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U.S. DEPARTMENT OF ENERGY

BUILDING ENVELOPE CAMPAIGN

BEC – What's new?

October 13, 2020

U.S. DEPARTMENT OF ENERGY

BUILDING ENVELOPE CAMPAIGN

The **Building Envelope Campaign** helps building owners and managers design more energy-efficient buildings.

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BUILDING ENVELOPE CAMPAIGN

Poll 1

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Better Buildings Alliance Tech Teams

Envelope Technology Research Team (ETRT)

Connecting Better Buildings partners with advanced building envelope technology solutions

- ✓ Technology verification studies
- ✓ Specification documents
- ✓ Case studies and fact sheets
- ✓ Calculators and analytic tools

Envelope technologies account for approximately 30% of the primary energy consumed in commercial buildings, playing a key role in determining levels of comfort, natural lighting, ventilation, and how much energy is required to heat and cool a building.

Hayley McLeod, M.S.P.P.

Building Envelope Campaign Lead

Simon Pallin, Ph.D.

Building Envelope Technical Lead

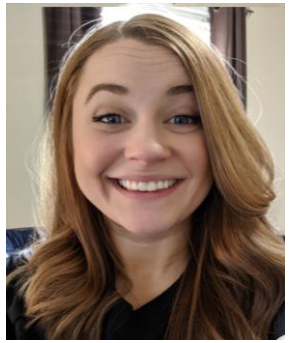
Mahabir Bhandari, Ph.D.

Building Envelope Tech Team Support

Jason DeGraw, Ph.D.

Building Envelope Tech Team Support

Kita Cranfill



Full Stack Developer

Building Envelope Campaign Goals

- **Motivate action and increase awareness** of the value of investing in high performance building envelope technologies for both new and existing commercial buildings
- **Recognize leaders** adopting and achieving high performing building envelope systems
- **Demonstrate and document** energy and cost savings with integrated design, construction, commissioning, and maintenance from implementation of high performing envelope systems

How are we going to achieve the goals?

- Broad Industry Engagement
- Supporters
  - Access technical expertise regarding envelope technologies
  - Partner with the BEC technical team to spread the word about the campaign
  - Gain recognition through the BEC website
- Participants
  - Access campaign resources and technical expertise in evaluating envelope options
  - Stay informed on envelope technologies and resources produced through the campaign
  - Gain recognition through the BEC website, achievement of awards, and participation in case studies (pending submitting validation information and building completion)
    - Projects completed since January 2019 are eligible to submit

Recognition Tiers and Categories

Existing Building – Envelope Retrofit

Recognition Tiers
Retro 30 Building envelope heat loss/gain reduction of 30%[a], due to implementation of building envelope improvements
Retro 50 Building envelope heat loss/gain reduction of 50%[a], due to implementation of building envelope improvements

(a) Reduction may consist of any energy retrofit measure that involve the building envelope thermal performance (R-value, Air leakage, Attachments, etc.)

Recognition Tiers and Categories

New Construction

Recognition Tiers
Novel 20 Building envelope heat loss/gain reduction of 20%[a] over code[b], due to incorporation of emerging high-performance envelope technologies
Novel 40 Building envelope heat loss/gain reduction of 40%[a] over code[b], due to incorporation of emerging high-performance envelope technologies

(a) Follow ASHRAE Advanced Energy Design Guides Reduction
(b) Most recent national energy code (ASHRAE 90.1 - 2016)

Recognition Tiers and Categories

Additional Recognition

Role Models

An additional level of recognition will be available to those buildings which meet a campaign recognition tier and *also* incorporate an additional advanced strategy or technology into their building envelopes, serving as role models within the industry.

Honorable Mentions

Buildings which do not meet a campaign recognition tier but still make a noteworthy impact on the campaign (e.g., substantial square footage) may apply for an Honorable Mention.

Participants – 34 Registered

- eSai LLC
- LANL *
- Better Building Works LLC
- Melrose Energy Commission
- Community College of Allegheny County
- H2M architects + engineers
- Flad Architects
- Tenderloin Neighborhood Development Corporation (TNDC)
- Judicial Council of California
- Arlington County Department of Environmental Services
- GLHN Architects & Engineers, Inc.*
- Parkway School District **
- Boulder Associates
- BG3 Architecture, LLC
- Baseys Roofing & Sheet Metal
- Fair Building Technology, LLC
- Mathis Consulting
- IMPACT Industrial Services ***
- Mass General Brigham
- VHA Energy Engineer's Advisory Board (VA) ***
- Bullitt County Public Schools
- RWDI

