



Easing the Squeeze in DSM Portfolio Planning: A Quantitative Analysis of Potential Impacts of Feedback/ Behavior-Based Programs

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Agenda

- *Initial Big Squeeze Analysis (2011)*
- *Big Squeeze II: Objectives & Methodology*
- *Feedback Program Types – Five Scenarios*
- *Uncertainty Analysis – Monte Carlo Simulation*
- *Probability Distributions of Required Inputs Parameters*
 - *Annual Household Electricity Savings*
 - *Participation Rate*
 - *Useful Life*
- *Potential Impacts on a Real DSM Portfolio Electricity Savings*

Initial Big Squeeze Analysis on Feedback Programs (2011)

Initial Big Squeeze Analysis (2011)

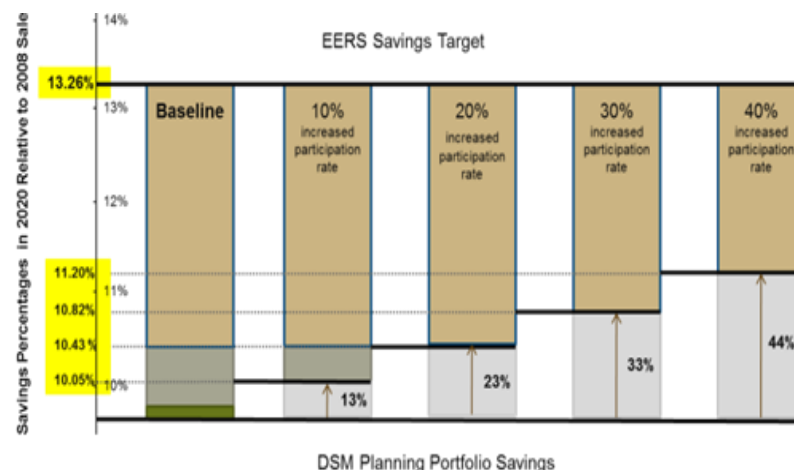


- Objective: To assess the “savings gap” between state-mandated saving targets, i.e. EERS, and current DSM portfolios, and examine options to fill it
- Methodology: Modeled a typical DSM portfolio against a typical EERS target
 1. ICF’s EEPM model used as the “engine”
 2. Built a generic DSM portfolio based on ICF client experience
 3. Used ACEEE data to calculate a typical EERS target
 4. Established a baseline scenario and “savings gap”
 5. Re-estimated the baseline and gap with federal lighting and appliance standards
 6. Developed several “gap-filler” scenarios

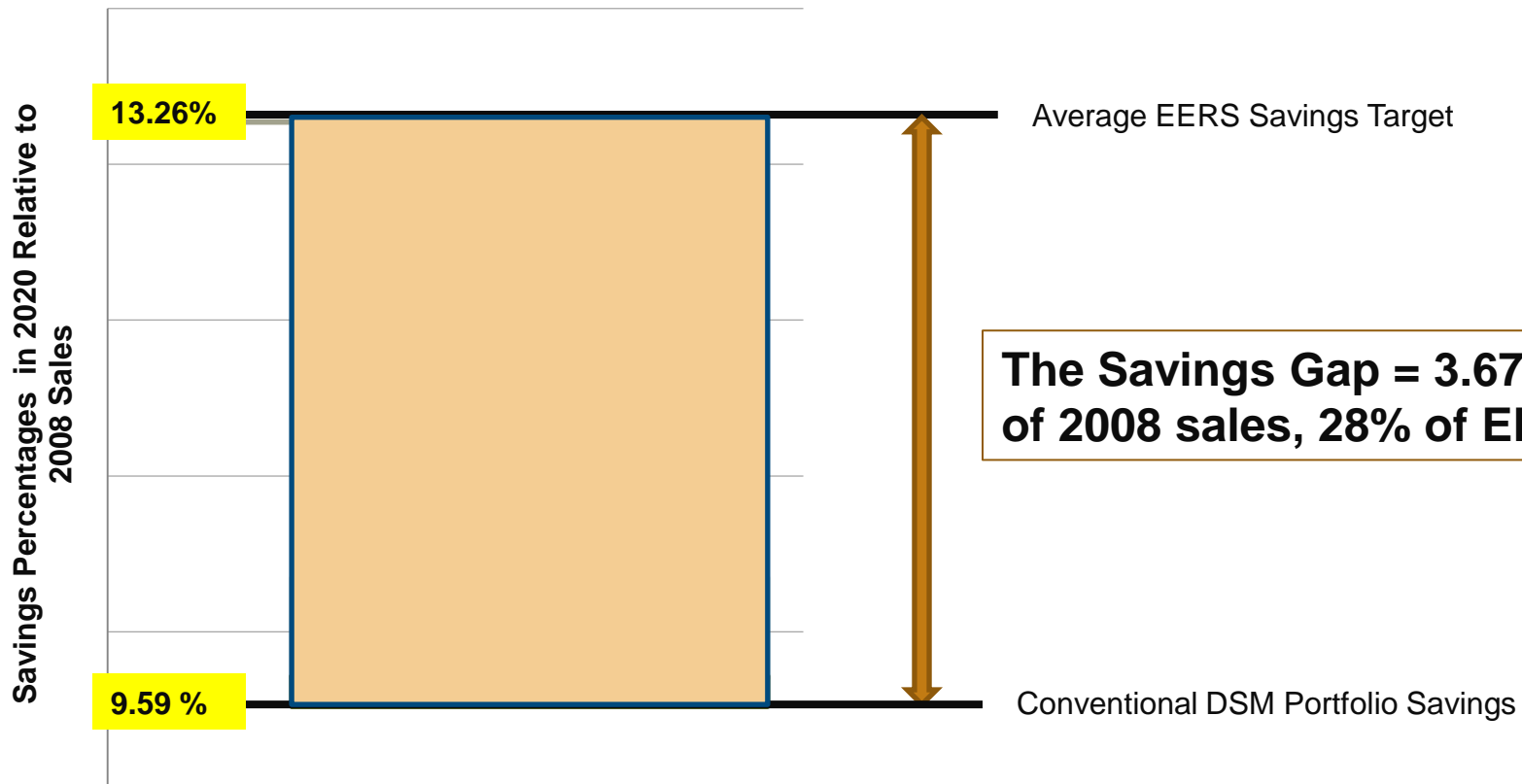


■ “Big Squeeze II”:

1. Used the same DSM portfolio as the baseline
2. Thorough review of existing literature and recent evaluation data
3. Used a more robust statistical technique – Monte Carlo simulation through @Risk software
4. Quantified how various feedback types can fill the savings gap estimated previously



