

**CT EEB X1931 PSD REVIEW (ALL SECTORS)
WITH X1941 MULTIFAMILY-SPECIFIC PSD TOPICS
7/15/2020
MEASURE REVIEW DISCUSSION
PART 2 – BATCH 3 & NEXT STEPS**

AGENDA

- Study Background
- Results Overview (*updated with Batch 3*)
- Batch 3 Comments Discussion
- Appendices Discussion
- Baseline Discussion and Primary Research
- Next Steps



Empowering you to make
smart energy choices



STUDY BACKGROUND AND RESULTS OVERVIEW

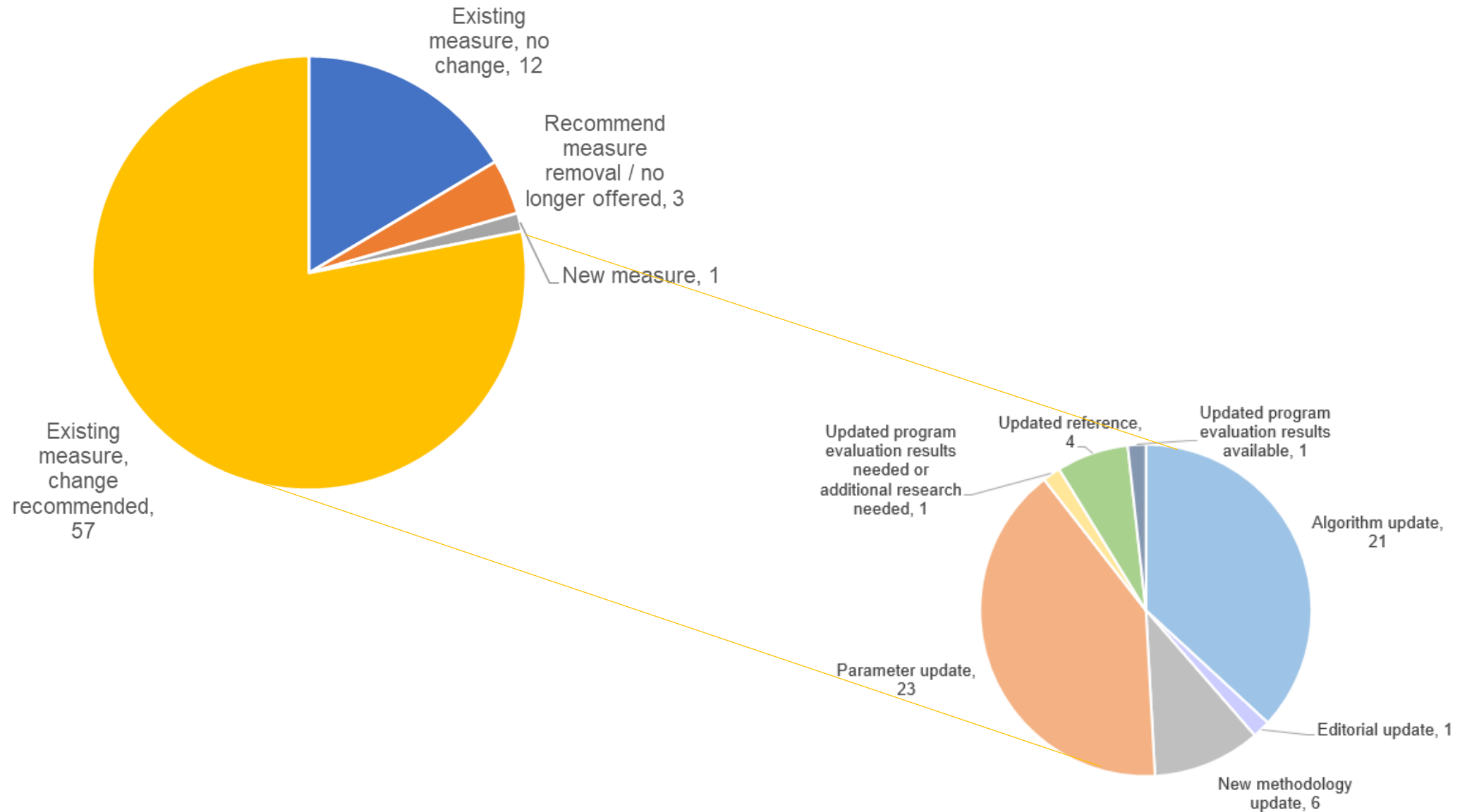
PHASE 1 STUDY BACKGROUND

- Last Friday and today's discussion meetings conclude 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 3 measures for today's discussion

