# Why Should Measuring Non-Programmatic Energy Savings Matter for Utilities?

*Carrie Cobb and Lauren Gage, Bonneville Power Administration, Portland, OR*
*Tina Jayaweera and Hossein Haeri, The Cadmus Group Inc., Portland, OR*

## ABSTRACT

The Northwest Power and Conservation Council's Sixth Power Plan calls for regional utilities and the Bonneville Power Administration to meet 90 percent of future regional load growth through energy conservation. As the size of the energy-efficiency resource grows, increasingly aggressive energy-efficiency performance standards in the Northwest and many state jurisdictions may change the balance of utility energy-efficiency resource acquisition strategies toward increased interest in measuring (and claiming) energy savings from non-programmatic sources, such as market-induced conservation, market transformation initiatives, and codes and standards. Because total energy savings achieved through all market mechanisms decrease future load obligations, regardless of utility incentives or attribution, measuring non-programmatic energy efficiency provides an important component in ensuring all cost-effective energy efficiency can be captured as a resource, avoiding acquisition of other resources to meet consumer demand.

Unlike savings from most programmatic initiatives, measuring non-programmatic savings' impacts credibly and reliably poses new challenges in terms of methodology and data availability. This paper reports results to date of the Bonneville Power Administration's ongoing effort in the Pacific Northwest region to design a research plan for estimating non-programmatic savings over the next five years. Similar to an evaluation plan, the research plan will assist future efforts to track and record such savings. This paper begins by defining non-programmatic savings, presents assessments of measure categories where the greatest savings are expected, and discusses potential data sources and analysis for estimating these savings' impacts.

## Introduction

Every five years in the Northwest, the Northwest Power and Conservation Council (Council) prepares a regional power supply plan, which includes a comprehensive assessment of power supply and conservation options to meet the region's future electricity demand. Similar to a utility's Integrated Resource Plan, this plan compares supply and demand-side resources, and estimates amounts of achievable, cost-effective efficiency measures possible beyond baseline efficiencies and measures incorporated in the load forecast.

The Bonneville Power Administration (BPA) has taken responsibility for achieving its regional share of cost-effective conservation. The Sixth Power Plan, published in February 2010 and applying to the 2010–2014 planning period, doubles the region's energy-efficiency targets, leading to increased focus on reliably estimating all regional energy conservation.

The Council has based its methodology for estimating energy-efficiency potential on an assumption of "frozen" efficiency. The baseline represents efficiency measures' market penetration at the time the Council produces its forecast and develops conservation supply curves. This baseline accounts for all previously achieved conservation. 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 baseline conditions resulting from new codes and standards,[1] market-induced conservation, utility activities, or other factors.

Moreover, the Council's supply curves have been based on "gross" savings, and, therefore, are indifferent to how conservation is achieved, who pays for conservation, or why conservation measures are installed. The Council is a power planning body, and any new conservation is considered a resource providing the region with a low-cost alternative to developing new power generation and transmission facilities, regardless of the mechanism or combination of mechanisms causing its acquisition.

Considering energy efficiency as a power resource[2] has proved a core underpinning in the plan's development. As such, the key factor in meeting the established goals has been to ensure capturing all energy efficiency so supply-side resources need not be developed.

Adopting this core philosophy means attribution and elements such as freeridership become secondary concerns to acquiring resources. The Council's methodology has focused on total—or gross savings—displacing generation, and recognizes savings may be achieved through multiple mechanisms, not only through utility programs. These include such additional factors as market transformation initiatives, codes and standards, or consumers' independent adoption of energy-efficient products and practices. Together, "non-programmatic" energy savings outside of utility programs can significantly contribute to a region's overall conservation. Fully understanding savings impacts from these non-programmatic factors has become a necessary step in power planning to meet future energy needs.

In the Northwest, a multiple-mechanism approach for acquiring conservation resources has worked well. Historically, Northwest conservation has resulted from activities initiated by a number of entities, including BPA, utilities, the Energy Trust of Oregon, the Northwest Energy Efficiency Alliance (NEEA), state and city agencies, and the Council, often through 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.

