

# Retail Plug-Load Portfolio (RPP) Program <sup>1</sup>

**Proposed Calculation Methodologies for  
Unit Energy Consumption (UEC) and  
Unit Energy Savings (UES)**

**Proposed Estimation Approach for  
Effective Useful Life (EUL) and Proposed EULs**

**EM&V and Residential Program Teams**

**January 22, 2015**





# Retail Plug-Load Portfolio (RPP) Meeting Agenda

Topic	Presenter
UEC/UES: Proposed Calculation Methodologies	Todd Malinick EMI Consulting
EUL: Proposed Estimation Approach and Proposed EULs	

# Critical Questions for CalTF Input

Are the assumptions and proposed methods for estimating the following inputs reasonable?

Does the CalTF have recommendations for estimating these key parameters?

Does the CalTF approve the proposed values for EULs?

- Unit Energy Consumption (UEC)
- Unit Energy Savings (UES)
- Effective Useful Life (EUL)



# RPP Program Objective

**Use retailer engagement to increase the demand and supply of targeted products**

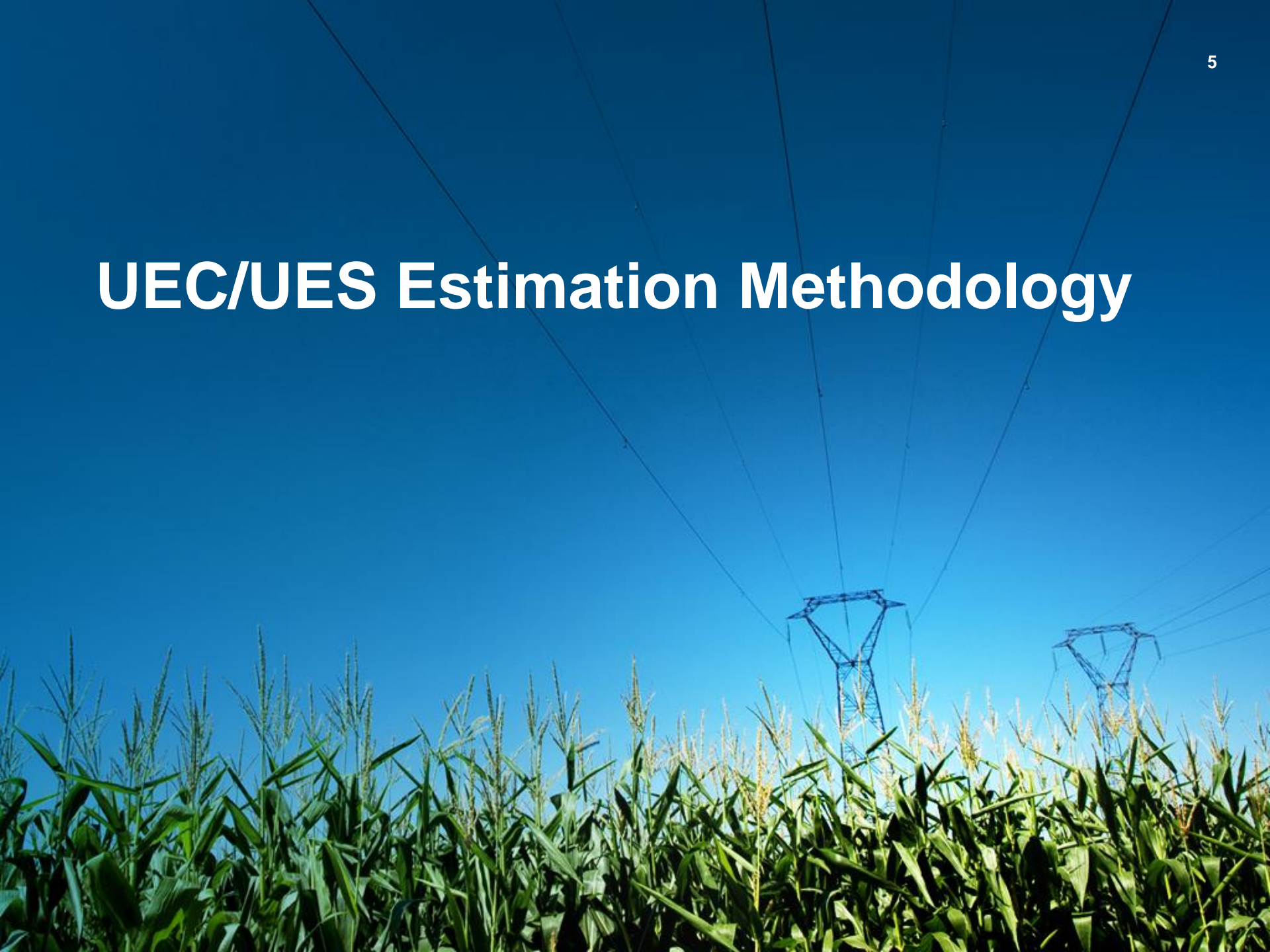
**Program Theory:** A combination of incentives and engagement will motivate retailers to assort, stock, and promote more energy efficient (EE) models than they would have absent the program.

