Residential High Efficiency Windows Measure Package Completion

Final Report

ET24SWE0004

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Executive Summary

The Residential High Efficiency Windows Measure Package Completion project continued the measure package development process which began under the completed CalNEXT project ET23SWE0043. The goal of both ET23SWE0043 and this project, ET24SWE0004, was to produce a completed measure package ready for California Public Utility Commission (CPUC) approval and subsequent use in California. This project provided measure package development support to the California Technical Forum (Cal TF) and supported the submission of the measure package to the CPUC.

Abbreviations and Acronyms

Acronym	Meaning
Cal TF	California Technical Forum
CBC	California Building Code
CEDARS	California Energy Data and Reporting System
CET	Cost Effectiveness Tool
CPUC	California Public Utility Commission
CZ	Climate Zone
DEER	Database for Energy Efficiency Resources
DMo	Mobile Home
eTRM	Electronic Technical Reference Manual
IDF	Input Data Files
IOUs	Investor-Owned Utilities
kWh	Kilowatt-hour
MDU	Multi-Dwelling Unit
MFm	Multifamily
PTAC	Packaged Terminal Air Conditioner
PTHP	Packaged Terminal Heat Pump
SCE	Southern California Edison
SFm	Single-family
SHGC	Solar Heat Gain Coefficient
TRC	Total Resource Cost
TSB	Total System Benefit

Acronym	Meaning
UEC	Unit Energy Consumption

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Introduction

The Residential High Efficiency Windows Measure Package Completion project continued the measure package development process which began under the completed CalNEXT project ET23SWE0043. The goal of both ET23SWE0043 and this project, ET24SWE0004, was to produce a measure package ready for CPUC approval and subsequent use in California. This project provided measure package development support to Cal TF and led to the submission of the measure package to the CPUC. CalNEXT supported by reviewing and editing the measure package, communication with Cal TF, and communication with the California Investor-Owned Utilities (IOUs).

Background

Residential windows can be a significant source of heat gain and loss. Research estimates windows account for 30 – 45 percent of envelope heat transfer. High efficiency windows are a fuel-neutral measure which is reflected in both electric and gas savings, for customers and utilities. Highly efficient windows with a reduced U-factor and Summer Heat Gain Coefficient (SHGC), have not been widely adopted in the residential market. The low market adoption may be due to several factors, including high incremental measure cost, limited awareness of the technology, and low frequency of window retrofits. The market is resolving some of these barriers through reduced window costs and the new ENERGY STAR® V7.0 Residential Windows specification. The results from installing highly efficient windows can provide meaningful savings for consumers and have reasonable incremental payback periods.

Project ET23SWE0043, completed through CalNEXT, developed a Draft Measure Package for residential high efficiency windows. This Residential High Efficiency Windows Measure Package Completion project was a continuation of findings from ET23SWE0043. Completed findings from ET23SWE0043 included a drafted Measure Package; this project moved the drafted measure toward technology transfer completion by submitting it to the CPUC for measure review and affirmation.

Objectives

The objective of this project was to bring the drafted measure package to the CPUC for review. By providing the final measure package to the CPUC, this project has completed the technology transfer steps needed for the residential high efficiency windows measure package. Southern California Edison (SCE) requested that CalNEXT proceed with this work to help advance technology transfer for ET23SWE0043, the residential windows measure package. This measure package will support IOU programs that include building envelope measures. The residential high efficiency windows measure package is considered a gas-exempt measure through Decision 23-04-035.[1] The CPUC has directed

[1] Decision 23-04-035, CPUC, https://www.cpuc.ca.gov/about-cpuc/divisions/energy-division/building-decarbonization/fuel-substitution-in-energy-efficiency

IOUs to facilitate the creation of new measure packages for gas-exempt measures. The measure package followed the Cal TF process for submitting and approving measure packages. The Cal TF website provides details for each step of the process.[2] An overview of the process is listed below:

