CT EEB X1931 PSD Review (All Sectors)
with x1941 Multifamily-Specific PSD Topics

Measure Review Discussion
Part 1 – Batch 1 & 2

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AGENDA

- Study Background

- Study Results Overview

- Comments Discussion (Cross-Cutting and MF-Specific)

- Appendices and Data Sources

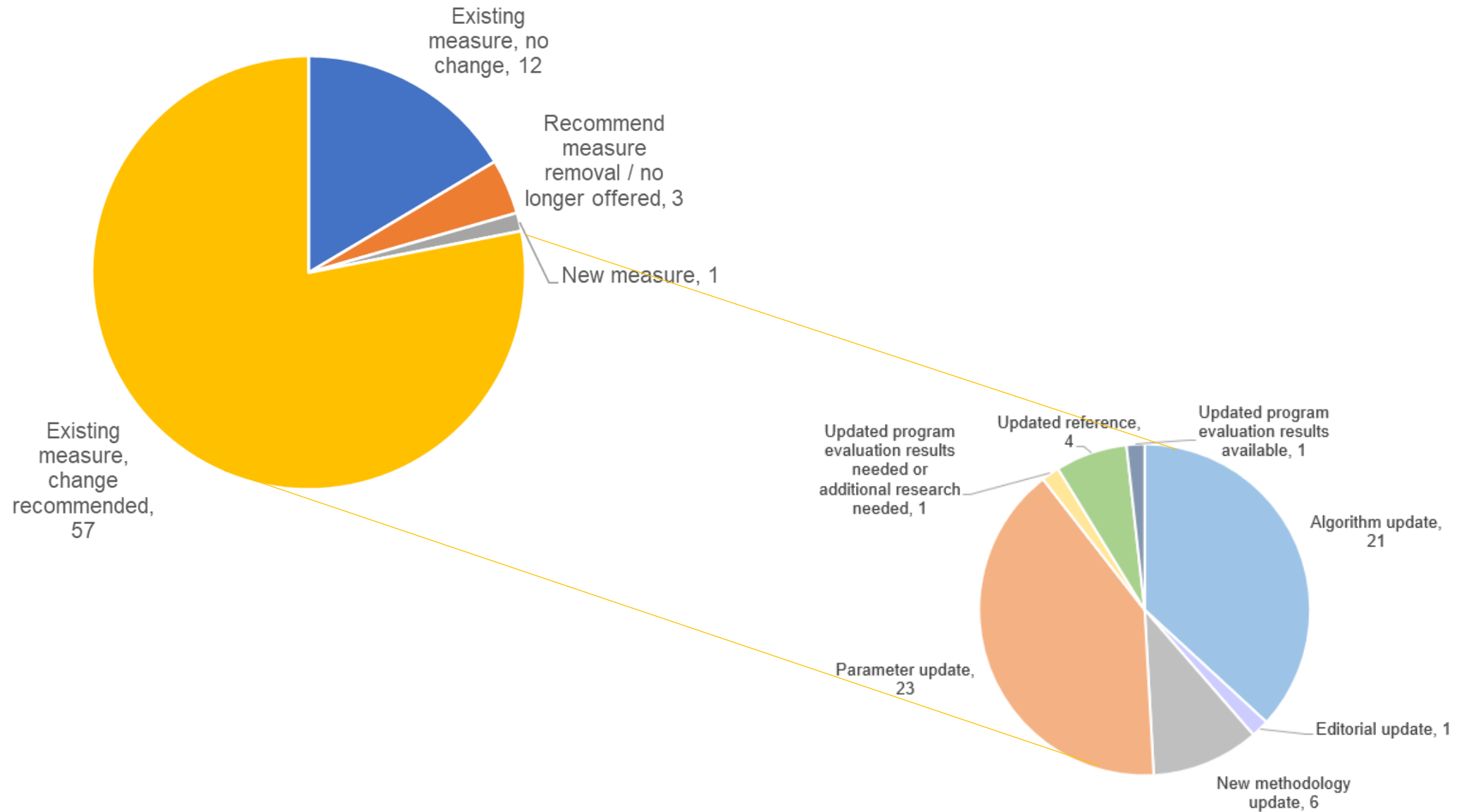# Study Background and Results Overview

STUDY BACKGROUND

- Today's and Wednesday's discussion meetings mark the conclusion of our detailed measure review findings to inform the 2021 PSD draft