<u>Totals</u>

Over 200 buildings

Over 17 million sf

* 500,000 sf
** 1 million sf
***10 million sf

Supporters – 43 Registered

- Becker Morgan Group, Inc.
- Fabreeka International, Inc.
- ThenDesign Architecture
- Tremco Commercial Sealants & Waterproofing
- Tremco Construction Products Group
- New Buildings Institute
- BA Consult
- Brandeis University
- Spray Polyurethane Foam Alliance
- Entegrity
- Structural Insulated Panel Assn. (SIPA)
- NEXUSbec, inc.
- Judicial Council of California
- Lawrence Berkeley National Laboratory
- Walter P. Moore
- American Primitives
- Newmark Knight Frank
- Fanning Howey
- Sunshine Sustainable Design
- Central Maine Community College
- SOPREMA
- Neudorfer Engineers
- CalBarrier, LLC
- Power Shield, Inc.
- OAC Services, Inc.
- Ghafari Associates
- NRG Insulated Block
- Arc Green Consultant
- Jacobs
- ARES Consulting
- University of Maryland
- EPS Industry Alliance
- Carlisle Construction Materials
- US Greenfiber LLC
- Arkema, Unc.
- Owens Corning
- Air Barrier Association of America

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Video 2

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Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Building Characteristics | Saved Buildings

New Building | Toggle Units: ft | Print Page

Building Description

Name or description of building:

My Building

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Building Type

Is this a new construction or a retrofit?

New Construction | Retrofit

Approximate year of building construction:

1990

Input data for the Building Envelope Campaign tool

Building Description

Building Type

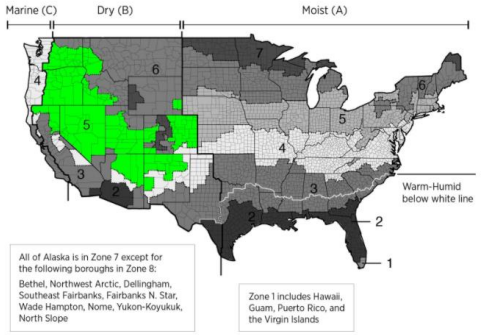
Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge



Climate

Select the climate zone where building is located

5B - Cold

Select the state where building is located

Arizona

On average, Arizona has a 4 year delay adopting new construction code.

Select the built enviroment

Suburban

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Geometry

Select the type of building. Default values represent reference building geometries, so please change as needed to match your building.

Large Office

Conditioned Floor Area: 498599 ft^2

Building Height: 156 ft

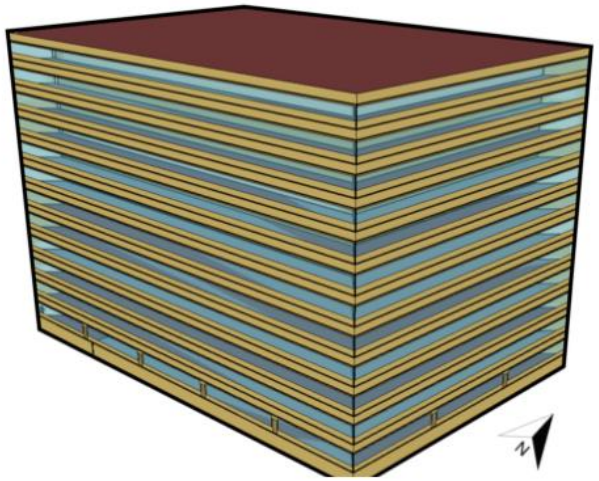
Building Floors: 12

Total Surface Area of the Walls (including windows)