1. Project Team submitted measure proposal form
2. Project Team submitted measure development plan
3. Project Team completed Draft Measure Packet
4. Cal TF and IOU Measure reviewed
5. Cal TF affirmed
6. SCE submitted measure for CPUC approval

Methodology & Approach

The methodology used for this project follows the requirements of the measure package review process for California, including the utilization of the California eTRM measure log for receiving and providing feedback. This measure package utilized the DEER Residential Building Prototypes for energy modeling. Assumptions for energy savings modeling were obtained from relevant industry information such as ENERGY STAR specifications, DEER Residential Building Prototypes, and the California Energy Code.

Measure Characterization Updates

Energy Solutions updated the Electric Savings (kWh) section of the eTRM measure package to match the new California eTRM Energy Plus Savings Characterization Template. References were also requested for the energy modeling inputs and results, and Base Case and Measure Case Costs. The eTRM Measure Characterization is attached in Appendix A: Measure Package

Energy Modeling Approach

For completed CalNEXT Project, ET23SWE0043, the simulations were run in local machines using the cloned CPUC Github EnergyPlus input data files (IDF). The ET23SWE0043 drafted window measure package was modeled using a building energy simulation software tool developed by the CPUC. The DEER prototypes were previously built for eQUEST/DOE-2© using batch file processing controlled by the MASControl3© batch control software package. The CPUC GitHub repository houses the current modeling system developed for transitioning DEER prototype building simulation models from DOE2-eQUEST to EnergyPlus. The GitHub tool reuses most of the scripts developed by the previous DEER Ex Ante team to manipulate MASControl3 outputs.

[2] More information on measure package submission steps can be found at www.caltf.org/submit-a-measure.

The current DEER Prototype System includes tools to run a batch of energy simulations in the EnergyPlus™ modeling tool. The batch process is managed by Big Ladder Software's Modelkit framework, and simulation post-processing is performed using Python and PostgreSQL scripts.

Table 1 compares the MASControl3 and EnergyPlus files to illustrate the changes in modeling methodology with the switch to the EnergyPlus modeling platform.

Table 1: DEER Prototypes – MASControl3/eQUEST-DOE2 (Old) & ModelKit/EnergyPlus (New)

Sector	Bldg Type	Description	MASControl3/ eQUEST-DOE2©	ModelKit/ EnergyPlus©
	SFm	Residential Single-family	Pre-DEER2024	DEER2024+
	MFm	Residential Multifamily	Pre-DEER2024	DEER2024+
	DMo	Residential Mobile Home	Pre-DEER2024	DEER2024+

Error! Reference source not found. provides information on residential prototype building characteristics that were used in the building energy modeling of the measure.

Table 2: Prototype Building Characteristics

Code [1]	Utility Applicable Sectors [2]	CEDARS/ eTRM Bldg Description [3]	Building Type Definition [5]	Representative Area (sqft.) [6]	HVAC Type(s) [7]
DMo	Res	Residential Mobile Home	Residential structure that is transportable in one or more sections when erected onsite is 400 or more square feet and is built on a permanent chassis and designed to be used as a single-family dwelling with or without a foundation system when connected to the required utilities, and includes the plumbing, heating, air conditioning, and electrical systems contained therein.	1,240	Packaged Terminal Air Conditioner (PTAC) Or Packaged Terminal Heat Pump (PTHP)
MFm	Res	Residential Multifamily	Multifamily residential (also known as multi-dwelling unit or MDU) is a housing classification where multiple separate housing units for residential inhabitants are contained within one building or several buildings within one complex or residential building that houses more than one family at a time. Apartments, condos, townhouses, duplexes, and quadruplexes are examples of multifamily housing options. A dwelling unit of occupancy group R, as defined in the California Building Code (CBC), that shares a common wall and/or floor/ceiling with at least one other dwelling Unit.	33,740	Rooftop Gas Pack OR Rooftop HP OR VAV or FC System + Central Plant (Chiller/Boiler)
SFm	Res	Residential Single-family	Single-family homes are designed to be used as a single-dwelling unit, with one owner, no shared walls, and its own land. A single dwelling unit of occupancy group R-3, as defined in the CBC, that stands separate from other dwelling units but may have an attached garage.	2200	Central (Direct Expansion/GAS or HP) HVAC

