insulation. Three reasons support this recommendation:

- Insulation presence/absence data are more reliable than quantity of insulation.
- Assuming R0-R11 (case X) or R0-R19 (case Y) provides a more conservative savings estimate than assuming R0 to higher insulation levels (such as R32).

[16] For example, BPA will conduct an evaluation of low-income weatherization across the state. Any savings booked through that program will be netted out from the estimated non-programmatic savings.

- Insulating a previously uninsulated home provides the largest source of insulation savings.

Given these constraints, it may be difficult to find a significant sample of homes that meet these requirements.

The floor and wall savings formulas are as follows:

$$Savings = (\Delta\ \#\ Homes\ Insulated\ (extrapolated\ to\ region))_{bt} \times (Units\ of\ Insulation\ (sq.ft.)) \times (Savings\ per\ unit)_{wb} - BPA\ Program\ Funded\ Measures\ Savings$$

Where:

w = weather zone

b = building type

t = time period, 2010 to 2014

For insulation measures, savings recorded by BPA and IOU programs would be removed from total savings calculated from RBSA data.

Attic Insulation

Cadmus anticipates that RBSA auditors will be able to collect attic insulation information on site—both for presence of insulation and the R-value. Attic insulation R-values are easier to obtain, as auditors can usually access and measure the insulation depth in an attic space. As such, the non-programmatic savings calculation will look at the change in attic insulation levels across the five-year program period:

$$Savings = (\Delta R_{value})_{bt} \times (Units\ of\ Insulation\ (sq.ft.)(extrapolated\ to\ region)) \times (Savings\ per\ unit)_{wb} - BPA\ Program\ Funded\ Measure\ Savings$$

Table 7 shows the R-value increments for attic insulation. Changes in insulation levels collected via RBSA must be matched as closely as possible to increments assumed in RTF deemed values. Once categorized, BPA can calculate overall savings resulting from attic insulation.

Savings per Unit (All Weatherization Measures)

The savings values depend on building types, insulation amounts, and weather zones. Table 7 presents the range of RTF-deemed savings values[17] for given measure and building types, where the range is representative of various weather zones in the region. Although in other cases, the 6th Plan savings are used, since the R-level increments are somewhat different between the 6th Plan and the RTF, for simplicity in accounting for program-funded measure savings, Cadmus recommends using the RTF savings values. There is no RTF-deemed savings value for doors; the 6th Plan numbers are used instead. The savings unit for the insulation and window measures is per square foot. Because the recommended methodology for wall and floor insulation savings only counts savings from homes going from R0 to code insulation levels, the range of savings values is only provided for these insulation measures.

[17] As of March 2010.

Table 7. Savings, Weatherization Measures

Measure Category	Measure Name and Building Type	Maximum Annual Savings (kWh/yr)	Minimum Annual Savings (kWh/yr)
Wall Insulation	Multifamily: R0 to R11	2.20	1.10
	Single-Family: R0 to R11	3.20	2.00
Attic Insulation	Single-Family: R0 to R19	3.10	2.00
	Single-Family: R0 to R38	4.15	2.66
	Single-Family: R0 to R49	4.41	2.83
	Single-Family: R19 to R38	1.10	0.70
	Single-Family: R19 to R49	1.36	0.87
	Single-Family: R38 to R49	0.26	0.17
	Multifamily: R0 to R19	3.79	1.93
	Multifamily: R0 to R38	4.56	2.33
	Multifamily: R19 to R38	0.77	0.39
	Manufactured Home: R0 to R19	1.00	0.60
	Manufactured Home: R0 to R30	1.65	1.02
	Manufactured Home: R19 to R30	0.80	0.52
Floor Insulation	Single-Family: R0 to R19	3.40	2.20
	Multifamily: R0 to R19	2.39	1.22
	Manufactured Home: R0 to R11	1.30	0.80
Windows	Manufactured Home: Prime Window Replacement with ENERGY STAR	3.60	2.20
	Multifamily: Prime Window Replacement with ENERGY STAR	1.70	1.50
	Single-Family: Prime Window Replacement with Class 30 (U-Factor 0.30) or lower ENERGY STAR	2.50	1.60
	Manufactured Home: Prime Window or Patio Door Replacement Efficiency Upgrades	39.75	17.21
	Multifamily: Prime Window or Patio Door Replacement Efficiency Upgrades	29.88	10.73
	Single-Family: Prime Window or Patio Door Replacement Efficiency Upgrades	42.46	19.16
Doors	Manufactured Home: DOOR R2.5 to R5	659	437
	Single-Family: DOOR R2.5 to R5	636	433
	Multifamily: DOOR R2.5 to R5	338	198

Estimating Numbers of Units

For windows and doors, Cadmus recommends using sales data, as on-site verification of efficiency level is difficult, if not impossible. For insulation data we recommend RBSA, given that sales data do not readily exist.

Sales Data

For windows and doors, ENERGY STAR shipment data is likely the best source of sales data. As more big box retailers are selling windows, POS data may also be a viable source. Finally,

data could also be collected via major installation contractors, as these contractors are the main source of window sales.

RBSA

For wall and floor insulation, Cadmus recommends using the RBSA as the data source. As stated before, auditors can reliably record the presence or absence of insulation. Therefore, the RBSA insulation data will be available and will be of high quality for purposes of estimating market-induced savings. Cadmus expects that RBSA attic insulation data will be complete and of high quality for the purposes of estimating market-induced savings.

Water Heaters

Two water heaters are expected to have non-programmatic savings: high-efficiency water heaters (energy factor (EF) ≥ 0.95)[18] and heat pump water heaters (EF ≥ 2.2), for a total of 0.8 aMW together. Recovery Act funds are being used to provide rebates for heat pump water heaters in Idaho and Oregon;[19] thus BPA will need to net out water heater savings funded by the Recovery Act if those savings are booked separately.

Savings Calculation

For water heating measures, both sales data and RBSA offer advantages and disadvantages, which are discussed in further detail in the following sections. For both types of water heaters, the variables for calculating savings are:

Calculation using Sales Data:

$$Savings = (Quantity\ of\ units\ sold * Savings\ per\ unit) - Program\ Funded\ Measure\ Savings$$

Calculation using RBSA Data:

$$Savings = (\Delta units\ installed_{yr5-yr1} * Savings\ per\ unit) - Program\ Funded\ Measure\ Savings$$

For RBSA data, the number of units installed will be compared between the pre (year 1, or 2010) and post (year 5, or 2014) data collection periods. Savings calculations will only be performed at the end of the five-year planning period. In Idaho and Oregon, Recovery Act funds are being used to rebate heat pump water heaters; thus, savings counted through those programs should be removed here.

Savings per Unit

Savings for water heaters are provided in Table 8. For these units, the 6th Plan supply curves assume a 50-gallon tank with a minimum 12-year warranty for high-efficiency units and a 15–year warranty for heat pump water heater units.

[18] The minimum EF varies by size of unit. For larger capacity water heaters, the EF can be lower.

[19] Oregon is using Recovery Act funds to support improvements for low-income residences.

Table 8. Savings, Water Heater

Type	Energy Factor	Annual Savings (kWh/year)
High-Efficiency	0.94	136
Heat Pump	2.2	2,182
Heat Pump	2.0	2,029

In the 6th Plan, a 2.2 energy factor (EF) is assumed to estimate the potential. As ENERGY STAR only requires a 2.0 EF, the savings for the lower efficiency unit are included as well. That value was derived from the 6th Plan supply curve workbooks.

Estimating Numbers of Units

At this time, it is not clear whether collecting numbers of units can be best achieved through sales data or RBSA. Both methodologies are presented for BPA's consideration. As the RBSA will be conducted during 2010 and 2011, the quality of the water heating equipment data may determine if sales data are also required.

Sales Data

Sales data for water heaters could be obtained from a variety of sources: POS, contractor surveys, or ENERGY STAR market share reports. POS data would likely be the easiest of these to obtain, as relationships with these retailers already exist for other measures, such as appliances. However, POS data represent a small share of the market; the majority of sales are associated with contractor purchases through distributors. Cadmus informally reviewed stock available at two major retailers, and found few qualified units available. Contractor surveys are another option to estimate total efficient units sold. Data on models sold and manufacturers should be collected to verify RTF-eligibility and savings estimates. Contractor surveys should also include information on zip codes served to confirm applicability to BPA's territory. Obtaining a statistically significant sample is relatively difficult through contractor surveys.

