



**eTRM**  
*best in class*

**BUILDING ENVELOPE**  
**RESIDENTIAL BLOW IN WALL INSULATION**  
SWBE007-01

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## MEASURE NAME

Residential Wall Blow-In Insulation

## STATEWIDE MEASURE ID

SWBE007-01

## TECHNOLOGY SUMMARY

This residential wall insulation measure involves installing insulation to the walls of a home. Installing insulation creates a better barrier between the conditioned space of the home and outside or unconditioned spaces. This will save energy by reducing the heating or cooling required to make up for lost heating and cooling.

### Historical Background

The residential wall insulation measure is a measure that was originally identified in the DEER 2005 database with DEER Measure IDs: D03-429 – D03-431 and D03-435 – D03-438. All wall insulation measures except for Measure ID D03-048 apply only to the new vintage. Measure ID D03-048, R-13 Blown-in Insulation, applies only to the oldest vintage. The residential wall insulation measure was divided into the following categories including:

1. Wall 2x4 R-15 Insulation-Batts
2. Wall 2x6 R-19 Insulation-Batts
3. Wall 2x6 R-21 Insulation-Batts
4. Wall 2x4 R-13 Batts + R-5 Rigid
5. Wall 2x6 R-19 Batts + R-5 Rigid
6. Wall 2x6 R-21 Batts + R-5 Rigid
7. Wall Blow-In R-0 to R-13 Insulation

Despite using many of the DEER READi cost-effectiveness parameters to support any residential wall insulation claims, the DEER READi tool does not support all cost-effectiveness parameters required for ex-ante data reporting requirements. This workpaper was created to allow for compliant reporting and claims.

## MEASURE CASE DESCRIPTION

The measure case is defined as Residential Wall Blow-In Insulation including:

1. Wall Blow-In R-0 to R-13 Insulation

## BASE CASE DESCRIPTION

The base case is defined per the 2005 DEER Prototype Vintage Descriptions as 2x4 Wall w/R-0 Insulation.

## CODE REQUIREMENTS

### Title 24 2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings

The 2019 Title 24 Building Energy Efficiency Standards Part 6, Subchapter 7 Low-Rise Buildings Mandatory Features and Devices, Section 150 (c), states

Opaque portions of above grade walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Items 1, 2, 3 and 4 below:

1. 2x4 inch framing, shall have an overall assembly U-factor not exceeding U-0.102 equivalent to an installed R-value of 13 in a wood framed assembly.

**EXCEPTION to Section 150.0(c)1:** Existing walls already insulated to a U-factor not exceeding U-0.110 or already insulated between framing members with insulation having an installed thermal resistance of R-11 or greater.

2. 2x6 inch or greater, framing shall have an overall assembly U-factor not exceeding U-0.074 or an installed R-value of 19 in a wood framed assembly.
3. Opaque non-framed assemblies shall have an overall assembly U-factor not exceeding U-0.102, equivalent to an installed R-value of 13 in a wood framed assembly.
4. Bay or Bow Window roofs and floors shall be insulated to meet the wall insulation requirements of TABLE 150.1-A.

**SECTION 110.8 (a)** Insulation Certification by Manufacturers. Any insulation shall be certified by Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation that the insulation conductive thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12-13, Article 3, “Standards for Insulating Material.”

**SECTION 110.8 (b)** Installation of Urea Formaldehyde Foam Insulation. Urea formaldehyde foam insulation may be applied or installed only if:

1. It is installed in exterior side walls; and
2. A four-mil-thick plastic polyethylene vapor retarder or equivalent plastic sheathing vapor retarder is installed between the urea formaldehyde foam insulation and the interior space in all applications.

**Applicable State and Federal Codes and Standards**

Code	Applicable Code Reference	Effective Date
CA Appliance Efficiency Regulations – Title 20	N/A	N/A
CA Building Energy Efficiency Standards – Title 24	Title 24	1/1/2020
Federal Standards	N/A	N/A

**NORMALIZING UNIT**

Area-ft<sup>2</sup>

**PROGRAM REQUIREMENTS**

Per the SDG&E Quality Assurance and Quality Control Plan (QAQCP) technicians must receive training as follows:

- *“New technicians receive individual classroom training from the production supervisor and on-the-job training by serving as a helper from a certified trainer.*
- *All technicians receive electrical training and follow safe electrical protocols, standards and practices.*
- *The contractor regularly enrolls its technicians in technical training.*

- All technicians are required to attend a weekly tailgate meeting, plus a monthly technicians meeting for on-going training. The type of information that is covered in these training sessions would include measure and service standards, review of safety standards, motivation, customer service, and quality control instruction.
- The production supervisor or assistant production manager also provides one-on-one training to technicians in the field.”

