



DEER2019 and Revised DEER2017 + DEER2018 Updates



Energy Division
California Public Utilities Commission

July 18, 2017



Welcome

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- Agenda:
 - Accessing the 2017 Update Data
 - Residential Pre-Existing Baselines
 - Residential Clothes Washer (pre-existing baseline - new measure)
 - Residential Refrigerator and Freezer
 - Residential DHW (pre-existing and HP)
 - Residential Furnace (Pre-existing
 - Res & Non-Res Air Conditioner Updates, Corrections and Scaling
 - Variable Refrigerant Flow (VRF)
 - Res & Non-Res Refrigerant Charge Adjustment
 - Chillers
 - Net-To-Gross (for accelerated replacement plus new values)



Accessing the 2017 Update Data

- DEEResources.com
 - Main Menu => DEER Versions => DEER2019 and June 2017 DEER Updates
 - This web page currently covers all proposed updates and additions that are part of the June 2017 DEER Update. The final version may move the descriptions and links based on the DEER version impacted (i.e. DEER2017, DEER2018, DEER2019).
 - The web page provides descriptions and links to all supporting documents.
- READI
 - Version 2.4.7, released in August of 2016, is the latest version. Download the READI program from DEEResources.com
 - Main Menu => DEER Versions => READI



Accessing the 2017 Update Data

- PEAR database
 - All proposed DEER updates are in the Preliminary Ex Ante Review (PEAR) database.
 - To view all the DEER Measures impacted by this update:
 - Open the PEAR database using READI,
 - On the Measures tab, click on the heading of the “Source Desc” column,
 - Select only “June 2017 DEER Update”.
 - The Measure List is then filtered to show only the measures impacted by this latest update.
 - Scroll, filter or search the Measure List to find measures of interest.
 - There are a number of Measures designated as Component measure type. To see these measures be sure to select Component Measures from the READI => View => Options => Measures and Ex Ante Options tab.



Accessing the 2017 Update Data

- PEAR database
 - The Net-to-Gross update is found in the Support Tables tab of READI.
 - One new column of data is included in the table structure, the Accelerated Replacement Adjustment Factor (AFar).
 - New records are listed with the Documentation field of “June 2017 DEER Update”
 - Changes to data in the PEAR database during the review period are noted in the PEAR change log (link on web page).



Residential Pre-Existing Baselines

- From 2012 California Lighting and Appliance Saturation Survey (CLASS)
 - 2,000 residences
- Pivot table workbooks used to review data and calculate averages
 - Variation with building vintage
 - For appliances: average of equipment four years and older at time of CLASS



Residential Clothes Washer Updates

- New Pre-Existing Baselines
- New Code for Top-Loading
- New Measure for Top-Loading



Clothes Washer

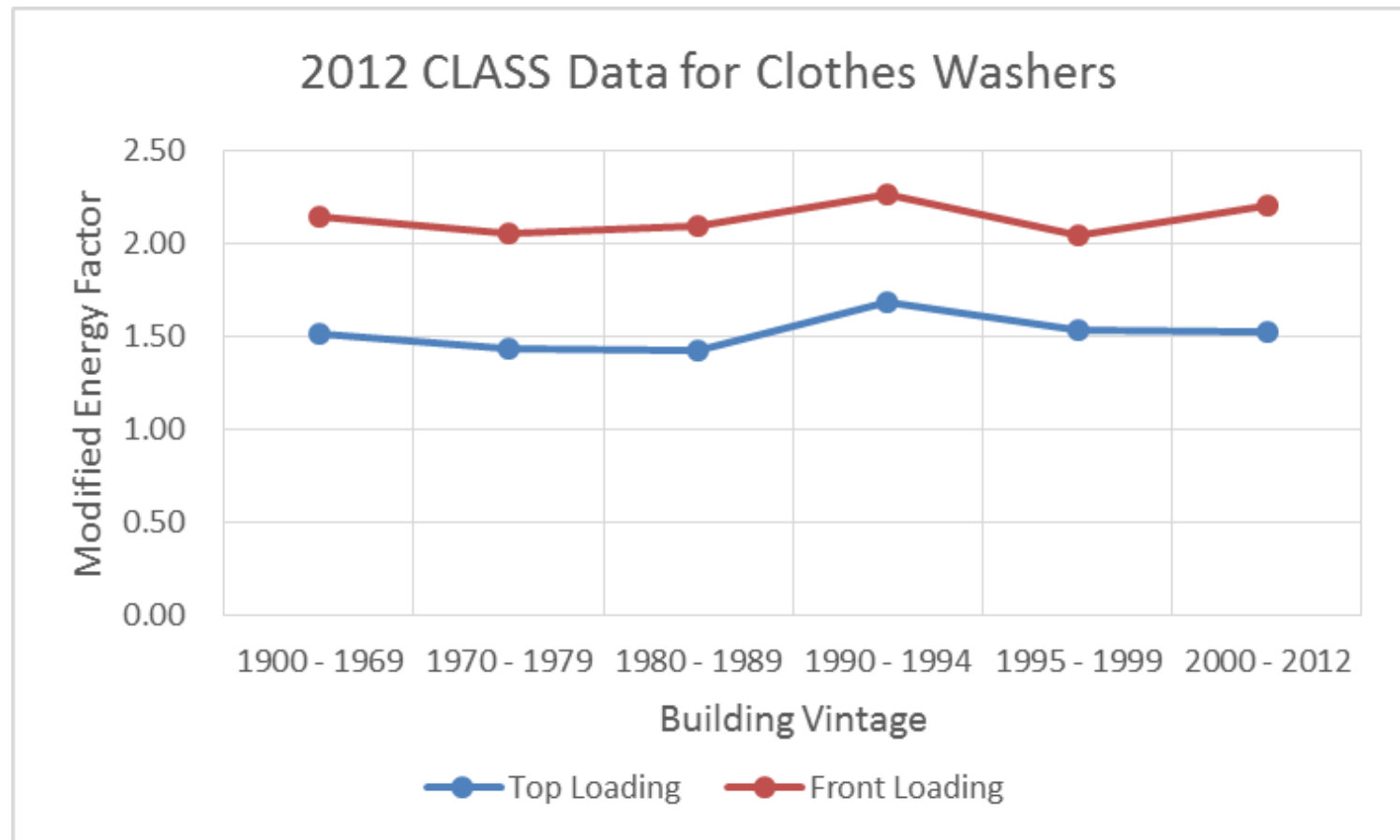
Supporting Documents

- Pre-existing baseline evaluation
 - Pivot_2014_06_09_CPUC_CLASS_2012_ClothesWasher.xlsx
- Development of performance values for models
 - DEER2017-2019-ClothesWasherUpdate.xlsx
- Comparison to previous Measure definitions and Energy Impacts:
 - ClothesWasher-DEER2016-DEER2017_compare.xlsx