Another option for heat pump water heaters is using ENERGY STAR market share reports. As indicated earlier, the EF used in the 6th Plan does not exactly match the ENERGY STAR requirement of an EF $\geq$ 2.0.[20] However, Cadmus estimated the savings for an EF = 2.0 and that value could be used. This is likely the best approach for heat pump water heaters.

Manufacturers provide another option for procuring sales data. Approximately a dozen manufacturers produce electric water heaters, and, if relationships exist or can be built, these manufacturers may provide information on sales for high-efficiency units and estimates of total numbers of sales in the region. These data may only be available at the regional level (although some may be available at the state level). However, given the limitations of the other approaches, this is likely the best approach for the high-efficiency storage water heaters (EF = 0.94).

[20] ENERGY STAR also requires a first-hour rating $\geq$ 50 gal/hr, a warranty $\geq$ 6 years, and that the unit passes specified UL safety ratings.

RBSA Data

The other option for collecting non-programmatic savings is through the RBSA. The 2010 data will be collected through site visits, with auditors collecting data on water heating fuel and, if the customer heats water with electricity, the auditor will also collect information on makes, models, capacities, and approximate water heater ages. Heat pump water heaters will be readily identifiable through site visits, particularly if an ENERGY STAR qualification is used. High-efficiency water heaters may not be as readily identifiable, as manufacturer and model numbers will need to be collected and compared against a database.

To ensure data are representative, a sample of a sufficient size (at least 67) will be required to satisfy the 90/10 criteria for statistical confidence and precision. If, near completion of the site visits, the number of homes with electric water heating is less than the required amount, an oversample will be necessary to obtain the targeted confidence and precision. During data collection, data quality will be reviewed to determine whether sufficient information on manufacturer and model numbers is available to determine the water heating units' efficiencies. Given that 1,200 homes will be visited, the sample of 67 will likely be achieved.

At the end of the planning period (2014), water heater data could be collected through telephone surveys rather than site visits. The telephone surveys could be conducted on a sample of customers, those visited during the 2010 RBSA who have electric water heaters, then ideally be stratified to customers with units older than 10 years in 2010.

Consumer Electronics

This section outlines the approach for tracking non-programmatic savings from consumer electronics, including televisions, set-top boxes, and computers (desktop and monitor). Approximately 4.8 aMW savings are expected to result from market-induced measure adoption. Because commercial computers and monitors are sold through channels similar to those of residential computers, Cadmus anticipates that an additional 1.2 aMW of savings for commercial computers and monitors can be measured using the same data collected for the residential sector and are thus only discussed here.

Cadmus presents the necessary data and assumptions to calculate non-programmatic savings using sales data, which Cadmus recommends utilizing, as other entities will likely be collecting these data. Recovery Act funds are not being used to provide rebates for consumer electronics and thus do not need to be accounted for here.

Savings Calculation

Calculation of non-programmatic savings, shown in the equation below, is based on the same approach for all consumer electronic measures:

$$Savings = (Quantity\ of\ Units\ Sold\ \times Savings\ Per\ Unit) - Program\ Funded\ Measure\ Savings$$

For set-top boxes, savings from program-funded measures will likely be zero, as no utilities currently run programs or rebates for set-top box measures. It is unlikely that Recovery Act funds will extend to consumer electronics, though changes to standards could affect savings from these measures.

Savings per Unit

All consumer electronic measures with ENERGY STAR ratings have savings values in the 6th Plan. However, televisions meeting the California standard but that are not ENERGY STAR certified do not have a deemed value. The savings value for these measures will need to be calculated in a manner similar to the way in which the ENERGY STAR savings were calculated. Table 9 summarizes savings values for consumer electronic measures.

Table 9. Savings, Consumer Electronics

Measure	Annual Savings (kWh/Unit)
ENERGY STAR—Weighted Average Television	227
Television—California Standard	n/a
ENERGY STAR—Weighted Average Residential Monitor	40
ENERGY STAR—Weighted Average Commercial Monitor	43
ENERGY STAR—Weighted Average Set Top Boxes	180
ENERGY STAR—Weighted Average Residential Desktop	185
ENERGY STAR—Weighted Average Commercial Desktop	151

These savings are based on an assumption of changing screen size over the 6th Plan's 20-year planning horizon. For the five-year program plan, the RTF will work with NEEA to determine actual screen size shares, likely resulting in different savings assumptions.

Estimating Number of Units

As noted, Cadmus recommends using sales data to estimate the number of units. It is expected that this information will be more reliable than attempting to collect manufacturer and model information from home electronics on RBSA site visits, as these items are difficult to record consistently and accurately. Currently, the CEE and a NEEA contractor are collecting (or have the capability to collect) sales data for various consumer electronics. Specifically, NEEA's contractor currently collects computer and monitor information (for programmatic savings), while the CEE plans to collect national sales data for the following items:

- Televisions
- Set-top boxes
- Computers
- Monitors
- A/V equipment
- Power strips
- Game consoles

NEEA's contractor already has relationships in place with original equipment manufacturers and will have reliable program data for ENERGY STAR computer units. This contractor may be able to leverage its existing relationships to obtain non-program units sales data in addition to programmatic sales. Because these sales will likely cover both residential and commercial, Cadmus recommends trying to estimate the portion of units that are residential and commercial computers; if necessary this data can be derived from the Council's 6th Plan.

As CEE's timeline and method for collecting data remains unclear, Cadmus recommends BPA monitor CEE's data collection activities and leverage them where possible. If necessary, BPA can contract to collect POS television data, because they comprise the largest portion of non-programmatic consumer electronic savings. Contracting for POS data may also provide more flexibility in the types of television data collected, including televisions meeting California standards.

Though set-top boxes are currently on CEE's data collection list, it is important to note that most set-top boxes are sold through cable or satellite providers. Because of the limited pool of equipment providers, it would be fairly easy to obtain sales data for most of the market by working with television service providers. Nearly all savings for this measure are likely non-programmatic, as service providers control the models and unit types installed, and currently there are no market transformation efforts in this market.

For consumer electronics, data at the manufacturer and make levels will be necessary to determine equipment efficiency levels. To calculate television savings, data will need to be separated into sales data for ENERGY STAR televisions and California standard televisions, as the different models will have different per unit savings values applied. Computers will likely be split into residential and commercial sales using the same procedure.

HVAC Units

This section outlines the methodology for estimating non-programmatic savings for HVAC units. Ductless heat pumps (DHP) and high-efficiency, air-source heat pumps (ASHP) encompass the measures in this category. Savings from ASHP generally accrue from replacing an existing, forced-air electric furnace or by upgrading a standard-efficiency unit to a high-efficiency unit. Both DHP and ASHP units have ENERGY STAR-qualified units, although these qualifications are not in alignment with RTF-deemed specifications. Recovery Act funds are being used in Idaho and Oregon[21] to offer rebates for DHP and ASHP units. BPA will need to net out any savings funded by the Recovery Act if those savings are booked separately.

Savings Calculation

Savings for HVAC units may be calculated based either on sales data or RBSA. In either case, program-funded HVAC measures will need to be removed. In Idaho, Recovery Act funds are being used to rebate ASHPs, and any non-programmatic savings claimed through that channel will need to be removed for estimating market-induced savings.

Calculation Using Sales Data

The market-induced savings will be calculated using the following algorithm if sales data are used:

$$Savings = (Quantity\ units\ sold * savings\ per\ unit)_{iw} - Program\ Funded\ Measures$$

Where:

[21] Oregon is using Recovery Act funds to support improvements for low-income residences.

i = efficiency level of the unit (HP only)
w= climate zone

Calculation Using RBSA Data

The market-induced non-programmatic savings will be calculated using the following algorithm if RBSA data are used:

$$Savings = \left(\Delta units\ installed_{yr5-yr1}(extrapolated\ to\ region) * Savings\ per\ unit_{iw}\right) - Program\ Funded\ Measures$$

Savings per Unit

In the 6th Plan, DHP savings range from 3,783 to 4,914 kWh per year for single-family homes, depending on weather zone. ASHP savings vary by building type, vintage, and construction type (e.g., crawlspace, half-basement). Savings are based on upgrading a standard-efficiency unit (efficiency rating 7.7 HSPF) to a high-efficiency unit (8.5 or greater HSPF). In addition, BPA-qualified savings are available for conversion from a forced-air electric furnace (with or without central air-conditioning) to an ASHP (of a minimum efficiency of 8.5 HSPF and 14 SEER). In the 6th Plan, the savings assume the installation to PTCS specifications.[22] Given that this requirement is not likely to be performed outside a utility program, the ASHP savings have been adjusted to remove this component. In addition, current requirements for a BPA-qualified ASHP are more stringent than those required by ENERGY STAR (8.2 HSPF and 14.5 SEER); consequently, BPA cannot readily leverage the ENERGY STAR market share for these measures. Table 10 provides the range of savings values for ASHP measures, less the impact of PTCS as determined by the RTF.