While the region has a strong history of energy-efficiency acquisition, a data gap occurs surrounding the total market for energy-efficiency products—a crucial component in estimating non-programmatic savings. This paper looks at sources for non-programmatic savings, and suggests data requirements to help fill such gaps, particularly for market-induced adoption. Collecting these data, and understanding the savings impacts they address, will inform developing future power plans to meet regional energy needs.

## Defining Non-Programmatic Savings

To properly track and report savings, BPA defines two primary savings categories: programmatic and non-programmatic. Programmatic savings result from those directly incented through utility-sponsored programs as well as through market transformation savings from NEEA's initiatives. Non-programmatic savings include all other energy-efficient products or practices above the Sixth Plan's baseline. Non-programmatic savings can be categorized as three main types:

1. Codes and Standards: Electricity use reductions resulting from energy codes and equipment standards taking effect after establishment of the Sixth Plan's baseline.
2. Baseline Adjustments: Regional targets based on a specified baseline at the time of Power Plan development. During the Plan period, the Regional Technical Forum (RTF, a

[1] Meaning, codes and standards that had not been adopted at the time of the Sixth Power Plan's development.
[2] Further discussion regarding energy efficiency as a resource can be found in: "Some Thoughts on Treating Energy Efficiency as a Resource" by Tom Eckman, Electricity Policy.com

committee of the Council) may change this baseline for regional deemed numbers. Any savings attributed to baseline increases may be reported towards the target.

3. "Market-Induced" Adoption: Total market adoption of efficient technologies by nonparticipants outside of utility programs. Possible market-induced conservation drivers could include:
    - Spillover: Influence from current or historic programs.
    - 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 altering the energy-efficiency marketplace.
    - The "Green" movement: As society places greater emphasis on green living, energy efficiency attains higher visibility and attractiveness for consumers.

Figure 1[3] illustrates the composition of regional conservation potential and the roles of different sources of non-programmatic savings. This paper focuses on impacts from market-induced adoption.

