

# Impact Evaluation of Select Residential Measures

November 2, 2017



NAVIGANT





# Shout out!

Big thanks to the utilities and SMEs who have provided:

- Utility Data— we know it's hard work to gather it!
- Review — whether on the programs, methodology, or initial findings, you've done a lot of work to get us here!

# Agenda

## Overarching Drivers and Context

- Why evaluation?
- Residential impact evaluation background

## Part 1: Insulation and Window Measures

- Approach & findings from 2016 data collection
- Summary & next steps

## On Deck

Forthcoming results from:

- Remaining 2016-2017 billing analysis of Residential DHP and Prescriptive DS
- Document review of PTCS QA Data

## Part 2: PTCS Measures

- Context of 2013 data collection and previous analyses
- Steps taken to validate methodology
- Findings from methodology applied to PTCS HP Conversion and Performance DS



# Why Evaluation

# What do we all want?



Energy efficiency programs that save customers money and energy.

To be trustworthy stewards of their money.

# Evaluation

What did we achieve?

How do we improve?



# Impact Evaluation

Savings reliability with  
independent  
verification



Program improvement  
opportunities

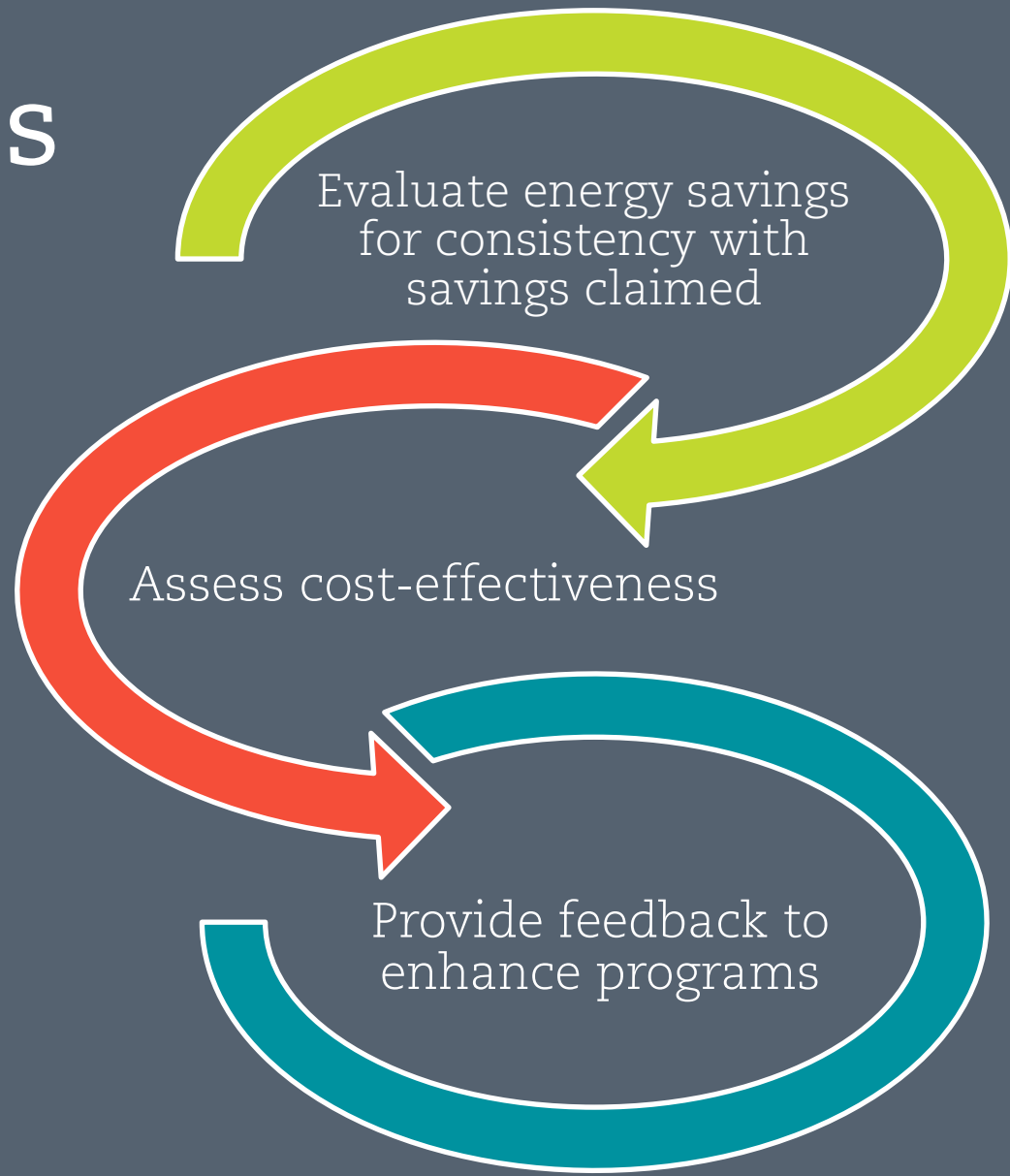




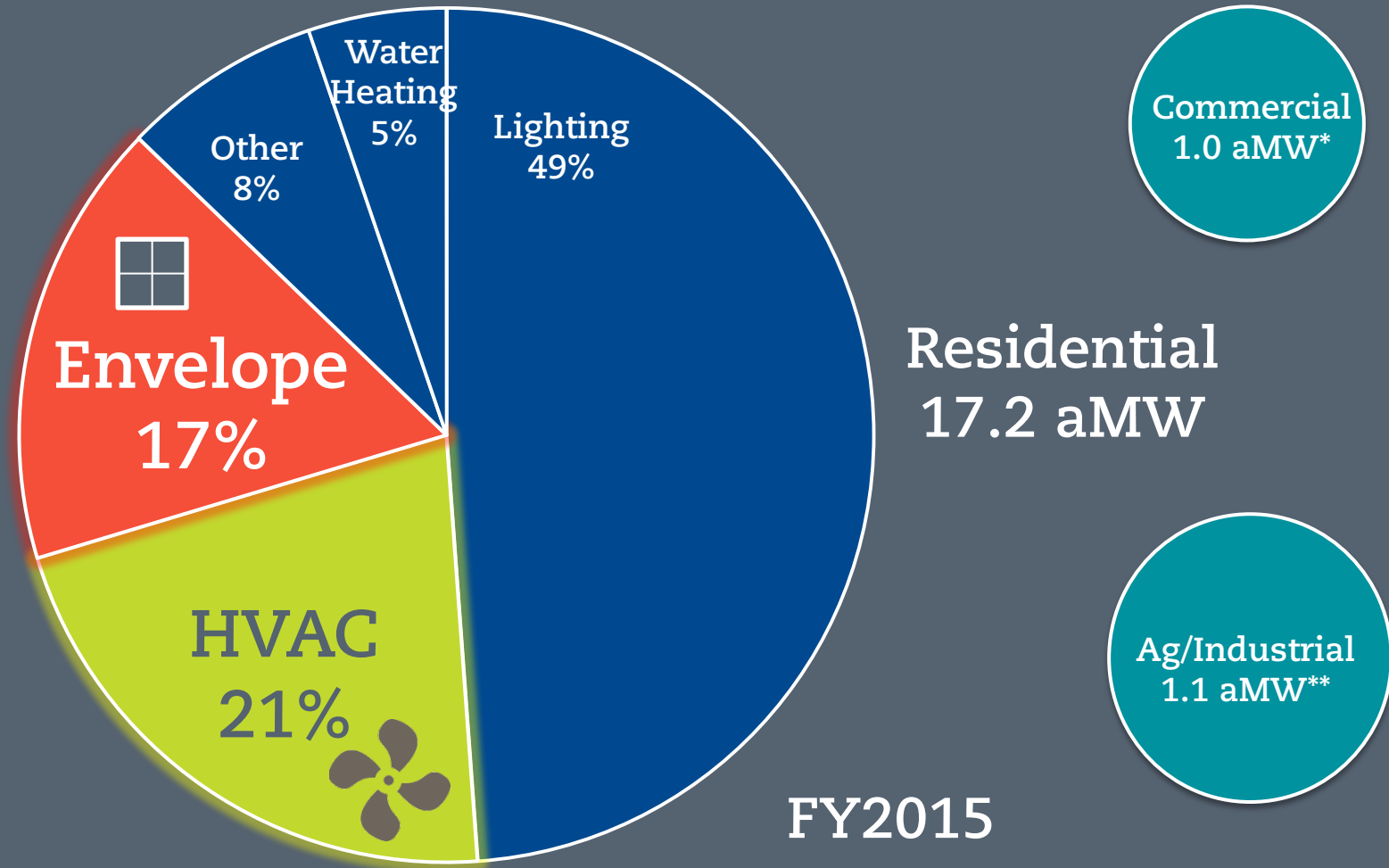
# Residential Impact Evaluation Background



# Objectives



# Large Contributors to UES



Source: Summarized from BPA's IS2.0 database, accessed 3/18/2016

\* Savings from Energy Smart Grocers deemed measures are not included in this summary.

\*\* Ag/Industrial value does not include savings achieved through the Scientific Irrigation Scheduling measure.

# How Did We Get Here?

## 2013— Billing Analysis Lessons Learned

Lessons learned from stalled analysis of PTCS measures launched development of a robust methodology for future billing analysis.

## Early 2015 — Measure Selection

Navigant and BPA systematically identify measures to include in a new billing analysis in 2016 evaluation plan.

## Late 2015 — Methods Development

Navigant and BPA develop an approach through collaboration with stakeholders and pilot approach using 2013 PTCS dataset.