The Savings Gap



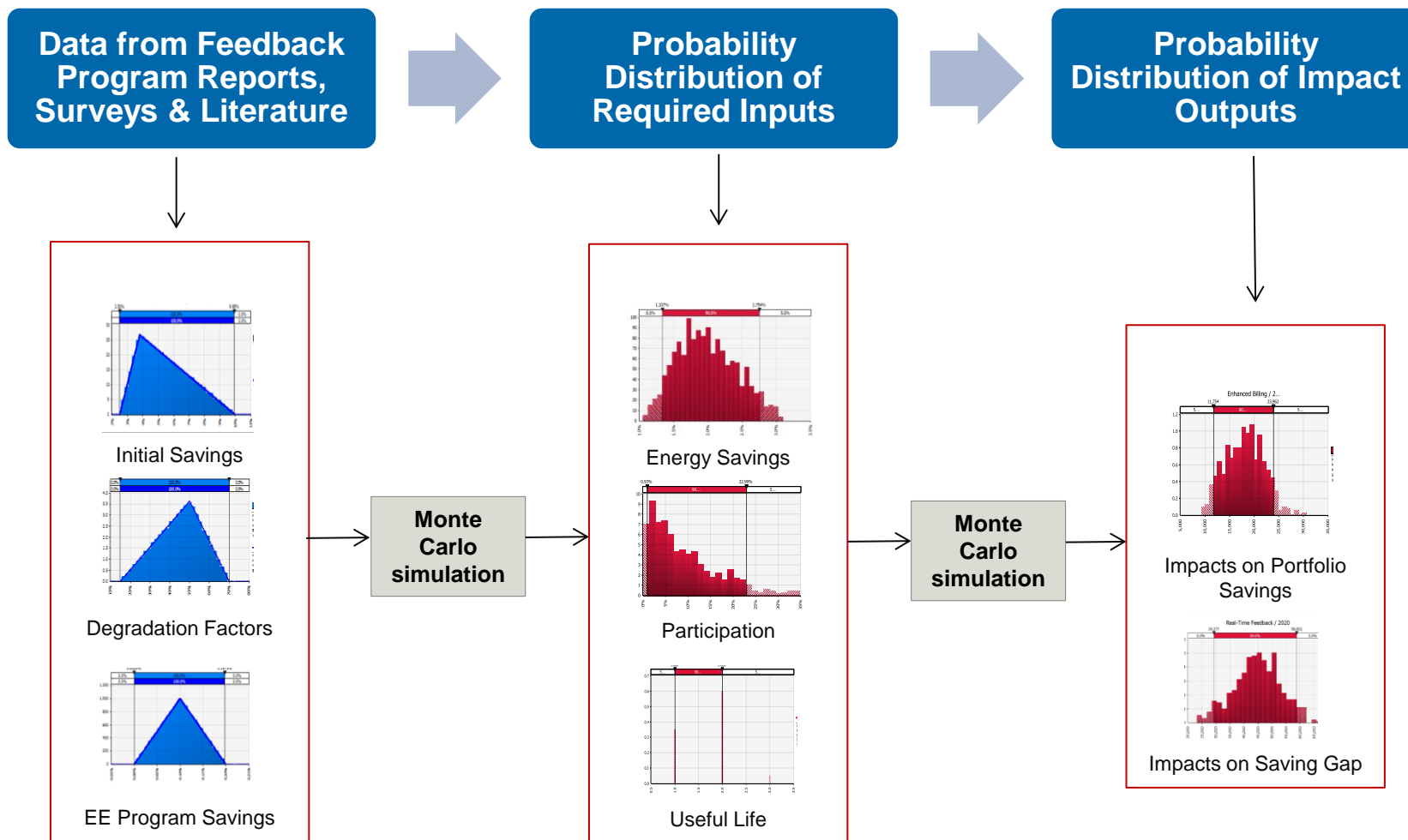
- ❑ By 2020, conventional DSM would likely fall 28% short of an average EERS target

“Big Squeeze II”: Overview & Objectives



- Feedback/behavior-based programs have been recognized as a mechanism to provide deeper energy savings and higher customer satisfaction.
- Significant uncertainty associated with their performance due to the limitations of robust ex post program evaluation data
- **Objectives:**
 1. Quantify the impacts of various feedback programs within a larger DSM portfolio while explicitly accounting for uncertainties associated with their performance.
 2. Assess how these emerging programs can fill the gap between the projected savings from typical DSM portfolios and state-mandated saving targets

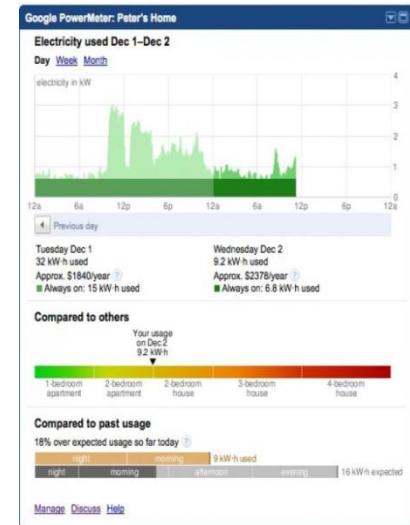
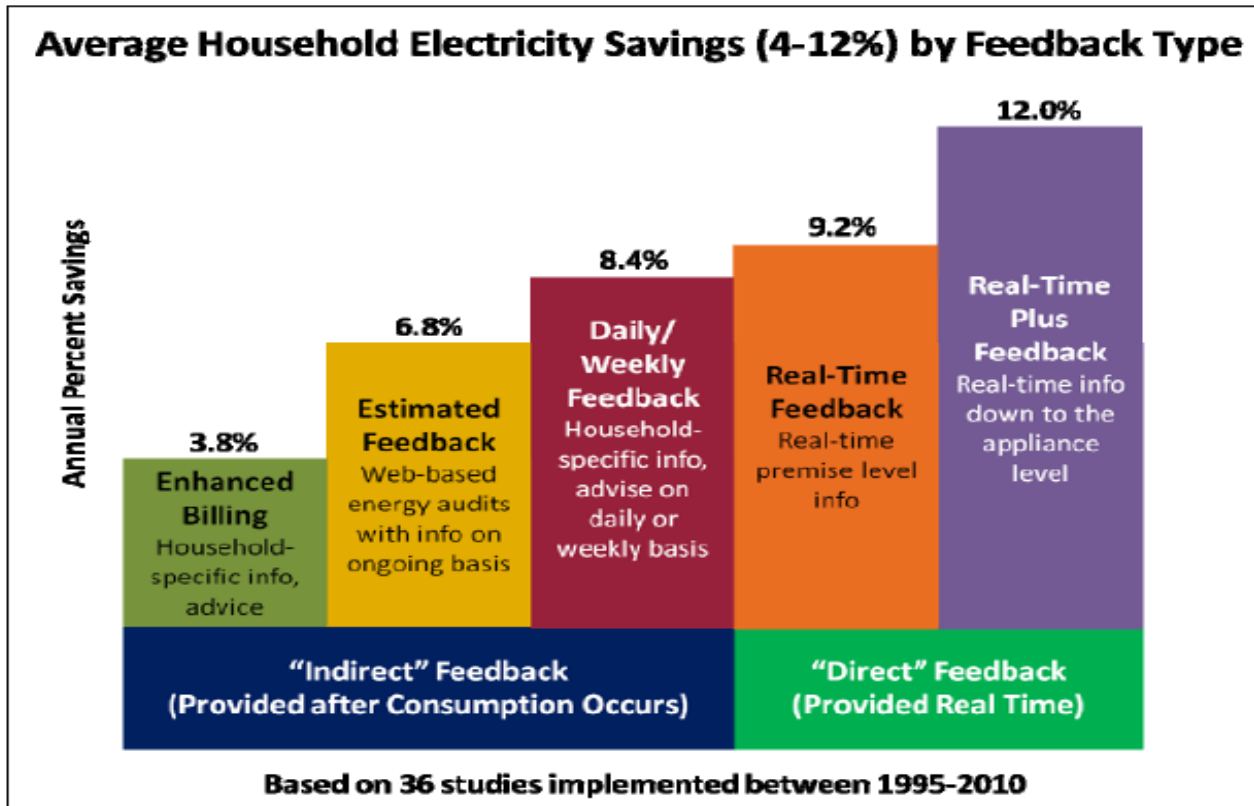
Uncertainty Analysis - Monte Carlo Simulation



Feedback Program Types – Five Scenarios



2010 ACEEE Study – A Meta-Review



Web-based Energy Audit Tool



In-Home Energy Display Device

Five Feedback Program Scenarios



| Scenario No. | Scenario Name | Feedback Type | Participation Plan | Description |
|--------------|-------------------------|---------------|--------------------|--|
| Scenario 1 | Enhanced Billing | Indirect | Opt-out | Household Specific Information and advice |
| Scenario 2 | Estimated Feedback | Indirect | Opt-in | Web-based energy audits without info on ongoing basis |
| Scenario 3 | Daily/Weekly Feedback | Indirect | Opt-in | Household specific info & advice on daily/weekly basis |
| Scenario 4 | Real-Time Feedback | Direct | Opt-in | Real time consumption & cost info at the aggregated level |
| Scenario 5 | Real-Time Plus Feedback | Direct | Opt-in | Real time consumption & cost info disaggregated at appliance level |

- **Opt-out Participation Plan**

Broad program reach, shallow savings
High continuing costs to maintain savings
e.g. mailers

- **Opt-in Participation Plan**

Narrow program reach, deep savings
Upfront cost to acquire, low continuing cost
e.g. give email address



Web-based Energy Audit Tool

Electricity Savings Associated with Various Feedback Programs



Total Electricity Saving Impact



- It is widely accepted that the behavior-based programs reduce energy use by

a) Direct Energy-Use Reduction (Change in Energy-Use Behaviors)



b) Increased Participation in Existing Residential Energy Efficiency Programs/Technologies (Energy Efficiency Investment Behaviors)