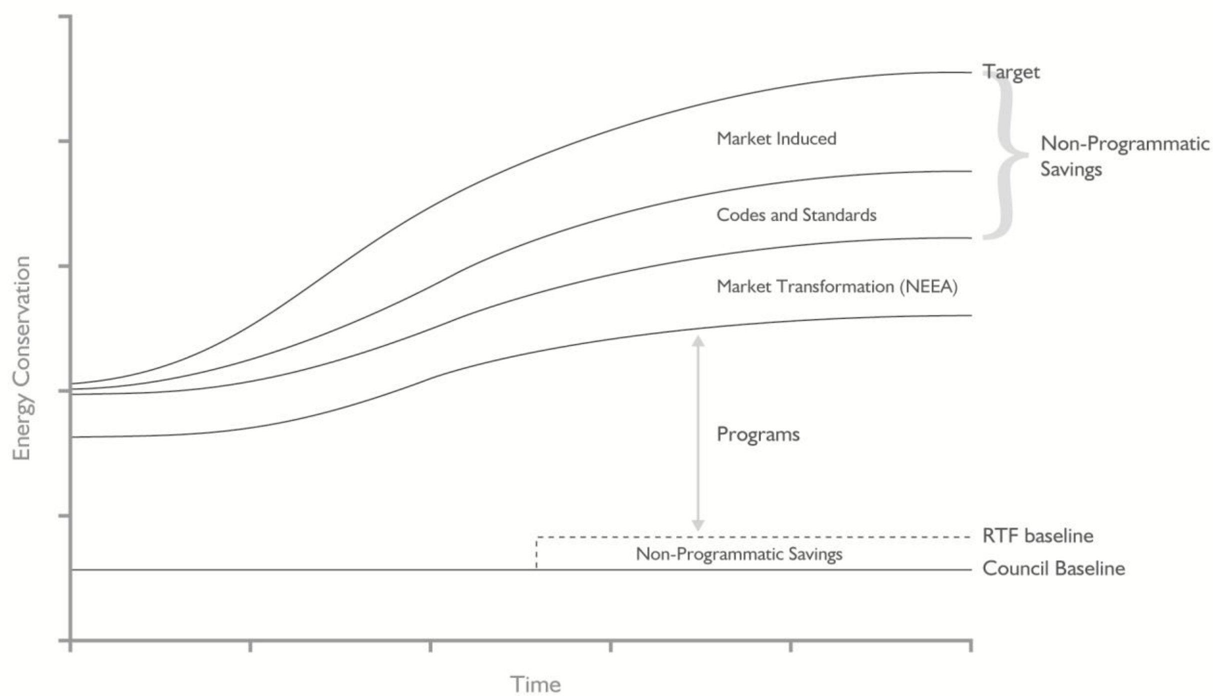


**Figure 1.** Source of Savings

**Market-Induced Adoption**

Market-induced effects refer to non-programmatic adoption of energy-efficient technologies and practices. These savings reflect total market adoption of energy-efficient technologies above the baseline, excluding those associated with codes and standards or incented by utilities. Such savings may be motivated by higher energy prices, utility programs, state agency actions, macroeconomic conditions, or shifts in cultural norms (e.g., the "green movement").

Market-induced adoption includes savings that could be classified as spillover or market transformation, with a key distinction being these savings' drivers do not need to be determined for

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

energy savings to be considered valid energy-efficiency resources. As such savings are as legitimate a resource as program-rebated savings; analysis does not require attribution or finding causality.

Programs may influence market-induced adoption by building awareness and increasing availability of energy-efficient measures. In the Northwest, however, these savings have not traditionally been tracked by utilities or other entities. In other territories, these savings may partly or wholly be tracked and claimed as spillover or market transformation. Tracking market-induced adoption can lead to estimates resulting from total gross savings achieved for energy efficiency in a given market. Theoretically, market-induced savings apply to all energy-efficient products and services, though acquiring data to measure such savings may not be feasible. Generally, savings estimates for these measures may be obtained by quantifying a measure's total saturation, and subtracting numbers of units incented through utility programs and initial, assumed saturation (the Council's baseline). For all measures, market data must be adjusted for all program-funded measures to avoid double-counting of savings.

## Market-Induced Planning Estimates

Tracking non-programmatic savings required understanding measure categories where non-programmatic savings would most likely occur. Knowing this, BPA could then more accurately allocate research resources to quantify such savings, and to establish the scope of available data for estimating savings. During the 2010–2014 planning period, market-induced savings have been projected to range from 38 aMW to 53 aMW for BPA,[4] with approximately three-quarters of savings occurring in the residential sector, and the remainder occurring in the commercial sector.

To derive these estimates, BPA and Cadmus assigned a probability for non-programmatic savings occurring in each Sixth Plan measure bundle (e.g., residential weatherization, commercial grocery refrigeration), using a nominal scale with five categories: none, very low, low, medium, and high. Assignments were based on: data collected from the 2005–2009 program period; ENERGY STAR market shares (ENERGY STAR, 2009); industry experience; and reviews of available process evaluations and freerider studies.[5] 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 1 shows planning assumptions for non-programmatic savings during the Sixth Plan's five-year period. These assumptions include low and high scenarios, which reflect the uncertainty inherent in estimating the likelihood of market-induced savings. In fact, final market-induced savings may be less than the low-scenario estimates. This analysis did not intend to provide a precise estimate of non-programmatic savings; rather, it was meant to inform the program planning process, and guide data collection efforts. These savings estimates might be considered reasonable approximations of market-induced savings. If possible, they will be revisited and adjusted annually, and anticipated impacts from market-induced and other non-programmatic sources will be adjusted, as necessary.

[4] Average megawatt (aMW) is a unit of energy used for planning purposes in the Pacific Northwest. It is calculated as the ratio of energy (MWh) and the number of hours in the year (8760). One aMW equals 8,760 MWh.
[5] Examples include: California statewide lighting evaluation (Cadmus); NEEA 80Plus MPER (Cadmus); Nevada Power Process Evaluation (Paragon Consulting); and ComED potential study (Cadmus).

**Table 1.** BPA Five-Year Target for Market-Induced Non-Programmatic Savings[6]

| 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%** |

As shown in the Table, lighting, which has been wildly successful in regional programs, is estimated to be one of the largest categories of non-programmatic savings, both for commercial and residential applications. The low-cost and strongly developed infrastructure for delivering lighting measures has resulted in a market where many installations are not directly incented by utilities. Further, the market for appliances and consumer electronics likely contains a strong percentage of sales above incented units.