Table 10. Savings, ASHP

Measure	HSPF	Minimum Annual Savings (kWh/yr)	Maximum Annual Savings (kWh/yr)
ASHP Efficiency Upgrades	8.5	51	3,121
ASHP Efficiency Upgrades	9.0	220	3,286
HVAC Conversion to ASHP	8.5	negligible	7,958
HVAC Conversion to ASHP	9.0	negligible	8,105

Estimating Numbers of Units

The number of installed units may come from either sales data or RBSA. RBSA is the preferred source, depending on the size of the post-audit. If the final sample satisfies the 90/10 criteria for statistical significance, then RBSA should be used; otherwise, sales data may be used instead.

Sales Data

Sales data for HVAC equipment would primarily come from contractor surveys and possibly manufacturer or manufacturer association market share data. If RTF requirements change to match ENERGY STAR specifications, ENERGY STAR market share reports may also be used. Alternatively, the Air-Conditioning, Heating and Refrigeration Institute (AHRI) is a trade

[22] http://www.ptcsnw.com/Default.aspx

association representing more than 300 manufacturers of air conditioning, heating, and commercial refrigeration equipment.[23] Although AHRI tracks market shares of high-efficiency units, these data are currently available only to AHRI members. It is possible that in the future, AHRI will offer these data to a broader audience. Given that this is likely the best avenue for obtaining market share information, BPA should work toward obtaining these data. This may best be achieved by collaborating with the Consortium of Energy Efficiency (CEE) or other national organization, to establish a collaborative data collection system with AHRI.

However, given that shipment data are not likely to be available in the near term, the other option to acquire sales data is installation contractor surveys. These surveys would provide a general estimate of percent of high-efficiency units installed. Information on areas served by the contractor could also be used to estimate numbers of units sold in specifically in BPA territory.

RBSA Data

The RBSA is another option for estimating non-programmatic savings. For the 2010 site visits, auditors will collect data on space heating fuel and information on types, makes, models, capacities, and approximate ages of HVAC units. To ensure a significant sample of electric HVAC units (90 percent confidence with 10 percent precision), at least 67 customers with electric furnace space heating, an additional 67 customers with standard efficiency heat pump, and 67 customers with baseboard heating will be required. If, near the time of completion of the site visits, the number of homes with the given space heating equipment is less than 67, an oversample will be required to obtain the required confidence and precision. During data collection, Cadmus recommends reviewing data quality to determine if sufficient information is available to determine space heating equipment efficiencies. For heat pumps, the SEER and HSPF levels are dependent on the combination of indoor units, outdoor units, and air-handling units, so auditors will need to collect all these data in order to properly classify efficiency levels. For customers with existing forced-air furnaces, the presence or absence of air conditioners will also need to be noted.

At the end of the planning period (2014), data could be collected through telephone surveys rather than site visits. Telephone surveys could be conducted on a sample of customers that were visited during the 2010 RBSA and that have electric space heating equipment, with a priority placed on homes with units older than 10 years in 2010.

As part of the 2014 survey, customers will be asked if they replaced their HVAC system during the proceeding five-year period; asked specific information on the new unit, such as type (e.g., heat pump vs. furnace); and asked if they participated in a utility-sponsored rebate program. If possible, the customer list can be prescreened to remove any known program participants. The study's primary disadvantage is anticipated attrition of the 2010 sample. From Cadmus' experience, it is likely that one-quarter of customers will move within the five-year period.

Appliances

This section outlines the approach for tracking non-programmatic savings from appliances, including clothes washers, dishwashers, refrigerators/freezers, and room air conditioning units.

[23] http://www.ahrinet.org/

Cadmus has included room air conditioning units with appliances, as their retail channels are more similar to appliances than to central heating and cooling equipment. Approximately 1.0 aMW savings are expected to result from market-induced measure adoption.

Cadmus presents the necessary data and assumptions to calculate market-induced non-programmatic savings using sales data, which Cadmus recommends for ascertaining these savings, as ENERGY STAR market share and sales data are likely easy to locate or buy from contractors already collecting this information. Also, sales data will be more reliable than collecting manufacturer and model information from appliances on RBSA site visits, as these items are difficult to consistently and accurately record.

The Recovery Act provides funding for states promoting energy-efficient appliances. All states provide rebates for some or all the ENERGY STAR appliances listed above.[24] As part of this assessment, care will need to be taken to avoid double-counting these savings.

Savings Calculation

Though the overall methodology for calculating market-induced savings is similar for all appliances, actual formulas vary slightly due to variations in savings per unit values.

The equation below shows the approach to calculating non-programmatic savings for freezers and refrigerators:

$$Savings = \sum_{ij} (Quantity\ of\ Units\ Sold\ \times Savings\ Per\ Unit) - Savings\ from\ Program\ Funded\ Measures$$

Where: *i= equipment capacity (for freezers only)*
j= measure configuration

The following equation is used to calculate savings from high-efficiency clothes washers and dishwashers:

$$Savings = \sum (Quantity\ of\ Units\ Sold\ \times Savings\ Per\ Unit)_{ij} - Savings\ from\ Program\ Funded\ Measures$$

Where: *i= efficiency tier*
j= water heating type (use weighted average between gas and electric)

Clothes washer and dishwasher savings values rely on the type of domestic hot water (DHW) equipment in a home. This information will not be available for POS data, as it cannot be collected from every consumer purchasing an appliance. Upon completion of the RBSA, fuel share data could be used to allocate savings between electric and gas water heaters. Without these data, the 6th Plan provides a value for "any hot water heater," and this value will need to be used to derive non-programmatic savings estimates.

[24] Oregon is using Recovery Act funds to support improvements for low-income residences.

Finally, room air conditioning unit values are dependent on weather zone and capacity; thus, the equation to derive non-programmatic savings is:

$$Savings = \sum_{ij} (Quantity\ of\ Units\ Sold\ \times Savings\ Per\ Unit) - Savings\ from\ Program\ Funded\ Measures$$

Where: *i= cooling capacity*
j= weather zone

Savings per Unit

Measure savings vary by efficiency tier, appliance configuration, capacity, weather zone, and water heater type. Table 11 lists the savings for freezers, refrigerators and room air conditioning units. Table 12Table 12 lists the savings for clothes washers and dishwashers. The range in savings for refrigerators and freezers is driven by differences in unit capacity and configuration; the range for room air conditioners is primarily driven by weather zone.

Table 11. Savings, Appliances

Measure Name	Maximum of Annual Savings (kWh/yr)	Minimum of Annual Savings (kWh/yr)
ENERGY STAR Freezer	64	18
ENERGY STAR Refrigerator	70	15
ENERGY STAR Room A/C	82	26

ENERGY STAR clothes washers offer savings with both the water heating load, as well as resulting dryer savings due to the faster spin cycle. Thus, the savings vary depending on the fuel source for both the water heater and the clothes dryer. The ranges given in each cell reflect the dryer fuel as well as the unit efficiency. For dishwashers, the range solely reflects the unit efficiency. If RBSA data are used, the water heating fuel will be the main driver, as efficiency levels may not be apparent; in those cases, the most conservative savings option should be used. If sales or shipment data are used, efficiency levels can be used to determine the savings. However, even if sales or shipment data are used to determine number of units, RBSA information should be used to determine the portion of electric versus gas water heaters. Alternatively, "Any Water Heater" savings would need to be used.