## 2016 — Impact Evaluation (Phase I)

Request billing data & perform billing analysis for residential windows and insulation measures (FY14/15 data). Analyze Heat Pump conversions and performance DS using PTCS dataset (FY09-11 data).

## 2017-2018 — Impact Eval (Phase II)

Perform billing analysis on Prescriptive Duct Sealing, Ductless Heat Pump eFAF & DHP Zonal measures using FY14/15 data, opt-in data, installation forms and participant surveys.

# Residential HVAC & Weatherization: 2016-2017 Impact Evaluation Scope & Status

| Measure                          | Data Source(s)  | Status         |
|----------------------------------|---|----------------|
| <b>Insulation</b>                | FY14/15 Billing Data  | Reporting*     |
| <b>Windows</b>                   | FY14/15 Billing Data  |                |
| <b>Prescriptive Duct Sealing</b> | FY14/15 Billing Data, Opt-In Data (FY14/15/16)  | Analyzing Data |
| <b>Ductless Heat Pump Zonal</b>  | FY14/15 Billing Data, Opt-In Data (FY14/15/16), Installation forms                      |                |
| <b>Ductless Heat Pump eFAF</b>   | FY14/15 Billing Data, Opt-In Data (FY14/15/16), Installation forms, participant surveys |                |

\* The evaluation team will also report the billing analysis results for select PTCS measures in Part 2 of this presentation (i.e. Heat Pump Conversions & Performance Duct Sealing) which use FY09-11 billing data.

# What happens after evaluation?

## Savings

- RTF reviews measures on fixed, intermittent intervals
- During review, RTF combines findings from regional research and updates UES as needed for heat zones, home types, etc.
- BPA adopts most recent UES before each program year\*

*\* As a result of the RTF process, any possible updates would come into effect in 2020 at the earliest.*

## Optional Future Research

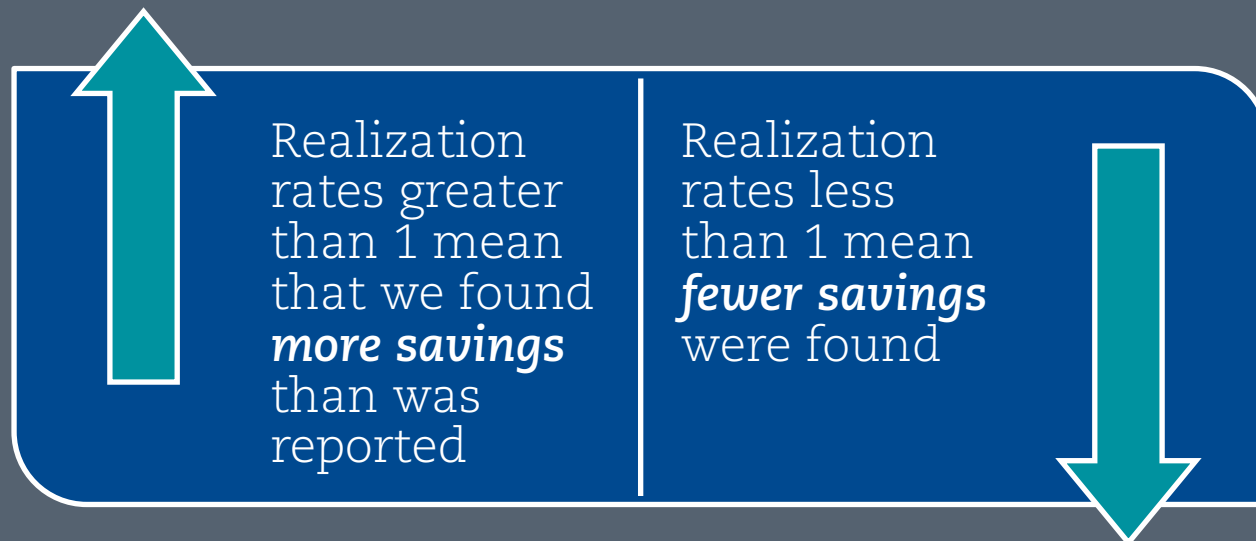
- Process & customer research to hear from our participants
- Identify new, promising measures to pilot
- Identify other existing measures to evaluate

# Realization Rate

Evaluated  
Savings

Reported  
Savings

= Realization  
Rate





# Part 1: Residential Weatherization Evaluation Approach & Findings

# Part 1: Evaluation Activities by Measure Group

|               | Billing Analysis Activities |                    |
|---------------|-----------------------------|--------------------|
| Measure Group | Base Model                  | Exploratory Models |
| Insulation    | ✓                           | ✓                  |
| Windows       | ✓                           | ✓                  |

Data vintage: 2014-2015 (collected in 2016)

