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July 5, 2018

### MEMORANDUM

**TO: Power Committee**

**FROM: Jennifer Light, RTF Manager**

**SUBJECT: Primer on Reported Energy Efficiency Savings**

### **BACKGROUND:**

**Presenter:** Jennifer Light

**Summary:** Council staff plan to present the results of the 2017 Regional Conservation Progress (RCP) report at the August 2018 Council meeting. This report provides an opportunity for the Council to track Bonneville's and the region's progress against the Power Plan goal. Staff has made improvements to the RCP data collection and analysis over time, which provides a better understanding of where the savings are coming from, including savings occurring outside of the direct program touch. With these improvements comes added complexity. The purpose of this presentation is to provide the Power Committee an understanding of the different types of savings reported in the RCP and how each of those components relates to the potential reflected in the Seventh Power Plan goal. Staff will also share known discrepancies between data reported by programs, the Northwest Energy Efficiency Alliance (NEEA), and the savings represented in the Council goal, and we will explain why we recommends continuing to use this longstanding approach.

Additionally, staff have developed a draft white paper that addresses many of the concepts we will share at this meeting. Staff is seeking initial

Power Committee input on these concepts, with a goal of releasing the draft white paper for comment at the August Council meeting.

**Relevance:** In the Seventh Power Plan, the Council set a six-year goal for conservation acquisition at 1400 average megawatts. In August, staff will present conservation savings from the first two years of the Plan.

**Workplan:** A.1.1. Coordinate with regional entities to ensure the regional goal for cost-effective conservation is achieved.

**Background:** Per its Charter, the Regional Technical Forum (RTF) conducts an annual survey of the region's utilities, Bonneville, the Energy Trust of Oregon, and NEEA to collect data on the previous year's energy efficiency accomplishments. These data feed into the Regional Conservation Progress Report, which allows the Council to track Bonneville and the region's progress against the Power Plan goal.

The RTF continually seeks to improve the data collection over time. One more recent improvement is including full market data, providing an increased understanding about additional energy savings outside of direct program touch. Finding these savings requires research aimed at tracking how the entire stock has changed over time or improvements in the average product sold across a full market. For these markets, the RCP results show Total Regional Savings, which is most directly comparable to the Power Plan goal.

In those markets where data on the whole market is not available, the RTF relies on Program Savings, NEEA Alliance Savings, and Codes and Standards Savings. Program Savings capture savings that Bonneville, Energy Trust of Oregon, and the utilities claim for each efficient product they directly touch. NEEA Alliance Savings account for additional efficient products being delivered to the region that are not already counted by Program Savings. Codes and Standards Savings represent saving from codes and standards that have been updated since the development of the Plan.

There are two approaches for developing per unit savings that feed into the Council Plan, RTF estimates, and regional programs. The first is to just look at the energy savings compared to the consumption of the existing, inefficient unit. This method is used for retrofit measures, such as weatherizing a house or adding a ductless heat pump to an existing home that uses electric resistance zonal heating. The second method is to look at the energy savings compared to the consumption of the "average product" in the market. This method is used for lost opportunity measures, such as purchasing an LED at retail to replace a burned out bulb or insulating a new home above code required levels.

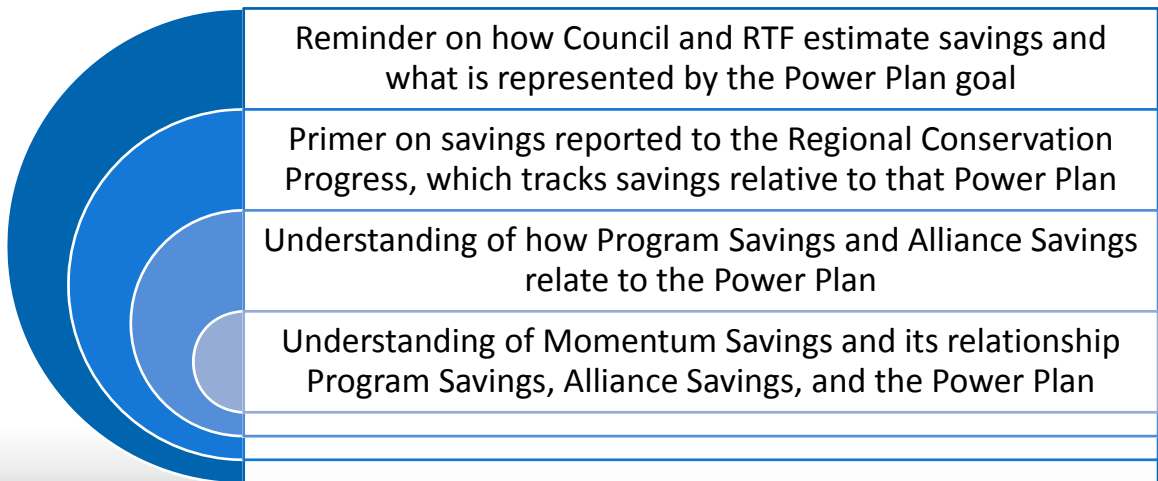
With lost opportunity measure, the per unit Program and NEEA Alliance Savings overstate energy savings relative to the Total Regional Savings represented in the Plan target. The main driver for this is that the Total Regional Savings includes the consumption of products that are less efficient than the “average product” in the market. Council staff has been aware of this issue and discussed it with the RTF and RTF Policy Advisory Committee. The consensus is, despite this flaw, the methodology for estimating per unit savings still provides the best estimate compared to alternatives. For one, it estimates total market change over the long term, which is the goal of the Council’s Power Plan. Additionally, it aligns best with the demand forecast, avoiding overcounting or undercounting efficiency savings and potential. Alternative methods that do not align with the Council’s demand forecast not only result in skewed estimates, but do not necessarily provide greater insight and may require expensive and subjective studies. Over time, Council staff have continually seen actual improvements in loads that are greater than those reported by historical Program and NEEA Alliance Savings. This suggests that there are additional savings in the market that are occurring outside of programs, but again can only be tracked through studies that measure the full market.