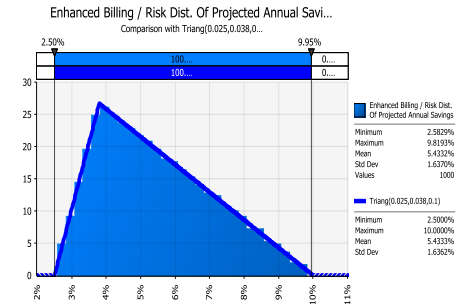


a) Direct Energy-Use Reduction – Initial Assumptions



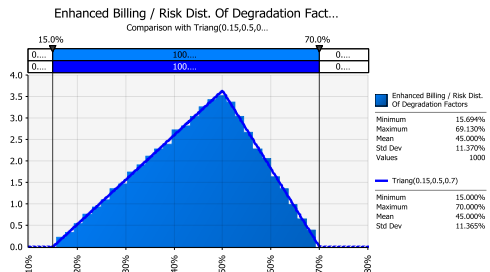
- Used saving ranges from the 2010 ACEEE study as the basis

| Household Electricity Saving Ranges from 2010 ACEEE Meta-Review of 36 Study | | | | |
|---|--------------------------|-------|---------|--------|
| No. | Name | Min | Average | Max |
| Scenario 1 | Enhanced Billing | 2.50% | 3.80% | 10.00% |
| Scenario 2 | Estimated Feedback | 5.00% | 6.80% | 8.50% |
| Scenario 3 | Daily/Weekly Feedback | 4.00% | 8.40% | 19.00% |
| Scenario 4 | Real-Time Feedback | 0.50% | 9.20% | 18.00% |
| Scenario 5 | Real-Time Pluse Feedback | 9.00% | 12.00% | 18.00% |



- Degraded the saving estimates by the following factors to match the assumptions with estimates from recent evaluation studies on existing feedback programs

| Degradation Factors | | | | |
|---------------------|-----------------------------------|-----|-------------|-----|
| No. | Name | Min | Most-Likely | Max |
| Scenario 1 | Enhanced Billing | 45% | 65% | 70% |
| Scenario 2 & 3 | Estimated & Daily/Weekly Feedback | 30% | 50% | 60% |
| Scenario 4 & 5 | Real Time Feedback | 20% | 40% | 60% |

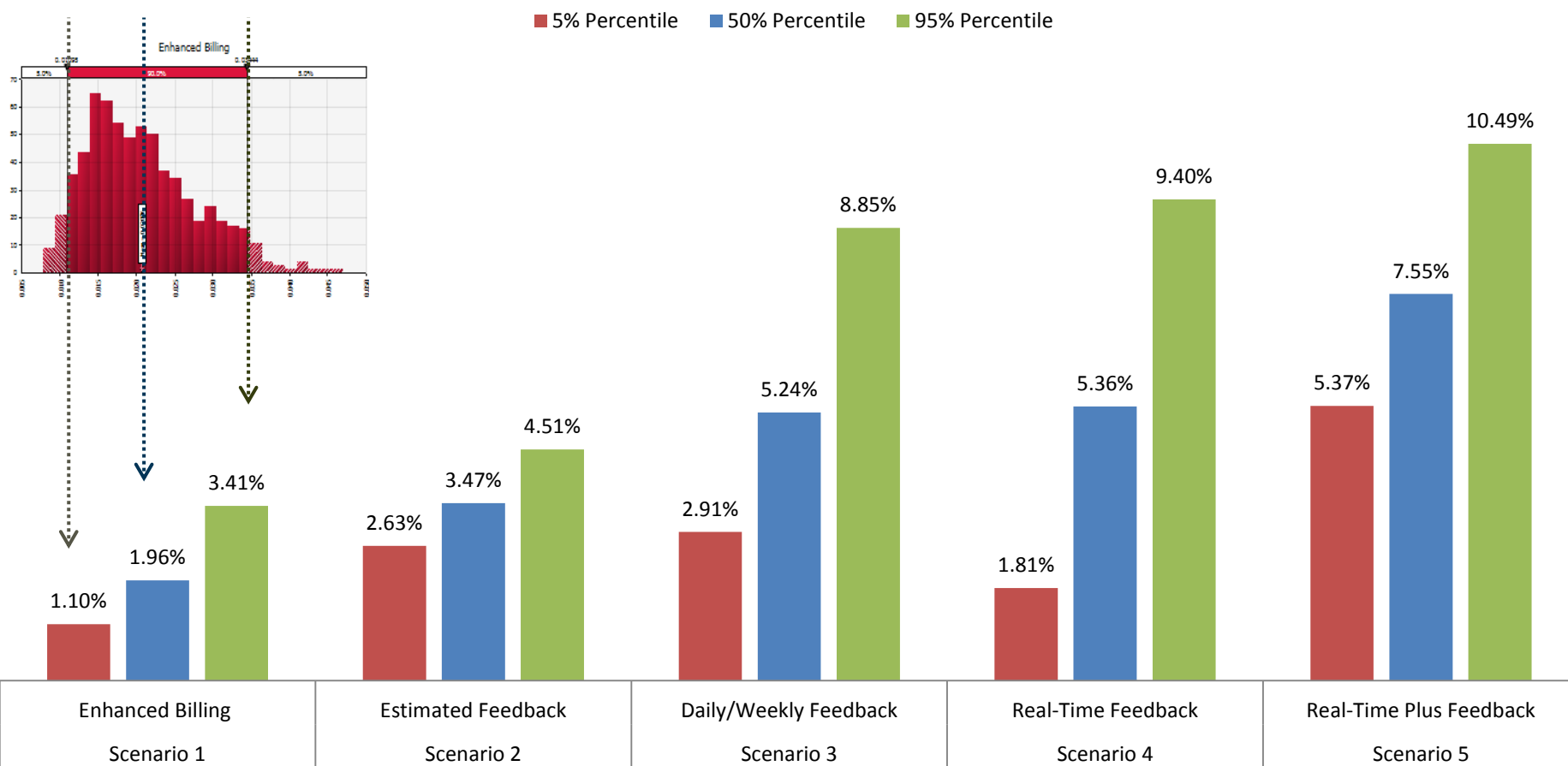


- Subtracted range of 0 – 2% to remove the potential savings resulting from increased participation in existing EE program

a) Direct Energy-Use Reduction Distributions



Household Electricity Saving Ranges for Various Feedback Program Types at 90% Confidence Level