Clothes Washer Pre-Existing Baselines

CLASS data vs. building vintage





Clothes Washer Pre-Existing Baselines

- Previous Code/Standard and pre-existing were 1.29 MEF based on federal standard value for top-loading
- Front-loading now has its own same-technology baselines

Measure	Vintage	Old Pre-Existing Baseline	New Pre-Existing Baseline	New Federal Standard	DEER2017 Code/Standard
Clothes washer, top loading	All	1.29	1.50	1.57	1.50
Clothes washer, front loading	All	1.29	2.14	1.84	2.14



Clothes Washer New Code

- New federal standard for top-loading washers
 - **Effective 1/1/2018**
 - IMEF will increase to from 1.50 (CLASS value) to 1.57



Clothes Washer New Measure

- Energy Star “Most Efficient Products” program
 - New Tier 3 measure for top-loading machines
 - IMEF 2.76 or greater
 - 19% higher IMEF than Tier 2 measure



Refrigerator and Freezer Supporting Documents

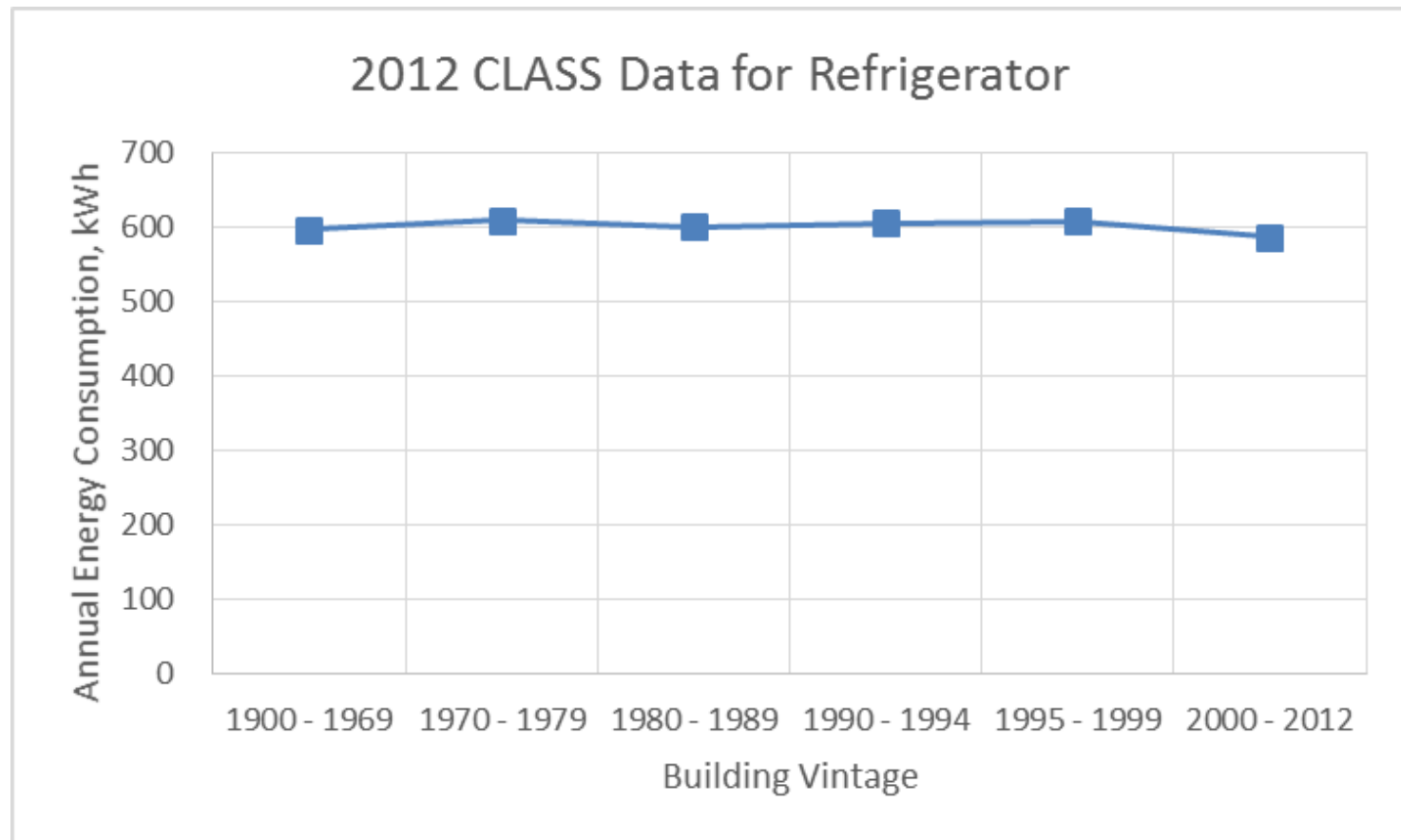
Pivot_2014_06_09_CPUC_CLASS_2012_Refrig.xlsx

Pivot_2014_06_09_CPUC_CLASS_2012_Freezer.xlsx



Residential Refrigerator and Freezer Baselines

CLASS data vs. building vintage





Residential Refrigerator and Freezer Baselines

2012 CLASS Review

- Typical refrigerator has an energy rating 18% higher than the minimum code requirement (excluding compact)
 - Compact refrigerator baselines were inconclusive due to lack of size information in that category
- Typical chest freezer has a 10% higher rating
- Typical upright freezer has a 54% higher rating



Residential DHW

- New Pre-Existing Baselines
- New Code/Standard Technology for electric water heaters > 55 gallons
- New Measure Technologies for HP water heaters



Residential DHW

New Pre-Existing Baselines

- CLASS data shows little variation in pre-existing technology efficiency level versus building vintage. Therefore, vintage dependency dropped.
- Baseline is the straight average of all efficiencies for units over 4 years old.
- There were no 60 or 75 gallon units over four years old. Efficiencies for these units are an average of all units.