Code [1]	Utility Applicable Sectors [2]	CEDARS/ eTRM Bldg Description [3]	Building Type Definition [5]	Representative Area (sqft.) [6]	HVAC Type(s) [7]
Res	Res	Residential	Weighted across all applicable residential building types. Note: E-5221 directs the PAs that "claims shall be based on actual building type rather than using Com or Res for all downstream programs and—where possible—for midstream and upstream programs."	N/A	

Energy Modeling Inputs

Baseline Energy Use Simulation

Modeling was performed using the DEER Residential Prototypes for all California climate zones (CZ) and residential building types. Table 3 provides the baseline U-factors and SHGC used in the modeling. The DEER Residential Prototype baselines were modified to reflect 2022 California Energy Code Mandatory U-factor requirements for new construction. Baseline efficiency for retrofits was assumed to be the DEER Residential Prototype baseline U-factor. No modifications were made to DEER Residential Prototype SHGC values.

Table 3: Baseline Parameters

Building Type and Vintage	DMo 197-1985	DMo New[3]	MFm 1985	SFm 1972-1985	MFm-T24 2022	SFm-T24 2022	DMo 1972-1985	DMo New	MFm 1985	SFm 1972-1985	MFm-T24 2022	SFm-T24 2022
Metric	U-Factor	U-Factor	U-Factor	U-Factor	U-Factor	U-Factor	SHGC	SHGC	SHGC	SHGC	SHGC	SHGC
CZ1	1.09	0.5	0.66	0.66	0.58	0.45	0.8	0.6	0.52	0.52	0.52	0.52
CZ2	1.09	0.5	0.59	0.59	0.58	0.45	0.8	0.6	0.46	0.46	0.23	0.23
CZ3	1.09	0.5	0.66	0.66	0.58	0.45	0.8	0.6	0.50	0.50	0.50	0.50
CZ4	1.09	0.5	0.60	0.60	0.58	0.45	0.8	0.6	0.47	0.47	0.23	0.23
CZ5	1.09	0.5	0.68	0.68	0.58	0.45	0.8	0.6	0.51	0.51	0.51	0.51
CZ6	1.09	0.5	0.69	0.69	0.58	0.45	0.8	0.6	0.51	0.51	0.23	0.23
CZ7	1.09	0.5	0.68	0.68	0.58	0.45	0.8	0.6	0.51	0.51	0.23	0.23
CZ8	1.09	0.5	0.71	0.71	0.58	0.45	0.8	0.6	0.53	0.53	0.23	0.23
CZ9	1.09	0.5	0.71	0.71	0.58	0.45	0.8	0.6	0.53	0.53	0.23	0.23
CZ10	1.09	0.5	0.68	0.68	0.58	0.45	0.8	0.6	0.52	0.52	0.23	0.23
CZ11	1.09	0.5	0.61	0.61	0.58	0.45	0.8	0.6	0.49	0.49	0.23	0.23
CZ12	1.09	0.5	0.61	0.61	0.58	0.45	0.8	0.6	0.47	0.47	0.23	0.23
CZ13	1.09	0.5	0.74	0.74	0.58	0.45	0.8	0.6	0.56	0.56	0.23	0.23
CZ14	1.09	0.5	0.69	0.69	0.58	0.45	0.8	0.6	0.54	0.54	0.23	0.23

[3] Based on US Department of Housing and Urban Development requirements.