Table 12. Savings, Clothes Washer and Dishwasher

Measure Name	Electric Water Heater Savings (kWh/yr)	Gas Water Heater Savings (kWh/yr)	Any Water Heater Savings (kWh/yr)
Single Family: ENERGY STAR Clothes Washer	10 - 142	7 - 96	21 - 114
Multi-Family: ENERGY STAR Clothes Washer	72 - 657	30 - 389	107 - 516
ENERGY STAR Dishwasher	15 - 61	9 - 51	13 - 57

Estimating Number of Units

Sales Data

Sales data for efficient appliances may be collected from a number of sources. The ENERGY STAR program hires a contractor to collect ENERGY STAR appliance data from partners. These data are usually available by state. In the past, these databases were not very robust; however, it appears ENERGY STAR is taking steps to improve the quality of the sales data. Another option is acquiring shipment data through sources such as Association of Home Appliance Manufacturers (AHAM). Similar as with heat pumps, a national data collection framework, established by CEE or other similar organization may be the most fruitful avenue to collecting these data. If shipment or market share data are not available from these sources, BPA could hire a contractor to collect POS data for these measures. Hiring a contractor to collect appliance data may be the best option, as specific measure characteristics are needed to accurately calculate savings.

With respect to measure data, efficiency levels (e.g., modified energy factor or MEF values), equipment capacity (e.g. 15 cubic feet), or equipment configurations (e.g., refrigerator, with top freezer) are required to match measures with appropriate RTF savings values. If BPA hires a contractor to collect sales data, this information may be available. BPA also can apply conservative assumptions to appliance sizes and configurations to estimate savings if specific measure information is not available.

Depending on the source, appliance sales data will likely be available at the state level. State aggregation likely provides a reasonable aggregation level for appliances, as some rural households may take trips to urban areas to purchase these items. BPA state-specific load shares of any market-induced non-programmatic savings will help address any leakage occurring between urban and rural areas.

5. Commercial Sector

Overview

Market-induced adoption will likely to occur in the following commercial measures or measure categories:

- Lighting;
- Refrigeration (primarily in the grocery segment); and
- Computer equipment, including network PC controls.

Table 13 summarizes the five-year potential and non-programmatic savings estimates for each commercial measure. Lighting comprises the majority of total commercial, non-programmatic savings. Though the total computer equipment bundle is just over 3 aMW, the largest portion of those non-programmatic savings is from network PC power management measures. Thus, the non-programmatic savings methodology primarily focuses on PC power management measures. Computer and monitor information will be parsed from the residential data collection strategy for consumer electronics, as discussed in Chapter 4.

Table 13. Five-Year Target and Non-Programmatic Savings by Commercial Measures

Measure Category	Measure	BPA 5-year Target (aMW)	BPA 5-year Non-Prog Savings Estimate (aMW)
Lighting	LPD reductions via interior, exterior, and control improvements	40.1	9.0
Refrigeration	Measure bundle—see refrigeration section	8.5	0.6
Computer Equipment	Servers	3.8	0.6
	Network PC controls	7.2	1.8
	Computers	3.8	1.0
	Monitors	1.2	0.2
TOTAL		64.6	13.2

Lighting

BPA can estimate non-programmatic savings from commercial lighting measures based on the change in commercial building interior lighting power density (LPD) over the 2010–2014 program period. The 2009 CBSA provides adequate baseline data for 2010 lighting measures. Table 14 shows the number of 2009 CBSA lighting data points for buildings in BPA's service area by building type and vintage. Recovery Act funds are being used to do commercial building retrofits, including lighting upgrades. As part of this assessment, care will need to be taken to avoid double-counting any savings booked through utility programs.

Table 14. Available Commercial LPD Baseline Data in BPA Territory

Building Type	Building Age				Total
	1987 or earlier	1988–1994	1995–2001	2002–2007	
Retail	16	4	10	32	62
University				6	6
Other / Miscellaneous	11	3	8	17	39
Grocery	10	3	3	4	20
Office	16	3	7	16	42
Restaurant	3			2	5
Warehouse	1		6	9	16
Hospital				12	12
Other Health	2		4	8	14
Hotel/Motel	2	2	4	4	12
School	4	4	1	26	35
Total	65	19	43	136	263

NEEA conducts the CBSA approximately every five years; results from the next study can provide a "post" interior LPD estimate from which to calculate the overall changes in lighting across the five-year program period. The sampling strategy for future CBSA data collection activities remains undetermined. As such, BPA should stay involved with CBSA discussions to ensure BPA territory is adequately covered in the next study. To capture a post-program period value, the CBSA study should commence at the end of 2013, with data collection occurring during 2014.

The formula used to calculate savings from LPD change is as follows:

$$Savings\ (aMW) = \sum_{b} \left(\frac{\Delta LPD_b\ (watts\ per\ sq.ft.) * Commercial\ Floorspace_b\ (sq.ft.) * hours\ of\ operation_b}{8760 * 1{,}000{,}000} * IF_b \right) - Program\ Funded\ Savings$$

Where: *b= building type*
IF = HVAC interactive factor

The algorithm given above is focused on determining the savings from lighting retrofits (e.g. replacing T12 with T8 fixtures), which is the source for the majority of savings (programmatic and non-programmatic). However, lighting controls are important to consider as well. In fact, the program-funded savings in the formula above are inclusive of retrofits and controls. Separating the impact of controls from the booked savings is impractical; thus, this approach will provide a conservative estimate of non-programmatic savings. In addition, the data available in the 2009 CBSA are not sufficient to accurately determine the baseline condition for controls, and thus determining the non-programmatic savings may not be feasible for the 2010-2014 Plan period.

For some building types, such as restaurant and warehouse, the available data are not sufficient to derive statistically significant results. However, if BPA is able to obtain a large enough "post" sample, only BPA program savings will need to be subtracted from total commercial lighting

savings. As noted in the above equation, an updated estimate in 2014 (based on CBSA) of commercial floorspace in BPA's service territory is needed to calculate commercial lighting savings. If adequate program data are available from the IOUs, this estimate can then be done at the region. The will improve the sample size, increasing accuracy of the savings estimate, particularly for those building types with limited observations.

Refrigeration

Total non-programmatic savings from refrigeration measures are estimated at 0.6 aMW. Refrigeration measures included in 6th Power Plan are shown in Table 15, along with per unit savings and BPA's portion of the five-year savings potential. Some measures have RTF-deemed savings, as noted in the table. There are no expected savings through Recovery Act-funded programs.

Table 15. Refrigeration Measures from 6th Power Plan

Refrigeration Retrofit Bundle	Savings per Unit (kWh)	Total 5-yr BPA Target (aMW)	RTF Deemed (yes/no)
Case Replacement Low Temp	1,066	1.06	No
Floating Head & Suction Controls	1,953	1.96	No
Low Temp Anti-Sweat Heat Control	1,066	1.06	Yes
Standalone to Multiplex Compressor	671	0.67	No
Med Temp Anti-Sweat Heat Control	729	0.72	Yes
Walk-In ECM	942	0.94	Yes
Visi-Coolers	34	0.04	No
Case ECM	1,110	1.11	Yes
Recommissioning	1,780	1.78	No
Night Covers	440	0.44	Yes
LED Case Lighting	1,066	1.06	Yes
Case Replacement Med Temp	91	0.09	No

Currently, BPA contracts with PECI to deliver its Energy Smart Grocer program. Through this program, PECI has conducted hundreds of grocery store audits around the region. These audit reports contain data on all measures listed in Table 15. From the audit data, BPA could determine baseline conditions for grocery stores in the region. To estimate non-programmatic savings achieved during the five-year planning period, BPA or its contractor will need to conduct additional site visits for a sample of grocery stores in 2014 to determine if measures have been installed and if stores have participated in a utility program.

PC Network Controls

Approximately 1.8 aMW of non-programmatic savings are estimated for PC network controls. This measure, applicable to offices, educational facilities (K-12 and colleges/universities), and health segments, reduces computers' power consumption by ensuring that energy management settings are appropriate on all computers within a network. Savings could be achieved through purchase of a commercial software package automating this control (e.g., Verdiem). It should be noted, however, that other methods are available to achieve similar savings without using a commercial software package. The facility's IT manager may set the power management

features for all new computers. In addition, ENERGY STAR offers a free software download to set power management features on PCs to result in energy savings. BPA might consider working with the RTF to review requirements and savings for this measure. However, as the target is based on the 6th Power Plan, which estimates PC network control savings of 103 kWh/year per PC for desktops and monitors, and 64 kWh/year per laptop.

To determine if these savings, as well as those for servers, are being achieved, Cadmus recommends surveying IT managers at a sample of facilities, including offices, educational facilities, and healthcare facilities. These surveys should be conducted twice: once in 2010 to determine the baseline, and again in 2014 to review the change. The 2014 surveys should be screened to exclude known participants in the utility-sponsored program. To achieve 90 percent confidence and 10 percent precision, at least 67 surveys should be conducted in each phase. There are no expected savings from Recovery Act-funded programs.