b) Increased Participation in Existing EE Programs



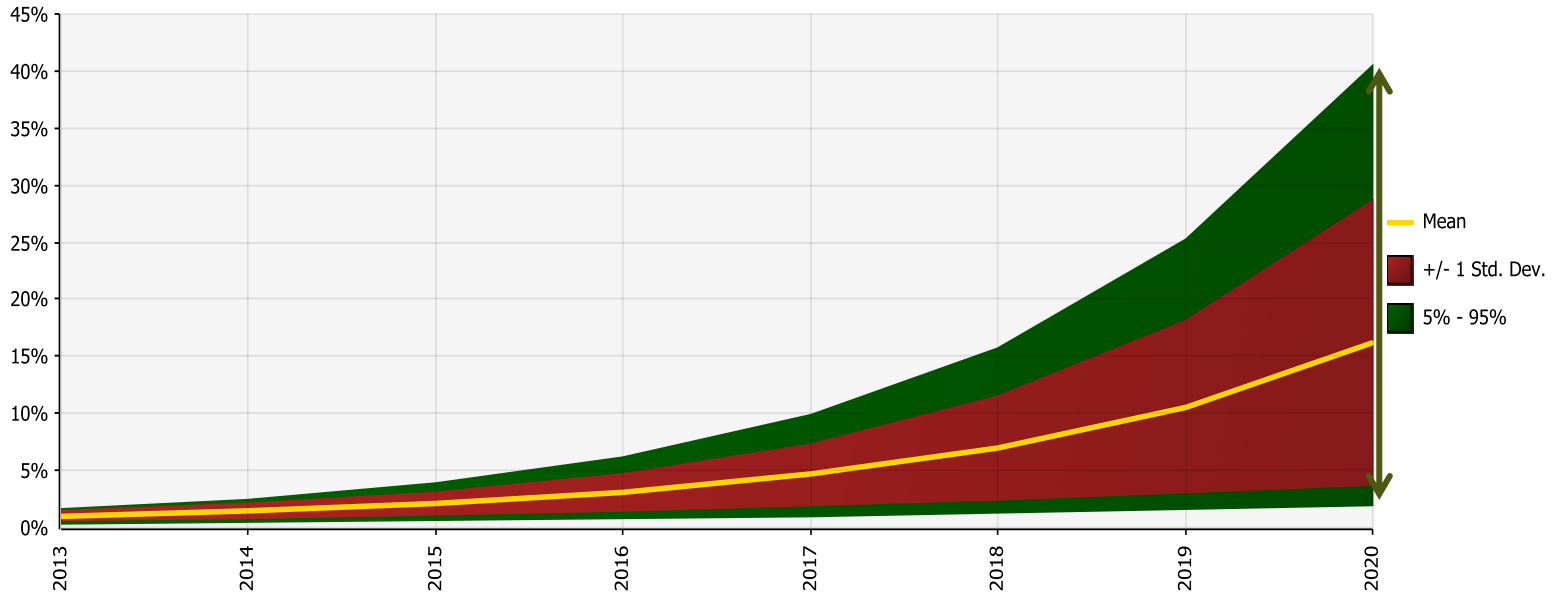
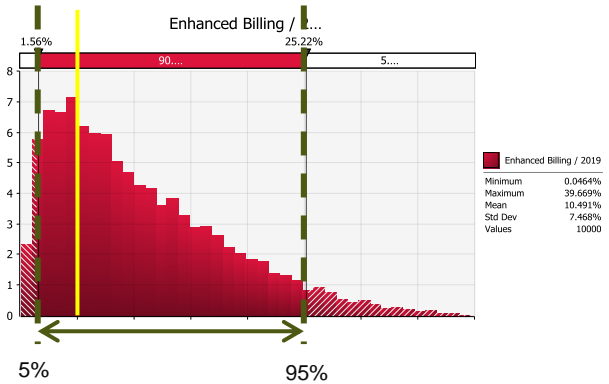
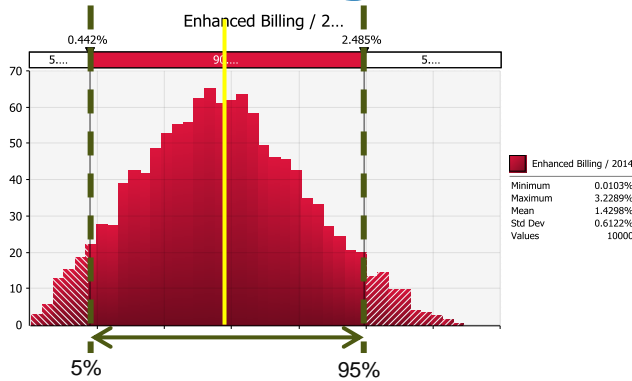
- 1) Assumptions for increased participation for Enhance Billing scenario in 2013 & the annual growth - based on the OCD study

| Enhanced Billing | Min | Most Likely | Max |
|---|-----|-------------|------|
| Increased Participation in Existing Residential EE Programs in 2013 | 0% | 1.0% | 2.0% |
| Annual Participation Growth Rate | 0% | 67% | 67% |

- 2) Data from a study by Karen Ehrhardt-Martinez, presented in 2012 ACEEE Summer Study, as well as average savings for each EE program type were used to estimate a weighted average for the impact of each feedback programs. By comparing the estimated weighted averages, we conclude that
- On average customers with online feedback are about 6% more likely to participate in EE programs
 - On average customers with real-time feedback are about 45% more likely to participate in EE programs

| Likelihood of Increased Participation in Existing EE Programs | | | |
|---|------|---------|------|
| No. | Min | Average | Max |
| Scenario 1 | 100% | 100% | 100% |
| Scenario 2 & 3 | 100% | 106% | 120% |
| Scenario 4 & 5 | 120% | 145% | 200% |

Increased Participation Input Distribution – Enhanced Billing

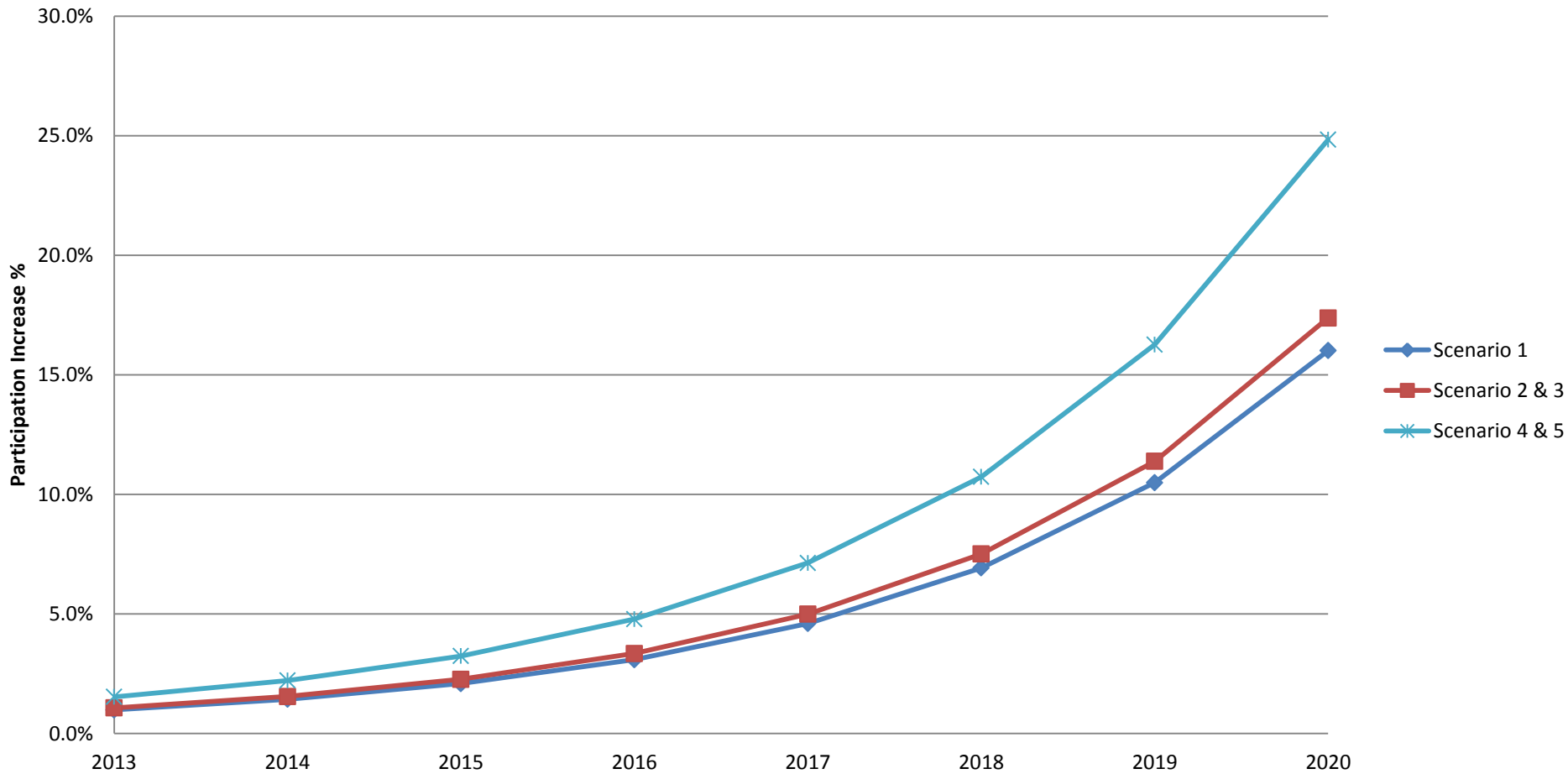


Enhanced Billing can be expected to increase EE program participation by a range of **2%-40%** with the mean of **16%** at the 90% confidence level

b) Increased Participation in Existing EE Programs



Increase in Annual Participation in Existing EE Programs (Mean)