- Detailed Measure Reviews – 72 Measures – 3 Batches

- Majority of comments were resolved with responses emailed to commenters

- Comments on specific Batch 1 and 2 measures for today's discussion – includes MF presentation

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MEASURE BATCHES

Batch 1 – June 18	Batch 2 – June 26	Batch 3 – July 2
Natural Gas Radiant Heaters	Chillers	Standard Lighting
Low Voltage Dry Type Distribution Transformers	Natural Gas Fired Boilers and Furnaces	Upstream Lighting
Lean Manufacturing	Natural Gas-Fired Domestic Hot Water Heaters	Unitary A/C and Heat Pumps
Commercial Kitchen Equipment	HVAC Variable Frequency Drives	Water and Ground Source Heat Pumps
Lost Opportunity Custom	Pipe Insulation	Dual Enthalpy Controls
Cool Roof	Duct Sealing	Demand Control Ventilation
Refrigerator LED	Steam Trap Replacement	Variable Refrigerant Flow (VRF) HVAC System
Water-Saving Measures	Blower Door Test (Small C&I)	Commercial Clothes Washers
Add Speed Control to Rooftop Unit Fan	Energy-Efficient Central Air Conditioning	Standard Lighting
Commercial Kitchen Hood Controls	Electronically Commutated Motor HVAC Fan	Duct Insulation
Custom Measures	Duct Sealing	Setback Thermostats
Cooler Night Covers	Quality Installation Verification	Lighting
Evaporator Fan Controls	Furnaces	Heat Pump
Evaporator Fans Motor Replacement	ECM Circulating Pump	Geothermal Heat Pump
Door Heater Controls	REM Savings	Heat Pump – Ductless
Vending Machine Controls	Infiltration Reduction Testing (Blower Door Test)	Package Terminal Heat Pump
Add Doors to Open Refrigerated Display Cases	Infiltration Reduction (Prescriptive)	Duct Insulation
Boilers	Wall Insulation	WI-FI Thermostat
Boiler Reset Controls	Ceiling Insulation	Clean, Tune and Test
Fossil Fuel Water Heaters	Floor Insulation	Residential Appliances
Heat Pump Water Heaters	Showerheads	Electronics
Residential Custom	Faucet Aerators	Window or Sliding Glass Door Replacement
	Pipe Insulation	Thermal Enclosure
	Solar Water Heater	Install Storm Window
	Behavioral Change	Insulate Attic Openings

Today's focus: Batch 1 and 2. Wednesday 7/15 presentation will focus on remainder.

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MEASURE STATUS AFTER REVIEW

Existing measure, no change, 12

Recommend measure removal / no longer offered, 3

New measure, 1

Existing measure, change recommended, 57

Updated program evaluation results needed or additional research needed, 1

Updated reference, 4

Updated program evaluation results available, 1

Algorithm update, 21

Editorial update, 1

New methodology update, 6

Parameter update, 23

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BATCH 1 AND BATCH 2 COMMENT SUMMARY

- 317 comments total

Addressed via email

- 110 No further action - Agreement
- 91 Consultant action required - Resolved
- 92 Consultant action required - Under Review

- 23 Further Discussion - Today
- Comments covering in three major topics
  - Prospective RR*
  - Multi-family blower door
  - HDD/CDD*
  - * Affects multiple measures