Residential DHW – Existing Baseline

	Gas Storage		Gas Storage	
Gallons	CLASS Count	DEER Update	CLASS Count	DEER Update
30	36	0.59	7	0.91
40	281	0.60	14	0.92
50	246	0.59	19	0.92
60	4	0.57	0	0.89
75	18	0.52	0	0.87

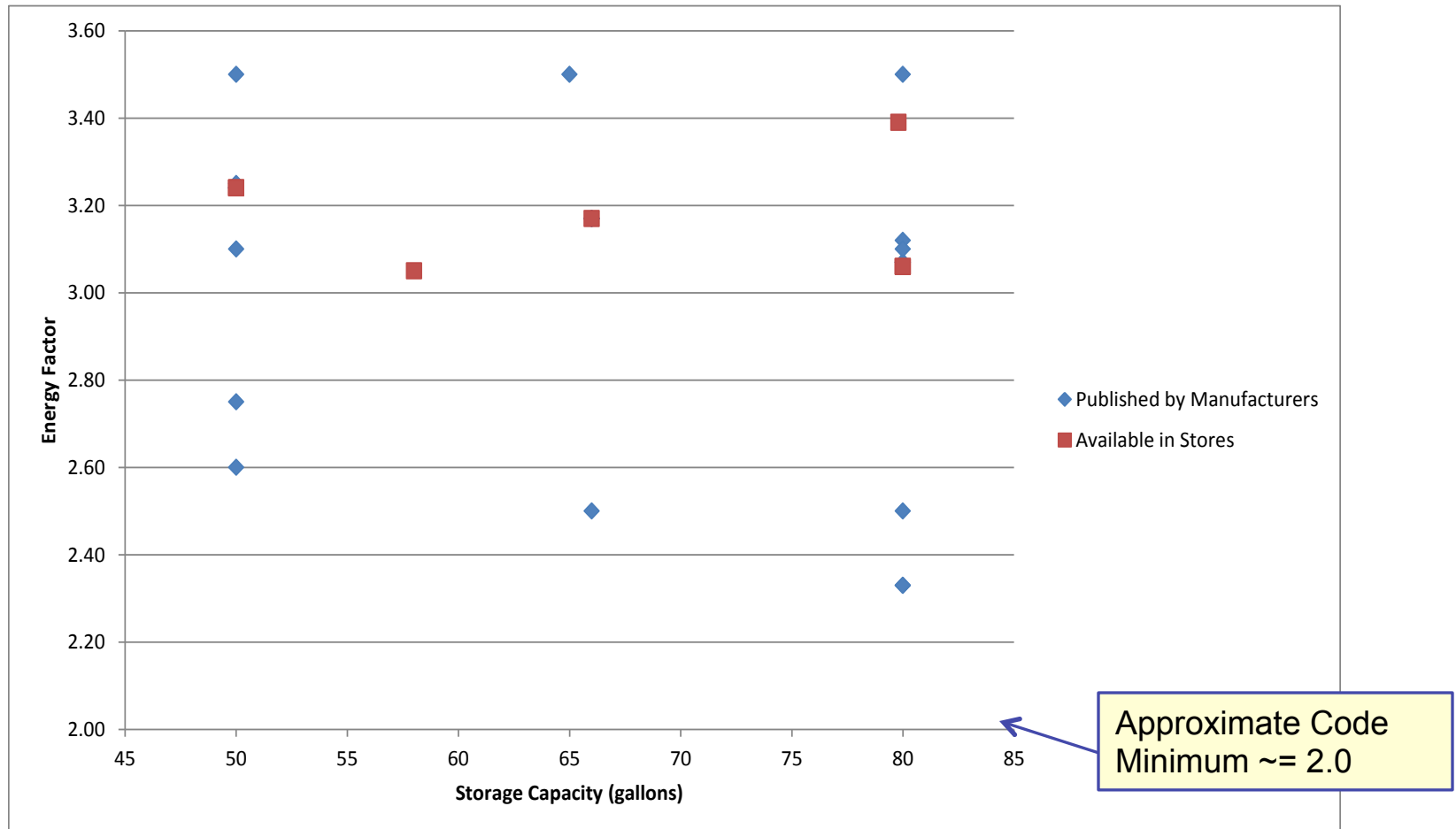


Heat Pump Water Heaters

- Efficiencies of available units greatly exceed current DEER measure definitions
- All units available in California greatly exceed minimum code requirements
- Smallest size available is 50 gallons
- Minimum code requirements for units >55 gallons is ~2, therefore code/standard baseline must be a heat pump water heater for 60 and 75 gallon replacements



Available Heat Pump Water Heaters





Heat Pump Water Heaters

- Standard baseline revised to 3.0 EF. This baseline applies to 60 and 75 gallon measures only. Smaller sizes are assigned the code baseline for conventional electric storage water heaters.
- Two measure tiers:
 - Tier 1 represents the lowest efficiency available in California in each of three storage capacity classes (50 gallon, 65 gallon, 80 gallon).
 - Tier 2 represents the most efficient water heater currently available from both manufacturers' literature and California retailers.



