



# EM&V Uniform Methods Project: Residential Lighting

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# Agenda

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- Overview of Residential Lighting
- Savings Algorithm
- EM&V Plan
- Questions/Comments



# Overview of Residential Lighting

- Measures
  - CFLs
  - ENERGY STAR fixtures
  - LEDs
- Delivery Strategies Vary
  - Upstream buy down/mark down
  - Direct installation
  - Giveaway
  - Coupons





# Overview of Residential Lighting

## **What is Covered?**

Methods address most measures  
and delivery strategies

## **What is Not Covered?**

Demand Savings

Attribution

EUL/ Inc. Cost

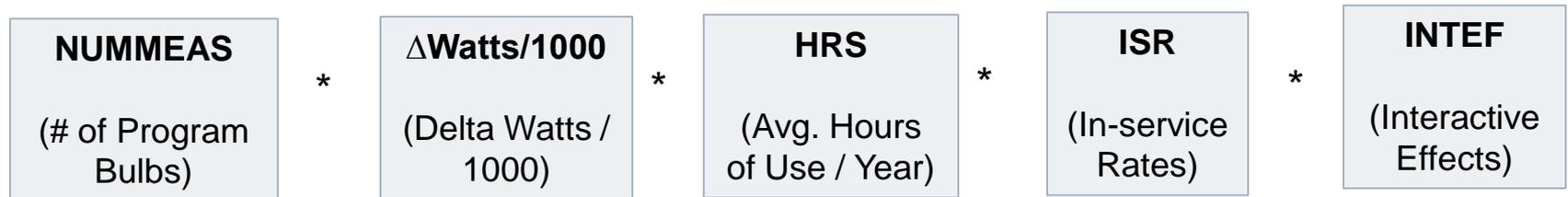
The Canadian Football League





# Savings Algorithm

$$\text{kWh}_{\text{saved}} =$$



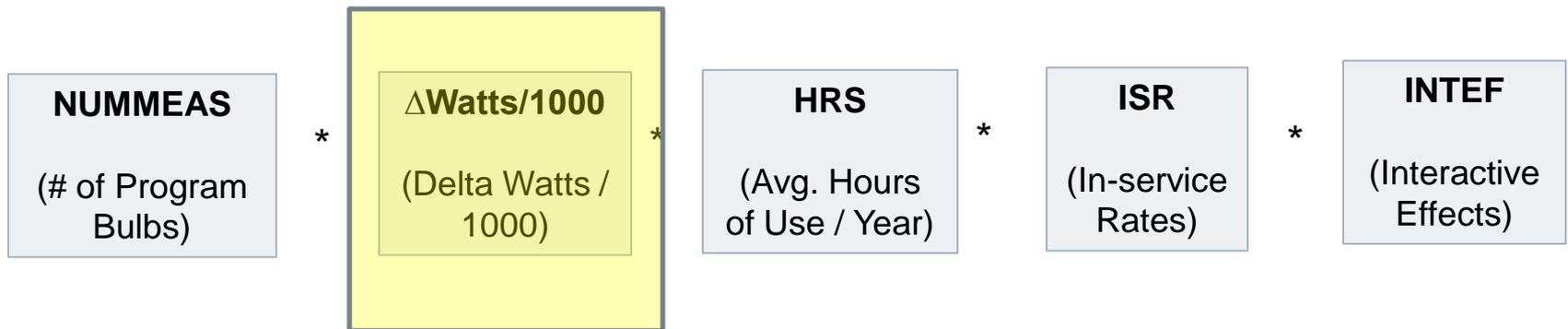


# EM&V Plan: Number of Measures

- Reported by Program Administrator
  - Implementation contractor typically has tracking database
- M&V Should Include Minimum of Basic Verification
  - Review detailed transaction database to replicate total savings claim
  - Discrepancies result in adjustment

# EM&V Plan: Delta Watts

kWh<sub>saved</sub> =





# EM&V Plan: Delta Watts

- Various Approaches
  - Self-report
  - In-home inspections
  - Multipliers
  - Manufacturer Rating
  - Lumen equivalence
- Strengths and Limitations of Each



# EM&V Plan: Delta Watts

- Recommended: Lumen Equivalence
  - Typically provides same as manufacturer rating
  - Matches up with EISA

Lumen Range	2011 Baseline	2012 Baseline	2013 Baseline	2014 Baseline
1490-2600	100w	72w	72w	72w
1050-1489	75w	75w	53w	53w
750-1049	60w	60w	60w	43w
310-749	40w	40w	40w	29w