**Long-term objective:** Induce market transformation (*structural changes in the market for targeted products*) by:

- Offering incentives to retailers, in exchange for →
- Changing stocking, promotion, and pricing practices to increase the sale of targeted products, leading to →
- Long-term outcomes of increased demand for EE products experienced by manufacturers, resulting in →
- Sustained increases in supply and availability at participating and non-participating retailers leading to →
- Market transformation through permanent alteration of behavior of key market actors throughout the supply chain.

**NOTE:** Revised basic logic model provided in Word document.

# UEC/UES Estimation Methodology



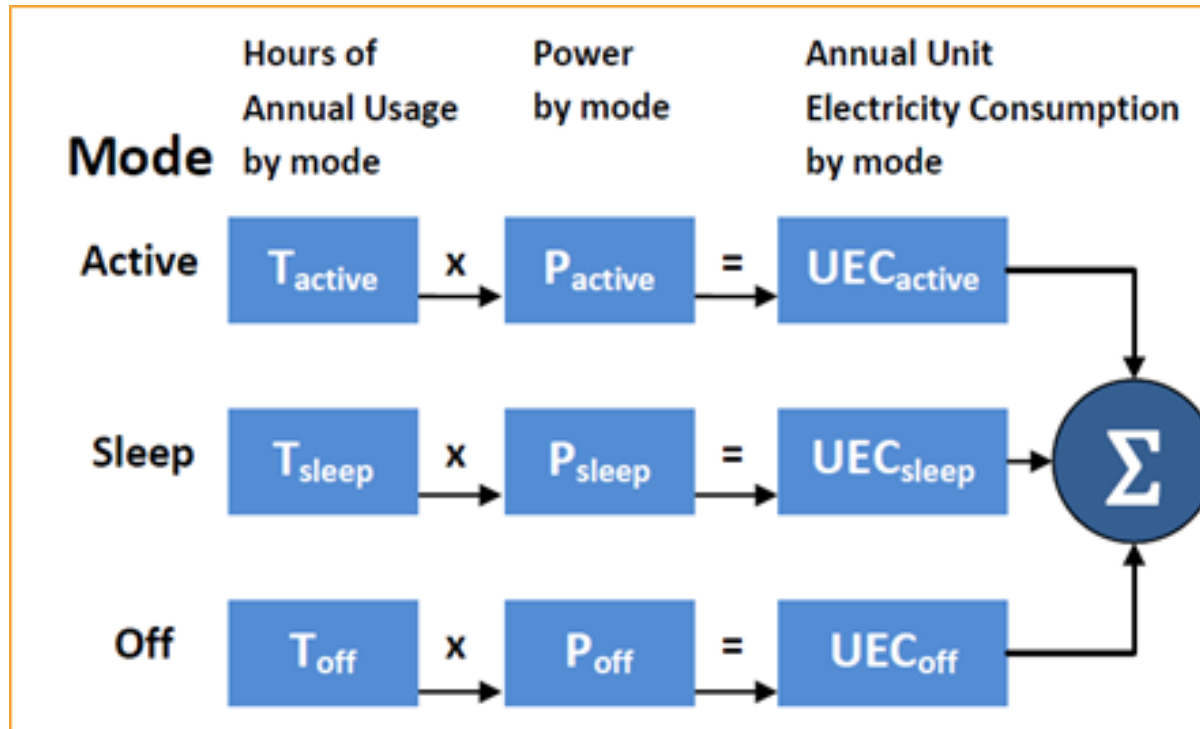
## UEC/UES Background

*In aggregate, there is substantial energy savings potential for product categories targeted through the RPP Program. However:*

- *Most products have low or decreasing per-unit energy consumption requiring a focus on achieving high sales volumes.*
- *There is a need to minimize cost, which includes the development of a cost-effective process for estimating UEC/UES that is:*
  - *Accurate*
  - *Transparent*
  - *Systematic*
  - *Scalable*

# Definitions and Calculations – UEC

*Unit energy consumption (UEC)* is the average estimated annual electricity usage (kWh), for a specific product or device.