Feedback Program Participation & Useful Life Input Distributions

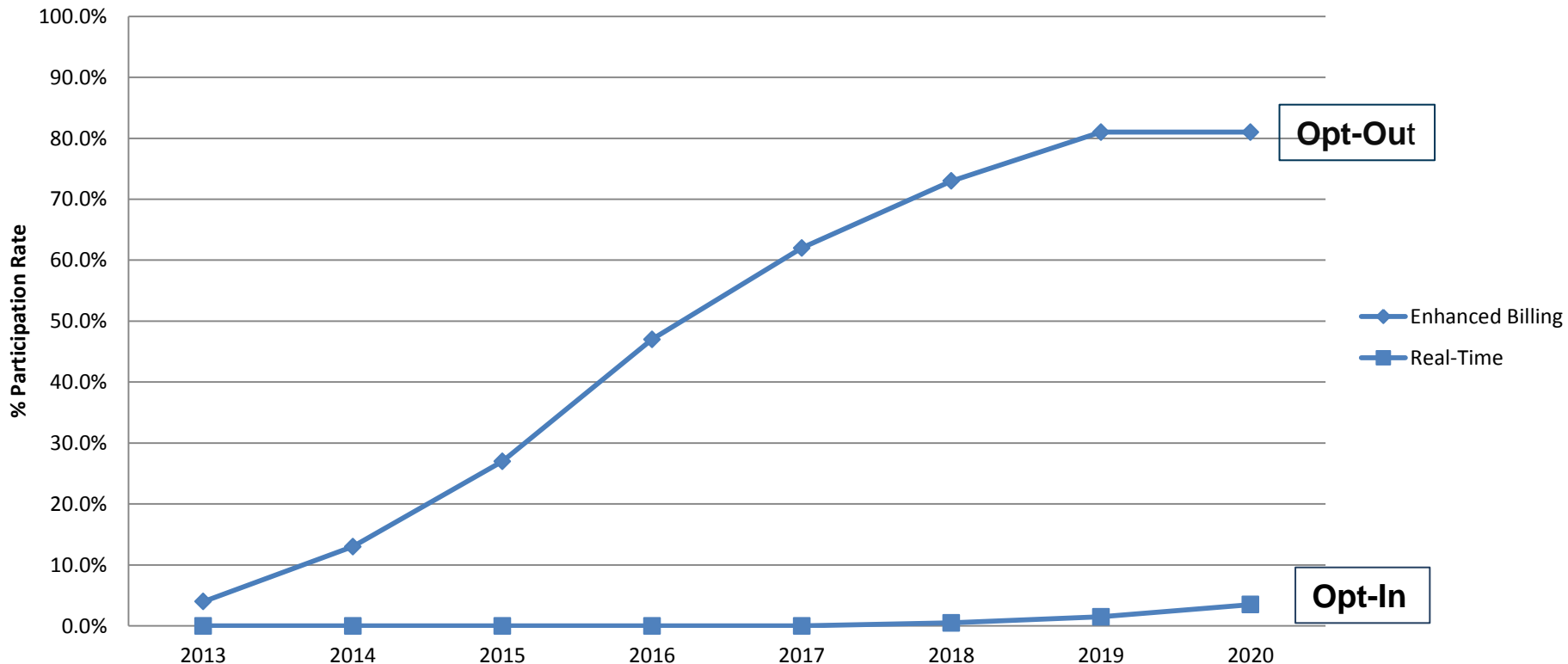


Program Participation Inputs – Scenario 1



- Participation in Enhanced Billing starts at **3%-5%** of household in **2013** and ramp up to **74%-87%** by **2019** & Real-Time Feedback starts at **0%-1%** in **2018** and ramp up to **2%-5%** by **2020**

Cumulative Participation Rate (Mean) - Scenario 1

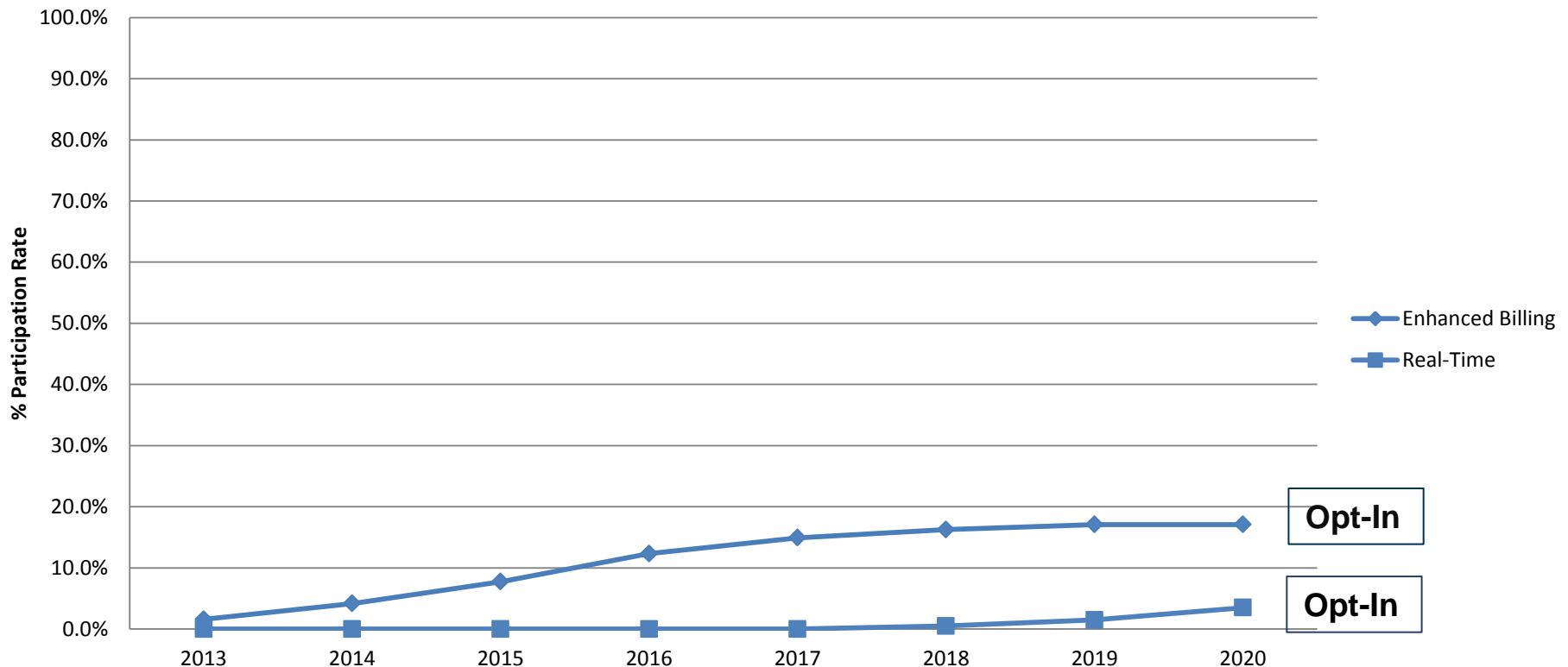


Program Participation Inputs – Scenario 2&3



- ❑ Participation in Estimated Feedback or Weekly/Daily Feedback starts at 1%-2% of household in 2013 and ramp up to 14%-20% by 2019 & Real-Time Feedback starts at 0%-1% in 2018 and ramp up to 2%-5% by 2020