*Measure Implementation Eligibility*

All combinations of measure application type, delivery type, and sector that are established for this measure are specified below. Measure application type is a categorization based on the circumstances and timing of the measure installation; each measure application type is distinguished by its baseline determination, cost basis, eligibility, and documentation requirements. Delivery type is the broad categorization of the delivery channel through which the market intervention strategy (financial incentives or other services) is targeted. This table also designates the broad market sector(s) that are applicable for this measure.

Note that some of the implementation combinations below may not be allowed for some measure offerings by all program administrators.

**Implementation Eligibility**

Measure Application Type	Delivery Type	Sector
Add-On Equipment (AOE)	DnDeemed	Residential
Add-On Equipment (AOE)	UpDeemed	Residential
Add-On Equipment (AOE)	DnDeemDI	Residential

*Eligible Products*

N/A.

*Eligible Building Types and Vintages*

This measure is applicable in all vintages in all residential single-family, multi-family and double wide mobile home dwelling units with a HVAC system using direct expansion gas furnace system (DEER: BldgHVAC: rDXGF) only.

*Eligible Climate Zones*

This measure is applicable in all California climate zones.

**PROGRAM EXCLUSIONS**

N/A.

**DATA COLLECTION REQUIREMENTS**

Data collection requirements are to be determined.

USE CATEGORY

Building Envelope (BldgEnv)

ELECTRIC SAVINGS (kWh),

Methodology

The base energy consumption and measure energy consumption values are directly from READI v.2.5.1 for the residential wall insulation measures including:

1. Wall Blow-In R-0 to R-13 Insulation

The applicable Measure IDs and associated Descriptions for the four measures are further broken out in the latest version of the DEER READi as shown in the table below.

MeasureID	Description
RB-BS-BlowInIns-R0-R13	Wall Blow-In R-0 to R-13 Insulation (DEER2020)

Inputs and Assumptions

As described in the 2004-2005 DEER Update Study Report, the residential measures simulated in DEER contains a top-level description of the methodology used to model each measure for all residential building types. Also included are the primary parameters used in the modeling of each measure and how those parameters are altered from the base case, to the code baseline to the measure; sometimes these parameters vary by climate zone and building vintage. To provide added detail of interest for the measure descriptions links are provided, when appropriate, into MAS tool spreadsheets, and other supporting documents that contain more details of parameter values. A sample of the assumptions used in the DEER simulation prototypes are shown in the figure below.

<b>Wall Blow-In R-0 to R-13 Insulation</b>	
<b>ID: D03-438</b>	<b>Abbreviation: RW413</b>
Measure Description	Wall Blow-In R-0 to R-13 Insulation
Baseline Characteristics	2x4 Wall w/R-0 Insulation
Code Baseline Characteristics	Overall wall U-factor based on climate zone
Measure Characteristics	Wall Blow-In R-0 to R-13 Insulation
Savings Reporting Units	1,000 sqft wall (excl. windows)
Savings Scalable By	n/a

*Electric Load Shapes*

The most applicable measure case load shape for this residential wall insulation measure is: DEER: Res\_BldgShell\_Ins. Each program administrator will have its own utility abbreviation at the front of the load shape name. (i.e. SDGE: DEER:Res\_BldgShell\_Ins).

*Gas Load Shapes*

Annual.

### Sample Calculation

Per the DEER 2004-2005 Update Study Final Report, the overall wall U-Factors for the measure, baseline and code baseline are listed in the Residential Wall Insulation Table (ResWallInsMeasures Sheet of 2005DEERResidentialMeasuresList\_05-08-15.xls).

### PEAK ELECTRIC DEMAND REDUCTION (kW)

#### Methodology

Based on the latest version of the DEER READi tool (READi v.2.5.1), the peak demand reduction values were exported to a spreadsheet named Ex Ante Source Tables Export.xlsx for this measure.

#### Inputs and Assumptions

As described in the 2004-2005 DEER Update Study Report, the residential measures simulated in DEER contains a top-level description of the methodology used to model each measure for all residential building types. Also included are the primary parameters used in the modeling of each measure and how those parameters are altered from the base case, to the code baseline to the measure; sometimes these parameters vary by climate zone and building vintage. To provide added detail of interest for the measure descriptions, links are provided, when appropriate, into MAS tool spreadsheets, and other supporting documents, that contain more details of parameter values.