If a product only has a single operating mode, annual UEC is simply annual HOU x power consumption.



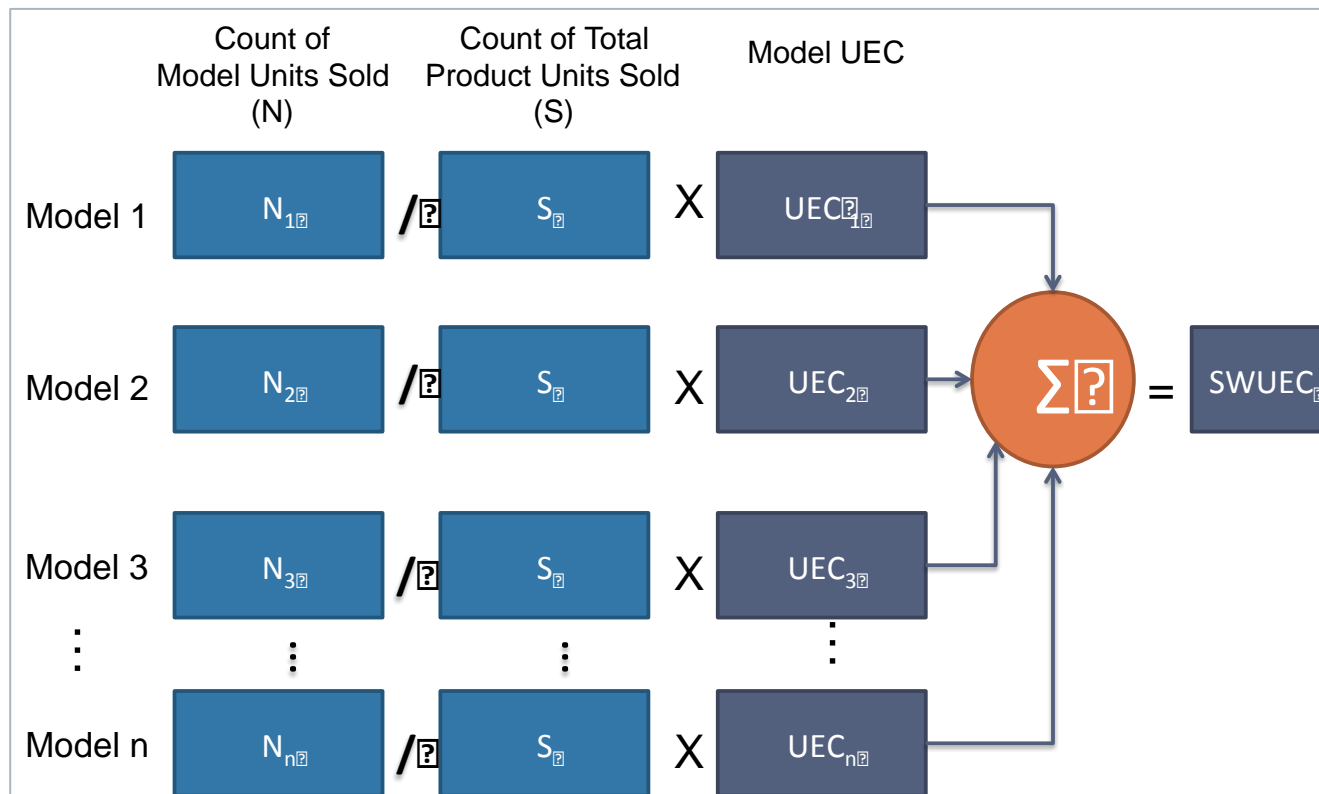
# Example: UEC Calculation for Soundbars

Annual Hours-of-Use			Power Draw by Mode (Watts)			Annual Power Consumption (Watts)			Modal UEC (kWh)			Annual UEC (kWh)
Active	Idle	Sleep	Active	Idle	Sleep	Active	Idle	Sleep	Active	Idle	Sleep	
1,580	730	6,450	30.0	12.0	4.0	47,400	8,760	25,800	47.4	8.76	25.8	81.96



# Definitions and Calculations – SWUEC

*Sales-weighted unit energy consumption (SWUEC) estimates are calculated as the average UEC value of all models sold by a retailer, within a product category, weighted by their respective sales volume.*