Packaged Refrigeration Equipment

Another area of potential market-induced non-programmatic savings is in packaged refrigeration equipment, including commercial refrigerators, ice makers, and vending machines. BPA's five-year target for these measures is 3.8 aMW. As these equipment are largely ENERGY STAR qualified, sales data could be acquired through ENERGY STAR market share reports. This report does not estimate the non-programmatic savings for these measures, but BPA is intending to further explore this.

Appendix A: Memorandum Quantifying 2005-2009 Non-Programmatic Savings

THE CADMUS GROUP, INC.

Date: 13 September 2010

To: Lauren Gage, Carrie Cobb

From: Tina Jayaweera, Crispin Wong, Hossein Haeri

Re: 2005-2009 Non-Programmatic Savings

This memorandum summarizes the results of an analysis of non-programmatic electricity conservation savings in the Northwest region and BPA's share of these savings for the 2005-2009 planning period. The analysis focused on the savings from conservation measures in three categories: CFLs, Non-Residential Lighting and Codes and Standards. These measures were selected because corresponding energy savings are significant and reliable data are available to estimate the savings. The results of the analysis, indicating BPA's shares of non-programmatic savings from these measures, are summarized in Table 1. Details for each measure category are outlined later in this document.

Table 1. BPA Share Non-Programmatic Savings by Measure Category

Category	BPA Share Non-Programmatic Savings (aMW)	BPA Share Average Annual Non-Programmatic Savings (aMW)
CFLs	26	5.2
Non-Residential Lighting	13	2.5
Codes & Standards	12	2.3
Total	**51**	**10**

Background

The Northwest Power and Conservation Council's conservation supply curves, and the targets derived from them, are based on achievable, cost-effective efficiency that is possible to attain beyond the baseline efficiencies and those already in the forecast. The forecast includes codes and standards that have already been passed and are scheduled to take effect in the course of the planning period. The baseline represents the penetration of the efficiency measures in the market at the time the Council produced the forecast and developed the supply curves.

The supply curves are indifferent to the manner in which the conservation can be achieved. Who pays for the efficiency or why the efficiency measures are installed is not important from the

resource planning perspective. However, the Council does indicate there are multiple ways to achieve the savings. These fall into two primary categories:

1. Programmatic conservation
    - Utility funded acquisition programs
    - Market transformation ventures
        - These programs directly fund new, in-region codes and the savings are accounted for through NEEA
    - The joint market effects of the acquisition and market transformation programs that are measured and reported by NEEA
2. Non-programmatic conservation (or naturally occurring conservation)
    - Results from actions induced by state and federal tax credits
    - State codes and appliance standards not included in the load forecast
    - National appliance and equipment standards not included in the load forecast
    - Adoption of efficient technologies by nonparticipants for reasons beyond energy efficiency, such as aesthetics, productivity, special features, etc
    - Unmeasured market effects of the programmatic conservation

In 2006, BPA took responsibility for 40% of the regional cost-effective conservation, totaling 56 aMW per year. This figure includes savings in all of the above-mentioned categories. Therefore, there was an interest by BPA management to budget for only the programmatic conservation ("utility funded" and "market transformation ventures") that BPA expected to achieve. It was determined that BPA would achieve a minimum of 52 aMW of savings through its programs and funding of NEEA. The remaining 4 aMW were considered "naturally occurring" or non-programmatic savings. At the end of FY2009, it was BPA's responsibility to estimate the quantity of non-programmatic conservation with the goal of ensuring at least the 4 aMW per year. However, as with the Council's targets, it is the aggregate savings, not the breakdown between program and non-program energy efficiency that matter from a regional resource planning perspective.

CFLs

In the 2005-2009 period, NEEA has reported market transformation savings from CFLs based on market sales data input into their Alliance Cost Effectiveness (ACE) model, which adjusts the total estimates for burnouts and CFL-to-CFL replacements. NEEA estimates their program impact (net market effects) as the difference between total market sales and a NEEA-defined baseline, less utility program claims. As part of the 2008 MPER #4, NEEA contracted KEMA to

conduct an independent estimate of baseline sales.[1] What NEEA calls the "baseline" is an estimate of the theoretical level of CFL sales that would have occurred in the absence of regional market interventions; i.e., non-programmatic savings. This study estimated approximately 26% of all bulbs sold in 2007 are attributable to the baseline. This baseline estimate is in-line with other studies Cadmus reviewed.[2]

In the 5th Power Plan, the Council estimated the CFL saturation (Council baseline) at 116 aMW, assuming an average of two bulbs installed per household as of 2005. NEEA's savings estimates are only from bulbs installed in 2005 or later. In addition, as these savings are based on total number of bulbs sold, less savings from CFL-to-CFL replacements, the existing market saturation is accounted for in NEEA's estimates. Total regional CFL savings from various sources are illustrated in Figure 1.

Figure 1 Distribution of CFL savings

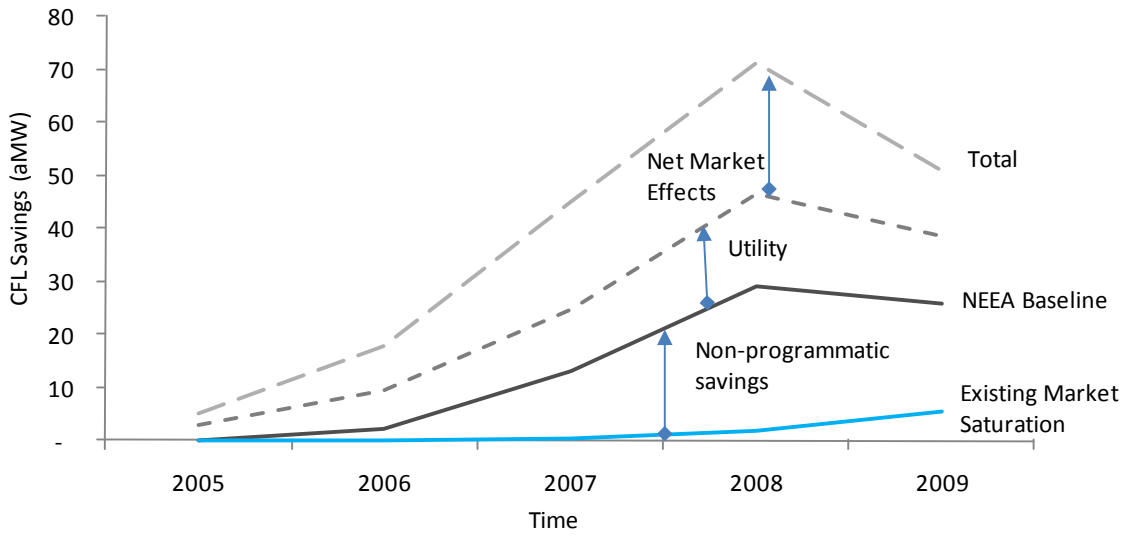

Table 2 shows the estimated savings from CFLs as a regional total, non-programmatic savings (baseline), and BPA share of the baseline. These estimates are taken from NEEA's ACE model and are net of the Council's baseline.[3] Note that the 2009 savings are estimated based on

[1] NEEA Residential CFL Baseline memo to Anu Teja, Karen Horkitz and Christine Jerko, NEEA from Tami Rasmussen, Kema Inc, Aug 15, 2008.

[2] Other studies include: Itron:2004/2005 Statewide Express Efficiency and Upstream HVAC Program Impact Evaluation, Cadmus: Compact Fluorescent Lamps Market Effects Final Interim Report, and Paragon: Project Phase I Process Evaluation: Report for Compliance with Docket No. 06-08020.

[3] NEEA Model ESL_2009v2_C4.xls received February 18, 2010.

projected sales and may change once the data are finalized. Of the 183 aMW of CFL savings for all five program years, 63 aMW can be attributed to non-programmatic savings. BPA's share, based on regional percent of load (42%) is 26 aMW. These data assume 33.5 kWh/year savings per bulb and are net of savings from burnout/replacement of existing CFLs. Data reflect fiscal year savings.