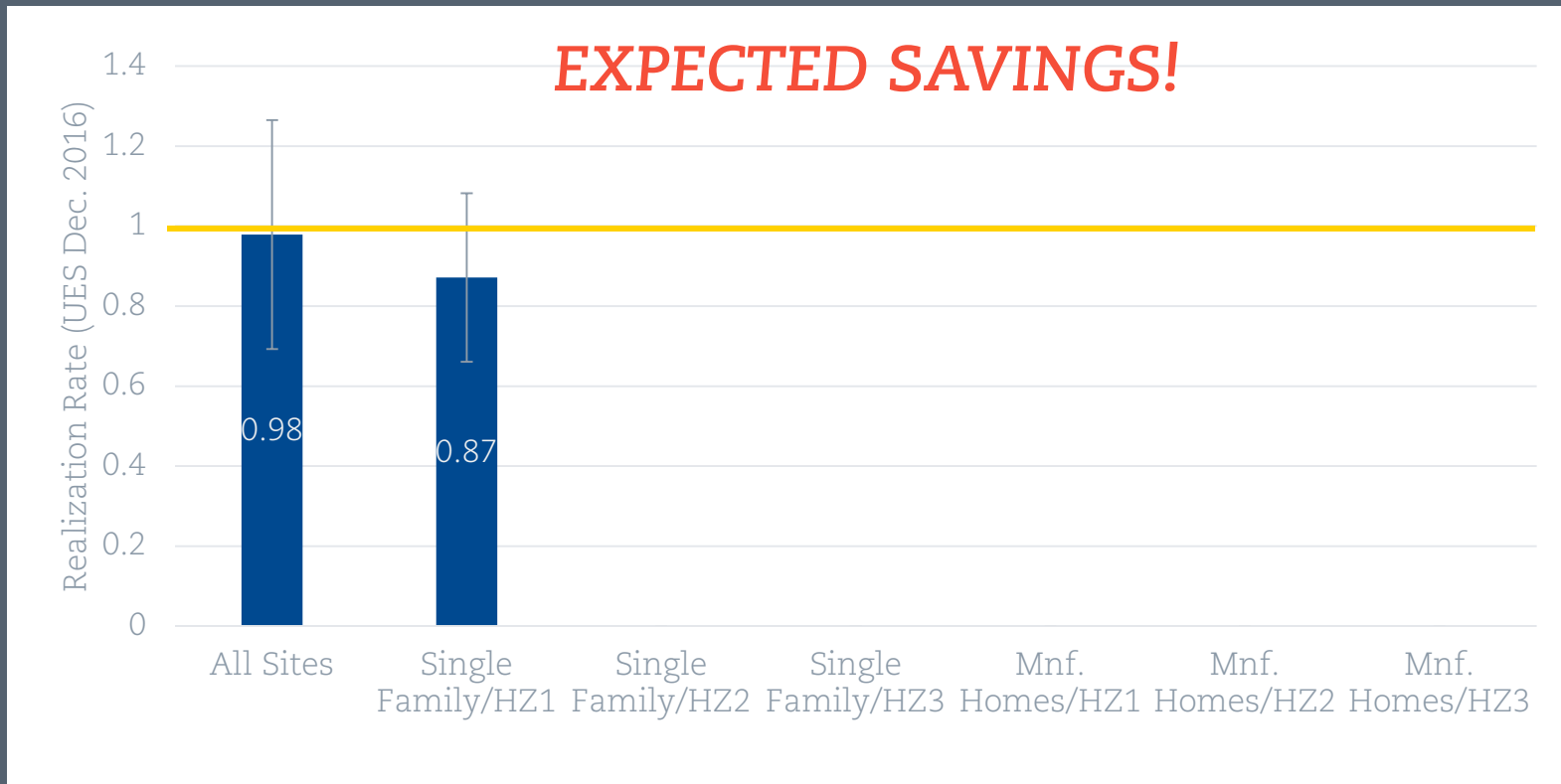


# Representativeness

| Count of Sites Included in Final Results |           |            |         |
|--|-----------|------------|---------|
| Home Type                                | Heat Zone | Insulation | Windows |
| Single Family                            | 1         | 909        | 970     |
|  | 2         | 176        | 328     |
|  | 3         | 4          | -       |
| Manufactured Homes                       | 1         | 37         | 61      |
|  | 2         | 20         | 19      |
|  | 3         | -          | -       |

| 15 Sampled Utilities  |
|---|
| Lower Valley Energy, Inc.                                       |
| Central Electric Cooperative, Inc.                              |
| Public Utility District No. 1 of Cowlitz County                 |
| Inland Power & Light Company                                    |
| Clark Public Utilities  |
| Northern Wasco County People's Utility District                 |
| Blachly-Lane Electric Cooperative                               |
| Public Utility District No. 1 of Grays Harbor County Washington |
| City of Cheney  |
| Midstate Electric Cooperative, Inc.                             |
| Tacoma Power  |
| Public Utility District No. 1 Of Snohomish County               |
| Eugene Water & Electric Board                                   |
| Lincoln Electric Cooperative, Inc.                              |
| Public Utility District No. 1 of Lewis County                   |