Cumulative Participation Rate (Mean) - Scenario 2 & 3

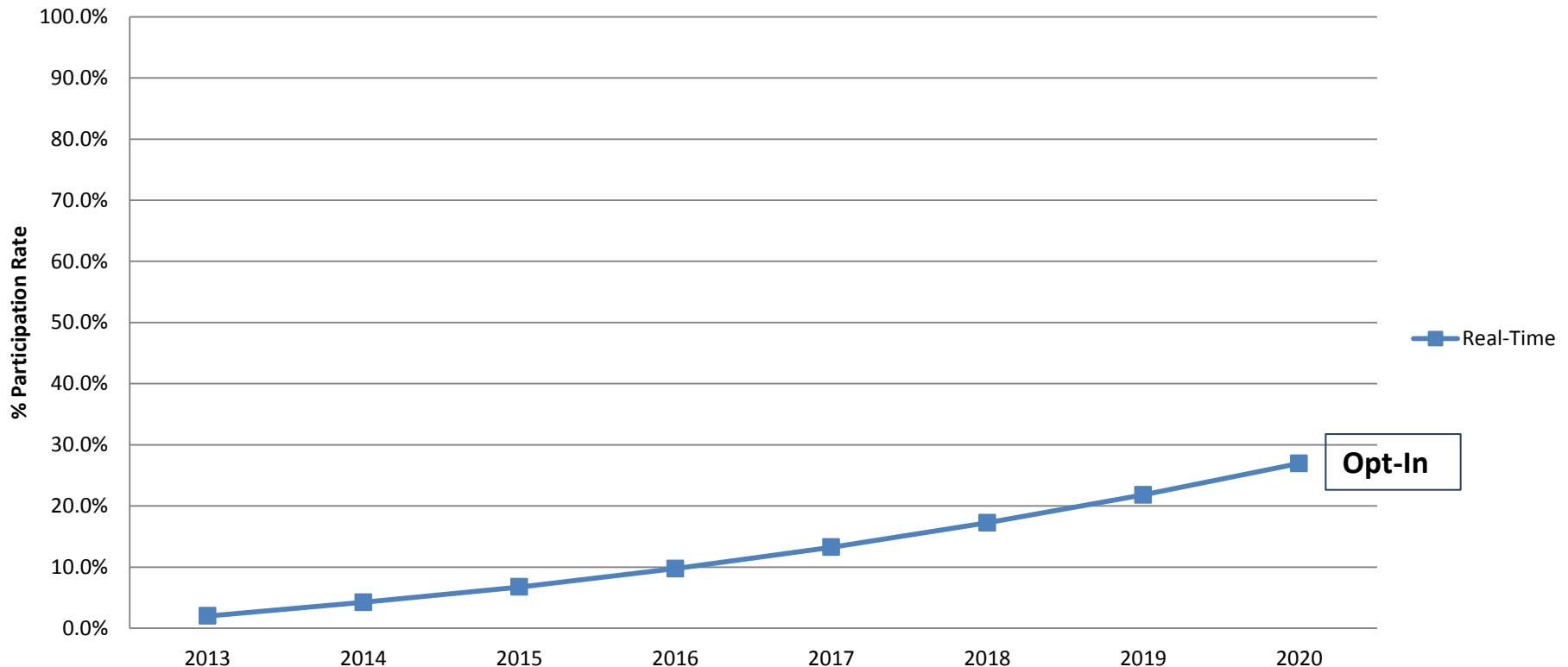


Program Participation Inputs – Scenario 4&5



- Participation in Real-Time Feedback starts at **1%-3%** in **2013** and gradually ramps up to **19%-34%** by **2020**

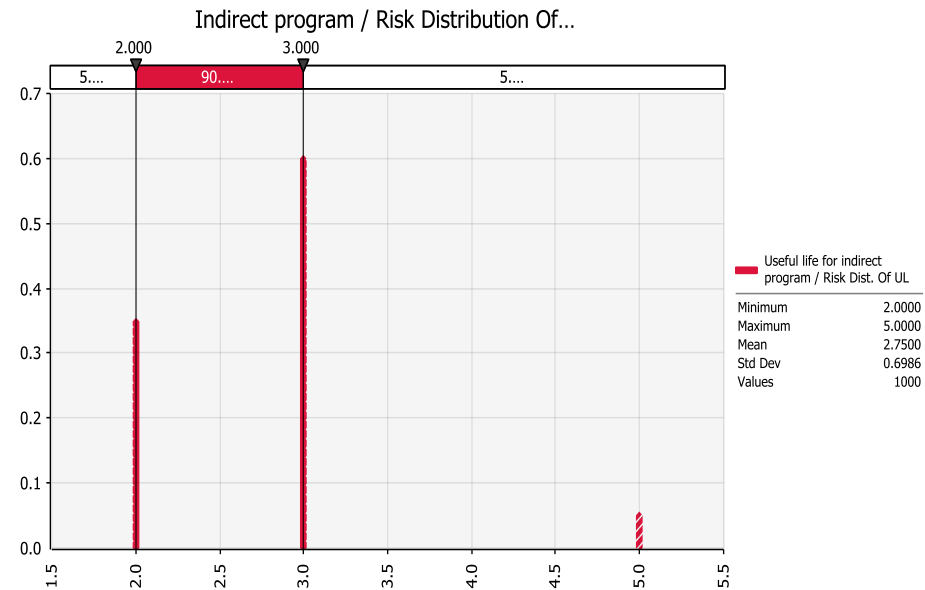
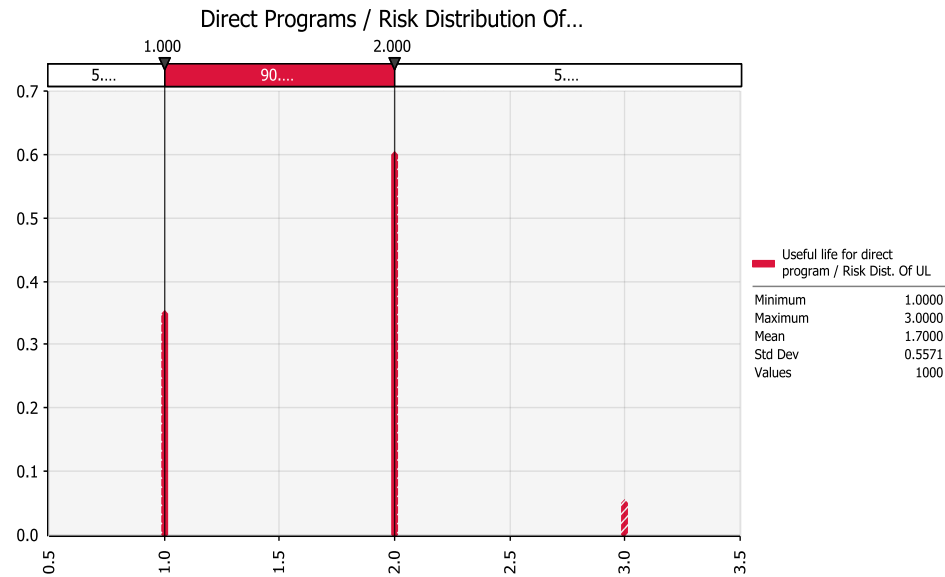
Cumulative Participation Rate (Mean) - Scenario 4 & 5



Useful Life Input Distributions



| Feedback Program Useful Life | Min | Most Likely | Max |
|------------------------------|-----|-------------|-----|
| Indirect Programs | 1 | 2 | 3 |
| Direct Programs | 2 | 3 | 5 |
| Probability of Occurrence | 35% | 60% | 5% |



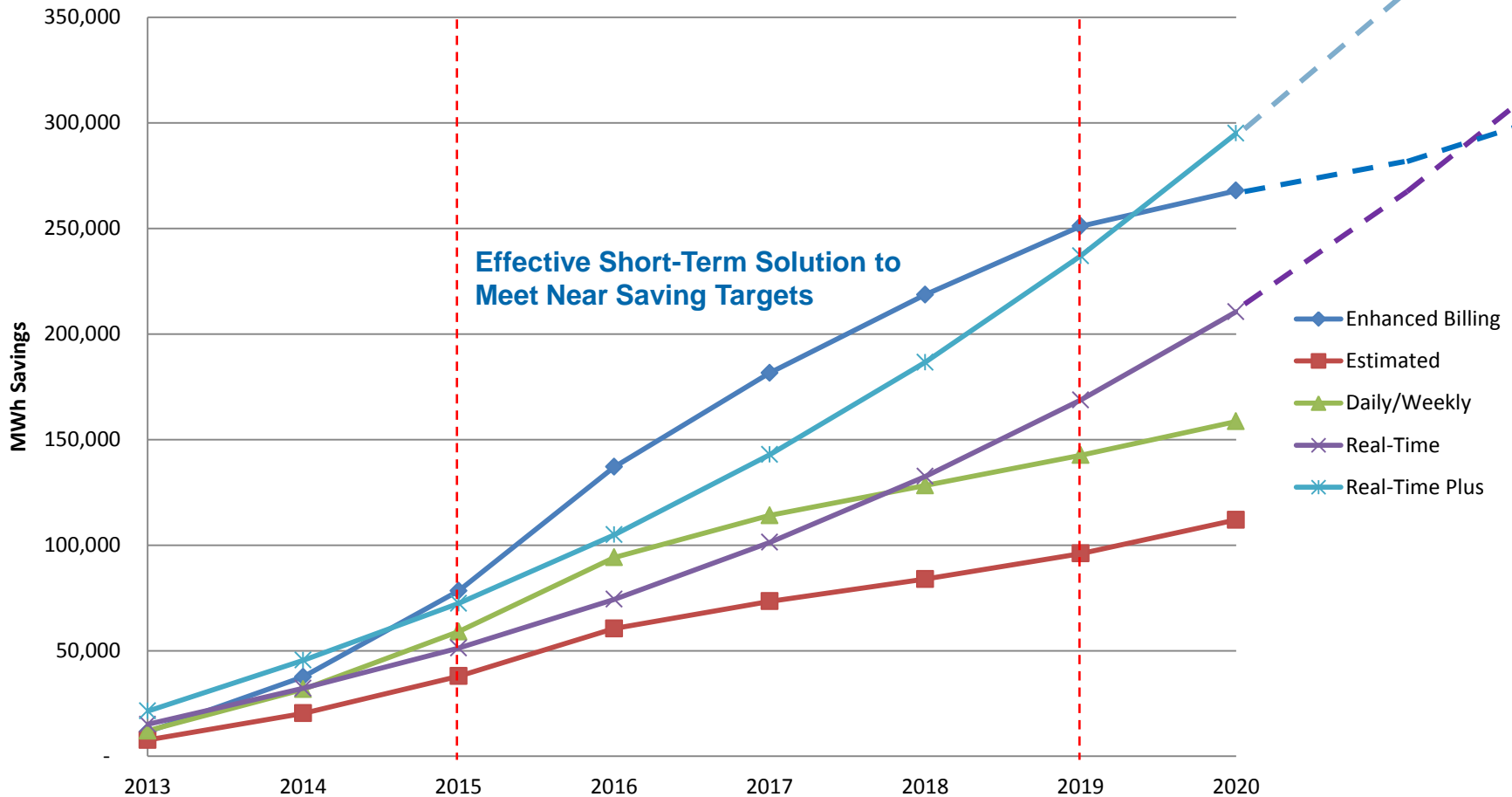
Potential Impacts on a DSM Portfolio Electricity Savings