Building Type and Vintage	DMo 197-1985	DMo New[3]	MFm 1985	SFm 1972-1985	MFm-T24 2022	SFm-T24 2022	DMo 1972-1985	DMo New	MFm 1985	SFm 1972-1985	MFm-T24 2022	SFm-T24 2022
CZ15	1.09	0.5	0.65	0.65	0.58	0.45	0.8	0.6	0.49	0.49	0.23	0.23
CZ16	1.09	0.5	0.64	0.64	0.58	0.45	0.8	0.6	0.50	0.50	0.50	0.50

Measure Case Energy Simulation

Modeling was performed using the DEER Residential Prototypes for all California CZ and residential building types. The U-factors and SHGC values were modified per Table 4 but all other values were unchanged. For the draft submission, the North-Central and the South-Central values per ENERGY STAR Residential Windows V7.0 Specification Requirements, were used. However, for the final measure package submission, CZ 3 and 5 were modified with the North-Central requirements per Sheetal Chitnis's recommendation that, per the 2022 California Energy Code (Title 24, Part 6), CZ 3 and 5 do not have SHGC requirements for buildings with three or fewer habitable stories and should be included in the North-Central criteria.

Table 4: Measure Parameter Modifications

Parameter	Parameter Description	Measure Value/Assumption
U-Factor	Thermal conductance of the window	CZ01,3,5,16 - 0.25 CZ04,6 – 15 - 0.28
SHGC	Solar Heat Gain Coefficient	CZ01,3,5,16 - 0.40 CZ04,6 – 15 - 0.23

Measure Permutations

With the energy modeling results uploaded to the eTRM, the Project Team built the measure permutations. The permutations account for CZ, building type, and measure application type as the primary differentiating inputs. Some of the new construction permutations have a Total Resource Cost (TRC) ratio below 1.0. This is due to existing California Energy Code requirements and DEER Residential Building Prototype baseline efficiency assumptions, which raised the new construction baseline, resulting in lower savings and a lower TRC ratio. Normal replacement measure application types have a much higher TRC ratio throughout all CZ. CZs have a significant effect on savings and cost effectiveness as well. Overall, there are 192 distinct permutations for high efficiency residential windows.

Cost Effectiveness Testing

After building the measure permutations, the Project Team evaluated the cost effectiveness of the measure. The measure premutation input file was downloaded from the eTRM and uploaded to the California Energy Data and Reporting System (CEDARS) Cost Effectiveness Tool (CET). The resulting output was uploaded to the eTRM measure package. Table 5 provides a summary of the test results representing averages across the 192 permutations for this measure. The Total System Benefit (TSB) is a dollar value that represents the energy, capacity, and greenhouse gas (GHG) benefits of a program throughout its lifecycle. The TRC ratio measures the relative costs and benefits of a program or project to both participants and non-participants

Table 5: Cost Effectiveness Results

Total System Benefit (TSB)	TRC	Net kWh	Net Therm
$2,204	1.23	1,093	23

Findings

Energy Modeling Results

Table 6 provides the results of building energy modeling of high-efficiency windows for all California CZ and building types. For existing buildings, the 1972 – 1985 building vintages were utilized. For new construction, California Energy Code (Title 24, Part 6)[4] requirements were utilized.

[4] 2022 Building Energy Efficiency Standards, Title 24, Part 6 Energy Code, CEC, https://www.energy.ca.gov/sites/default/files/2022-12/CEC-400-2022-010_CMF.pdf