Residential DHW – Supporting Files

- CLASS baseline workbook
 - http://deeresources.com/files/DEER2019/download/Pivot_2014_06_09_CPUC_CLASS_2012_WaterHeater.xlsx
- Heat pump update workbook
 - <http://deeresources.com/files/DEER2019/download/DEERHeatPumpWaterHeaterUpdate-Jul2017.xlsx>
- DHW calculator workbook
 - <http://deeresources.com/files/DEER2019/download/DEER-WaterHeater-Calculator-v2.1.xlsm>



Residential Furnace Pre-existing Baseline

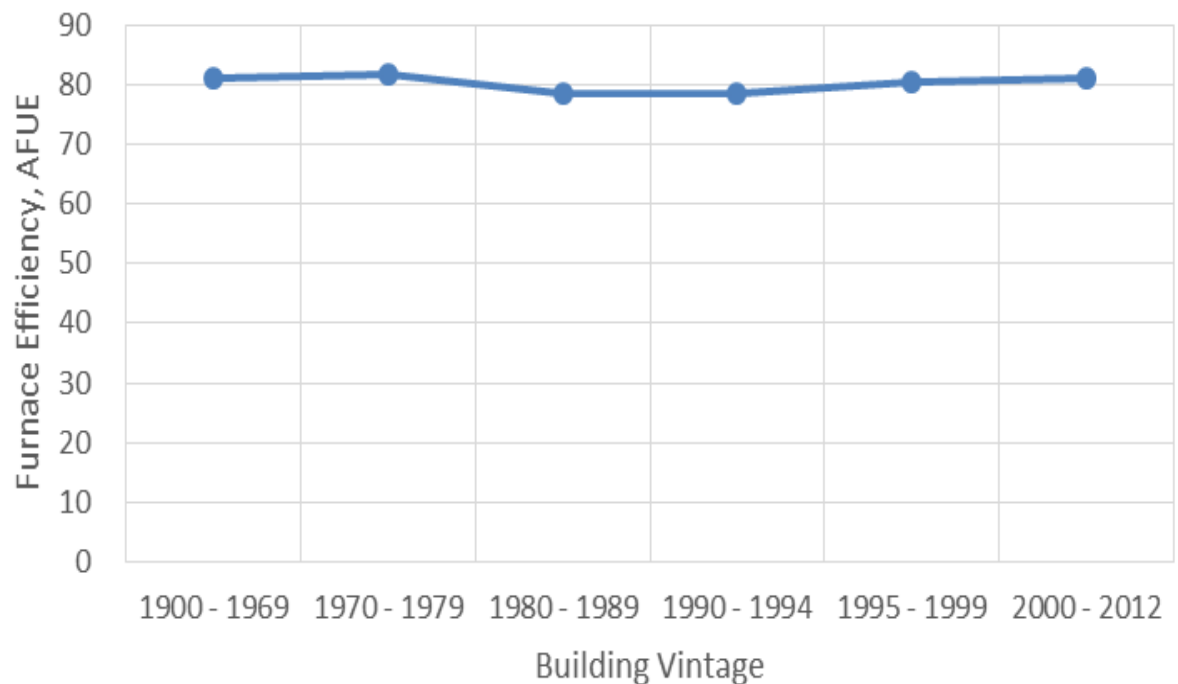
Supporting Document:

Pivot_2014_06_09_CPUC_CLASS_2012_Heating.xlsx

New pre-existing
AFUE is 80%

- Previous was 78 AFUE
- Code/Standard AFUE is 80

2012 CLASS Data for Furnace Efficiency





Air Conditioner Efficiency Updates

Residential

- Pre-existing baseline updates from CLASS

Commercial

- Corrections to errors
- Pre-existing baseline updates from Commercial Saturation Survey (CSS)

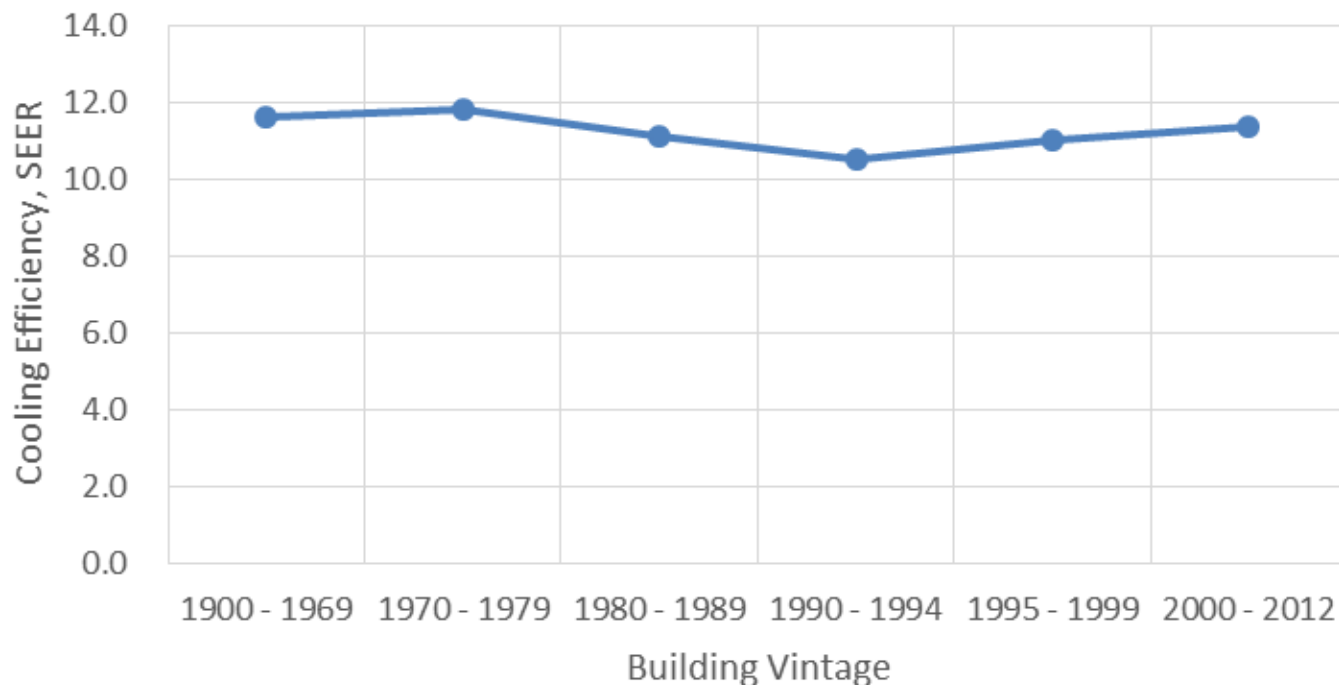


Residential Air Conditioner Efficiency Updates

New pre-existing baseline value is SEER 11.4

Pivot_2014_06_09_CPUC_CLASS_2012_Cooling.xlsx

2012 CLASS Data for Cooling Efficiency





Commercial Air Conditioner Efficiency Error Corrections

Cycling loss error

- Incorrect minimum for loss curve
- Affects one-speed split AC systems and all one-speed HP systems smaller than 65 kBtu/hr
- Slightly increased impacts for affected measures