MEASURE BATCHES

Batch 1 – Delivered June 18	Batch 2 – Delivered June 26	Batch 3 – Delivered 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

MEASURE STATUS AFTER REVIEW OF ALL BATCHES



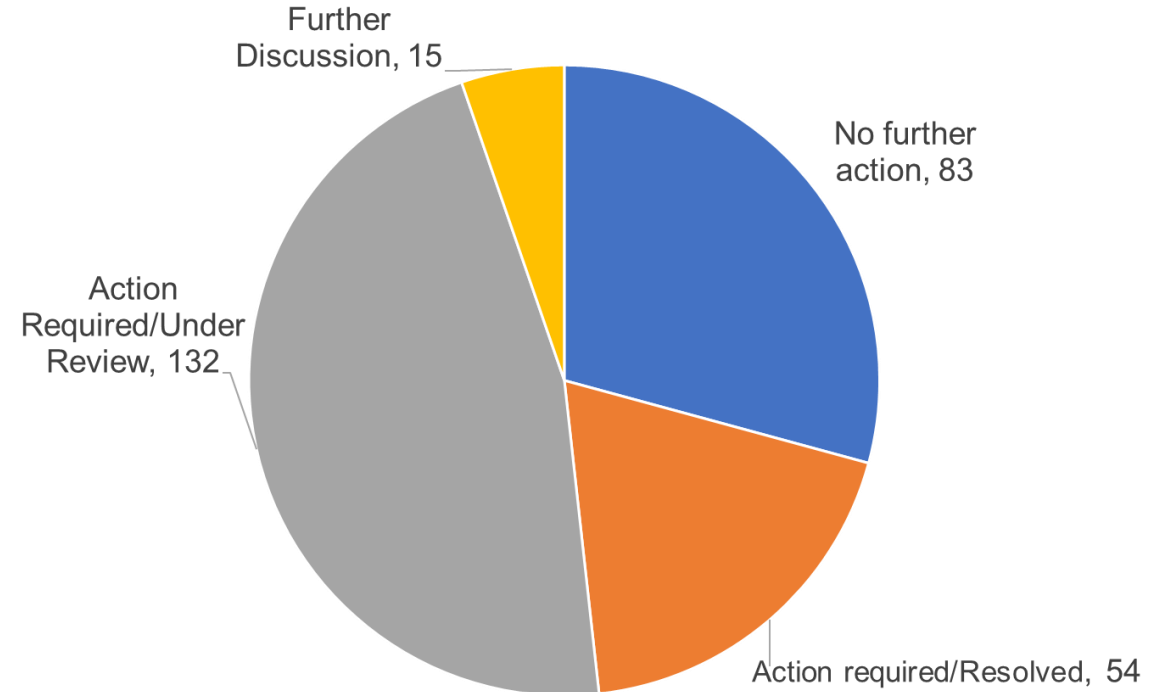
BATCH 3 COMMENT SUMMARY

- 284 comments total

Addressed
via email

- 83 No further action - Agreement
- 54 Consultant action required - Resolved
- 132 Consultant action required - Under Review

- 15 Further Discussion - Today
- Comments covering in three major topics
 - Multifamily Lighting Hours
 - Occupancy sensor/lighting controls
 - Ductless HP – cCHPs
 - GSHP – LO Baseline