Further Discussion, 23

Action Required/Under Review, 92

No further action, 110

Action required/Resolved, 91

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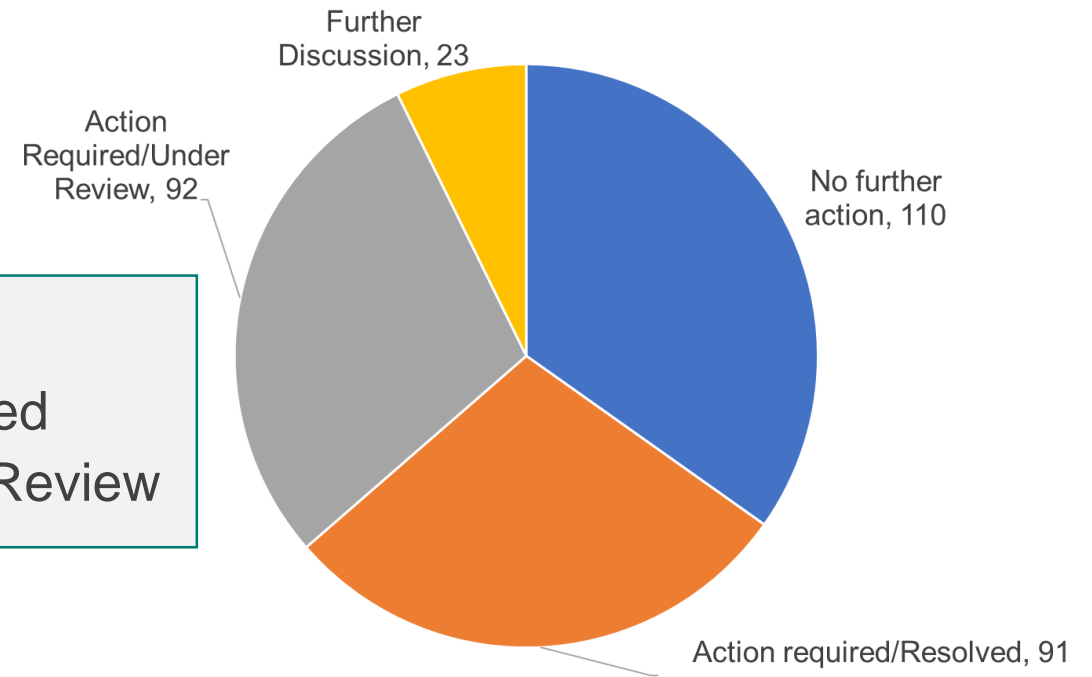
BATCH 1 AND BATCH 2 COMMENT SUMMARY EMAIL

Measure ID	Measure name	Parameter	Current PSD Value	Recommended Value	Recommended action	Justification	Comment	ERS Response	ERS Response Category
PSD2.2.7	Natural Gas Radiant Heaters	EFLH	Varies by building type	Varies by building type	Proposed Further Secondary Research	Aligns with other TRMs	EFLH table in PSD says "Heat Pump FLH" which are likely to be different from a standard furnace or radiant heater EFLH due to variable capacity and efficiency with temperature. Suggest making this a candidate for future primary research. Consider creating heating and cooling FLH for several climate zones - coastal, central and mountains?. CT values are consistently much higher than NYTRM.	ERS to discuss recommendation at 7/10/2020 call with stakeholders	Further Discussion
PSD2.2.7	Natural Gas Radiant Heaters	EFLH	Varies by building type	Varies by building type	No change	Aligns with other TRMs	No measrue lifetimes?	No further action - Lifetimes reviewed in separate	No further action
PSD2.2.7	Natural Gas Radiant Heaters	OF - oversize factor	1.0 single-heaters, 1.1 multiple-heaters	1.0 single-heaters, 1.1 multiple-heaters	Proposed Further Secondary Research	Most instances will use existing furnace size, so adjusting for oversizing is not relevant unless proper sizing is required by the program. Adjusting oversize by 1.1 for multiple systems is reasonable, but could be researched during evaluation to confirm its accurate.	estimate. I'm not sure if we can assume that multi-unit systems will be more oversized than single unit systems. I think we can probably leave at 1.1 for 2021 publication unless we find source that suggests better. -JW	No further action	No further action
PSD2.2.7	Natural Gas Radiant Heaters	PD - peak day savings	0.00544 X ACCF	0.00544 X ACCF	No change	Standard algoritms	Since a gas measure, peak may not be relevant	Remove peak savings	Action required/Resolved
PSD2.2.7	Natural Gas Radiant Heaters	SFR - savings fraction	0.25	0.25	Proposed Further Secondary Research	Savings are highly dependent on how the system is used, and the referenced source is 17 years old. The savings percentage is currently consistent with other TRMs, but could be updated with further evaluation.	This would probably be good to update/investiate further. I think we should try to find some studies to update the 25% SFR value. - JW	Proposed secondary research	Action required/Resolved
PSD2.2.7	Natural Gas Radiant Heaters	nb - base efficiency	0.8 - Reference IECC 2015	0.8 - Reference IECC 2018	Updated reference	The value is the same, but the reference should be updated to 2018 IECC Table C403.3.2(4) Warm Air Furnace Minimum Efficiency Requirements. CT adopting IECC 2018.	We will update this refrence in the 2021 publication. -JW	No further action	No further action