Council staff have developed a white paper (attached) that speaks to many of these issues. The purpose of the white paper is to explain how the Council and RTF develop energy savings estimates, how utilities can use those estimates for planning and reporting, inconsistencies across these efforts, and rationale for continuing with the approach. At the August 2018 Council meeting, staff will be seeking release of this draft white paper for public comment. Release, alongside the reporting the RCP, should allow for greater clarity of what is captured in the Power Plan goal and how the reported savings relate to that goal.

# Primer on Reported Efficiency Savings Reported to the Regional Conservation Progress Survey

Jennifer Light  
July 10, 2018

## Objectives for Today's Discussion



## Another Objective: The White Paper

- Staff has developed a white paper to discuss the concepts and issues that we will walk through today
- Staff is seeking to bring the white paper to the Council at the August meeting for decision to release for comment

## Presentation Overview

- Definitions
- Baseline
- Codes and Standards Savings
- Retrofit Measures
  - Estimating savings and regional potential
  - Understanding savings claims
- Lost Opportunity Measures
  - Estimating savings and regional potential
  - Understanding savings claims



## Definitions: Measure Types

### Retrofit

- Discretionary measures that improve the efficiency of an existing building or equipment
- Also those replaced prior to natural turnover
- Examples:
  - Weatherization in an existing home
  - DHP installed in an existing home with zonal electric resistance heat
  - Direct installation of lighting
  - Replacing a working motor with a higher efficiency option
- Use pre-conditions baseline

### Lost Opportunity

- Measures that can only be captured during a limited window of opportunity (at product turnover or the addition of a load)
- Examples:
  - Insulating a new home above code required levels
  - Installing a DHP in a new home where not required by code
  - Lighting purchased at retail to replace a burned out bulb
  - Replacing a failed motor with a new efficient one
- Uses a current practice baseline

## Definitions: Savings

### Total Regional Savings

Represents the total savings seen in the region relative to the Power Plan baseline *These savings are most comparable to the Plan target*

### Program Savings

Savings claimed by utilities, BPA, and Energy Trust of Oregon for specific measures that they have incentivized

### NEEA Alliance Savings

Savings reported by NEEA that represent efficiency occurring above and beyond those claimed by programs

### Momentum Savings

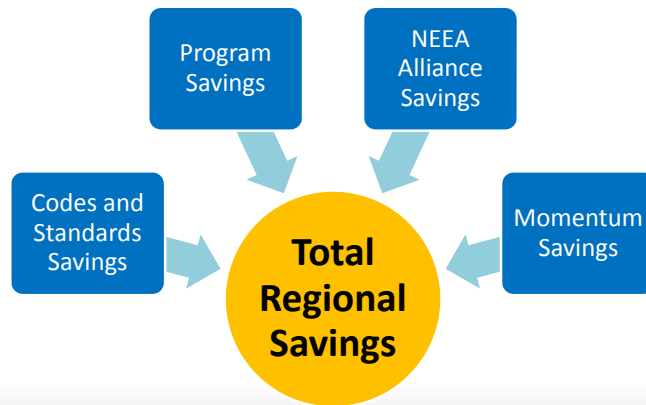
Additional savings calculated by taking the total regional savings and subtracting other reported savings

### Codes and Standards

Savings from new buildings or equipment that meet a new code or standard not captured in the Power Plan baseline

## Components of Savings

All of these are components of Total Regional Savings, but they don't necessarily all stack together nicely.



## BASELINE: FROZEN EFFICIENCY DEMAND FORECAST

## Need to First Pick a Baseline

- **Baseline provides a starting place for loads, conservation potential, and reporting**



## What is the Frozen Efficiency Demand Forecast?

- **Consumption/efficiency of current stock is fixed (frozen) at the start of the plan period**
  - Adjusted for natural turnover of products to today's efficiency levels
- **It does not mean the loads are constant**
  - New construction builds loads
  - Existing buildings become more efficient due to equipment stock turnover
  - Building shell efficiency doesn't change
- **Any additional increases in product or practice efficiency beyond today's current assumptions are captured in the conservation supply curves**