Commercial Air Conditioner Efficiency Error Corrections

Code/Standard was incorrectly set as two-speed unit

- Affects all AC and HP systems 55 to 65 kBtu/hr
- Market research indicated two-speed SEER 15 units are rare, so the SEER 15 measure was converted to a one-speed unit
- Increased savings for SEER 16 and higher



Commercial Air Conditioner Pre-existing Baselines

CSS_NonRes_DX_Effic_Review.xlsx

Bldg Vintage	Split SZ < 65 kBtuh	Pkg SZ < 65 kBtuh	65 to 135 kBtuh	135 to <240 kBtuh	240 to < 760 kBtuh	>=760 kBtuh	
	Count SEER	Count SEER	Count EER	Count EER	Count EER	Count	EER
CSS Average Values							
Pre-2006	47 11.5	85 11.6	19 10.0	12 9.7	4 10.5	1	10.1
Values for DEER 2017 Update					CV VAV	CV	VAV
Pre-2006	11.5	11.6	10.0	9.7	9.8 10	N/A	9.2
2006 to 09	11.5	11.6	10.0	9.7	9.8 10	N/A	9.2
2010 to 2017	same as DEER 2015						
DEER 2015 Values					CV VAV	CV	VAV
Pre-2006	10.0	9.7	10.1	9.5	9.3 9.5	9	9.2
2006 to 09	13.0	13.0	10.1	9.5	9.3 9.5	9	9.2
2010 to 2017	13.0	13.0	11.0	10.8	9.8 10	9.5	9.7
2015-2017	14.0	14.0	11.0	10.8	9.8 10	9.5	9.7
Title 20-2016	14.0	14.0	11.0	10.8	9.8 10	9.5	9.7



Commercial Air Conditioner Air Flow Control

Claims from SCE Packaged HVAC Early Retirement Program
(see A.12-07-004-ED-SCE-EE Stats-27475Q.01Attachment_HVAC_EarlyRetirement.xlsx)

- Previous DEER had separate measure values for constant volume and variable volume
- DEER 2017 Update has single weighted value for 240 to 760 kBtu/hr range, and only VAV for ≥ 760 kBtu/hr

		Installed System Capacity by Equipment Vintage (Btu/hr)							Percent
		Pre 1978	1978 - 1992	1993 - 2001	2002 - 2005	2006 - 2009	Unknown	Total	
≥ 760 kBtu	VAV	0	3,735,010	9,386,476	0	0	0	13,121,486	100%
	CV	0	0	0	0	0	0	0	0%
240 \geq kBtu < 760	VAV	0	15,417,000	13,410,000	0	0	240,000	29,067,000	80%
	CV	0	1,389,000	5,249,000	0	0	600,000	7,238,000	20%



Scaling of AC Measures

- The new above pre-existing energy impacts are a weighted combination of the previous above pre-existing impacts and the above code/standard energy impacts.
- For example, if the pre-existing technology was updated from a SEER 10.0 unit from a SEER 11.4 unit, the new above pre-existing impacts are a combination of the previous above-code impacts based on a SEER 10 technology and the existing above code/standard energy impacts that are based on a SEER 13 technology.
- Support workbooks:
 - Res-HVAC-DEER2017-Update-ScaledImpacts.xlsx &
 - Com-HVAC-DEER2017-Update-ScaledImpacts.xlsx

Workbooks provide a comparison of new and old results and, document how the scaled results were created.



Variable Refrigerant Flow (VRF)

New Measures

- Expansion of previous work from March 1, 2017, which included tier level measures for four building types
- Now extended to eleven building types
- New measures are based on unit capacity and efficiency instead of tier levels



New VRF Measure List

All capacities run for all building types

Capacity, Tons	Heat Pump VRF			Heat Recovery VRF		
	Title 20	Tier 1	Tier 2	Title 20	Tier 1	Tier 2
6 to < 11.25	11	13.2	15.7	10.8	13	15.5
11.25 to < 14	10.6	13.2	15.7	10.4	13	15.5
14 to < 20	10.6	12.7	14.2	10.4	12.5	14
20 to < 24	9.5	11.7	13.7	9.3	11.5	13.5
24 to < 35	9.5	10.9	11.4	9.3	10.7	11.2
35 +	9.5	10.9	11.4	9.3	10.7	11.2



VRF Supporting Files

March 2017 Reports (included with March 1, 2017 VRF Workpaper Disposition)

- Performance Assessment Report: general information about modeling assumptions and methods
- Measure Impacts Report: specific results including same-technology comparisons and technology switch comparisons



VRF Supporting Files

DEER 2017 Update Material

- Description of system sizing and piping layout assumptions
VRF_Geometry.xlsx
- Summary of manufacturer's data used in the assessments
VRF_Mfg_Data.xlsm



VRF Supporting Files

- Complete package to run all VRF measure simulations:
VRF_Modeling_Tools_2017_07_10.zip
 - Workbook tool to run simulations and extract results
Run_VRF_Measures.xlsm
 - Simulation executables and support files
 - Simulation model template files for all buildings, climates and vintages
 - Folders for command line procedure files and simulation output files