# The What – Insulation

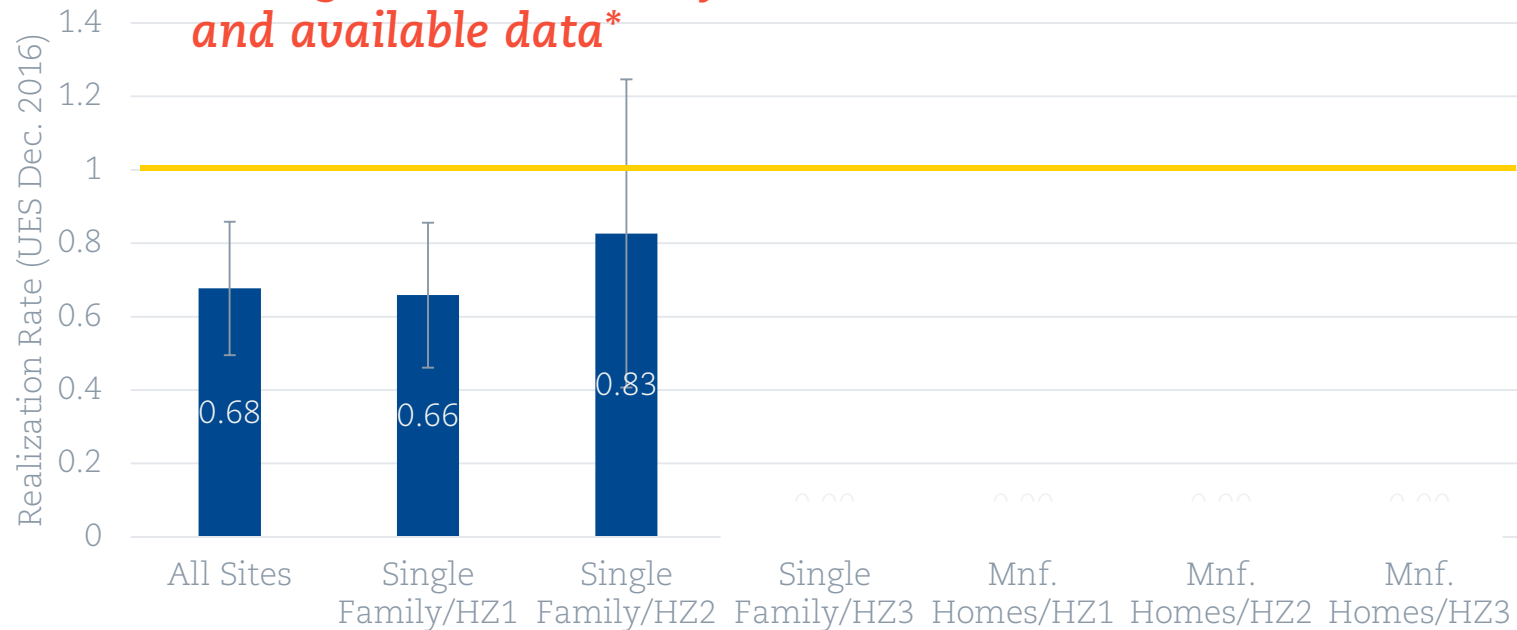


Data vintage: 2014-2015 (collected in 2016)

|                 |           | Single Family |     |     | Manufactured Homes |     |     |
|-----------------|-----------|---------------|-----|-----|--------------------|-----|-----|
| Category        | All Sites | HZ1           | HZ2 | HZ3 | HZ1                | HZ2 | HZ3 |
| Number of Sites | 1,146     | 909           | 176 | 4   | 37                 | 20  | 0   |

# The What & Why – Windows

**Savings are lower than expected and Savings are consistently low across characteristics and available data\***



Data vintage: 2014-2015 (collected in 2016)

| Category        | All Sites | Single Family |     |     | Manufactured Homes |     |     |
|-----------------|-----------|---------------|-----|-----|--------------------|-----|-----|
|                 |           | HZ1           | HZ2 | HZ3 | HZ1                | HZ2 | HZ3 |
| Number of Sites | 1,378     | 970           | 328 | 0   | 61                 | 19  | 0   |

\* Savings were consistently low when differentiating by baseline panes and efficient U-value as well as by home type and heat zone.