Total Cumulative Electricity Savings Impacts



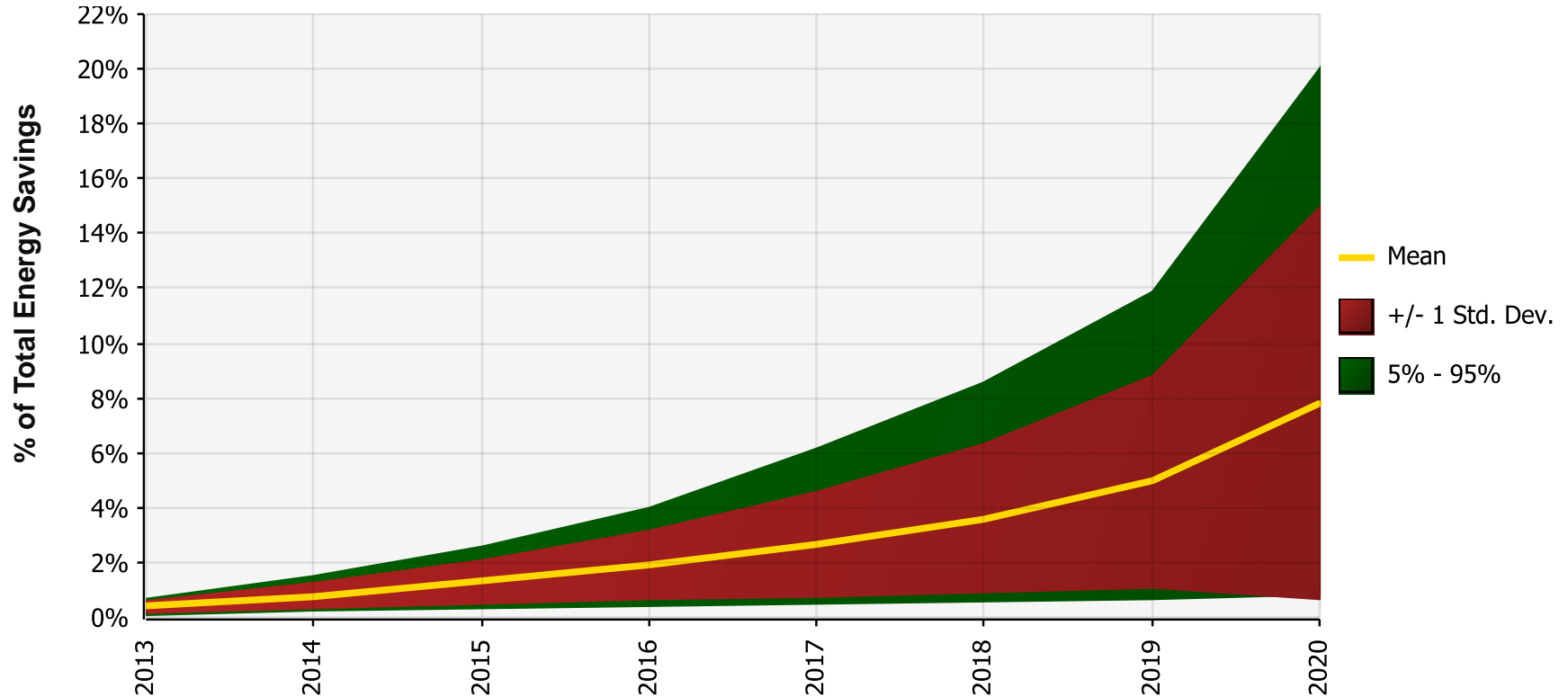
Total Cumulative Feedback Program MWh Savings - Mean (Direct Energy Reduction + Increased Participation in Existing EE Programs)



Impact of Increased Participation in EE



% Savings Resulting from Increased Participation in Existing EE Programs

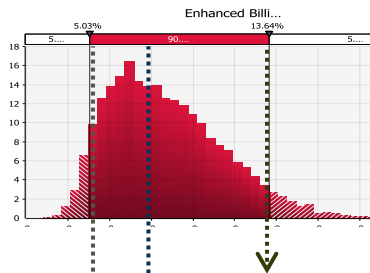


The impact of increased participation on existing EE program savings starts from **0.1%-0.7%** with the mean of **0.4%** of total program savings in **2013** and increases to **1%-20%** with the mean of **5.7%** of total program savings in **2020**.

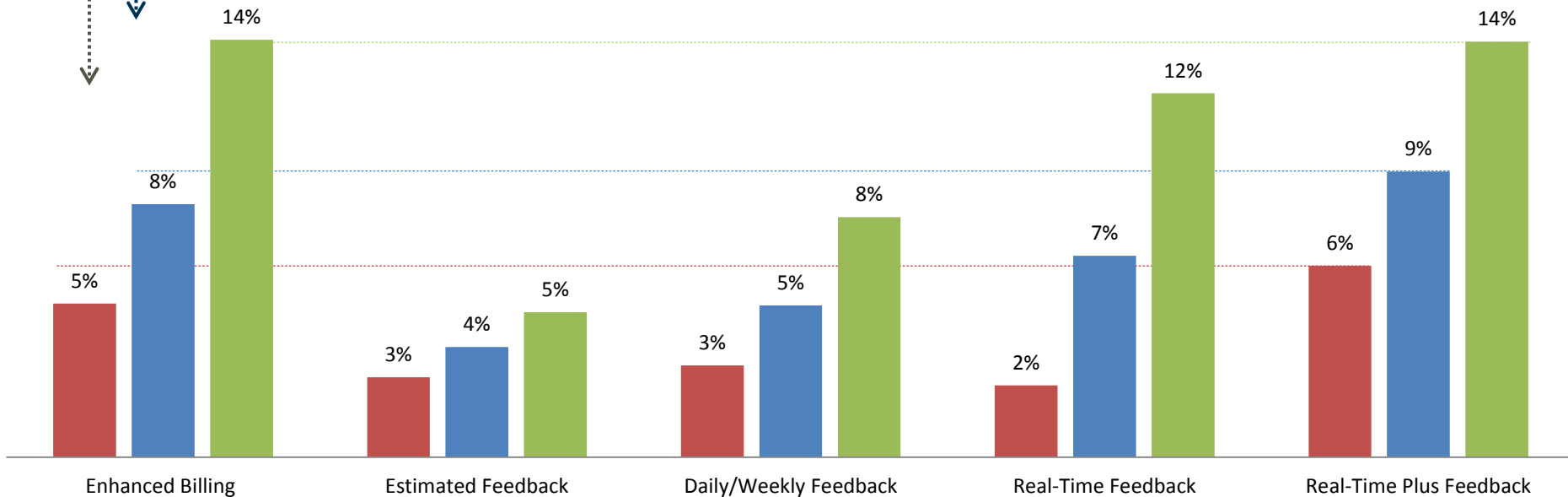
Impact of Feedback Programs on Total Portfolio Savings



Increased Total Portfolio Savings% in 2020 by adding Feedback Programs - 90% Confidence Level