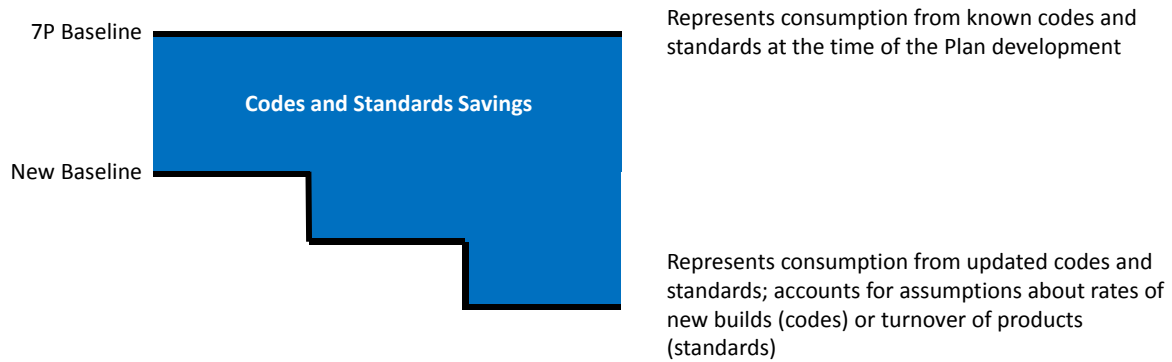


## CODES AND STANDARDS SAVINGS

## Codes and Standards

- Frozen efficiency demand forecast accounts for known codes and standards
- As codes and standards are updated after the Plan, essentially creating a new baseline, the savings between the Plan baseline and the new code/standard are Codes and Standards Savings
- Anticipated Codes and Standard Savings since 7P include:
  - WA Residential and Commercial Building Code Updates
  - Expansion of the residential lighting standard

# Codes and Standards



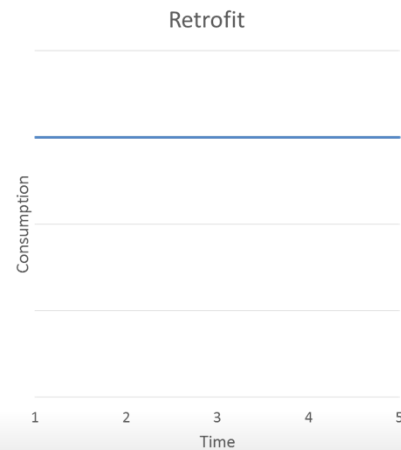
In reporting Codes and Standards Savings, we are mindful of avoiding double counting with other savings

Developing Savings Estimates and Potential

## RETROFIT MEASURES

## Retrofit Measures in the Frozen Efficiency Demand Forecast

- Retrofit measures use a pre-condition baseline, which is represented by the existing stock
- Existing stock is already built into the demand forecast
- As these upgrades are discretionary and do not naturally turnover, the demand forecast assumes no change in the existing stock



## Baseline: Pre-Conditions

Pre-conditions baseline represents the consumption of the specific item being replaced or retrofitted



Weatherization



DHP with Existing  
Zonal ER Heat



Direct Install Lighting



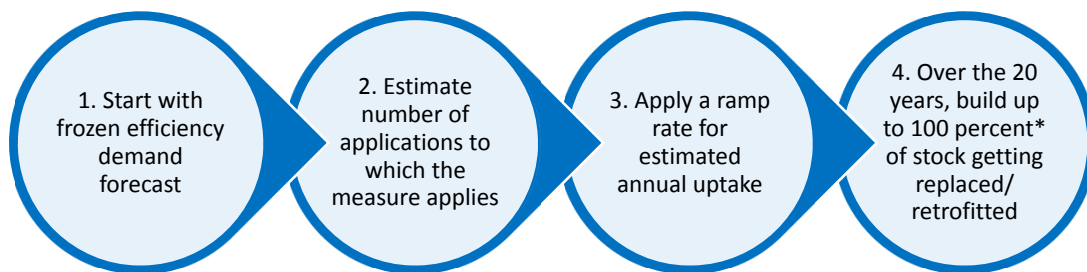
Early Motor  
Replacement

## Estimating Savings

Savings are estimated by taking the difference in consumption between the efficient technology and that being replaced or retrofitted. In this example, a DHP is being added to a home with an existing zonal baseboard heating.



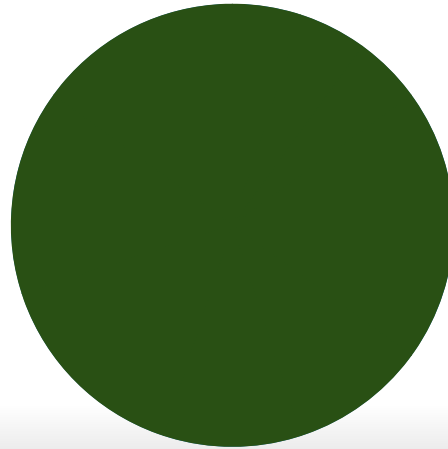
## Estimating Regional Potential



*\*The Council also adds an 85% achievability factor to this analysis.*

## Modeling Potential for DHP Example

- Start with all the homes with existing zonal electric resistance heating
- Estimate potential for adding a DHP in those homes based on per unit savings
- Apply ramp rates to estimate what portion of the stock is assumed to be retrofitted each year
- Over the 20 years, the 100% of the homes are assumed to be retrofitted

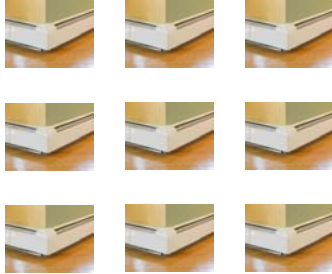


Claiming Savings

## RETROFIT MEASURES

## Retrofit: Total Regional Savings

Baseline: Existing Stock



Energy Consumption of the Stock:  
 $9 \times 10,000 \text{ kWh/yr} = 90,000 \text{ kWh/yr}$