BATCH 3 COMMENT SUMMARY EMAIL

Measure ID	Measure name	Parameter	Current PSD Value	Recommended Value	Recommended action	Justification	Comment	ERS Response	ERS Response Category
PSD2.1.1	Standard Lighting	CFL - lighting coincidence factor	Varies by building type. See PSD Table A-1-1.	0.80 summer, 0.61 winter	Parameter update	MA TRM uses a much newer study by DNVGL (2017 vs 2007) and simplified coincidence factor calculation which streamlines program savings calculations.	C1635 EO Impact recommends CFs by building type, season. Based on analysis of multi-year, multi-program logger files.	ERS will review and incorporate recommendations of recent evaluations (C1635)	Action required/Resolved
PSD2.1.1	Standard Lighting	H - Facility lighting hours of use	Site specific, or as tabulated in A5-1	Update table A5-1 based on forthcoming evaluation	Awaiting Evaluation Results	Evaluation results on lighting hours are forthcoming. C1635 EO Impact Evaluation.	C1635 EO Impact results are now available, including lighting HOU.	incorporate recommendations of recent evaluations	Action required/Resolved
PSD2.1.1	Standard Lighting	Sector (C&I, Residential)	C&I	C&I	No change	Aligns with other TRMs	Please ensure any factors here that change will remain compatible with the	incorporate recommendations of recent	Action required/Resolved
PSD2.1.1	Standard Lighting	Baseline equipment	Energy code baseline	Energy code baseline, using either Space-By-Space method or Building Area method	Parameter update	Other TRMs use both space-by-space and building area methods	reference both building area method and space by space area method options. JW	language earlier in the measure to clarify that space-by-space is an	Action required/Resolved
PSD2.1.1	Standard Lighting	Energy efficient equipment	Exceeds current energy code	Exceeds current energy code with DLC- or EnergyStar-approved lighting equipment	Parameter update	Adds specificity to the kinds of equipment that should be incentivized. Forthcoming NMR Retail Lighting Study.	need to review NMR study before commenting on this. JW	recommendation pending forthcoming evaluation results from NMR.	Action required/Under Review
PSD2.1.1	Standard Lighting	Energy efficient equipment	Exceeds current energy code	Update efficacy based on forthcoming NMR Retail Lighting Study.	Awaiting Evaluation Results	Adds specificity to the kinds of equipment that should be incentivized. Forthcoming NMR Retail Lighting Study.	need to review NMR study before commenting on this. JW	recommendation pending forthcoming evaluation results from NMR.	Action required/Under Review

COMMENTS DISCUSSION

Multifamily Lighting Hours of Use

Current parameter	HOU = 7,665
Proposed parameter	HOU = 6,388

- Justification for proposed change:
 - CT PSD value of 7,665 is not sourced, and is higher than other TRMs
 - MA applies 17.5 hrs/day (6,388 per year) for all Multifamily common area types. WI TRM has a value of 5,950 for multifamily common areas. That value reflects CFLs only, and most replacements are now LEDs. But the WI value does indicate that the current CT value is too high.
- Comment: “Specify interior common areas, or other assumption.”
- Response:
 - The MA value of 6,388/yr applies to all common area lights, including interior common areas
 - While it would be more accurate to have different values for different multifamily common areas, that is overly complicated



Occupancy Sensor Recommendations

Current method	Occupancy sensors are part of the "Standard Lighting" measure (3.1)
Proposed method	Create a standalone measure for "Lighting controls"

- Note: This would apply to both commercial and multifamily common areas
- Comment: “need to understand why we are recommending separate occ sensor measure before comment here. In general, I think that it is better to keep occ included in lighting section.”
- Justification:
 - Lighting controls such as occupancy sensors may be installed independently of other lighting upgrades.
 - Other TRMs list Occupancy Sensors or Lighting Controls as an independent measure (e.g., MA and RI TRMs)
- If lighting controls are retained within Standard Lighting, language should clarify the base wattage (Wn) for the controls is the new (installed) fixture, if the retrofit includes a fixture replacement *and* lighting controls



INCLUDE SEPARATE ALGORITHMS FOR CCHP

Current PSD Value:	No differentiation between non-cold climate and cold climate HP units
Recommended Update:	Separate savings algorithms for cold climate HP units

- Middle ground between MA and NY TRMs
- MA TRM does not differentiate between non-cc and ccHP units leading to results such as WKW = 0, WCF = 0.
- NY TRM explicitly includes ccHP (both air-source and ground-source) with complex savings algorithms.
- How are cold-climate heat pumps being considered on implementation side?
- We recommend explicitly separate savings algorithms for ccHPs, which are not as complex as NY TRM.

Affected Measures – Batch 3

Heat Pump

Ductless HP

Unitary AC and HP

C&I GSHP ISP Lost Opportunity BASELINE

Current PSD Value:	Code-compliant GSHP Baseline
Recommended Update:	Code-compliant GSHP Baseline

- Stakeholders comments suggest fossil fuel/central AC baseline.
- We believe that a C&I customer planning to install GSHP system would not have installed a fossil fuel heat source.
- It makes more sense to compare HP to HP

EVALUATION REPORTS

CT EVALUATIONS TO BE INCORPORATED

- [C1635] Energy Opportunities (EO) Program Impact Evaluation
- ERS review left place holders for the following
 - 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*

CT EVALUATIONS TO BE INCORPORATED

- [C1634] Energy Conscious Blueprint (ECB) Program Impact Evaluation

Item	Current Recommendation	Updated Recommendation
Dual enthalpy economizer	Keep Measure - Align with NY DOE-2	Remove from PSD - minimal/no savings
Variable speed air compressor	No recommendation/Not current measure	Add measure/develop as part 2 of this study
Lighting HOU	Future study incorporating data from C1634	HOU recommended area of future study - aggregate collected raw (C1635) data and potentially obtain additional data
Chiller Anaysis - 8760 for demand savings	BIN Analysis (No change from PSD)	Under Review
Baseline Study - Lighting/LPD, HVAC efficiency, boiler efficiency and ROF	Further research	Futher research