# Example: Hypothetical SWUEC Calculation

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Model	Qty	Proportion [Qty / $\Sigma$ Qty]	UEC	Proportion x UEC
Model 1	25	0.17	250	41.67
Model 2	50	0.33	100	33.33
Model 3	50	0.33	100	33.33
Model 4	25	0.17	500	83.33
TOTAL	150	1.00		191.67

# Initial Approach – Focus on SWUEC

## ***Initial approach:***

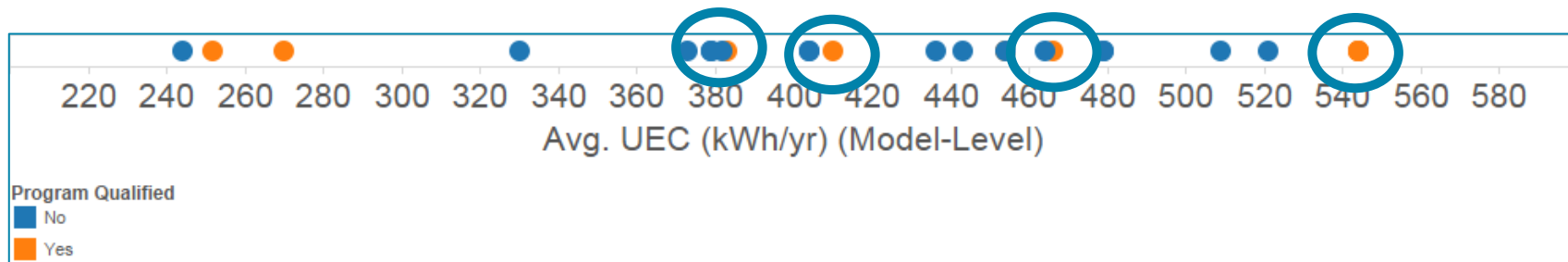
- *For each retailer, derive product-level savings by assessing the difference between SWUECs for non-qualified and qualified models within broad product categories*
- *This model-level approach relied on specific UEC values for each and every model (thus the need for sales-weighting)*

## ***Key findings:***

- *Initial product categories were too broad*
- *Reliable model-level UEC values not available for all products*
- *Preference to use DEER values when available*

# Initial Product Categories Too Broad

## Example: Refrigerators



- Program-qualified models often use more energy than non-qualified models because they are larger in size and/or more fully-featured.
- At the product level, selling more qualified units could drive SWUEC up.
- Not really a fair comparison – e.g., for refrigerators, consumers are usually constrained by size.



# Revised Product Classifications

Product	RPP Product Classes
Air Cleaners	<100 CADR
	>=100 CADR
DVD/Blu-Ray Players	Standard DVD
	Blu-Ray
Home Theaters-in-a-Box (HTIB)	HTIB
	HTIB w/ Standard DVD
	HTIB w/ Blu-Ray
	Soundbars
Room Air Conditioners	<12,000 BTU (<1.00 ton)
	12,000-17,999 BTU (1.00-1.49 ton)
	18,000-23,999 BTU (1.50-1.99 ton)
	24,000-29,999 BTU (2.00-2.49 ton)
	>=30,000 BTU (>=2.50 ton)
Refrigerators	52 DEER Classes
Freezers	12 DEER Classes



## Lack of Reliable Model-Level UEC Values

Of the 6 product categories targeted, no model-level UEC values available for 2 categories:

- DVD/Blu-Ray Players (standard DVD, Blu-Ray)
- HTIBs (HTIB, HTIB w/std. DVD, HTIB w/Blu-Ray DVD, Soundbar)

Best available data allows estimation of UECs at the ***measure-level*** (i.e., estimated UEC for program-qualified models within a class and estimated UEC for non-qualified models within a class).