## Retrofit: Total Regional Savings

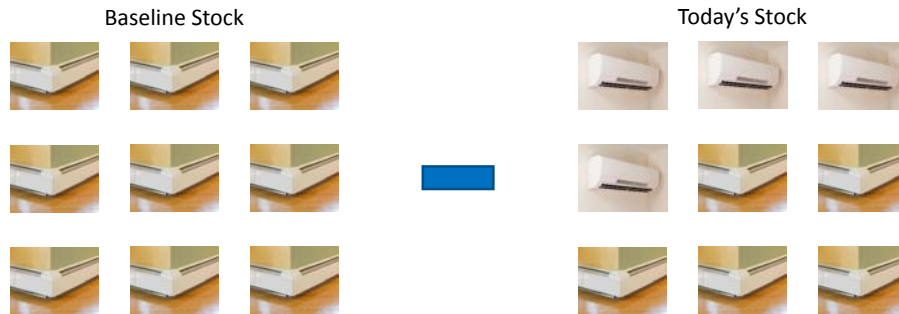
Savings: Today's Stock

*4 homes have added a DHP to  
supplement the baseboard heat*



Energy Consumption of Today's Stock:  
 $(5 \times 10,000 \text{ kWh/yr}) + (4 \times 8,000 \text{ kWh/yr})$   
 $= 82,000 \text{ kWh/yr}$

## Retrofit: Total Regional Savings



Consumption difference between baseline and today's stock:  
 $90,000 \text{ kWh/yr} - 82,000 \text{ kWh/yr} = 8,000 \text{ kWh/yr}$

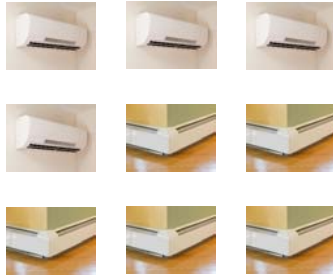
## Retrofit: Total Regional Savings



For retrofits, this is equal to multiplying all of the new efficient units by the savings per unit  
 $4 \times 2,000 \text{ kWh/yr} = 8,000 \text{ kWh/yr}$

## Retrofit: Program Savings

Today's Stock



Programs claim savings for the units they directly incentivize in some way; for example providing rebates for DHP installs.

In their claims, they use the unit energy savings (~2,000 kWh/yr) and multiply that by number of units incentivized

## Retrofit: Program Savings

Today's Stock



*For savings reporting purposes, programs do not track inefficient units; or homes with zonal electric resistance baseboard heating*



## Retrofit: Program Savings

Today's Stock



*Programs do not necessarily touch (incentivize) every efficient unit; not all DHPs come through programs*

## Retrofit: Program Savings

Today's Stock

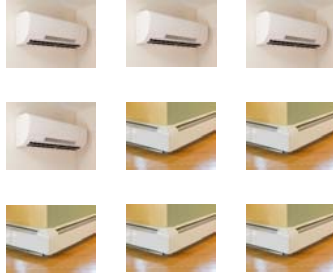


In this example, 2,000 DHPs were installed and claimed by programs.

Therefore Program savings are:  
 $2 \text{ DHPs} \times 2,000 \text{ kWh/yr savings}$   
 $= 4,000 \text{ kWh/yr}$

## Retrofit: NEEA Alliance Savings

Today's Stock



NEEA reports savings for efficient units that they track in their market data that:

- Are not already claimed by programs; and
- For which they have an initiative and/or an estimate of savings

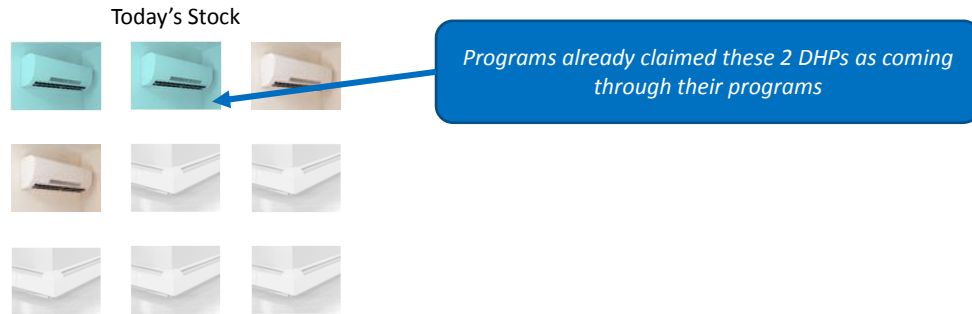
## Retrofit: NEEA Alliance Savings

Today's Stock

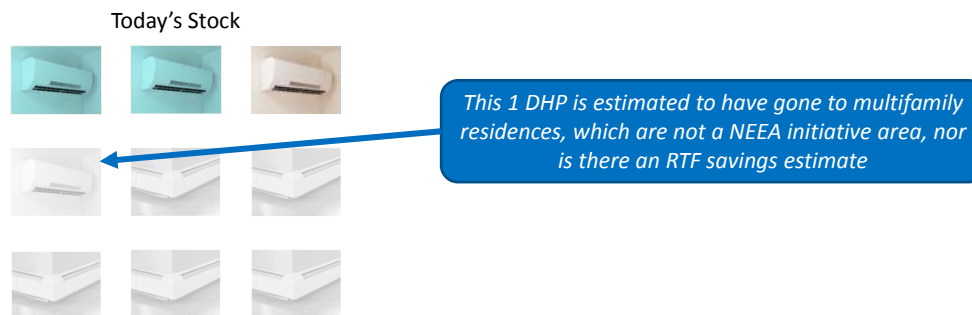


*For Alliance Savings, NEEA does not report on inefficient units; or homes with zonal electric resistance baseboard heating*

## Retrofit: NEEA Alliance Savings

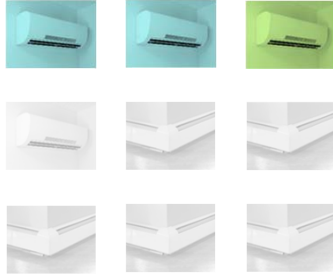


## Retrofit: NEEA Alliance Savings



## Retrofit: NEEA Alliance Savings

Today's Stock



NEEA reports savings for this 1 unit going into single family and manufactured homes (initiative areas with RTF estimates) that are not already claimed by programs.