# Part 1: Residential Weatherization Summary and Next Steps

# What happens next for these Measures?



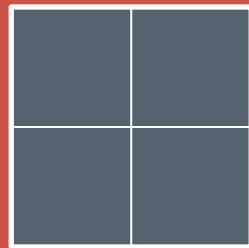
**RTF  
updates  
to UES  
Values**

**Candidate  
for Process  
& Customer  
Research**

# What happens next for these Measures?

Insulation

RTF  
updates  
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Windows

Candidate  
for Process  
& Customer  
Research



# Part 1: BPA Take on Residential Weatherization

# Part 1: BPA Evaluation take on Residential Weatherization

These measures will be stable in the Implementation Manual until FY 2020

Planning & Programs will work together, looking more closely at the data to identify potential areas of program improvement

BPA will work with utilities in the region to find the most fruitful areas for process & customer research





# Interlude





# Part 2: PTCS Analysis

## Evaluation Approach & Findings

# Part 2: Evaluation Activities by Measure Group

| Measure Group            | Doc. Review Approach* | Billing Analysis Activities |                   |
|--------------------------|-----------------------|-----------------------------|-------------------|
|                          |                       | Base Model                  | Exploratory Model |
| Performance Duct Sealing | ✓                     | ✓                           | ✓                 |
| Heat Pump Conversions    | ✓                     | ✓                           | ✓                 |

Data vintage: 2009-2011 (collected in 2013)

\*The evaluation team is conducting separate on-going document review leveraging PTCS QA inspections for select PTCS measures. 27

# Part 2: Haven't we seen results from the PTCS data before?

Yes!

- We collected FY2009-2011 billing data for PTCS measures in 2013
- In 2015-2016, we used these data to validate a robust methodology

Why now?

- We're reporting our results using our validated methodology on this dataset

Important to keep in mind

- The RTF has worked with the data extensively over the past few years
- The findings are in line with what we expected, based on previous analyses

# Representativeness

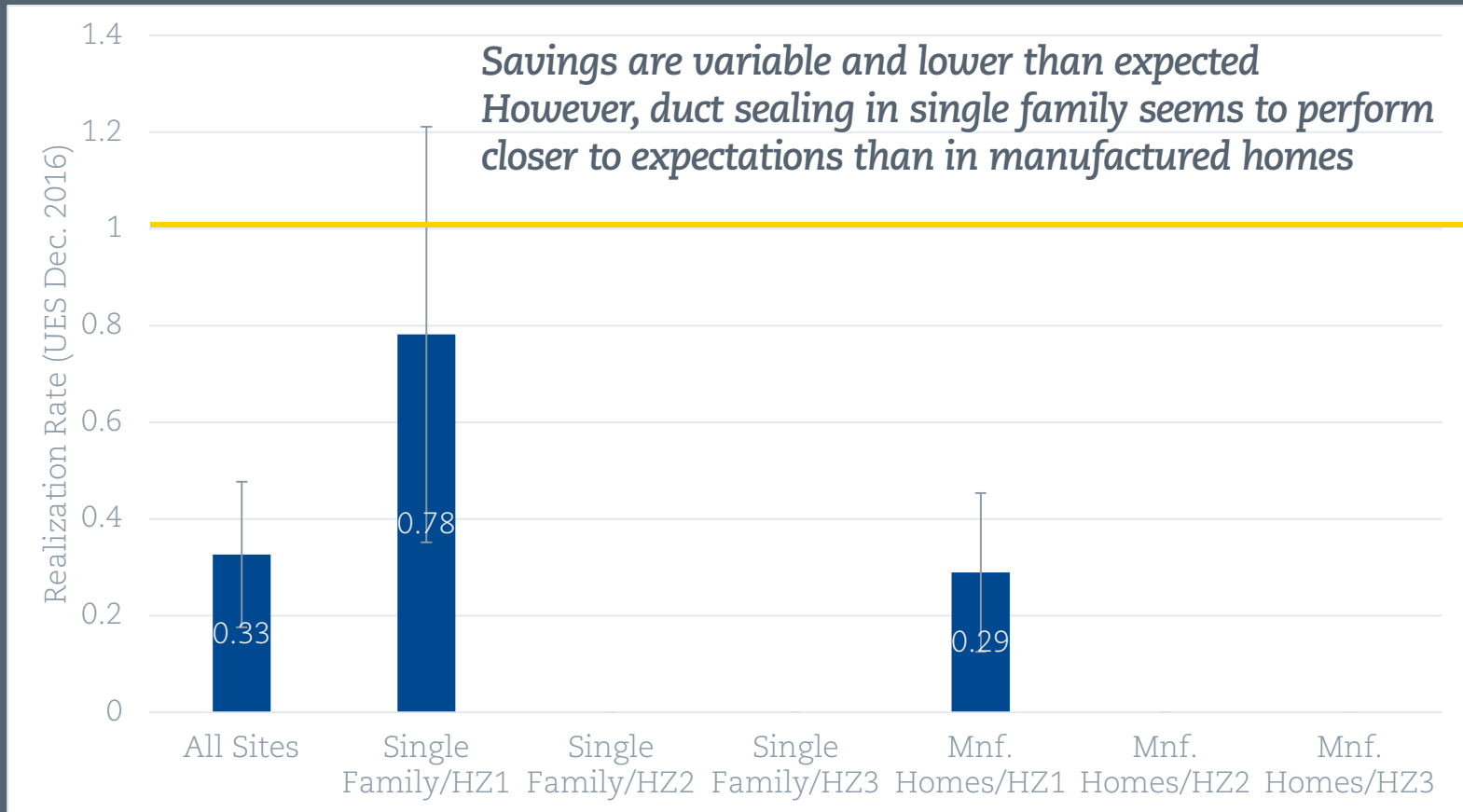
## Count of Sites Included in Final Results