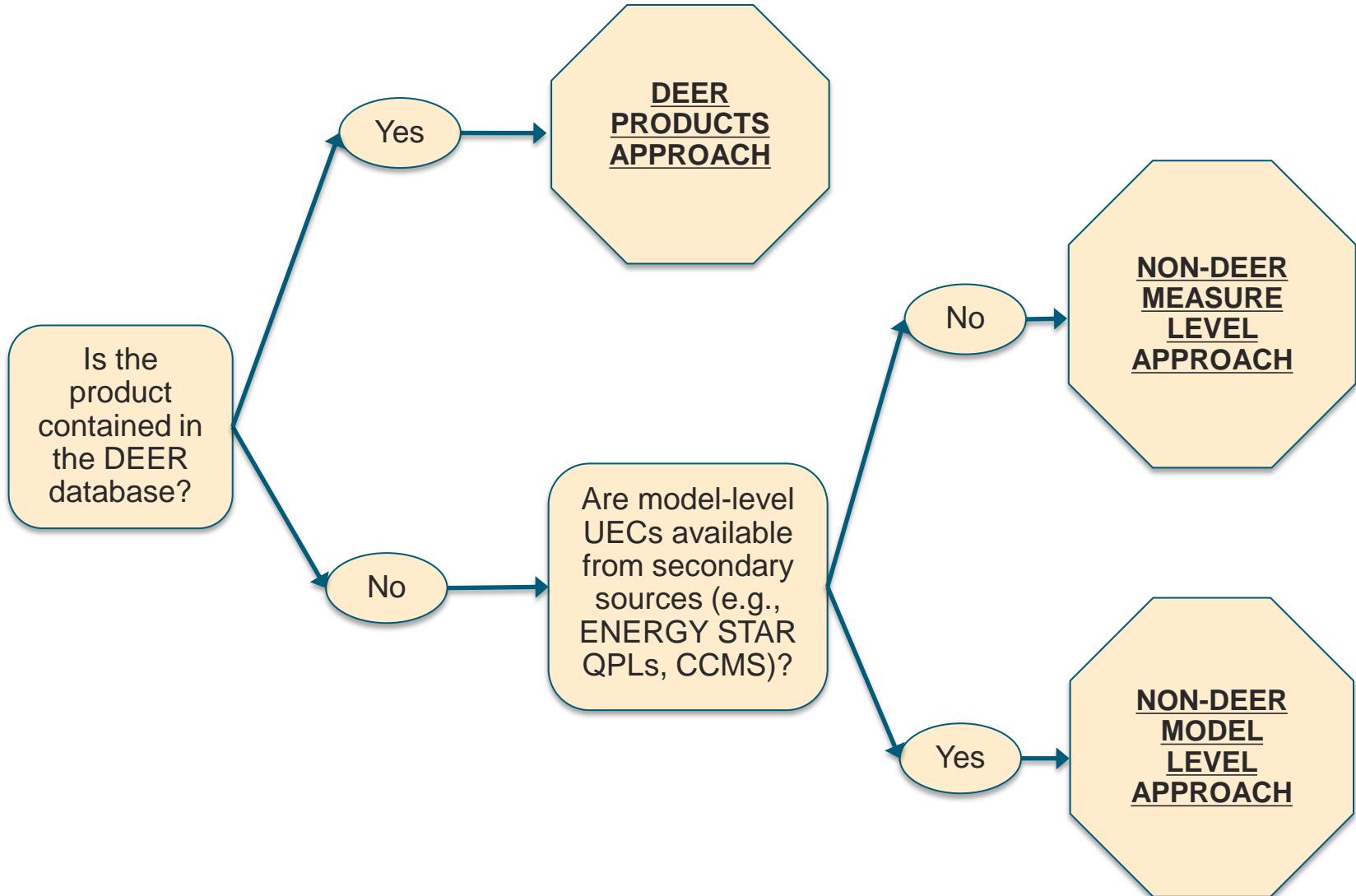


# RPP Approach to Calculating UECs: Use DEER Values When Available

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- Approach: Use DEER values when available
- DEER values are derived using a ***measure-level*** approach
  - Within a product class, all “baseline” models (i.e., those only meeting the current code) receive the same UEC; all “measure” models (i.e., those consuming energy at a certain % below the baseline) receive the same UEC
  - The difference between the two UECs is the UES for the product class
- Taken together, these last two slides make the use of SWUECs irrelevant for these product categories
  - No need to sales-weight: all qualified models get same UEC; all non-qualified models get same UEC

# RPP Approach to Calculating UECs: Decision Tree







# RPP Approach to Estimating UECs: DEER Approach

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- DEER UEC and UES will be assigned to each model contained in the retailer sales data when available.
- Products will be subcategorized to align with DEER type and size classes.
- The values in the most recent publicly-available update of DEER will be used.



# RPP Approach to Estimating UECs: Non-DEER Model-Level Approach

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A UEC value will be estimated for each *model* contained in the retailer sales data based on best available information.

Computation of UES estimates is a three-step process:

1. Use credible secondary data sources (ENERGY STAR QPLs, DOE's CCMS, manufacturer/retailer/industry websites or data sources).
2. Compute separate SWUEC values for qualified and non-qualified models within each product subcategory for a specified time period.
3. Compute gross UES values by taking the difference between the non-qualified and qualified SWUECs:

$$UES_{p,t} = SWUEC_{Non-qualified_{p,t}} - SWUEC_{Qualified_{p,t}}$$



# RPP Approach to Estimating UECs: Non-DEER Measure-Level Approach

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When no model-level UEC values are available, secondary research and published literature exist that can be used to estimate UEC/UES values, but only at the **measure** or product subcategory level.