Therefore, NEEA reports Alliance Savings as:  
 $1 \text{ DHPs} \times 2,000 \text{ kWh/yr} = 2,000 \text{ kWh/yr}$

## Retrofit: Momentum Savings

Momentum Savings represent additional savings not previously claimed. Therefore, it is the **remainder** between the Total Regional Savings and other claims.

Reminder, in this example:

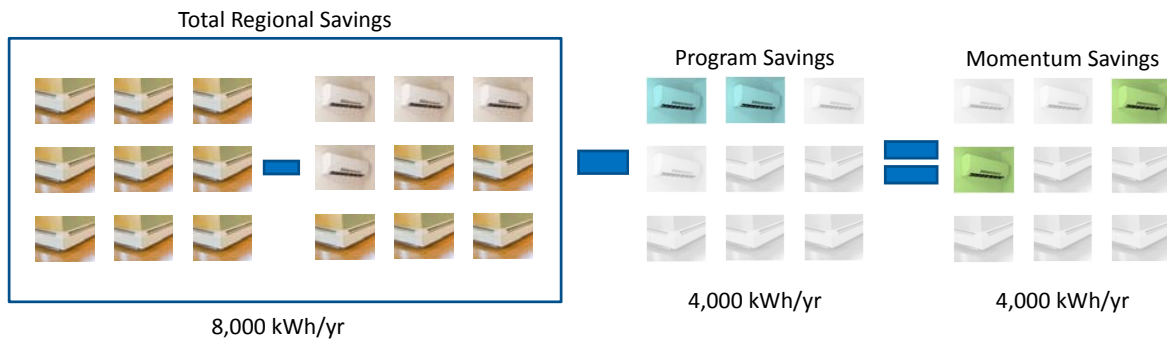
**Total Regional Savings = 8,000 kWh/yr**

This can be calculated two ways:

1. Momentum Savings = Total Regional Savings – Program Savings
2. Momentum Savings = Total Regional Savings – (Program Savings + Alliance Savings)

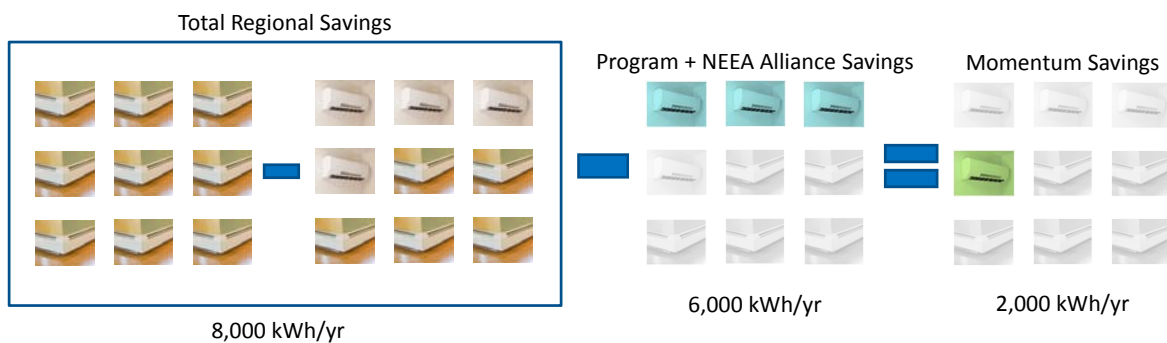
# Retrofit: Momentum Savings

## Option 1: Removing only Program Savings



# Retrofit: Momentum Savings

## Option 2: Removing Program Savings *plus* NEEA Alliance Savings

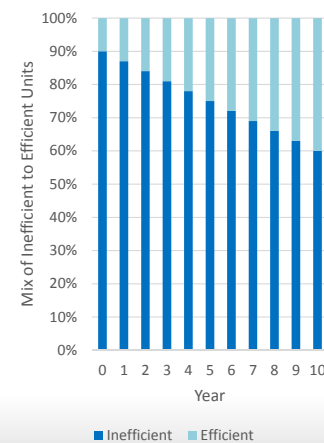


Developing Savings Estimates and Regional Potential

## LOST OPPORTUNITY MEASURES

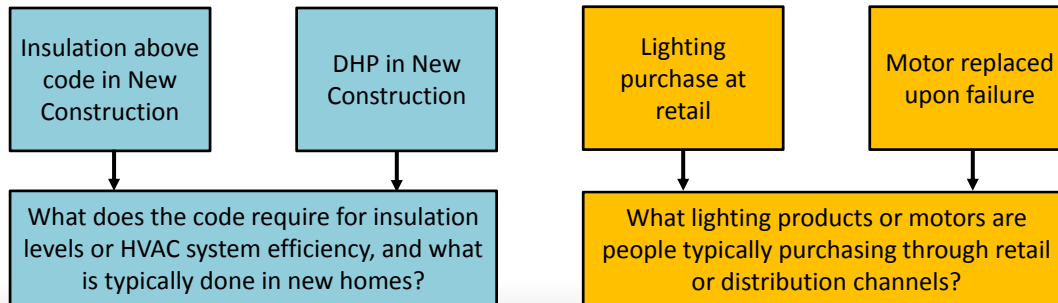
## Product Turnover in the Demand Forecast