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COMMENTS DISCUSSION

Multifamily Infiltration: Blower Door Test

Current algorithm	BF = 0.7818 - 0.0002xD + 0.0012xF D = Shared Surface Area (ft2) between conditioned spaces. F = Envelope Perimeter (ft) is used to describe the sum of all the lengths of the edges of the unit, common and exterior surfaces.
Proposed algorithm	BF = 0.67 + DuctLocationTerm - 0.088xDoors - 0.0002xD + 0.0012xF DuctLocationTerm = 0.27 for ducts in unconditioned space, and 0.05 for ducts in conditioned space or if no ducts Doors = number of exterior doors D and F = same as before

- **4.4.2 Infiltration Reduction Testing (Blower Door Test)**
- Background:
  - For multifamily buildings, the PSD includes a "blower door CFM reduction factor" (BF)
  - BF reduces dwelling unit blower door result, because some infiltration comes from adjacent (conditioned) spaces
  - The PSD BF equation is from CARB (2013), but the original CARB equation for BF had more parameters. (PSD simplified it)
  - Recommended (proposed) algorithm
    - Adds back in some terms from original CARB study for improved accuracy
    - Adjusts the 1st coefficient accordingly and based on calibration from field data

Multifamily Infiltration:
Blower Door
Test

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- Comment: "For MF buildings, blower door test results need to account for inter-unit leakage. A guarded blower door test can be used in some cases. The Companies also worked with SWA to develop an approach that had a back end savings (billing?) analysis component. The vendors were not happy with this methodology, though I haven't heard concerns raised recently."

- Response:
  - We recommended adding a reference for projects conducting a guarded test: Air Barrier Assoc. of America, Standard Method for Building Enclosure Airtightness Compliance Testing, 2016
  - BF accounts for inter-unit leakage for unguarded tests.
    - BF results are improved by adding more terms from original CARB study
    - Results from our recommended BF calculation agrees better with (unpublished) guarded results from garden-style units.
    - The SWA reference in the PSD is a calculator that uses the project's billing data, which would be big departure from BF approach

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- Comment: "this Measure is being reviewed under the MF Impact study which will shade more light about the parameter or Impact factors (using billing data, engineering algorithm .. Etc)."
- Response:
  - The MF Impact study conducted by TRC will not use billing data (beyond scope)
  - While BF does account for inter-unit leakage, the CARB study (and the data we used to calibrate results) are mostly from garden-style units or townhomes
  - Additional research could use the SWA calculator (which uses project billing data) with a sample of multifamily units on enclosed corridors. Purpose:
    - Compare SWA calculator results to BF calculation outputs to see how well BF represents MF units on enclosed corridor, and
    - Investigate interactivity effects for MF, from projects that conducted air sealing AND installed HVAC measures

UPDATE HDD AND CDD BY LOCATION

Current PSD Value:	Single CDD and HDD values to represent the whole state
Recommended Update:	Inland and Coastal weather HDD and CDD