The steps involved in deriving these estimates include:

1. Measure-level UECs are assigned to qualified and non-qualified products based on secondary research, and updated with ED-led *ex-post* evaluations as available.
  - All program-qualified models within a subcategory will have the same UEC value
  - All non-qualified models within a subcategory will have the same value.
2. Compute UES values by taking the difference between the non-qualified and qualified UEC values within each subcategory:

$$UES_{p,t} = UEC_{Non-qualified_{p,t}} - UEC_{Qualified_{p,t}}$$



# UEC/UES Approaches, Data Needs, and Data Sources: Summary Table

	Room ACs	Refrigerators	DVD/Blu-Ray Players	Home Theatres In-a-Box (HTIBs)	Freezers	Air Cleaners	Electric Clothes Dryers
RPP Program Year	2014 Only	2014 Only	2014 Only	2014 & 2015 <sup>a</sup>	2014 & 2015	2014 & 2015	2015 Only
UEC/UES Approach	Non-DEER <i>Model Level</i>	DEER	Non-DEER <i>Measure Level</i>	Non-DEER <i>Measure Level</i>	DEER	Non-DEER <i>Model Level</i>	Non-DEER <i>Model Level</i>
Data Needs	Cooling capacity, HOU	Capacity, configuration, defrost type	Prod type, power usage by mode, HOU by mode	Prod type, power usage by mode, HOU by mode	Capacity, configuration, defrost type, through-the-door ice	CADR, hours-of-operation	Test load size, power usage in standby and op cycle, 120V vs. 240V
Data Sources	ENERGY STAR QPL, mfr/retailer websites	DEER	Secondary research or literature	Secondary research or literature	DEER	ENERGY STAR QPL, manufacturer or retailer websites, or default assumptions	ENERGY STAR QPL, manufacturer or retailer websites, or default assumptions

<sup>a</sup> For the 2014 Program Trial, soundbars were considered a subcategory of the broader HTIB category. For the 2015 Program Trial, soundbars will be a separate category from HTIBs without subcategories.

# Timeframe for UEC/UES Estimation

- **Approach:** Recalculate UEC/UES estimates yearly
  - Initial estimate based on one year of historical sales data.
  - Period will be defined as the year immediately preceding first month of each retailer's participation in the program.
- Note that recalculating estimates matter only for:
  - Products where UEC/UES values are estimated at the model level, **OR**
  - DEER products that experienced a DEER update, **OR**
  - Products where UEC/UES values are estimated at the measure level, when more recent secondary sources have become available.



# Within-Retailer Versus Across-Retailer UES Values

- For the model-level approach, UES values can be computed *within each participating retailer* or *across all participating retailers*.
- For the DEER or measure-level approaches, it is only possible to compute one UES value.
- Once data are available from multiple retailers, we will conduct analyses to assess differences between *within-retailer* and *across-retailer* UES values.
- Small variability supports the use of *across-retailer* UES values, which would simplify the implementation of the program.



# Ex-Ante Gross Program Energy Savings

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- A significant benefit of this proposed UEC/UES approach is that it greatly simplifies the estimation of ex-ante gross program energy savings.
- *Ex ante gross program energy savings* is calculated by:
  - Multiplying the UES, (kWh), for a product subcategory ( $p$ ) and time period ( $t$ ) by:
  - Total number of units sold ( $Q$ ) for a product subcategory within a time period, and then:
  - Summing across all subcategories across all products.

$$\text{Ex-Ante Gross Program Energy Savings} = \sum (UES_{p,t} \times Q_{p,t})$$