Table 2. Total and Non-Programmatic Savings from CFLs (aMW)

Year	Regional Total	Existing Market Saturation	Utility Programs	NEEA-Reported Net Market Effects	Non-Programmatic Savings (NEEA Baseline)	BPA Share of Non-Programmatic Savings
2005	5	0.0	2.9	2.1	0.0	0.0
2006	18	0.0	7.4	8.3	2.2	0.9
2007	45	0.2	11	21	13	5.4
2008	70	1.7	18	25	27	11
2009	45	5.6	13	12	20	9
TOTAL	**183**	**7**	**52**	**68**	**63**	**26**

Non-Residential Lighting

To quantify non-programmatic savings in non-residential lighting measures, Cadmus worked with Council staff to estimate non-residential lighting savings from Commercial Building Stock Assessment (CBSA) data and compared those savings with BPA's and regional investor-owned utilities' (IOUs) recorded program savings in the non-residential lighting sector. The CBSA is a study commissioned by NEEA to conduct on-site audits of hundreds of commercial facilities across the region every five years, most recently in 2007-2008. It is a comprehensive study that gives regionally reliable data regarding equipment and lighting in commercial buildings.

The data indicates a statistically significant[4] drop of 0.12 watt/square foot in interior LPD between 2003 and 2009 studies ($t = 3.55$, $p = 0.0005$); see Table 3. This estimate includes only

[4] Statistical significance was determined using a difference of means tests, where a statistical significance was measured at a probability value of 0.05 or less.

the same panel of pre-2002 buildings to control for the effects on LPD of new building codes enacted in 2002 or later.

Additional analysis of saturation levels for various bulb type between the 2003 and 2009 studies further showed that the number of less efficient lighting technologies such as T12, incandescent bulbs, and HID decreased, while saturation of more efficient technologies such as T8 and other fluorescent bulbs such as T5 increased (Table 4). Changes in count of individual technologies were not statistically significant. This result is not surprising as we expect more variation in bulb composition than in LPD. Buildings may achieve a reduction in LPD through a variety of different strategies, which may result in wider variation in bulb installations.

Table 3. CBSA Nonresidential Lighting Savings Options (2005-2009)

Change in LPD 2003 to 2009 Studies (watts/sq.ft.)	Regional Square Footage[5]	Total Regional Market Savings (aMW)
0.12	2,467,000,000	118

Table 4. CBSA Changes in Bulb Type from 2003 to 2009 Studies

Bulb Type	T12	T8	Other Fluorescent (including T5)	Incandescent	HID
Direction of Change	↓	↑	↑	↓	↓

The estimated 0.12 reduction in LPD translates into a regional lighting savings of 118 aMW (24 aMW annually). BPA's non-residential lighting programs have recorded approximately 30 aMW from 2005 to 2009, for an average annual rate of 6.1 aMW. Regional IOU lighting programs[6] are estimated to have saved 55 aMW in that period, for an average annual rate of 11 aMW. Therefore, to estimate non-programmatic savings without double counting, the programmatic savings (BPA and IOU program achievements) should be removed from the total market savings. This approach yields non-programmatic savings of 33 aMW, or 6.6 aMW annually, for the region in the 2005-2009 period. BPA's share of this, based on 38% of the commercial sector load, is 13 aMW, or 2.5 aMW annually (Table 5).

[5] Excludes new construction vintage cohort

[6] Estimated from program data from Idaho Power, Energy Trust of Oregon, Puget Sound Energy, PacifiCorp (WA), Northwestern Energy, and Avista. Analysis excluded savings from controls and new construction.

Table 5. LPD Reduction Savings (aMW)

	Total Regional Market Savings	IOU Programmatic Savings	BPA Programmatic Savings	Regional Non-Programmatic Savings	BPA Share of Non-Programmatic Savings
Average Annual	24	11	6.1	6.6	2.5
Total Five Year	118	55	30	33	13

Codes and Standards

Appliance Standard Changes

Similar to CFLs, NEEA estimates savings from clothes washers across the different market actors (utility programs, baseline savings, and net market effects). However, these savings include washers with MEF 1.26, which is below the federal standard of MEF 1.27, enacted in 2007. As such, the 5th Power Plan assumes MEF 1.27 for the baseline and Cadmus excluded the savings claimed by NEEA for the MEF 1.26 clothes washers. All the savings MEF 1.27 and greater are included in this analysis. Total regional savings from various sources are illustrated in Figure 2. Table 6 summarizes NEEA's standards savings estimates for clothes washers during the 2005-2009 period.[7] Note that the 2009 savings are estimated based on projected sales and may change once the data are finalized. Data reported are by fiscal year. The regional non-programmatic savings total is 18 aMW; BPA's share is 7.4 aMW, as given in Table 6.

[7] Data compiled from NEEA ACE model ESWasher_May2008.

Figure 2. Distribution of Clothes Washer Savings

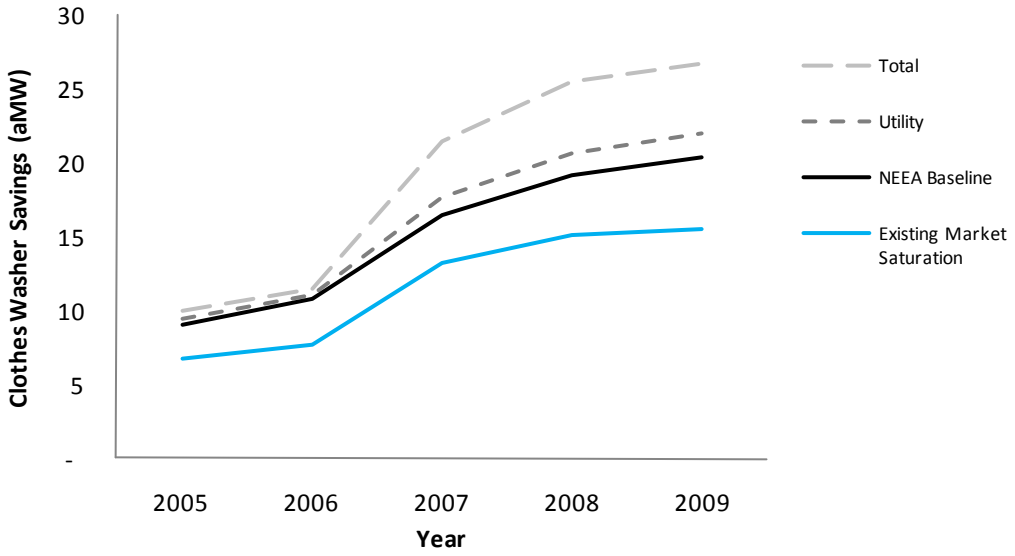

Table 6. Total and Non-Programmatic Savings from Clothes Washers

Year	Regional Total	Regional Total less MEF 1.26 units	Utility Programs	NEEA – Reported Net Market Effects	Non-Programmatic Savings (NEEA Baseline)	BPA Share of Non-Programmatic Savings
2005	10	3.3	0.3	0.7	2.3	1.0
2006	11	3.8	0.3	0.4	3.1	1.3
2007	21	8.3	1.1	3.9	3.3	1.4
2008	26	10	1.5	4.9	4.0	1.7
2009	27	11	1.7	4.6	4.8	2.0
TOTAL	**95**	**37**	**4.8**	**14**	**18**	**7.4**

Building Code Changes

NEEA performed an estimate of regional savings from building code improvements. Savings from building code changes in the residential sector were in Washington, Oregon, and Idaho which had new codes become in effective in July 2007, July 2008, and January 2008, respectively. For the non-residential sector, Washington and Oregon both adopted a new code in

2007 and Idaho adopted the new energy code in January 2008. Montana did not change its energy code in the 2005-2009 time period.

Based on NEEA's analysis, there was approximately 23 aMW of regional savings from codes changes in 2005 through 2009. [8] Cadmus did an independent verification of this assessment that is consistent with NEEA's estimate. A separate NEEA study found that between 40 and 75 percent of the codes changes were due to NEEA program involvement, depending on the state. [9] Therefore, NEEA attributes 13 aMW to their program. The remaining savings occurred in the market but are not claimed by any organization and are therefore non-programmatic savings. The regional non-programmatic savings total is 10 aMW; BPA's share is 4.4 aMW, as given in Table 7.