Table 6: Building Energy Modeling Results

Building Type		DMO				MFM				SFM			
Building Vintage		EX		NEW		EX		NEW		EX		NEW	
Climate Zone (CZ)	HVAC Type	kWh/ft2	Therm/ft	kWh/ft2	Therm/ft	kWh/ft2	Therm/ft	kWh/ft2	Therm/ft	kWh/ft2	Therm/ft	kWh/ft2	Therm/ft
CZ01	rDXGF	0.8296	0.18338	0.26008	0.02401	5.72924	0.12910	0.11203	0.00537	0.84516	0.82314	0.34924	0.06839
CZ01	rDXHP	3.1989	-0.0001	0.71689	3.75E-5	6.05687	0.00174	1.92756	0.13213	12.1312	0.00151	2.08640	-5.5E-05
CZ02	rDXGF	3.3054	0.08028	1.36477	-0.0318	0.53481	0.25692	-0.0013	0.00544	2.86569	0.69046	-0.0076	0.04937
CZ02	rDXHP	1.6243	0.00040	-1.1294	0.00027	4.68469	0.00234	0.22695	0.00024	10.7563	0.00028	0.58849	6.24E-5
CZ03	rDXGF	4.5037	0.20889	1.43107	0.05488	0.07339	0.27917	0.33820	0.01065	1.79165	0.69335	0.40769	-0.0030
CZ03	rDXHP	6.0829	0.00043	1.81654	0.00015	2.77917	0.00212	0.39017	3.91E-5	9.78350	0.00104	0.26791	-1.8E-05
CZ04	rDXGF	3.2252	0.14406	1.57101	0.00627	0.81658	0.30101	-0.0019	0.00511	3.16146	0.58306	0.01215	0.02686
CZ04	rDXHP	3.9876	0.00037	1.00364	0.00022	3.77823	0.00155	0.08634	0.00022	9.84883	0.00027	0.34068	0.00012
CZ05	rDXGF	3.5207	0.19865	1.02924	0.04828	0.27961	0.29176	0.3649	0.01056	2.30640	0.67982	0.51617	-0.0063
CZ05	rDXHP	4.8483	0.00021	1.24571	9.51E-5	3.70580	0.00236	0.39204	4.78E-5	10.5995	0.00110	0.11546	-7.8E-05
CZ06	rDXGF	4.7998	0.08141	2.73994	0.01305	0.83743	0.13107	-0.0916	0.00739	3.79415	0.26533	-0.0583	0.00966

Building Type		DMO				MFM				SFM			
CZ06	rDXHP	5.4653	0.00067	2.82766	0.00040	1.97285	0.00110	-0.0319	0.00052	6.50718	0.00023	0.04126	8.51E-5
CZ07	rDXGF	3.3646	0.06009	2.08632	0.00992	0.48696	0.11158	-0.0760	0.00573	2.72812	0.29341	-0.0368	0.00712
CZ07	rDXHP	3.7797	0.00044	2.12359	0.00033	1.42781	0.00149	-0.0297	0.00059	6.01015	0.00014	0.05718	7.41E-5
CZ08	rDXGF	4.1034	0.07202	2.29525	0.00500	1.04491	0.12849	-0.0263	0.00291	5.48855	0.40378	-0.0072	0.00627
CZ08	rDXHP	4.6389	0.00065	2.29276	0.00039	2.16373	0.00135	-0.0011	0.00019	10.0423	0.00010	0.05946	9.25E-5
CZ09	rDXGF	5.0522	0.07902	2.85780	0.00630	1.47734	0.1508	-0.03456	0.00399	5.97967	0.34315	-0.0701	0.00649
CZ09	rDXHP	5.6843	0.00099	2.89576	0.00056	2.75020	0.00116	0.00030	0.00015	9.70612	-0.0002	-0.0067	4.84E-5
CZ10	rDXGF	5.3890	0.18157	2.56603	0.00831	1.6645	0.15678	-0.0091	0.00413	4.76268	0.47962	0.01898	0.01487
CZ10	rDXHP	6.4288	0.00057	1.86951	0.00034	3.59478	0.00172	0.11326	0.00023	9.49584	0.00094	0.19410	4.4E-05
CZ11	rDXGF	6.0967	0.29129	2.70938	0.02531	2.37743	0.24765	0.01812	0.00528	7.59068	0.84669	0.04774	0.02909
CZ11	rDXHP	8.4533	0.00034	2.26335	0.00042	5.77541	0.00165	0.20578	0.00016	17.3381	0.00053	0.46537	4.04E-5
CZ12	rDXGF	5.2728	0.25630	2.46584	0.01377	1.38647	0.20307	-0.0008	0.00676	4.30077	0.55291	0.02535	0.03137
CZ12	rDXHP	6.6600	0.00045	1.13643	0.00043	3.99102	0.00159	0.19625	0.00021	9.32892	0.00075	0.39774	8.81E-5
CZ13	rDXGF	6.5069	0.19642	2.97731	0.01375	2.86843	0.21469	0.00831	0.00628	10.1625	0.65830	0.05957	0.02273