## Overview of Research Plan and Challenges Ahead

Having estimated sources of non-programmatic savings, the second phase determined how best to collect data needed to verify these savings. This section provides an overview of potential data sources, calculation methodologies, and regional representativeness issues common to all measures with market-induced, non-programmatic savings. Though a research plan to collect these data has been suggested, future modifications will likely need to be as collected, as key information will likely pose challenges. This paper does not present detailed methodologies by measure or by sector; however, two examples are given.

### Data Sources for Total Market

Market-induced savings may be directly estimated from data on energy-efficient products saturations at the total market level. These data derive from two main sources:

1. Sales data for energy-efficient equipment sold in the region; and
2. Regional building characteristics and market studies.

[6] Total target is 504 aMW (4,415,040 MWh)

## Sales Data

Three types of sales data can be used for estimating market-induced savings: shipments, point-of-sales (POS), and distributor data. All can provide reasonable estimates of total numbers of energy-efficient products sold, though their preferred use greatly depends on the product and the information desired. As sales data are notoriously difficult to collect, many uncertainties around data quality remain, and adaptations likely will be needed. Some market data on energy-efficient products can be derived from other sources, such as the Consortium for Energy Efficiency. In the past, contractor surveys have also been used to obtain market data.

For BPA, shipment data may be the preferred data source, where available. Shipment data show numbers of units sent into a specific state or region. Shipment data sources include manufacturer or trade-ally associations, ENERGY STAR, and, for imported goods, the U.S. Census Bureau. Shipment data are generally available at aggregate regional and state levels; therefore, the data's main limitation occurs when attributing shipments to a particular territory. As BPA's large geography covers much of the Northwest, attribution can be simpler than for a smaller territory. For some measures, adjusting total regional shipments by the load or household share for the given sector offers a reasonable approach, particularly as demographics for the total BPA territory closely mirrors the entire region. In other cases, consideration of more detailed differences in characteristics will result in more robust estimates. For example, as customers in BPA's territory tend to have higher saturations of electric space and water heating than the regional average, space and water heating fuel saturations may be the best adjustor.

Beyond the difficulty in obtaining shipment data, another difficulty arises in estimating leakage to stores outside the region. As Vancouver B.C. is close to Seattle, shipment data might include shipments ultimately arriving in Canada.

POS provides another sales data source, deriving directly from retailers, and, in the Northwest, can usually be obtained through third-party contractors, having developed relationships with retailers. Sometimes, these data can be obtained at the zip-code level, potentially providing data for individual utility service territories. Further, utility and retailer relationships can be leveraged to gain information on a local area's energy-efficiency market. POS data, however, are limited as quality depends on market percentages captured. For some product categories, a few vendors account for the market's majority, providing good candidates for using POS data. For example, a few do-it-yourself retailers, such as Home Depot, may account for up to 80 percent of home appliance sales in local markets, providing fairly reliable estimates. Cross-referencing these data with other total market sources to develop a ceiling for efficiency can improve the reliability of analysis.

Where measures are delivered through distributors and contractors rather than retail venues, and shipment data are not available (especially in the commercial sector), distributor and contractor interviews may be used to develop market estimates. These methods require cross-referencing various sources to ensure capturing the entire market appropriately. Developing an appropriate sample frame of distributors (from sources such as Dun & Bradstreet) and obtaining sales information from individual vendors must be done carefully to ensure representing the region appropriately. While these data have been used successfully, they can also be complex and difficult to interpret.

## Regional Building Characteristics and Market Studies

Regional building characteristics studies, when conducted at regular intervals, can provide information to help estimate the total market for particular energy-efficient measures. NEEA routinely conducts two major market studies of the existing Northwest building stock: one for the residential sector; and one for the commercial sector. These exhaustive audits collect information on structural characteristics, energy system specifications, and energy-using equipment.