Table 7. Regional Savings from Building Codes (aMW)

Year	Total Code Savings	NEEA – Reported Net Market Effects	Non-programmatic Savings	BPA Share of Non-Program Savings
2005	4.4	2.7	1.7	0.7
2006	4.7	2.7	2.0	0.9
2007	4.7	2.6	2.1	0.9
2008	4.8	2.6	2.2	0.9
2009	4.8	2.5	2.3	1.0
TOTAL	**23**	**13**	**10**	**4.4**

Table 8 summarizes the codes and standards savings as a combination of NEEA's estimates for clothes washers and code savings estimates during the 2005-2009 period. Note that the 2009 savings are estimated based on projected sales and may change once the data are finalized. Data reported are by fiscal year.

[8] Based on internal spreadsheets sent to BPA and Cadmus from NEEA.

[9] Summit Blue, Review of Energy Savings Related to Codes and Standards Efforts, April 2006 and reassessed by Cadmus as part of the NEEA Codes and Standards Support Initiative MPER #2, April 2008.

Table 8: BPA Savings from Codes and Standards (aMW)

Year	BPA Share of Appliance Savings	BPA Share of Building Code Savings	BPA Share of Savings
2005	1.0	0.7	1.7
2006	1.3	0.9	2.2
2007	1.4	0.9	2.3
2008	1.7	0.9	2.6
2009	2.0	1.0	3.0
TOTAL	**7.4**	**4.4**	**12**

Summary and Future Recommendations

Based on this analysis, BPA's share of 2005-2009 non-programmatic savings is 51 aMW from CFLs, Nonresidential Lighting, and Codes and Standards. These savings are significant but do not include potential savings from other measures not examined in this analysis. As such, Cadmus agrees with BPA that procedures should be put in place to estimate the savings from all measures for the next five years as soon as possible. The suggested methodology to estimate these non-programmatic savings will be presented in a follow-up memo "2010-2014 Non-Programmatic Savings".

Appendix B: Memorandum Quantifying 2010-2014 Non-Programmatic Savings

THE CADMUS GROUP, INC.

Date: **5 February 2010**

To: **Lauren Gage**

From: **Tina Jayaweera, Hossein Haeri, Crispin Wong**

Re: **2010-2014 Non-Programmatic Savings**

Cadmus analyzed the measure bundles in the 6th Power Plan supply curves[1] to quantify non-programmatic electricity savings for the 2010-2014 planning period. These consist of savings from (a) codes and standards that will likely be implemented, (b) projects completed using Recovery Act funds, and (c) market-induced savings. The results of the analysis indicate BPA's share of savings non-programmatic savings are approximately 52 aMW over the planning period, distributed as shown in Table 1. Cadmus estimates the total cost to determine these savings is approximately $3.27M. The savings quantification approach, and suggested methods and costs for verifying these savings by sector are described below.

Table 1. Five-year Non-programmatic Savings

Sector	Codes and Standards (aMW)	Recovery Act (aMW)	Market-Induced Adoption (aMW)	Total Five-Year Non-Programmatic Savings (aMW)	Total Five-Year Targets (aMW)	Non-Programmatic Savings as Percent of Target
Residential	8	3	26	37	256	14%
Commercial	1	2	12	15	97	15%
Industrial	0	0	0	0	100	0%
Agricultural	0	0	0	0	21	0%
DSEI	0	0	0	0	30	0%
Total	**9**	**5**	**38**	**52**	**504**	**10%**

[1] Analysis was based on Council data publically available at the time of this writing.

Codes and Standards

All northwest states are likely to update their energy codes within the next five-year period. Washington and Montana are both expecting to have a new code starting in 2010, Idaho is expected to adopt a new code in 2011, and Oregon is scheduled to adopt a new non-residential code in 2010 and a residential code in 2012. In addition, federal or state standards for televisions, commercial lighting, and residential canned lighting will also likely be implemented in 2012. Since the Council only assumes codes and standards that have been signed into law at the time of the Power Plan development, these updates are not included in the baseline assumptions of the 6th Power Plan. As such, a portion of the non-programmatic savings will occur through these changes.

Of BPA's five-year target, approximately 22 aMW of residential-sector savings and 6 aMW of commercial-sector savings are from measures installed in new construction projects. For each state, Cadmus estimated, using information from each state's code council, the expected savings resulting from the new codes.[2] These savings are above the 6th Power Plan's assumed baseline. The weighted average savings across the states are expected to be approximately 15% from the code improvements, and these savings are spread out over the five-year planning period using the schedule of code adoption given above. Approximately 4 aMW could result from code updates – 3 aMW in the residential sector and 1 aMW in the commercial sector. As NEEA is active in promoting the adoption of new codes, a portion of the savings will be attributable to NEEA.[3] The net (non-programmatic) portion of the savings is then 2 aMW - 1.5 aMW and 0.5 aMW in the residential and commercial sectors, respectively.

In addition, it is likely that Oregon and Washington will adopt the same television standards currently being proposed in California, starting in 2011. These standards will partially close the gap between the 6th Plan's assumed baseline to those certified by ENERGY STAR®.[4] If these standards are adopted, this would cover around two-thirds of Oregon and Washington's share of the 15 aMW in BPA's five-year target for ENERGY STAR® televisions, or about 8 aMW. Discounting for NEEA's share, the non-programmatic savings are 4.6 aMW. Finally, savings can be attributed to the new federal standards taking effect under the Energy Policy and Conservation Act amendment in 2012. From that Act, approximately 2 aMW will come from the residential canned lighting improvements and 0.3 aMW from commercial lighting improvements. These

[2] Washington state savings for the residential sector are based on an estimate of 15% savings provided by Liz Klumpp e-mail dated 11/24/09

[3] NEEA currently claims 40% in WA, 75% in OR, 70% in ID and 40% in MT of savings due to codes.

[4] The Council assumes ENERGY STAR 4.0 standards, which take effect March 2010.

savings are above the 6th Power Plan assumed baselines as the standards were set after the release of the draft measure savings estimates.

BPA should work with NEEA to verify these code impacts. In addition, BPA may be able to leverage any current research undertakings. For example, Ecotope has done some analysis for Washington utilities to estimate savings from that state's planned code updates. The approximate cost for this research across all states is estimated to be $120,000, or $30,000 per state. Table 2 gives the estimated savings from codes and standards for the residential and commercial sectors.

Table 2. Savings from Codes and Standards by Sector (aMW)

Sector	Codes	Standards	Total
Residential	1.5	6.5	**8**
Commercial	0.5	0.3	**0.8**
Total	**2**	**7**	**9**

Recovery Act

The American Recovery and Reinvestment Act of 2009 (Recovery Act) was signed into law on Feb. 17, 2009 providing $32.7 billion to the Department of Energy (DOE). The following Recovery Act funding areas may complement BPA's current incentive reimbursement activities in Montana, Idaho, Washington, and Oregon.

Energy Efficiency and Conservation Block Grants (EECBG). Assists U.S. cities, counties, states, territories, and Indian tribes to develop, implement, and manage energy efficiency and conservation projects and programs, including, but not limited to: building retrofits, traffic and street light replacement, and residential and commercial building audits.

State Energy Program (SEP). Expands current state energy related efforts. Most emphasize retrofitting public buildings such as local and state government, K-12 schools, and universities.

Weatherization Assistance Program (WAP). Reinforces existing WAP efforts, such as increasing the number of low-income homes weatherized and additional field training.

State Energy Efficiency Appliance Rebates. Expand current utility appliance programs. It is likely that the federal documentation required will be onerous for smaller utilities and therefore only the largest utilities will participate. At this time, participating utilities, appliances, incentives and how saving may be impacted are unknown.

BPA estimates savings resulting from Recovery Act projects and activities over the five-year Plan period will amount to 13 aMW, 3.8 aMW in the residential sector and 9.5 aMW in the commercial sector. See Memo entitled "Recovery Act Savings"[5] for more details on the determination of this value. It is expected a portion of these savings will be captured by the utility's a claimed through BPA's program tracking system. However, the portion that will not be captured will be estimated as non-programmatic savings. The portion of savings varies by state and by program, resulting in a total of approximately 5 aMW (2 aMW in commercial and 3 aMW in residential, primarily from WAP) that will be non-programmatic savings. BPA will need to verify these savings and the cost to do this is estimated to be $120,000 ($30,000 per state).

Market-Induced Adoption

Overall Approach

For each measure bundle (e.g. residential weatherization, commercial grocery refrigeration), Cadmus assigned the likelihood of non-programmatic savings to each measure, using a nominal scale with five categories: none, very low, low, medium, or high. This assignment was based on the data collected from the 2005-2009 program period and our industry experience and knowledge. Each nominal scale category was given an associated percentage of total savings that would be captured through non-programmatic activities. These are given in Table 3 below.