- R91 study recommended two sets of DD values: inland and coastal

- PSD currently recommends single CDD and HDD values to represent the whole state

- Other TRMs offer varying DD values by geography: NY, Mid-Atlantic TRMs

- Our analysis of TMY data shows that inland HDDs are 12% greater than coastal; inland CDDs are 9% greater than coastal

- **Can program implementers and tracking systems handle inland vs. coastal DDs?**

- Secondary observation: Current PSD values consider NOAA weather, 1979-2008. Other jurisdictions are updating typical weather to reflect recent climate changes.

Affected Measures – Batch 1 & 2

Chillers

Boilers and furnaces

Duct sealing

Blower door test

Residential CAC

QI verification

Building envelope

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PROSPECTIVE RRS

Current PSD Value:	Multiple parameters
Recommended Update:	Multiple parameters
Affected Measures:	Multiple measures

- Issue: Proposed changes affect relevance of prospective RRs based on use of the prior PSD

- *If/when should RRs be adjusted in tandem with PSD measure changes?*

- Appropriate to adjust if all conditions apply:
  1. Quantifiable at Appendix 3 level
  2. Systematic directional bias
  3. Significant
  4. Not part of a routine baseline evolution

- Requires detailed program data. Not in X1931 scope.

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Appendices and Data Sources

PSD APPENDICES

- Appendix One – Peak Factors
  - Values updated through regular impact studies
  - Team will be providing high-level, best-practice recommendations on 7/15 call
- Appendix Two – Load Shapes
  - Values updated through regular impact studies
  - Team will be providing high-level, best-practice recommendations on 7/15 call
- Appendix Three – RRs
  - Values updated through regular impact studies
  - Ripple effects of PSD updates on RRs – discussed today
- Appendix Four – Lifetimes
  - Detailed research upcoming (X2001)
  - Team will be providing high-level, best-practice recommendations on 7/15 call
- Appendix Five – Hours of use
  - Values updated through regular impact studies
  - Team will be providing high-level, best-practice recommendations on 7/15 call
- Appendix Six – Non-Energy Impacts
  - Detailed research upcoming (X1942)

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LEVERAGING CT EVALUATION STUDIES

- 16 previous CT evaluation studies incorporated
  - Previous studies between 2014-2019 – Checked and recommendations either already incorporated or recommendations made to update
- Very recent evaluation studies being investigated: C1635, C1634, R1973
- [C1635] Energy Opportunities (EO) Program Impact Evaluation
  - Update Energy and Demand RR for EO Program End Uses
  - Update Seasonal Peak CF - *Add new building types*
  - Update Upstream Lighting kWh gross RR and ISR – *Replace current RR table – PSD currently assumes 100% - Must also update algorithms to include ISR*
  - Upstream Lighting HOU – *Not for all building types*
  - Add Lighting/HVAC Interactive Factors – *Done through RRs*

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LEVERAGING CT EVALUATION STUDIES

- [C1634] Energy Conscious Blueprint (ECB) Program Impact Evaluation
  - Remove: Dual Enthalpy Economizer
  - Add: Variable Speed Air Compressor
  - Incorporate light logger data with other evaluation studies (C1635) – <u>Potential future research opportunity</u>
  - Chiller – Update language to using 8,760 hourly analysis instead of bin analysis
- [R1973] ESRPP and E-Commerce Retail Non-Lighting Evaluation
  - Update kWh savings – Appliances and electronics based on the VT TRM
    - VT was not a TRM used for comparison in x1931
  - Documentation of key factors and assumptions
  - Document consistent calculation approach
  - Consider deemed approach

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NEXT STEPS

- Next Wednesday's (7/15) call:
  - Notable Batch 3 comments – last call for Batch 3 comments: **today COB**
  - Straggler Batch 1 & 2 comments
  - Appendix observations and best practices
  - Preliminary list of possible primary research topics – data gaps

- Final comments or questions?

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Thank You