Commercial Refrigerant Charge Adjustment

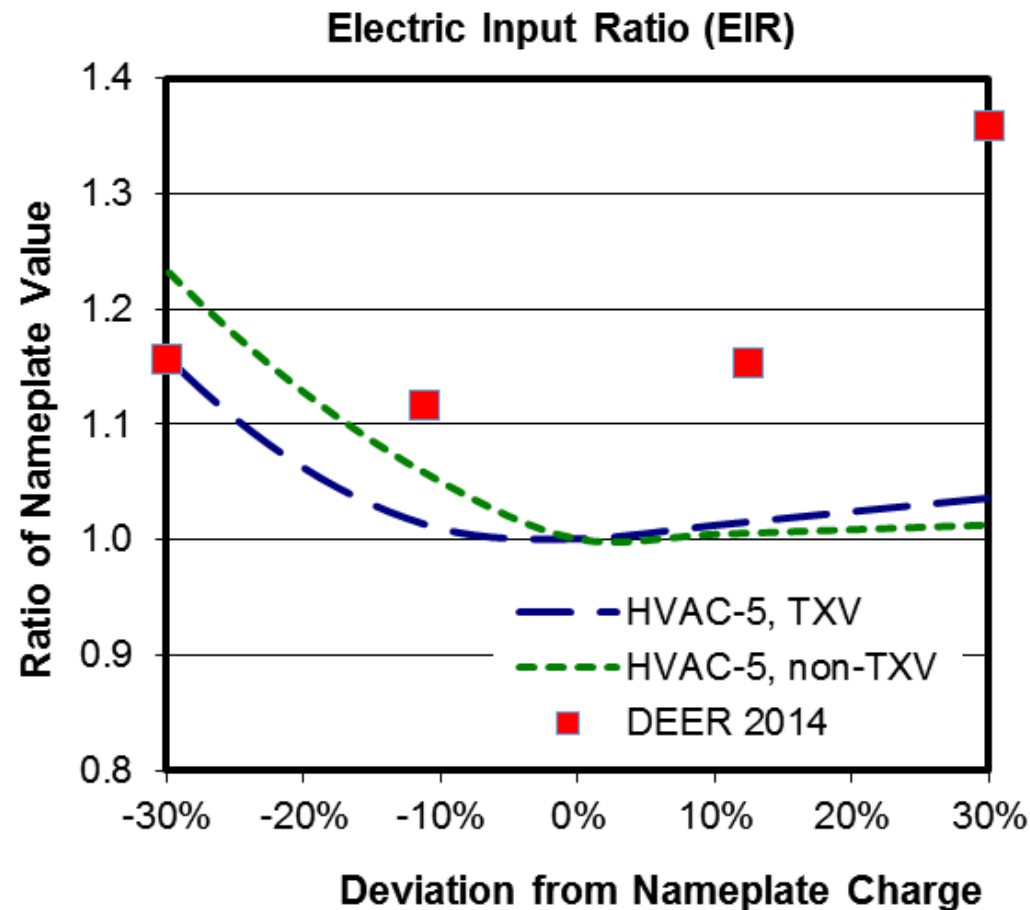
HVAC-5 EM&V study

Refr. charge lab tests

Updated performance values

RefrChg_NonRes_

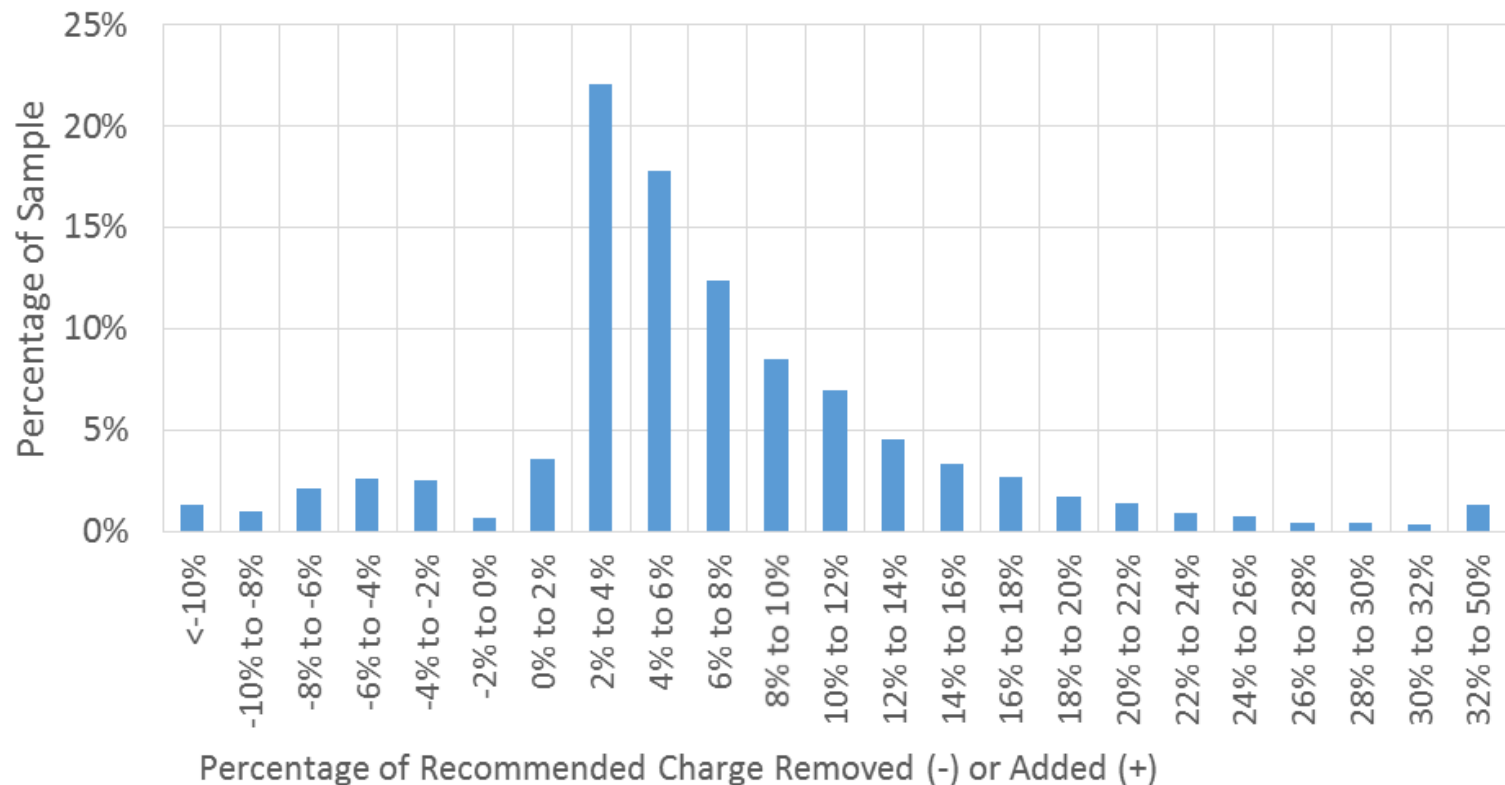
ImpactCorrelations.xlsx





Commercial Refrigerant Charge Adjustment

- HVAC-3 EM&V study – program claim data:
RefgChg_NonResHistograms.xlsx (23,000 samples)