We also sorted the measure bundles by five-year economic potential and determined that all measures which cumulatively account for less than 5% of the total five-year potential were of limited importance and were excluded from the non-programmatic savings analysis.[6] All Distribution System Efficiency Initiative (DSEI), industrial, and agriculture measures were assumed to have no non-programmatic savings (a "none" rating). DSEI is excluded because, by definition, is an efficiency measure implemented by a utility, not an end-use customer. Although there may be a small amount of non-programmatic savings in the industrial and agricultural sectors, quantifying and verifying these savings will likely be quite complex and are thus not included. A complete list of all measures and their estimated impacts are Appendix A.

[5] From Charlie Stephens and Tina Jayaweera to Lauren Gage, December 4, 2009.

[6] In the residential sector, there were a couple measures within this grouping for which the non-programmatic savings were given an impact other than "very low" as they are very similar to other measures. For example, freezers account for a small amount of the overall potential, but are likely to have similar levels of market-induced adoption as refrigeration and thus given a "medium" rating.

Table 3 Likelihood of Non-programmatic Savings

Category	Percent of Savings	Total Savings Potential (aMW)	NonProgrammatic Savings (aMW)
None	0%	183	0
Very Low	2.5%	45	1.1
Low	7.5%	165	12
Medium	15%	39	5.8
High	25%	73	18

Note that there is the possibility of overlap between savings obtained through Recovery Act funds and market-induced adoption. However, since the Recovery Act funds are only available for 2010 and 2011, and only target a limited market (e.g. in Oregon, the savings are likely to largely be schools) the overall overlap is likely small. At most, we expect a reduction of 0.5 aMW (0.2 aMW in the residential sector from appliances and 0.3 in the commercial sector, with 0.1 from schools and the remainder from other possible sources).

Proposed Data Collection Activities

Residential Sector

Cadmus estimates approximately 26 aMW of market-induced savings to come from the residential sector. The bulk of these savings (16 aMW) come from lighting, of which approximately 5 aMW applies to specialty lighting. Other major contributors are: electronics (3.8 aMW), weatherization (2.8 aMW), and showerheads (2.7 aMW). Water heating, HVAC equipment and appliances constitute the balance.

Since the residential sector accounts for approximately two-thirds of the non-programmatic savings, Cadmus proposes a comprehensive residential building stock assessment (RBSA) to determine the impacts. This assessment would need to be completed in two phases: early 2010 to capture current baseline conditions and then again in late 2014. As an additional source of savings, BPA could use these site visits as an opportunity to distribute low-cost energy-efficiency measures, such as low-flow showerheads.

An overview of the assessment approach is shown in Table 2. For 90/10 confidence and precision in the study and three levels of sample stratification (region, building type and vintage), a total of 2100 site visits will be required in each phase. Cadmus recommends a

random sample for each phase. The total cost for two phases is approximately $3M; assuming approximately $600/site visit, and approximately $500k for data analysis. Note that BPA could choose to increase or decrease segmentation, which would alter the cost. For example, if BPA chose to achieve 90/10 confidence without including vintage, the cost would decrease to $1.8M, as shown in the second row of Table 4. Given the trained personnel resources required to complete all the surveys in a timely manner, Cadmus recommends excluding vintage. BPA may also be able to leverage NEEA's 2007 existing multifamily saturation and new construction studies, to offset some of the data collection requirements. [7,8]

Table 4. Overview of Residential Building Stock Assessment Options

Stratification	# Site Visits*	# Phases†	Cost per Site	Total Cost
• 5 regions (Puget, Western OR, Western WA, Eastern OR/WA, ID/MT) • 3 housing types (single, multi, manufactured) • 2 vintages (pre-2009, post-2009)	2100	2	$600	$3M
• 5 regions (Puget, Western OR, Western WA, Eastern OR/WA, ID/MT) • 3 housing types (single, multi, manufactured)	1050	2	$600	$1.8M

*70 sites per segment for 90/10 confidence and precision.
†The two phases are early 2010 and late 2014.

Given the length of time required to complete these site visits, BPA may want to consider performing a phone survey in 2014 in addition to the RBSA site visits. This phone survey will be select customers visited in 2010 (a longitudinal study) and will include questions of whether the homeowner has installed a variety of measures since the site visit and if he or she received a utility rebate. Although it is often difficult for homeowners to know what insulation exists in the house or equipment efficiency levels, there is high likelihood that they will know what improvements had been made in the previous four or five years. Thus, for the purposes of determining non-programmatic savings, this phone survey will give a reasonable assessment although not as accurately as a full RBSA. The cost to complete this survey with analysis is estimated to be $30,000.

[7] "Existing Multifamily Tenant Appliance Efficiency Saturation Study: Market Research Report", prepared by RLW Analytics, NEEA Report #E07-180, August 15, 2007.

[8] "Residential New Construction Characteristics and Practices Study", prepared by RLW Analytics, NEEA Report, March 20, 2007.

Manufactured Homes

In addition, BPA has seen historically that only about 10% of the homes built as part of the Northwest Energy Efficient Manufactured Housing Program (NEEM) are being reported through the PTR system. Although BPA is planning on revising the system to be able to capture all of these savings, that isn't expected to occur until 2012. Thus, there are savings in 2010 and 2011 that are likely to be missed. On average, in 2009, participants in the ENERGY STAR new manufactured homes program saved 4,500 kWh each. Given that there are approximately 3,000 homes annually not being recorded, this translates to approximately 1.5 aMW annually in savings not currently being captured.

Commercial Sector

The majority of the anticipated 12 aMW of market-induced savings in the commercial sector comes from lighting upgrades – 8 aMW. To verify these savings, Cadmus proposes BPA utilize the results of the 2008 Commercial Building Stock Assessment (CBSA) for baseline conditions and conduct a similar, though more targeted, end-user survey in 2014. This follow-on survey will be similar to CBSA in approach, but will focus on collecting data on a limited number of high-saving measures, specifically interior and exterior lighting in existing and new commercial buildings. Cadmus estimates that a recommended 500 site visits, at a cost of approximately $1,200 each, will cost around $825,000, including analysis and reporting.

In addition, grocery refrigeration is a fairly significant portion of the non-programmatic savings potential (1 aMW), and if BPA chooses to verify these savings, targeted end-user site-visits would be the recommended approach. In the 2008 CBSA, baseline data only exists for about five of the 14 refrigeration measures, accounting for less than 50% of the bundle's savings potential. As such, BPA would want to conduct supplemental site visits in early 2010 of grocery stores to have a comprehensive set of baseline conditions. These 100 additional site visits are estimated to cost an additional $150,000, including data analysis. The grocery stores should be also be revisited in 2014 as part of the targeted end-use study described above, adding an additional $75,000.

The other significant contributor to non-programmatic savings in this sector are computers/servers and network PC management (3 aMW). Data on computers is best obtained through shipment data supplemented with non-participant end user surveys. Network PC management savings are best estimated through surveys. The cost to collect these data totals approximately $75,000 and should be collected in 2010 and 2014 at a total cost of $150,000. Together, quantifying the lighting, computers and grocery refrigeration savings come to a total cost of $1.2M.

Industrial Sector

No proposed research is given for the industrial sector as the likelihood for non-programmatic savings is fairly low and the methodology to determine these savings could

be quite complex. However, NEEA is expected to try to quantify any savings through program tracking and BPA should work closely with NEEA to ensure any savings estimates are claimed. BPA is not planning to claim any savings in this sector.

Agricultural Sector

No proposed research is given for the agricultural sector as the expected savings are likely small and the methodology for determining these savings could be quite complex.

Summary

Sector	Significant Measures	Data Collection and Verification Method	Approximate Sample Sizes	Approximate Cost
Codes & Standards	State dependent	Engineering analysis of code changes	--	$120,000
Recovery Act	State dependent	Analysis of Recovery Act impacts	---	$120,000
Residential	Lighting, Weatherization, Showerheads	RBSA	840	$1,800,000
		Phone Survey	300	$30,000
Commercial	Lighting	Targeted End-User Survey	500	$825,000
	Grocery Refrigeration	Two-Phase Targeted End-User Survey	100	$225,000
	Computers	Shipment Data, Non-participant Survey	100	$150,000
Industrial	Continuous Energy Management, Equipment	NEEA Program Tracking	--	--
Agricultural	Pump, Nozzle & Gasket Replacement	None	--	---