### Sample Calculation

Per the DEER 2004-2005 Update Study Final Report, the overall wall U-Factors for the measure, baseline and code baseline are listed in the Residential Wall Insulation Table (ResWallInsMeasures Sheet of 2005DEERResidentialMeasuresList\_05-08-15.xls).

### GAS SAVINGS (Therms)

#### Methodology

Similar to the Electric Energy (kWh) section of this workpaper, the base energy consumption and measure energy consumption values are directly from READi v.2.5.1 for the residential wall insulation measures including:

1. Wall Blow-In R-0 to R-13 Insulation

#### Inputs and Assumptions

As described in the 2004-2005 DEER Update Study Report, the residential measures simulated in DEER, contains a top-level description of the methodology used to model each measure for all residential building types. Also included are the primary parameters used in the modeling of each measure and how those parameters are altered from the base case, to the code baseline to the measure; sometimes these parameters vary by climate zone and building vintage. To provide added detail of interest for the measure descriptions, links are provided, when appropriate, into MAS tool spreadsheets, and other supporting documents that contain more details of parameter values.

### Sample Calculation

Per the DEER 2004-2005 Update Study Final Report, the overall wall U-Factors for the measure, baseline and code baseline are listed in the Residential Wall Insulation Table (ResWallInsMeasures Sheet of 2005DEERResidentialMeasuresList\_05-08-15.xls).

## LIFE CYCLE

Effective useful life (EUL) is an estimate of the median number of years that a measure installed through a program is still in place and operable. Remaining useful life (RUL) is an estimate of the median number of years that a technology or piece of equipment replaced or altered by an energy efficiency program would have remained in service and operational had the program intervention not caused the replacement or alteration.

The methodology to calculate the RUL conforms with Version 5 of the Energy Efficiency Policy Manual, which recommends “one-third of the effective useful life in DEER as the remaining useful life until further study results are available to establish more accurate values.”<sup>1</sup> This approach provides a reasonable RUL estimate without requiring any prior knowledge about the age of the equipment being replaced.<sup>2</sup> Further, as per Resolution E-4807, the California Public Utilities Commission (CPUC) revised add-on measures so that the EUL of the measure is equal to the lower of the RUL of the modified system or equipment or the EUL of the add-on component.”<sup>3</sup>

The EUL and RUL specified below, are based upon the DEER READi Tool version 2.5.1 Support Table. Per

### Effective Useful Life and Remaining Useful Life

Parameter	Value	Source
EUL (yrs) – measure	20	DEER READi Tool version 2.5.1 Support Table EUL ID: BS-BlowInIns
EUL (yrs) – host	20	DEER READi Tool version 2.5.1 Support Table EUL ID: BS-BlowInIns
RUL (yrs)	6.7	DEER READi Tool version 2.5.1 Support Table EUL ID: BS-BlowInIns

## BASE CASE MATERIAL COST (\$/UNIT)

Based on Work Order 17, the base case is the customer’s existing insulation. Therefore, the base case cost as described in Work Order 17 is \$0.00.

## MEASURE CASE MATERIAL COST (\$/UNIT)

The 2010-2012 WO17 Ex Ante Measure Cost Study provides wall insulation costs but does not provide blown in wall insulation per-square foot costs.

The Home Advisor (<https://www.homeadvisor.com/cost/insulation/install-blown-in-insulation/>) website<sup>4</sup> provided costs for blown in insulation at \$495 for every 1,000 square feet. Therefore, the material cost per square foot of blown in insulation amounted to \$0.495 per square feet.

<sup>1</sup> California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 32.

<sup>2</sup> KEMA, Inc. 2008. "Summary of EUL-RUL Analysis for the April 2008 Update to DEER." Memorandum submitted to Itron, Inc.

<sup>3</sup> California Public Utilities Commission (CPUC). 2016. Resolution E-4807. December 16. Page 13.

<sup>4</sup> <https://www.homeadvisor.com/cost/insulation/install-blown-in-insulation/>

R-Value	Bags Per 1,000 Sq. Ft.	Material Cost	Installed Thickness (Inches)	Labor Hours
R-30	15	\$495	10.25	4
R-38	20	\$660	13	5
R-44	23	\$759	14.75	6
R-49	26	\$858	16.5	7
R-60	32	\$1,056	20	8

### BASE CASE LABOR COST (\$/UNIT)

The base case is the existing insulation. Therefore, the base case labor cost is \$0.00.