- Demand forecast accounts for natural product turnover and addition of new units
- As products turnover, demand forecast assumes they turnover to today's market mix or the code/standard, whichever is more efficient
- This results in efficiency improvements in the frozen efficiency demand forecast over time
- Example: Stock of 100 units, only 10 percent of which are efficient
  - Sales data shows that in today's purchases 40% of products purchased are efficient
  - Every year, as products turnover, they turn over at this frozen assumption of 40% efficient, 60% not-efficient based on today's sales




## Baseline: Current Practice


Represents the consumption of the average product in the market today, or the code or standard, whichever is more efficient.

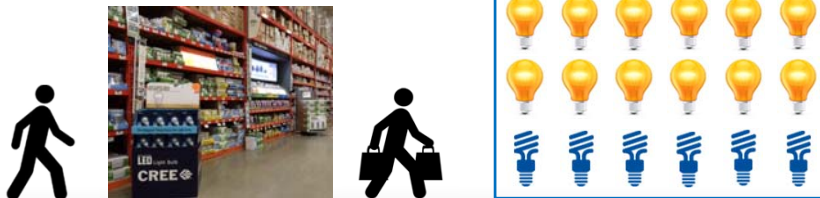


## Baseline: Current Practice

To estimate the average product in the market, we look at current sales today and take the average efficiency of those. For example with lighting, we look at the average efficiency of all lamps sold.

 Represents **inefficient** lighting  
Consumption = 60 kWh/yr

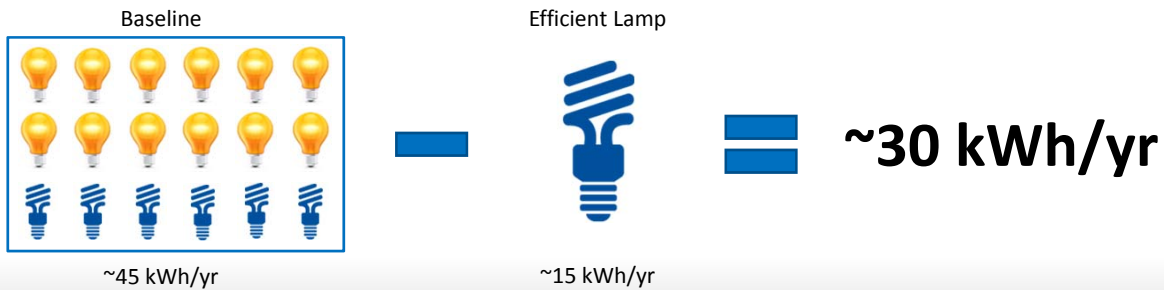
 Represents **efficient** lighting  
Consumption = 15 kWh/yr



Baseline consumption is:  
 $(60 \text{ kWh/yr} \times 67\%) +$   
 $(15 \text{ kWh/yr} \times 33\%)$   
 $= 45 \text{ kWh/yr}$

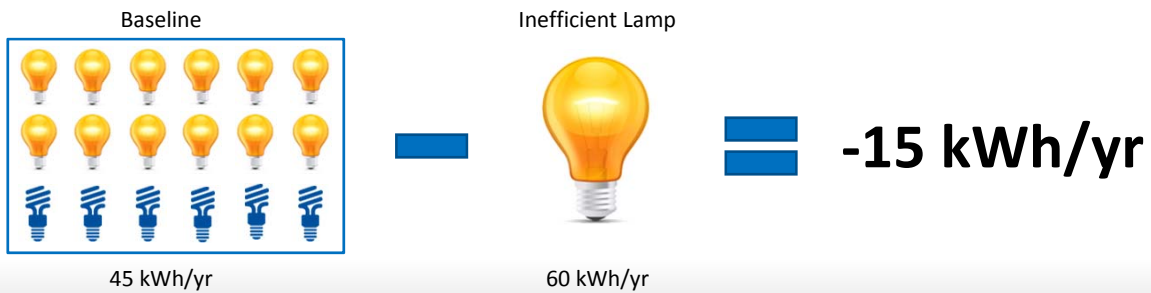
## Estimating Savings

Savings are estimated by taking the difference in consumption between the efficient technology and current practice baseline



## A Note About the Baseline and Savings

Since this baseline includes a mix of inefficient and efficient products, some products purchased are ***less efficient*** than the baseline; resulting in negative savings



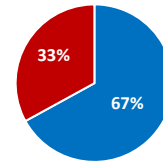


# Modeling Potential for Lighting Example

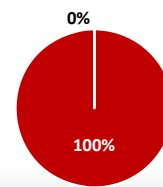
1. Start with assumption about the stock turnover; how many lamps per year burn out and get replaced
2. Estimate potential for each of those lamps to get replaced with an efficient LED
3. Apply ramp rate to determine which portion of the stock each year is assumed to have turned over to the efficient unit
4. By twenty years, assume that all\* lamps being replaced that year turnover to the efficient option