Building Type		DMO				MFM				SFM			
CZ13	rDXHP	7.7166	0.00058	2.37002	0.00039	5.17669	0.00059	0.14965	0.00011	17.4172	0.00073	0.38230	6.38E-5
CZ14	rDXGF	7.4916	0.33376	3.16120	0.01065	2.99403	0.20648	0.02158	0.00667	8.89686	0.89167	0.09030	0.02003
CZ14	rDXHP	9.4201	0.00044	2.01498	0.00036	5.55221	0.00131	0.20833	0.00021	17.4964	0.00043	0.43972	3.96E-5
CZ15	rDXGF	9.9948	0.13100	4.33013	0.00835	4.72235	0.11064	0.04718	0.00243	16.8752	0.41386	0.13754	0.01061
CZ15	rDXHP	11.003	0.00095	4.33399	0.00051	5.77521	0.00090	0.08080	0.00010	21.5113	0.00052	0.25978	6.75E-5
CZ16	rDXGF	4.9186	0.32546	1.55656	0.07304	1.30664	0.39933	0.46674	0.01628	2.38787	0.72197	1.15174	0.02057
CZ16	rDXHP	10.429	4.85E-5	2.90699	6.31E-5	10.9859	0.00321	0.83332	2.87E-5	15.8345	0.00168	1.28630	-7.1E-05

eTRM Review & CPUC Submission Process

The Project Team responded to Cal TF feedback on the Draft Measure Packet, tracked ModelKit updates relevant to the project, and joined Cal TF modeling meetings. During the development of the ET23SWE0043 project, the first version of Database for Energy Efficiency Resources (DEER) Mobile Home (DMo), Single-family (SFm), and Multifamily (MFm) prototypes were used to calculate the savings. For SFm and MFm new construction, the 2022 California Energy Code (Title 24, Part 6) mandatory requirements were used as the baseline.

For SFm retrofits, 1975 and 1985 vintage DEER prototypes were used for CZ 1 – 9 and 10 – 16 respectively. For MFm retrofits, 1985 prototypes were used. For DMo, both new construction and retrofits, DEER DMo 1975 – 1985 properties were used since DMo code file for new construction was not available. The vintages represent building envelope characteristics from the year specified.

After running the first set of simulations, there were a few ModelKit errors and typos that were identified by the ModelKit developers and resolved. Updated versions have been released with modified scripts, templates, and prototypes based on the Cal TF team's input and comments. The final version of the ModelKit was based on the latest DEER residential prototypes that were updated in April 2024. The ModelKit resources and update log can be found at www.github.com/sound-data/DEER-Prototypes-EnergyPlus.

The Project Team submitted the completed measure package to the eTRM and received comments through the eTRM Measure Log from SCE and Cal TF during the measure review process. A log of the resolved comments is provided in Appendix B: Supplemental Information. The Project Team resolved all the comments and re-modeled the MFm savings for CZ01 due to an error in the Modelkit. For CZ1, there were eight severe errors related to the supply airflow fraction with few other warnings even though the simulation was successful with no output extracted. These warnings and errors were investigated, and the rerun model outputs were extracted and updated for this Final Report. Finally, SCE submitted the measure package to the CPUC for final review and approval.