Data from these surveys may be used to estimate saturation changes of energy-efficient equipment and appliances as long as consistent data collection methods and protocols are used. For example, changes in lighting power density were estimated for the 2005–2009 period using the Commercial Building Stock Assessment (CBSA), which measured a significant drop in regional lighting power density, only partially explained by incented lighting projects. Further, these data provide valuable reference points for sales data collection, both to determine regional distribution of measures and to extrapolate sales data to a total market.

### Data Adjustments

To avoid double-counting savings and properly informing the power plan, program-incented savings must be excluded from the total savings estimate resulting from changes in market share. With data specific to BPA's service area (e.g., measures from regional studies; sales data at the territory level), only BPA program savings need be debited from total savings. For measures with only regional or state data available, IOU program savings must 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, programmatic savings adjustment should be calculated annually to facilitate tracking of total savings.

## Examples of Possible Analytical Approaches: Appliances and Commercial Lighting

### Appliances

This section outlines a possible approach for tracking non-programmatic savings from appliances, including clothes washers, dishwashers, and refrigerators/freezers. Market-induced adoption of such measures likely results in approximately 1.0 aMW savings.

Tracking appliances is relatively straightforward, as market sales data can be obtained through multiple sources, such as the Association of Home Appliance Manufacturers. Though overall methodologies for calculating market-induced savings are similar for all appliances, actual formulas differ slightly due to variations in savings per unit values. The equation below shows the approach to calculating non-programmatic savings for freezers and refrigerators:

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

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 a home's type of domestic hot water equipment. This information will not be available for POS data as it cannot be collected from every consumer purchasing an appliance. Upon completion of the current residential audit survey, fuel share data could be used to allocate savings between electric and gas water heaters. Without these data, the Sixth Plan provided a value for "any hot water heater," and this value will have to be used to derive non-programmatic savings estimates. In addition, ENERGY STAR clothes washers offer savings through water heating loads and through resulting dryer savings due to faster spin cycles. Thus, savings vary depending on fuel sources for both water heaters and clothes dryers, resulting in a range of savings reflecting the dryer fuel as well as the unit efficiency. Again, the residential audit survey could inform the relative proportion of gas versus electric dryers.

**Commercial Lighting**

This section outlines a possible approach for tracking non-programmatic savings from commercial lighting measures. Between 8.4 and 9.0 aMW savings are expected to result from market-induced adoption of these measures.

BPA can estimate commercial lighting measures' non-programmatic savings, based on changes in commercial building interior lighting power density (LPD) over the 2010–2014 program period. The 2009 CBSA provided adequate baseline data for 2010 lighting measures. Table 2 shows the number of 2009 CBSA lighting data points for buildings in BPA's service area, by building type and vintage.

**Table 2.** 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; the study's results provide a "post" interior LPD estimate, from which to calculate overall changes in lighting across the five-year program period.

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 above focuses on determining savings from lighting retrofits (e.g., replacing T12 with T8 fixtures), as a source for the majority of savings (programmatic and non-programmatic). However, lighting controls must also be considered. In fact, program-funded savings in the formula above include retrofits and controls. As separating controls' impacts from booked savings proves impractical, this approach provides a conservative estimate of non-programmatic savings. The 2009 CBSA data were insufficient to accurately determine baseline conditions for controls, thus determining non-programmatic savings may not be feasible for the 2010–2014 Plan period.

## Conclusion

BPA's targets, established through the Sixth Power Plan for the 2010-2014 planning period, include savings expected to be achieved through utility program incentives, NEEA market transformation, and non-programmatic channels. This paper presents BPA's estimate of market-induced. non-programmatic savings, and the research plan designed to measure amounts achieved during the five-year period. The presented methodologies address collecting sales data (e.g., shipments, point-of-sales, and distributor data) and conducting regional studies, and provide two examples of data required to estimate market-induced, non-programmatic savings. By understanding and collecting data required to estimate non-programmatic savings, future resource plans will reflect more accurate estimates of the region's energy needs.

## References

ENERGY STAR 2009. "ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary". http://www.energystar.gov/ia/partners/downloads/2009_USD_Summary.pdf

Grist, Charlie 2010. The Potential Role of Codes and Standards in Efficiency Acquisition. Presentation to Pacific Northwest Utilities Conference Committee, April 2.