Commercial Refrigerant Charge Adjustment

- Measure Values
RefgChg_NonRes_MsrCalcs.xlsx
- Measure Definitions
 - Under-charged and over-charged
 - TXV versus non-TXV
 - Fault level: typical
 - High and low undercharged measures were investigated and are included as Component type measures, however the typical values are the proposed values for claims



Residential Refrigerant Charge Adjustment

- Correction
 - split to separate TXV and non-TXV measures
- Measure Definitions
 - Under-charged and over-charged
 - TXV vs. non-TXV
 - Fault level: typical
 - Remove weighted measure
 - 4% and 16% undercharge measures were investigated and are included as Component type measures, however the typical values are the proposed values for claims



Chillers - Summary

- Revised measure definitions based on efficiencies of available machines
- DEER standard baseline for full-load and part-load efficiencies revised to be the same as minimum code requirements
- All chiller measures must exceed code requirements for full-load and part-load efficiency by at least 10%
- Added water-cooled VSD screw chillers



Chillers – Update Example

Conventional Water-Cooled VSD Centrifugal Chiller (Path B)

Size range	Code		Code + 15%			Code + 10% (new)	
	kW/ton	IPLV	kW/ton	IPLV revised	IPLV current	kW/ton	IPLV
< 150 tons	0.695	0.440	0.591	0.374	0.353	0.626	0.396
150 to 299 tons	0.635	0.400	0.540	0.340	0.323	0.572	0.360
300 to 399 tons	0.595	0.390	0.506	0.332	0.303	0.536	0.351
400 to 599 tons	0.527	0.380	0.497	0.323	0.298	0.527	0.342
>= 600 tons	0.585	0.380	0.497	0.323	0.298	0.527	0.342



Chillers – Support Documents

Measure	Reference	Location
DEER2017 (from Aug 2016) Measures	Revised measure definitions	http://deeresources.com/files/DEER2019/download/DEER2017Update_ChillerMeasures_10Jul2017.xlsm
DEER2017 (from Aug 2016) Measures	Simulation files	http://deeresources.com/files/DEER2017/download/DEER2017ChillerModels.7z
VSD Screw	Measure definitions; performance map background	http://deeresources.com/files/DEER2019/download/DEER2017Update_ChillerMeasures_10Jul2017.xlsm
VSD Screw	Simulation files	http://deeresources.com/files/DEER2019/download/DEER2017UpdateChillerModels-Jul2017.zip



Net-to-Gross Updates

- DEER 2017 updates for accelerated replacement
- DEER 2019 updates based on available evaluation findings

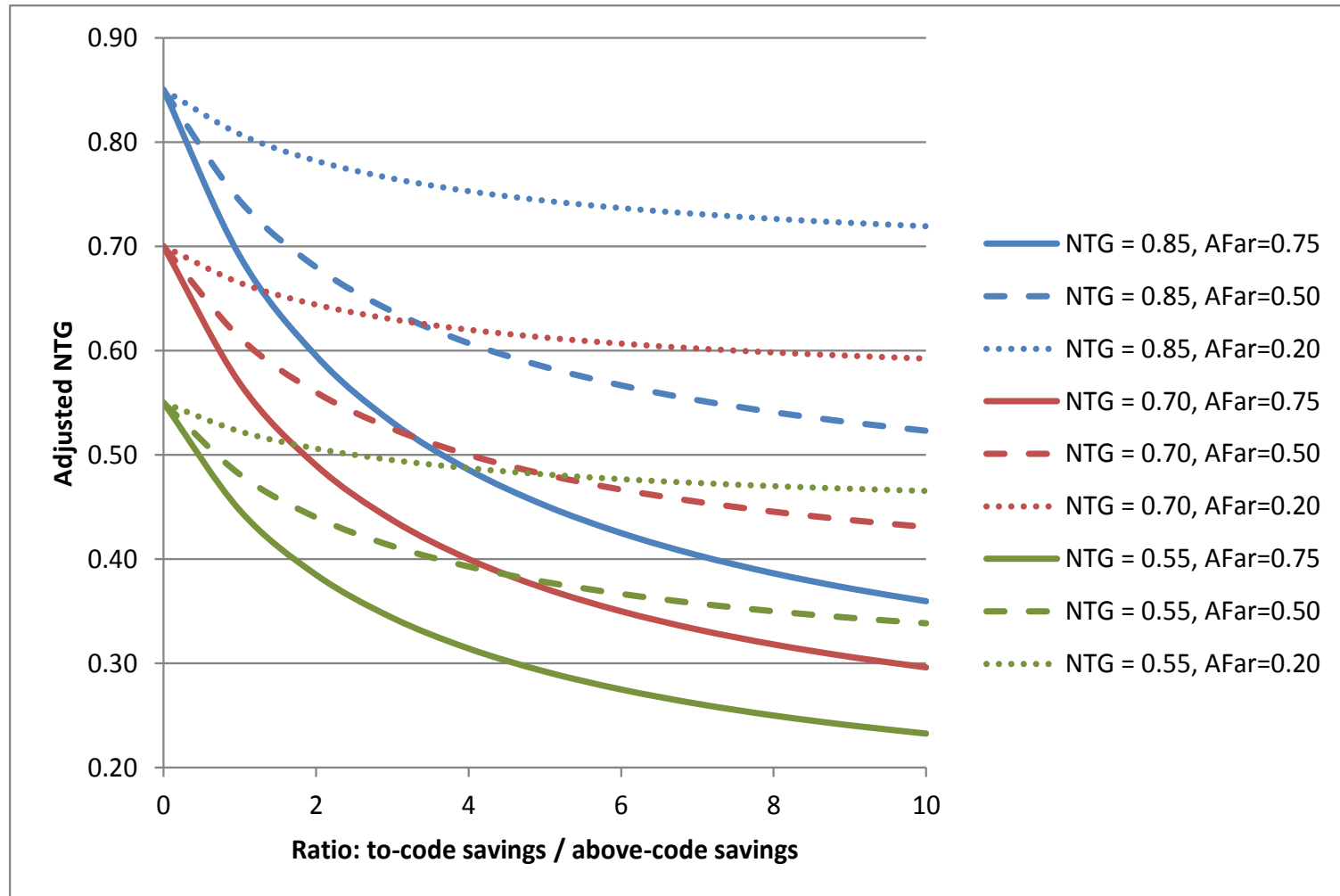


AF_{AR} Development

- Dependent on ratio of “to-code” to “above-code” savings
- Not reasonable to create a single NTG value for accelerated replacement
 - too much reduction for measures with small to-code savings
 - too little reduction for measures with large to-code savings