| Home Type         | Heat Zone | ASHP Conversions | ASHP Conversions w/<br>Duct Sealing | Performance Duct Sealing |
|-------------------|-----------|------------------|-------------------------------------|--------------------------|
| Single Family     | 1         | 292              | 502                                 | 899                      |
|                   | 2         | 107              | 135                                 | 123                      |
|                   | 3         | -                | -                                   | 4                        |
| Manufactured Home | 1         | 9                | 160                                 | 3,375                    |
|                   | 2         | 6                | 32                                  | 1,524                    |
|                   | 3         | -                | -                                   | 262                      |

# Representativeness

| 42 Sampled Utilities         |                           |                              |
|------------------------------|---------------------------|------------------------------|
| Ashland                      | Flathead Electric Coop    | Monmouth                     |
| Benton Co. PUD #1            | Franklin Co. PUD #1       | Nespelem Valley Electric     |
| Benton REA                   | Grant Co. PUD #2          | Northern Lights              |
| Big Bend Electric            | Grays Harbor Co. PUD #1   | Northern Wasco PUD           |
| Central Electric Coop., Inc. | Inland Power & Light      | Peninsula Power & Light Inc. |
| Central Lincoln PUD          | Klickitat Co. PUD #1      | Port Angeles                 |
| Clallam Co. PUD #1           | Kootenai Electric Coop    | Ravalli Electric Coop        |
| Clark Co. PUD #1             | Lane Electric Coop., Inc. | Richland                     |
| Clearwater Power Co.         | Lincoln Electric Coop     | Skamania Co. PUD #1          |
| Columbia River PUD           | Mason Co. PUD #1          | Springfield                  |
| Consumer's Power, Inc.       | Mason Co. PUD #3          | Tacoma Power                 |
| Cowlitz Co. PUD #1           | McMinnville               | Tillamook PUD                |
| Douglas Electric Coop., Inc. | Midstate Electric Coop    |                              |
| Emerald PUD                  | Mission Valley Power      |                              |
| Eugene (EWEB)                | Missoula Electric Coop    |                              |

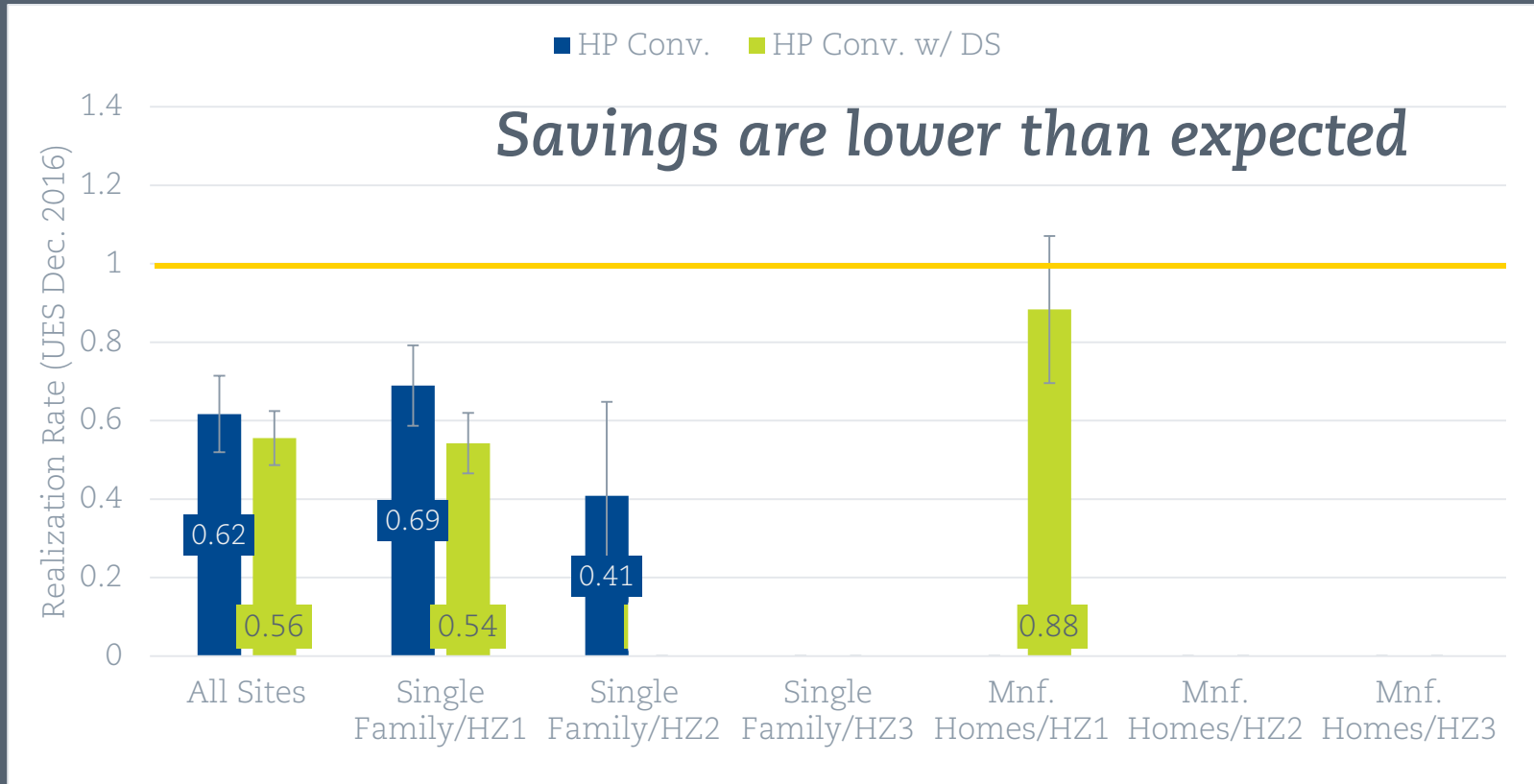
# The What & Why – Performance Duct Sealing