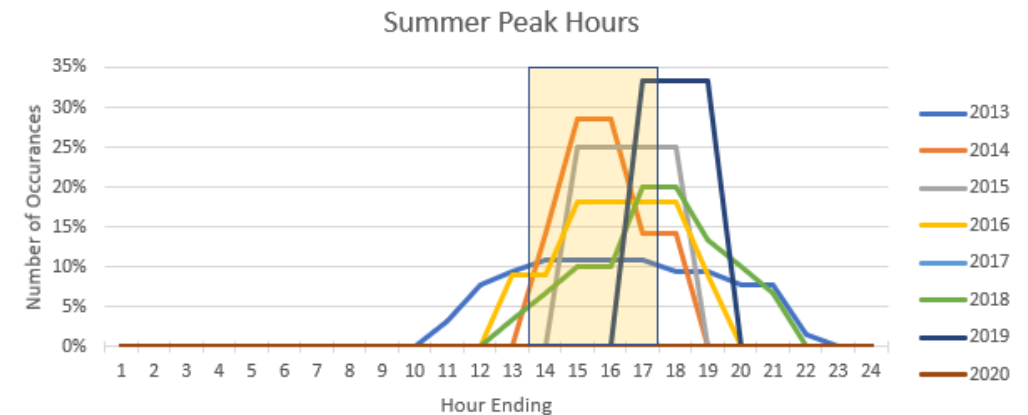
CT EVALUATIONS TO BE INCORPORATED

- [R1973] ESRPP and E-Commerce Retail Non-Lighting Evaluation
 - Update kWh savings – Appliances and electronics based on the VT TRM
 - Documentation of key factors and assumptions
 - Document consistent calculation approach
 - Consider deemed approach

APPENDICES

APPENDIX ONE: PEAK FACTORS

- Provides peak factors for 19 of the PSD's 72 measures
- Remaining measure CFs are provided in individual measure chapters
- Peak factors supported by 14 references:
 - Two explicitly specify ISO-NE Seasonal Peak definition (account for 55% of factors)
 - These two studies are from 2007
 - Two references are not cited
 - Five references could not be accessed – broken link
- Seasonal peak has generally shifted since 2007
- Appendix One recommendations:
 - Specify ISO-NE Seasonal Peak only when confirmed
 - Expand Appendix One to include all measure CFs, even those not confirmed to be seasonal peak
 - Use evaluation studies, primary research to refresh seasonal peak CFs, as current peak is likely later than 2007's



APPENDIX FOUR: LIFETIMES

- References are generally old, with most from 2005-2009
 - Many of the technologies addressed have had a full lifecycle or more since
 - Commercial references are generally older than residential
 - Several references now inaccessible due to broken link, spreadsheet
- Commercial EULs cite “estimate” in 66 instances
- Example EULs recommended for revision after detailed measure review:
 - Residential: furnace, heat pump
 - Commercial: fan control, vending machine control
- RUL values provided for only 2 commercial and 6 residential measures
 - Related to dual baseline discussion today – credible RULs needed for early replacement claim
- Upcoming X2001 study provides opportunity for original research
- Appendix Four recommendations:
 - Revise links and embed PDFs and spreadsheets within PSD itself
 - Refresh obsolete references with new research (X2001) – secondary research is circular and dated
 - Secondary/primary research on RULs required for dual baseline claim

APPENDIX FIVE: HOURS OF USE

- Nearly all EFLHs cannot be cited to a specific source
 - “These hours have been developed over the years and are taken into account during program evaluations.”
 - References to prior evaluation studies, in CT or elsewhere, are unknown
 - Data request submitted 7/14/2020
- Unclear how EFLH changes have affected prospective RRs
 - “Any errors, whether positive or negative, are trued up in the realization rates.”
- Example EFLHs recommended for revision after detailed measure review
 - Residential: heat pump (ASHP, DMHP, GSHP), wifi thermostat
 - Commercial: door heater control, heating system components
- Appendix Five recommendations:
 - Support EFLHs with transparent, accessible citations
 - Leverage CT evaluation study results for EFLH update/pooling of data
 - Follow evaluators’ prospective RR guidance when EFLHs change
 - Consider coastal/inland differentiation for EFLHs when possible
 - Related to Friday’s discussion on degree days