■ 5% Percentile ■ 50% Percentile ■ 95% Percentile

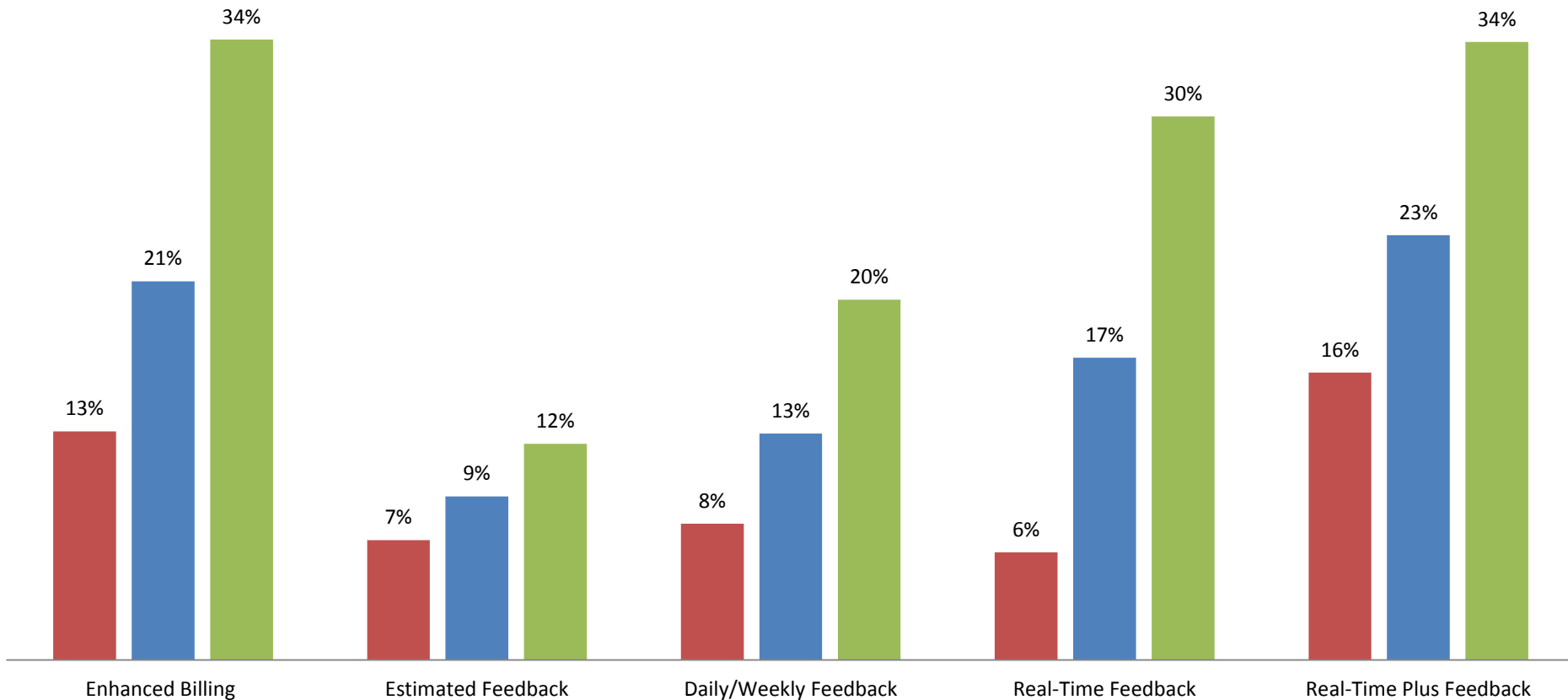


Impact of Feedback Programs on Residential Portfolio Savings

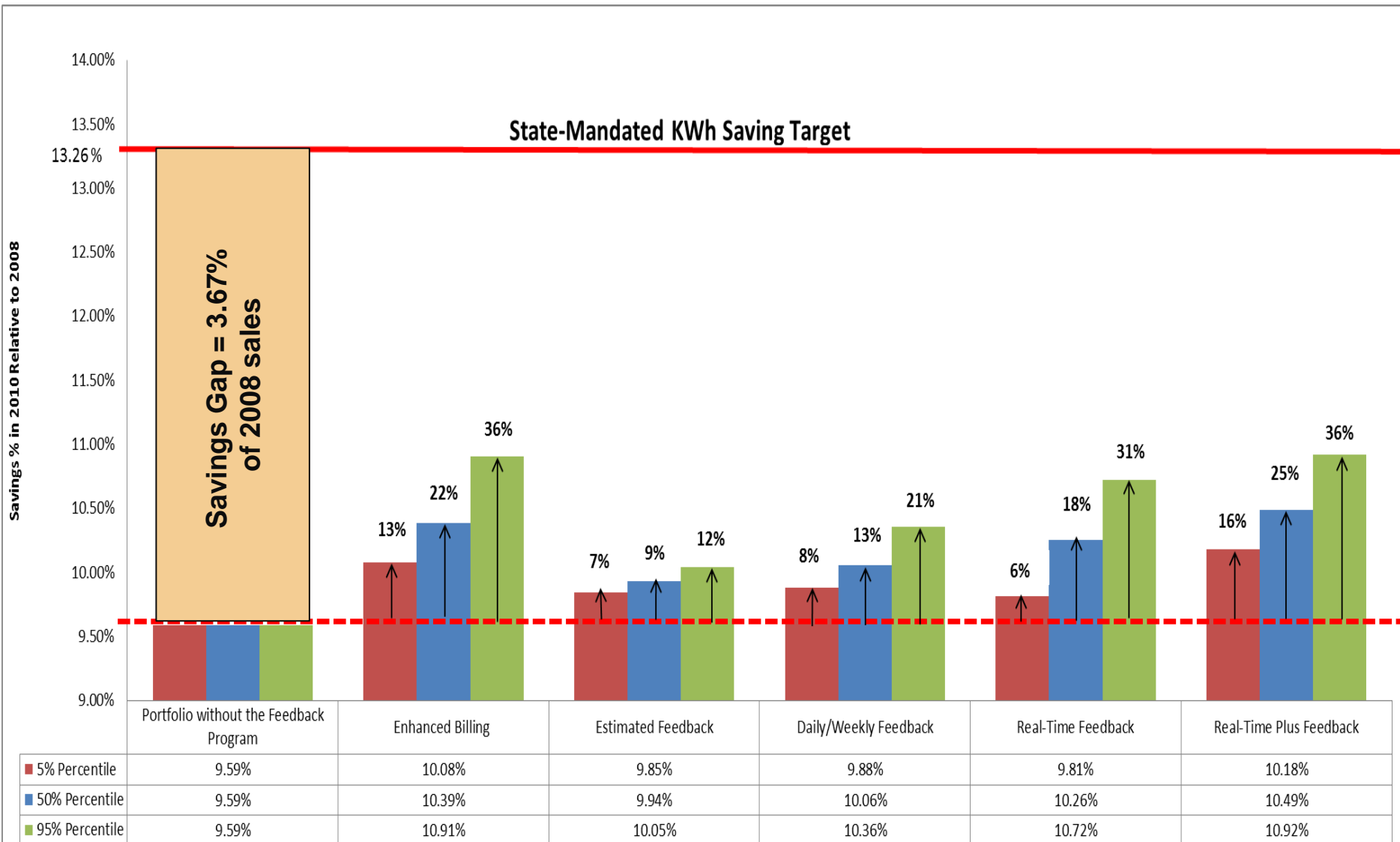


Increased Residential Portfolio Savings% in 2020 by adding Feedback Programs - 90% Confidence Level

■ 5% Percentile ■ 50% Percentile ■ 95% Percentile



Percentage of Savings Gap Potentially Filled by Feedback Programs



Conclusions



- This “Big Squeeze II” analysis confirms previous studies on the potential contributions of residential feedback programs to portfolio savings.
- By 2020, there is a 90% chance that feedback programs increase total DSM portfolio electricity savings by 2% - 14% with the average of 7%.
- By 2020, there is a 90% chance that feedback programs increase residential portfolio electricity savings by 6% - 35% with the average of 17%.
- Program planners/administrators can fill 7%-36% (average of 17%) of the 2020 EERS savings gap by integrating residential feedback programs into DSM portfolio planning.
- The impact of Enhanced Billing could be significant in **short-term** compared to other feedback types. Given its lower cost of the implementation, this approach could be a very effective short-term solution to meet the near state-mandated saving targets.



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Next Steps



- Cost - effectiveness analysis (e.g. TRC test)
- Further sensitivity analysis of saving distributions to input variables and identify the level of impact
- Thorough analysis of change in patterns of final savings across the range of input variables to better understand the impact of each input on savings
- Identify & prioritize the areas of focus for program planners and administrators to more effectively unlock the potentials of feedback programs