AF_{AR} and “To-Code” Savings





NTG: Accelerated Replacement

Reduced NTG for “To-Code” savings only using an adjustment factor for accelerated replacement (AF_{AR})

Measure Group	To-Code NTG Reduction (AF_{AR})	Reference
Lighting	20%	http://deeresources.com/files/DEER2019/download/DEERToCodeNTGUpdates-Jul2017-1.xlsx
Package HVAC	75%	See analysis for 2015 deemed ESPI payments (E-4807 page 14)
All others	50%	Preponderance of Evidence standard requires a 50% probability that accelerated replacement is program influenced



2019 NTG Updates

Description	DEER NTG ID	Current Value	Updated Value	EM&V Report Reference
NonRes-sAll-mELtg-DnStrmDeemed (NEW) Res-sALL-mELtg-DnStrmDeemed (NEW)	LED outdoor lighting fixtures, deemed + downstream	0.60 (default)	0.45	2015 Nonresidential ESPI Deemed Lighting Impact Evaluation
NonRes-sAll-mLtg-ci	Custom lighting	0.55	0.50	2015 Nonresidential ESPI Custom Lighting Impact Evaluation
Agric-Sprklr-All	Sprinklers	0.40	0.50	2015 Nonresidential ESPI Deemed Sprinkler Impact Evaluation
NonRes-sAll-mPipeIns-deemed, NonRes-sAll-mPipeIns-ci	Pipe Insulation	0.60	0.45	2015 Nonresidential Downstream ESPI Deemed Pipe Insulation Impact Evaluation
NonRes-sAll-mHVAC-Pkg, Res-sAll-mHVAC-DX-up	Upstream Package HVAC	0.75	0.60	Impact Evaluation of 2015 Upstream HVAC Programs (HVAC 1)



NTG Update Table

<http://deeresources.com/files/DEER2019/download/SupportTable-NTG.xlsx>

	A	B	C	D	E	F	G	H	I	J
1	Ex Ante database Support Table Export									
2	Support Table Group: cpCostEff									
3	Support Table: NTG									
4	This file created on 7/17/2017 11:01:53 AM while connected to AmazonWS-RDS as sptviewer.									
5	Program/Database Description: READI v.2.4.7 (Preliminary Ex Ante Review data) options: include Non-DEER and Proposed data; 1/1/2013 - 12/31/2025									
6										
7	Index	NTG	Version	StartDate	ExpiryDate	NTG_Measure_Type	NTGR_kWh	NTGR_therm	AFar	BldgType
89	82	K-12School-ComCollege	DEER2015	1/1/2015		All K-12 and community college projects	0.85	0.85	0.5	ERC
90	83	ConstrainedAreaProgram	DEER2015	1/1/2015		All programs targeting local T&D or generation constrained area	0.85	0.85	0.5	Any
91	84	Res-sAll-Frzzr-mid	ExAnte2016	1/1/2016		ENERGY STAR Freezers	0.2	0.2		Any
92	85	Res-sAll-EffCD-Elec-mid	ExAnte2016	1/1/2016		ENERGY STAR Electric Clothes Dryers	0.2	0.2		Any
93	86	Res-sAll-EffCD-Gas-mid	ExAnte2016	1/1/2016		ENERGY STAR Gas Clothes Dryers	0.3	0.3		Any
94	87	Res-sAll-RmAirCleaner-mid	ExAnte2016	1/1/2016		ENERGY STAR Room Air Cleaners	0.2	0.2		Any
95	88	Res-sAll-Soundbar-mid	ExAnte2016	1/1/2016		ENERGY STAR Sound Bars	0.2	0.2		Any
96	89	Res-sAll-mHVAC-RmAC-mid	ExAnte2016	1/1/2016		ENERGY STAR Room Air Cleaners	0.36	0.36		Any
97	90	Res-sAll-mHVAC-Pkg-dn	DEER2017	1/1/2017		All package HVAC AC and HP replacements with downstream incentives	0.6	0.6	0.75	Any
98	91	NonRes-sAll-mHVAC-Pkg	DEER2017	1/1/2017		All package HVAC AC and HP replacements with downstream incentives	0.6	0.6	0.75	Any
99	92	NonRes-sAll-mCFL	2017 Ex Ante	7/1/2017		All nonresidential CFLs, all delivery mechanisms	0.85	0.85		Any
100	93	Res-sAll-mCFL	2017 Ex Ante	7/1/2017		All residential CFLs, all delivery mechanisms	0.85	0.85		Any
101	94	NonRes-sAll-mLEDspcl	2017 Ex Ante	7/1/2017		All nonresidential specialty LED lamps (other than A-lamp and screw-in re	0.6	0.6		Any
102	95	Res-sAll-mLEDspcl	2017 Ex Ante	7/1/2017		All residential specialty LED lamps (other than A-lamp and screw-in reflect	0.6	0.6		Any
103	96	NonRes-sAll-mLEDAREfl	2017 Ex Ante	7/1/2017		Nonresidential LED A-lamp and screw-in reflector, all delivery mechanism	0.91	0.91		Any
104	97	Res-sAll-mLEDAREfl	2017 Ex Ante	7/1/2017		Residential LED A-lamp and screw-in reflector, all delivery mechanisms	0.91	0.91		Any
105										
106										
107										
108										

New AF_{AR} Values

Updated NTG Values