*\*The Council also adds an 85% achievability factor to this analysis.*

Current Practice Baseline



Assumed Turnover in Year 20



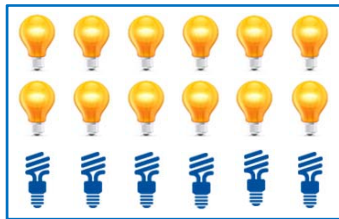
■ Inefficient ■ Efficient

Claiming Savings

## LOST OPPORTUNITY MEASURES

## Lost Opportunity: Total Regional Savings

Baseline: Current Practice



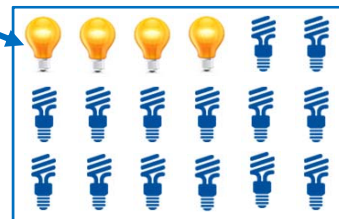
Energy Consumption of the Baseline:  
 $18 \text{ lamps} \times 45 \text{ kWh/yr/lamp} = 810 \text{ kWh/yr}$

## Lost Opportunity: Total Regional Savings

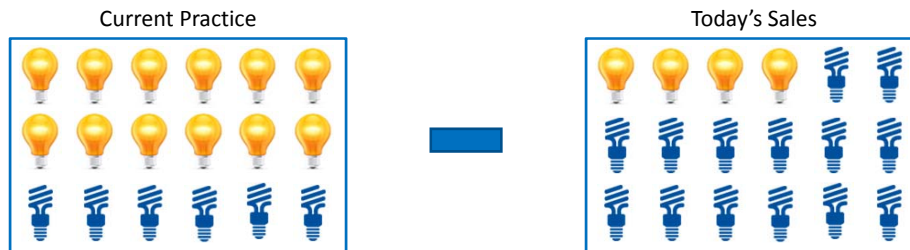
Today's data show that 78% of  
sales are the efficient lamp

Energy Consumption of the Today's Market:  
 $(4 \times 60 \text{ kWh/yr}) + (14 \times 15 \text{ kWh/yr})$   
 $= 450 \text{ kWh/yr}$

Savings: Today's Sales



## Lost Opportunity: Total Regional Savings



Consumption difference between baseline and today's market:  
 $810 \text{ kWh/yr} - 450 \text{ kWh/yr} = 360 \text{ kWh/yr}$

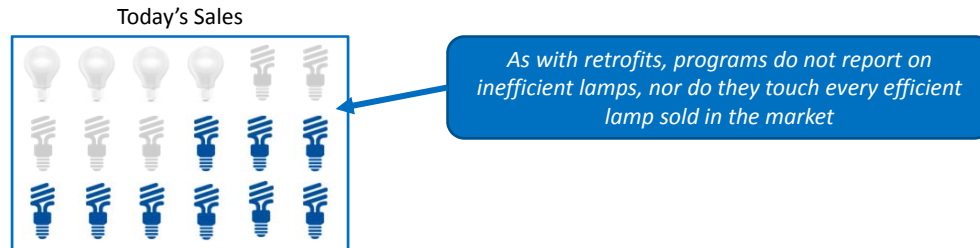
## Lost Opportunity: Program Savings



Programs claim savings for the units they directly incentivize in some way; for example buying down lamps at retail or sending out energy saver kits.

In their claims, they use the unit energy savings (~30 kWh/yr) and multiply that by number of units incentivized.

## Lost Opportunity: Program Savings



## Lost Opportunity: Program Savings



In this example, 7 lamps were purchased and claimed by programs.

Therefore Program savings are:  
 $9 \text{ lamps} \times 30 \text{ kWh/yr/lamp savings}$   
 $= 270 \text{ kWh/yr}$

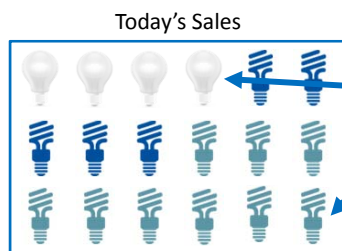
## Lost Opportunity: NEEA Alliance Savings



NEEA tracks and reports savings for efficient units that they track in their market data that:

- Are not already claimed by programs; and
- For which they have an estimate of savings and/or an initiative

## Lost Opportunity: NEEA Alliance Savings



*Again, inefficient lamps are not included in this reporting, and programs already claimed savings for 9 lamps that they incentivized*

## Lost Opportunity: NEEA Alliance Savings



NEEA reports savings for these 5 efficient lamps that were purchased, but not already claimed by programs.

Therefore, NEEA reports Alliance Savings as:  
 $5 \text{ lamps} \times 30 \text{ kWh/yr/lamp savings}$   
 $= 150 \text{ kWh/yr}$

*This number might be catching your eye.  
 If so, hold that thought... more in a few slides.*

## Lost Opportunity: Momentum Savings

Momentum Savings represent additional savings not previously claimed. Therefore, it is the **remainder** between the Total Regional Savings and other claims. For lost opportunity measures, this is sometimes called other market savings.