OTHER APPENDICES

- Appendix Two: Load Shapes
 - PSD references Appendix Two only 4 times – natural gas peak factor
 - References dated between 2011-2016
- Appendix Three: Realization Rates
 - Prospective RRs may require revision after PSD updates
 - Related to Friday's discussion on criteria needed for prospective RR update
 - Including RR detail would allow more transparent revision of prospective RR:
 - Program-reported vs. evaluated savings underlying the RRs
 - Differentiation by sector when possible: e.g., SF vs. MF for HES/IE
- Appendix Six: Non-Energy Impacts
 - Residential NEIs addressed in aggregate – HES/IE, MF, Rebate (per R4 and R31 studies)
 - Commercial: only PRIME/RCx/O&M programs addressed per C1641 study
 - Measure-specific and commercial NEIs are lacking
 - X1942 study provides an opportunity for primary research, priorities informed by DEEP B/C directions

BASELINE REVIEW

BASELINE REVIEW

- Industry standard practice baseline vs. code, when both exist & differ
 - Boilers already reflect higher ISP baseline (*next page*)
 - *Furnaces will have updated recommendations (next page)*
 - Known: Furnaces, custom lighting, need to review new C1634 ECB results
- Dual baseline / early retirement
 - X1939 focus
 - Integrating effort with X1931
- Market event characterization review
 - Replace on failure versus retrofit baseline
 - How to best apply:
 - One or other
 - Both
 - Blended average

BASELINE REVIEW IN PSD

Category	Measure	MA Baseline	PSD Baseline
Boilers Residential	HVAC - Forced Hot Water Boiler, Gas	ROF: 82% AFUE rated boiler (79.3% AFUE actual). ER: 80% AFUE rated boiler (77.4% AFUE actual).	ROF: 85% AFUE rated boiler, ER: 80% AFUE rated boiler.
Boilers Residential	HVAC - Forced Hot Water Boiler, Oil/Propane	ROF AFUE of 84% for oil boiler. ROF AFUE of 79.3% for propane boilers (code-compliant AFUE of 82% adjusted by a degradation factor of 0.967)	ROF AFUE of 84% for oil and 85% for propane, with ER baseline AFUE of 80%.
Boiler Commercial	HVAC - Boilers	Equal to code (IECC 2018 starting in 2020 /ASHRAE 90.1-2016 starting in 2020).	IECC 2015
Furnace Residential	HVAC - Furnace, Gas	ROF: 85% AFUE furnace, ER: 78% AFUE furnace (Actual 78.9% AFUE).	ROF: 85% AFUE furnace, ER: 78% AFUE furnace.
Furnace Residential	HVAC - Furnace, Oil/Propane	ROF: AFUE of 83% for oil and AFUE of 85% for propane furnace. ER: 78% AFUE furnace (both oil and propane)	For oil: 82% AFUE furnace for ROF and 76% AFUE for ER. For propane: 85% AFUE furnace for ROF and 78%
Furnace Commercial	HVAC - Furnace, Gas	ISP instead of code. "Recommended baseline is code except the Warm Air, Gas-fired <225 MBH = 85% AFUE Warm Air, Oil-fired <225 MBH = 83% AFUE Warm Air Ducted, Gas-fired <225 MBH = 85%	ASHRAE and 2015 IECC minimum efficiency require

FUTURE PRIMARY RESEARCH

PSD REVIEW PHASE 2: PRIMARY & SECONDARY RESEARCH

- Preliminary prioritized list based on PSD review, stakeholder interviews, and literature review – to be refined and discussed further in next call (after modeling work)

High	Medium	Low
*Baseline: Code vs. ISP	*ACOP/COP - Refrigeration Measures	*Savings Fractions - Natural Gas Radiant Heaters
*Hours of Use	*Interactivity of HVAC and Air Sealing	*Measure Development (new additions to PSD) - Passive house, refrigerant leak, codes and standards
*Peak Factors (Measure specific)	*Infiltration Reduction (Blower Door Test)	
*Prospective Realization Rates	*Measure Development (new additions to PSD) - Integrated Controls/Home Automation, EMS, ALC, Variable speed air compressor	
*Strategic Electrification		

NEXT STEPS

NEXT STEPS

- Finalize measure recommendations
 - 99% Complete by Wednesday 7/22/2020
 - Any stragglers before the end of the month (HDD/CDD, Heat Pump)
- Follow up meeting to address primary and secondary research recommendations for Phase 2 of this X1931 PSD project with the committee

THANK YOU