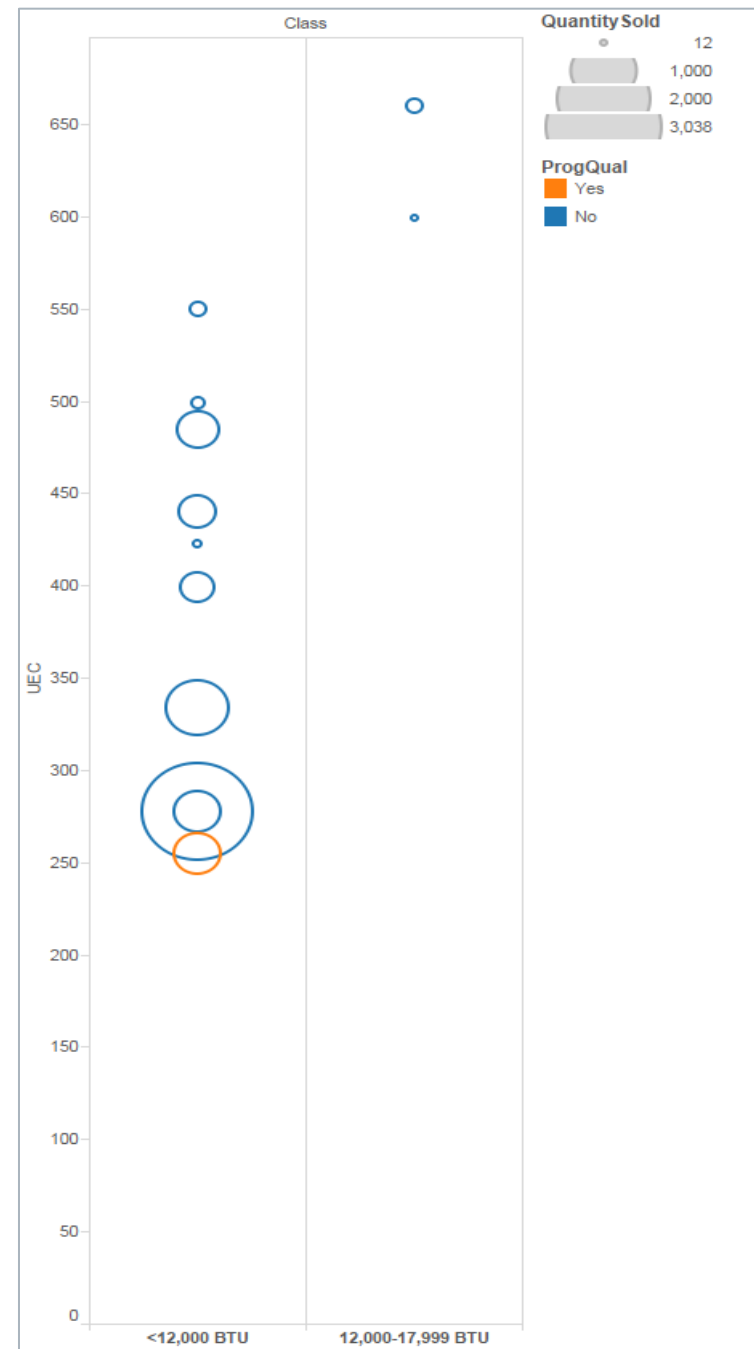


# Example: Room ACs (Model-Level)

Only program-qualified unit is in  
<12,000 BTU class

Class	Non-PQ SWUEC	PQ SWUEC	UES
<12,000 BTU	324.4	254.8	69.6

Note that SWUEC/UESs were computed using 12  
months of historical data





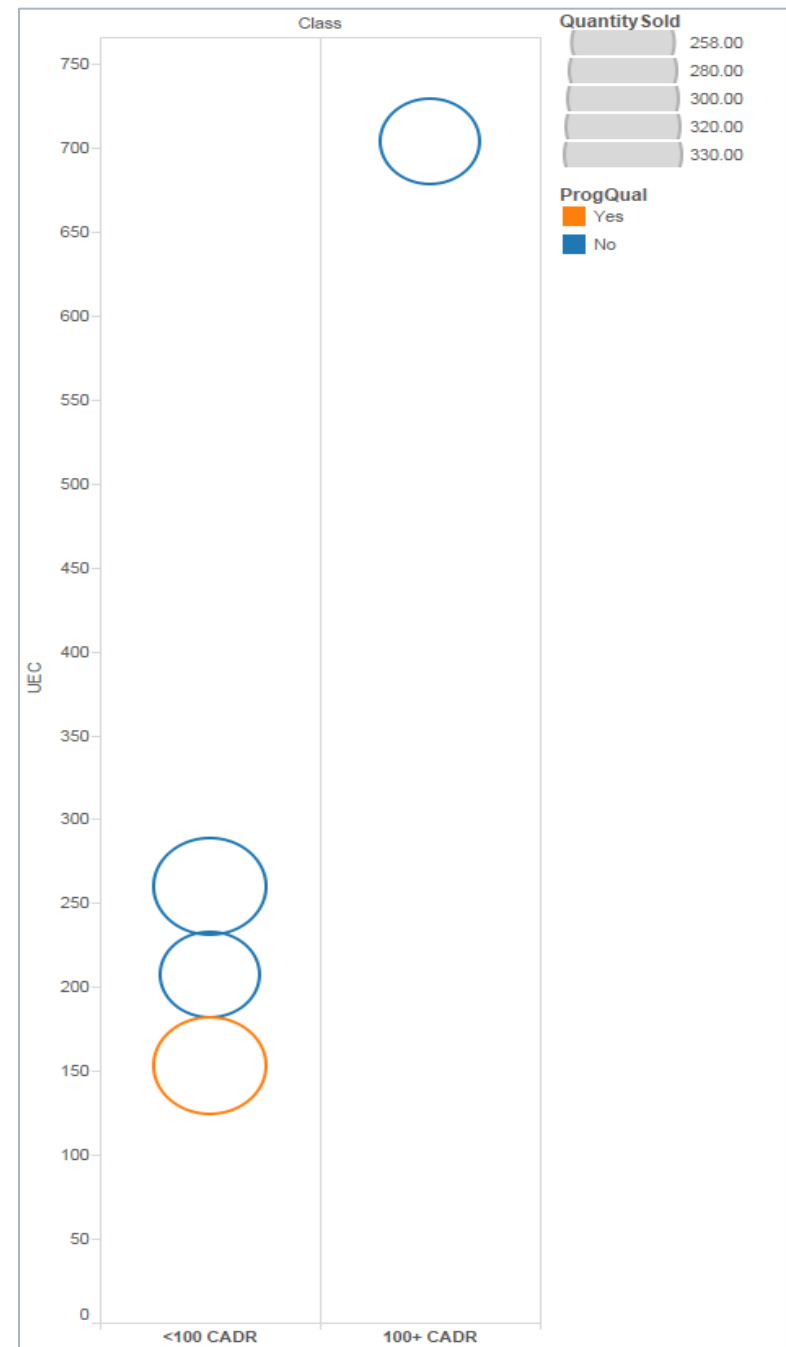


# Example: Air Cleaners (Model-Level)

Only program-qualified unit is in  
<100 CADR class

Class	Non-PQ SWUEC	PQ SWUEC	UES
<100 CADR	236.5	153.0	83.5

Note that SWUEC/UESs were computed using 12  
months of historical data





# Examples: DVDs and HTIBs (Measure-Level)

## DVD/Blu-Ray Players

Product Type	Non-PQ UEC	PQ UEC	UES
Standard DVD	16.2	10.3	5.9
Blu-Ray	17.5	12.7	4.8

## Home Theaters-in-a-Box

Product Type	Non-PQ UEC	PQ UEC	UES
Soundbar	82.0	37.5	44.5



# Hypothetical Example: Ex-Ante Gross Energy Savings

Product	Subcategory	UES	Hypothetical PQ Sold	Gross kWh Savings
Air Cleaners	<100 CADR	83.5	1,000	83,500
DVD/Blu-Ray Players	Standard DVD	5.9	1,000	5,900
	Blu-Ray	4.8	1,000	4,800
Refrigerators	RefgFrz-BM-VLarge	61.0	1,000	61,000
	RefgFrz-BM-Ice_VLarge	69.0	1,000	69,000
	RefgFrz-SM-TTD_VLarge	72.0	1,000	72,000
	RefgFrz-TM_CmpMini	38.0	1,000	38,000
	RefgFrz-TM_Med	42.0	1,000	42,000
	RefgFrz-TM_VLarge	48.0	1,000	48,000
Total Ex Ante Gross Program Savings				424,000

# Effective Useful Life





# Estimating Effective Useful Life (EUL)

**Proposal: Use a simple decision rule for estimating the effective useful life for each product category:**

- Use DEER estimate, if one exists.
- If no DEER estimate is available, then use ENERGY STAR estimate, if one exists.
- If neither exists, then estimate using secondary sources.
- If no credible secondary data sources exist, or if estimates are widely divergent, then convene a Delphi panel to estimate.



# Proposed EULs for RPP Products

	Soundbars	Home Theater-in-a-Box Systems	Freezers	Electric Clothes Dryers	Air Cleaners	Room ACs (2016)
DEER EUL	N/A	N/A	11 years	N/A	N/A	9 years
ENERGY STAR EUL	7 years	7 years	11 years	12 years	9 years	9 years



# Action Items and Next Steps





# Meeting Objectives/ Critical Questions for CalTF Input

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Are the assumptions and proposed methods for estimating the following inputs reasonable?

Does the CalTF have recommendations for estimating these key parameters?

Does the CalTF approve the proposed values for EULs?