Recommendations

Energy Solutions recommends developing a process for supporting Lead Program Administrators of measure packages through the CPUC review and approval process within the current CalNEXT Technology Support Research project.

Appendix A: Measure Package

Appendix B: Supplemental Information

Measure Comment Log

The following is a log of the comments the Project Team resolved during the eTRM measure review process.

- Change Description:
    - Update the change description to the boilerplate text.
- Cover sheet:
    - Complete the cover sheet. Note, the cover sheet wiped out the previous data each time a new draft is created, and measure developer must repopulate the data. Cal TF Staff is working on an enhancement to "correct" this behavior.
- Supporting Data
    - Parameter:
        - Version: Change the label to ExAnte2025 to match the program year. Note, if "ExAnte2025" is not available in the current version of the parameter, navigate to the Dependencies tab and you may need to upgrade the parameter to the latest version.
    - Value Table:
        - Offering ID "Measure Offering Description" column:
            - Use sentence casing for the description (ex. "ENERGY STAR compliant window")
            - Since NC and NR have different offering ID, append the MAT (ex. "..., NR") or add the replacing base case (ex. "... replacing single pane window") to the description to distinguish the two offerings. Each offering ID must have a unique offering description and vice versa.
- Base Case Description:
    - "Existing Description" column: Use sentence casing for description (ex. "Single pane window")
    - "Standard Description" column: Use sentence casing for description
- Emerging Technologies
    - "Year Introduced to Programs" column: Update the column API to "introYear"
- Permutations:
    - Configure field:
        - ETP FIRST YEAR INTRODUCED TO PROGRAMS --> Remap field to "Emerging Technologies: Year Introduced to Programs" column
- Re-run permutations
- Reupload the CET

- Configure the Emerging Technologies table column and hide the "Year Introduced to Programs" column.
- Unit Energy Consumption (UEC) Modeling Tool Summary
    - Is this table complete? Please see the latest eTRM+Measure+Characterization+Template+v6.0+2024.03.22 on the eTRM Measure Developer Resources SharePoint
- Cost Data
    - Update the text to the following: The cost data for windows was gathered through a survey of online retailers. Products were grouped into base case and measure case based on U-factor. The material cost was calculated as the average of each group.
- Labor Costs
    - Please verify if the following statement is correct. If yes, then rewrite the section to the following: The labor costs were derived using the 2023 edition of the RSMeans Unit Cost data. The labor cost was calculated as the product of the residential carpenter labor rates and the installation hour for a carpenter to install a window of up to 30 sqft.
- Annual Unit Energy Savings – Electric
    - Below this calculation, add the API definition for the API names in the equation:
        - UECBase__YrkWh = Annual unit energy consumption - baseline, electric (kWh/yr) UECMeas__YrkWh = Annual unit energy consumption - measure case, electric (kWh/yr)
- Measure description readability. Change to: This measure is the installation of high-efficiency windows with reduced thermal conductance and improved radiant emissivity. The measure applies to residential buildings under new construction and retrofit applications."
- In the Eligibility Requirements section, I suggest creating a table that shows the mapping to the California CZs in the measure package. A comprehensive table, broken down by California CZs, showing corresponding max U-factor and min SHGC, will assist Implementers in verifying eligible products using the NRFC labels.
- Baseline: Under Base Case Description, leave the existing and standard description as “Single pane window”. Under “Eligible Products”, add a few sentences clarifying that single pane windows and any other existing conditions are eligible for NR (single pane, double pane non vinyl, etc.).
- HVAC Type: Keep as “Any”. Add note under “Eligible Building Types and Vintages” that any HVAC system type is eligible. Permutation savings shall show rDXGF savings (both kWh and therms).
- Could we provide guidance that the most conservative BT savings should be claimed if the BT cannot be confirmed in upstream/midstream?