Data vintage: 2009-2011 (collected in 2013)

|                 |           | Single Family |     |     | Manufactured Homes |       |     |
|-----------------|-----------|---------------|-----|-----|--------------------|-------|-----|
| Category        | All Sites | HZ1           | HZ2 | HZ3 | HZ1                | HZ2   | HZ3 |
| Number of Sites | 6,187     | 899           | 123 | 4   | 3,375              | 1,524 | 262 |

# The What – ASHP Conversion



Data vintage: 2009-2011 (collected in 2013)

| Measure                  | All Sites | Single Family |     |     | Manufactured Homes |     |     |
|--------------------------|-----------|---------------|-----|-----|--------------------|-----|-----|
|                          |           | HZ1           | HZ2 | HZ3 | HZ1                | HZ2 | HZ3 |
| HP Conv.                 | 414       | 292           | 107 | 0   | 9                  | 6   | 0   |
| HP Conv. w/ Duct Sealing | 829       | 502           | 135 | 0   | 160                | 32  | 0   |



# The Why - ASHP Conversion

Participant heating use was lower than expected\*  
 Participants experience the expected % savings

Navigant savings (2009-2011 data, collected in 2013):

| Heating Zone | Insulation Type | Heating & Cooling Load (kWh/year) | Evaluated Savings (kWh/year) | Percent Savings |
|--------------|-----------------|-----------------------------------|------------------------------|-----------------|
| All          | All             | 9,967                             | 3,705                        | 37%             |

RTF savings:

| Heating Zone & Home Type | Insulation Type | Heating Load (kWh/year) | Savings (kWh/year) | Percent Savings |
|--------------------------|-----------------|-------------------------|--------------------|-----------------|
| HZ1, Single Family       | Good            | 9,383                   | 3,711              | 40%             |
|                          | Fair            | 13,358                  | 6,327              | 47%             |
|                          | Poor            | 19,063                  | 8,943              | 47%             |
| HZ2, Single Family       | Good            | 11,871                  | 3,605              | 30%             |
|                          | Fair            | 16,427                  | 6,098              | 37%             |
|                          | Poor            | 23,739                  | 8,591              | 36%             |

\* BPA typically assumes ASHP conversion customers have “fair” insulation, but participant heating aligns better with RTF-defined “good” insulation homes.

# Forthcoming Residential Impact Evaluation Results

Results on  
Additional  
HVAC Billing  
Analysis  
(*Spring 2018*)

- *Ductless Heat Pumps (eFAF and Zonal)*
- *Prescriptive Duct Sealing*

Results of  
Document  
Review on PTCS  
Measures  
(*Spring 2018*)

- *Heat Pump Conversions & Upgrades*
- *Variable Speed, Air-Source, and Ground-Source Heat Pumps*
- *CC&S*
- *Prescriptive Duct Sealing*

# Next Steps



Draft Report – incl. cost-effectiveness results

Comment Period

Final Report

Program Response

# Thank you!