# EM&V Plan: Delta Watts

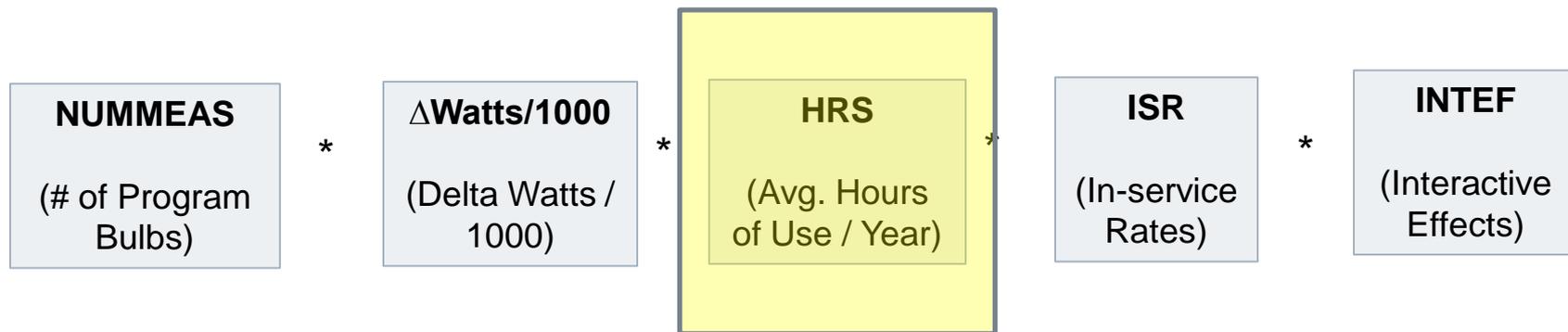
- Exceptions to Lumen Equivalence
  - Values above/below ranges
  - EISA exceptions: 3-way, candelabras, reflectors
  - Use manufacturer rated in these cases





# EM&V Plan: Annual Operating Hours

$$\text{kWh}_{\text{saved}} =$$





# EM&V Plan: Annual Operating Hours

- Recent Metering Studies Show Wide Range in HOU for CFLs
- Data are Not Readily Transferable

Region	Publication Year	Estimated Daily HOU
Illinois (AIU)	2011	2.74
Maryland (EmPower)	2011	2.98
CA (PG&E, SCE, and SDG&E service areas)	2010	1.9
CT, MA, RI, VT	2009	2.8
Pacific Northwest	2010	2.32
Ohio	Forthcoming	2.85
North Carolina / South Carolina	2011	2.54/ 2.67



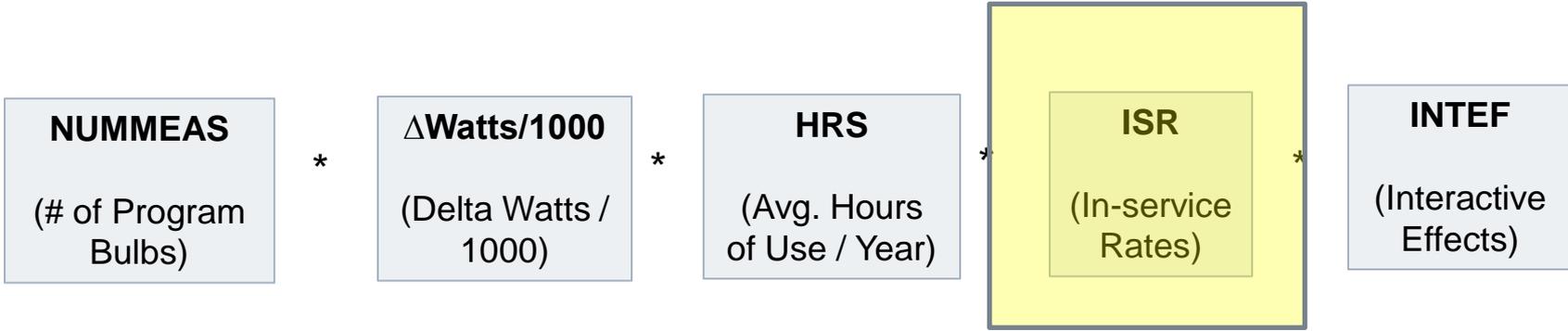
# EM&V Plan: Annual Operating Hours

- Recommended: Metering Study
  - Adjust for seasonality
  - Conduct in-home audit during study
  - Can select sample of measures/home
  - Weighting techniques
- For Recent Launch or Smaller Programs: Secondary Data
  - Select “like” region, weight by room



# EM&V Plan: In-Service Rate

$$\text{kWh}_{\text{saved}} =$$





# EM&V Plan: In-Service Rate

- Recommended: Onsite Audit for Upstream Programs
  - Based on all similar measures (i.e., do not need to identify program bulbs)
- For Recent Launch or Smaller Programs: Telephone Survey



# EM&V Plan: In-Service Rate

- Some Measures Installed in Year Following Program
- Assume 99% Installed Within 2 Years Following Program
  - Based off of CA Study

Region	Publication Year	Percentage of CFLs Installed in Program Year
Arizona (APS)	2008	90%
California (PG&E, SCE, and SDG&E service areas)	2010	67%
CT, MA, RI, VT	2009	76%
Illinois (ComEd)	2011	74%



# EM&V Plan: HVAC Interactive Effects

$$\text{kWh}_{\text{saved}} =$$

**NUMMEAS**  
(# of Program  
Bulbs)

\*

**$\Delta$ Watts/1000**  
(Delta Watts /  
1000)

\*

**HRS**  
(Avg. Hours  
of Use / Year)

\*

**ISR**  
(In-service  
Rates)

\*

**INTEF**  
(Interactive  
Effects)



# EM&V Plan: HVAC Interactive Effects

- Varies Based on Climate Zone
  - Additional savings in cooling dominated areas
- Recommendation: Use Northwest Regional Technical Forum Calculator
  - Need to adjust inputs for actual climate/conditions
  - Based on electric impact only



# EM&V: Other Evaluation Issues

- Cross Customer Class Sales
  - Some sales may go to non-residential
- Cross Service Area Sales (Leakage)
  - Cannot verify each purchaser in upstream program



# EM&V: Other Evaluation Issues

- Recommendation: Can Exclude These Parameters
  - May be offsetting
  - Difficult to estimate accurately
  - Many neighboring programs
  - Many programs minimize leakage

# Project Team

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