### MEASURE CASE LABOR COST (\$/UNIT)

The 2010-2012 WO17 Ex Ante Measure Cost Study provides labor hourly rate for the batt insulation but does not provide the blow-in insulation labor hours per unit. Using the hourly rate of \$54.71 from WO17 Study and 4 hours of labor for 1,000 sq. ft. from the above reference, the labor cost of \$0.22 per sq. ft. is assumed for this measure.

### NET-TO-GROSS (NTG)

The net-to-gross (NTG) ratio represents the portion of gross impacts that are determined to be directly attributed to a specific program intervention. These NTG values are based upon the average of all NTG ratios for all evaluated 2006 – 2008 commercial, industrial, and agriculture programs, as documented in the 2011 DEER Update Study conducted by Itron, Inc. These sector average NTGs (“default NTGs”) are applicable to all energy efficiency measures that have been offered through commercial, industrial, and agriculture sector programs for more than two years and for which impact evaluation results are not available.

#### Net-to-Gross Ratios

Parameter	Value	Source
Res-sSF-mShellIns	0.28	DEER READi Tool version 2.5.1 Support Table derived from California Public Utilities Commission (CPUC). 2012. Decision 12-05-015 in the Order Instituting Rulemaking to Examine the Commission's Post-2008 Energy Efficiency Policies, Programs, Evaluation, Measurement, and Verification, and Related Issues (R.09-11-014). Issued May 18, 2012. O.P. 14.  California Public Utilities Commission (CPUC), Energy Division. 2013. Energy Efficiency Policy Manual Version 5. Page 21.

### GROSS SAVINGS INSTALLATION ADJUSTMENT (GSIA)

The gross savings installation adjustment (GSIA) rate represents the ratio of the number of verified installations of the measure to the number of claimed installations reported by the utility. This factor varies by end use, sector, technology, application, and delivery method. This GSIA rate is the current “default” rate specified for measures for which an alternative GSIA has not been estimated and approved.

**Gross Savings Installation Adjustment**

Parameter	GSIA	Source
Def-GSIA	1.00	California Public Utilities Commission (CPUC), Energy Division. 2013. <i>Energy Efficiency Policy Manual Version 5</i> . Page 31.

**NON-ENERGY IMPACTS**

Non-energy benefits for this measure have not been quantified.

**DEER DIFFERENCES ANALYSIS**

This section provides a summary of inputs and methods based upon the Database of Energy Efficient Resources (DEER), and the rationale for inputs and methods that are not DEER-based.

**DEER Difference Summary**

DEER Item	Comment
Modified DEER methodology	No
Scaled DEER measure	No
DEER Base Case	2x4 Wall w/R-0 Insulation
DEER Measure Case	Wall Blow-In R-0 to R-13 Insulation
DEER Building Types	Single-Family, Multi-Family and Double-Wide Mobile Homes
DEER Operating Hours	N/A
DEER eQUEST Prototypes	N/A
DEER Version	DEER READi (Version 2.5.1)
Reason for Deviation from DEER	N/A
DEER Measure IDs Used	RB-BS-BlowInIns-R0-R13
NTG	Source: DEER READi Tool version 2.5.1 Support Table. The NTG of 0.28 is associated with NTG ID: <i>Res-sSF-mShellIns</i>
GSIA	The GSIA of 1.0 is associated with GSIA ID: <i>Def-GSIA</i>
EUL/RUL	Source: DEER READi Tool version 2.5.1 Support Table EUL ID: BS-BlowInIns. The RUL value of 6.7 years is associated with EUL ID: <i>BS-BlowInIns</i> .

## REVISION HISTORY

## Measure Characterization Revision History

Revision Number	Revision Complete Date	Primary Author, Title, Organization	Revision Summary and Rationale for Revision
01	12/09/2019	RMS Energy Consulting, LLC	Draft of consolidated text for this statewide measure is based upon: <ul style="list-style-type: none"> <li>• DEER Measure IDs: RB-BS-BlowInIns-R0-R13</li> <li>• WPSDGEREHC1066, Revision 0</li> </ul>
	01/21/2019	Chan Paek SoCalGas	Corrections in EAD Tables: Entries for BldgLoc in EnergyImpact table are corrected with CZ## values.
01	06/04/2020	Jeff Cun SoCalGas	Correction in the EAD Tables/savings per PEAR db update to include some missing climate zones.
01	07/16/2020	Jeff Cun SoCalGas	Reverted the workpaper revision number from “-02” (6/4/2020) to “-01” (7/15/2020) as requested by CPUC.