Reminder, in this example:

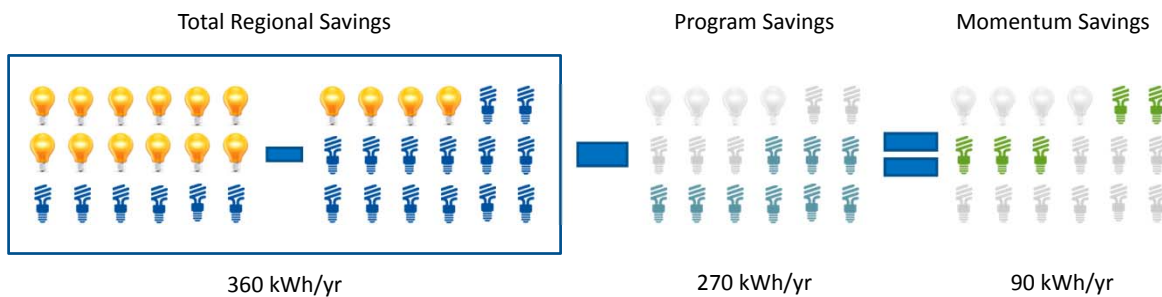
**Total Regional Savings = 360 kWh/yr**

This can be calculated two ways:

1. Momentum Savings = Total Regional Savings – Program Savings
2. Momentum Savings = Total Regional Savings – (Program Savings + Alliance Savings)

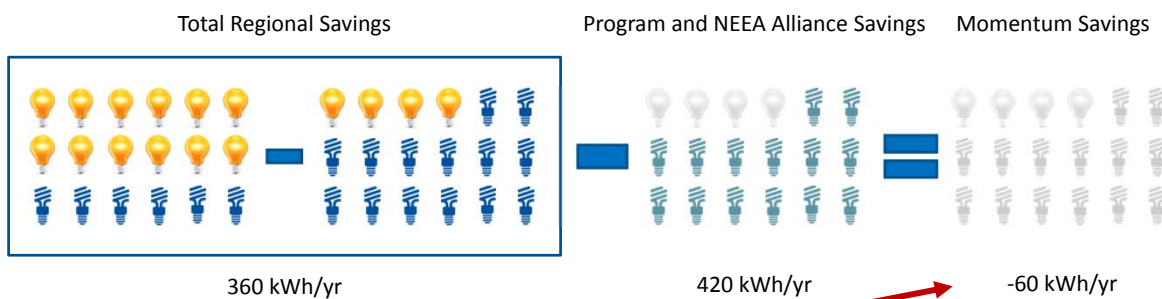
# Lost Opportunity: Momentum Savings

## Option 1: Removing only Program Savings



# Lost Opportunity: Momentum Savings

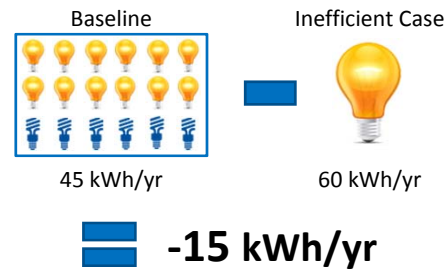
## Option 2: Removing Program and NEEA Alliance Savings



*Wait... WHAT?? Negative momentum savings?*

## Why Does this Happen?

- The Power Plan accounts for all products (efficient and inefficient) in the region
- The Plan's goal represents **Total Regional Savings**
- For lost opportunity measures, some portion of total regional savings includes products less efficient than the baseline (until there is 100% market transformation)
  - This is not the case for retrofit measures
- Program Savings and Alliance Savings **only count efficient units**, which overstate relative to the goal



## Overstatement of Savings Relative to the Total Market Change

Unit savings is correct when there is full market change :



This result is also true when there is no efficiency in the baseline, like with retrofit measures

	Total Regional	Programs/ Alliance	Momentum Savings
Total	540 kWh	540 kWh	0 kWh
Per unit	30 kWh	30 kWh	n/a

Extreme case: program claimed savings can occur despite no market change:



Sales continue to show 67% of lamps sold are inefficient, consistent with the consumption in the baseline

	Total Regional	Program/ Alliance	Momentum Savings
Total	0 kWh	180 kWh	-180 kWh
Per unit	0 kWh	30 kWh	n/a



## Overstatement of Savings Relative to the Total Market Change

The reality is in between of the extremes, and Momentum Savings is more or less depending on what programs and NEEA report for savings.

Example 1: Programs and NEEA Alliance Savings account for all efficient lamps



	Total Regional	Program/ Alliance	Momentum Savings
Total	360 kWh	420 kWh	-60 kWh
Per unit	25.7 kWh	30 kWh	n/a

Example 2: Programs and NEEA Alliance Savings account for a small portion of lamps



	Total Regional	Program/ Alliance	Momentum Savings
Total	360 kWh	120 kWh	240 kWh
Per unit	25.7 kWh	30 kWh	n/a

## Summary (1)

- Results from 2017 RCP will be reported to the Council at the August meeting and updating results from 2016
  - Continue to strive for better data, which brings increased complexity
- Where possible, we will report Total Regional Savings
  - These savings best represent the Council's goal
  - For 2017, this includes residential lighting and a handful of other residential markets
  - Allocating Total Regional Savings is never 100% accurate (we will not attempt to do so)
  - We can only calculate Momentum Savings for markets where we have total regional savings; and these savings may be negative
- For other markets, we will report Program, NEEA Alliance, and Codes/Standards savings
  - For all measures, savings reported may include different assumptions than the Power Plan
  - For lost opportunity measures, stacking these savings is likely to overstate savings relative to the goal

## Summary (2)

- For lost opportunity measures, per unit estimates overstate savings relative to the goal
  - RTF, RTF PAC, and the Council staff have discussed and continue to agree with this approach
  - Programs and NEEA are doing good work, and we want to reflect their accomplishments
  - Historical load trends demonstrate reductions in load that are greater than reported savings alone
  - Approach creates incentive for full market research, providing important insight to programs
  - Alternative approaches would either:
    - Not reflect reality by overstating savings potential relative to the demand forecast
    - Result in resource intensive net-to-gross analysis and potential litigation
- Staff wants to release a white paper for comment in August describing these concepts