North	South	East	West
22464 ft^2	22464 ft^2	14976 ft^2	14976 ft^2

Window Area

North	South	East	West
14976 ft^2	14976 ft^2	9984 ft^2	9984 ft^2



Input data for the Building Envelope Campaign tool

Building Description

Building Type

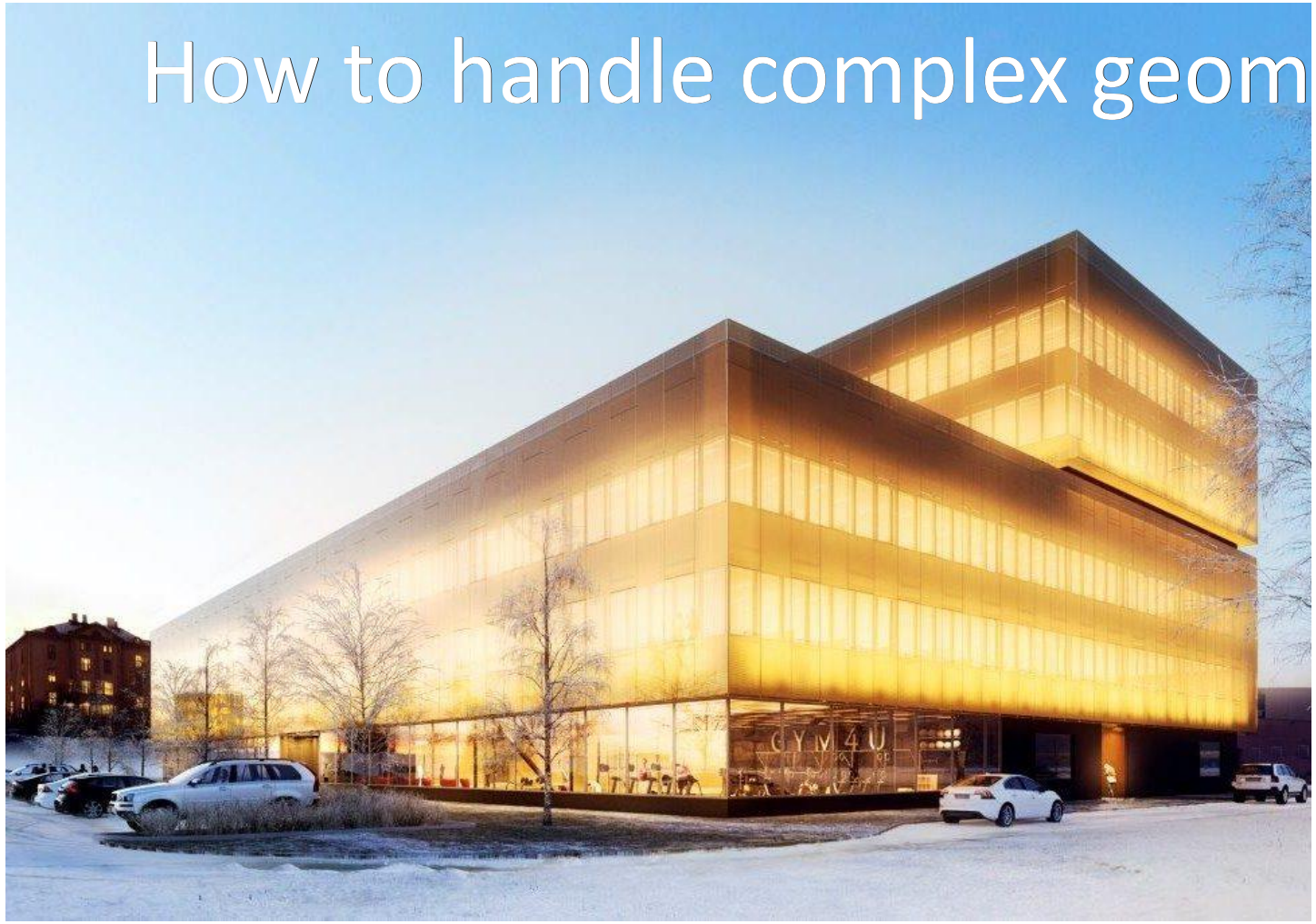
Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge



Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

To calculate the total window and wall area for each orientation when the building is not a square or rectangle. Simply sum the area of the window and wall faces for a given orientation.

South Wall Façades

West Wall Façades

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Building Components/Material Properties

Default values for "Existing Building" are based on estimate code at time of construction. Please change as found necessary.

Existing Building

Wall *R*-value

6.3

Click here to access R-value calculator

Predominant Wall Facade Material

Painted Surface – Light

Roof *R*-value

18.8

Click here to access R-value calculator

Roof Surface Material

Black Membrane

Window U-factor

0.59

Need Help? Click here

Window SHGC

0.39

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Build Your Wall Assembly

The capacity of an insulating material to resist heat flow. The higher the R-value, the greater the insulating power.

1. What type of **Cladding**? Help

Painted Surface – Light | 0.1 in

2. What type of **Intermediate Material**? + Add Material — Remove Material Help

Concrete blocks | 8 in

Sprayed Polyurethane Foam: Closed Cell | 3 in

3. What type of **Interior Cladding**? Help

Gypsum Board | 0.6 in

Submit Cancel

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Building Components/Material Properties

Default values for "Existing Building" are based on estimate code at time of construction. Please change as found necessary.

Existing Building

Wall *R*-value

6.3

Click here to access R-value calculator

Predominant Wall Facade Material

Painted Surface – Light

Roof *R*-value

18.8

Click here to access R-value calculator

Roof Surface Material

Black Membrane

Window U-factor

0.59

Need Help? Click here

Window SHGC

0.39

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

How to handle multiple façades?

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

$$R_{tot} = \left(\frac{A_1}{A_{tot}} \frac{1}{R_1} + \frac{A_2}{A_{tot}} \frac{1}{R_2} + \ldots + \frac{A_n}{A_{tot}} \frac{1}{R_n} \right)^{-1}$$

Area façade (1) = A_1

R-value wall (1) = R_1

Area façade (2) = A_2

R-value wall (2) = R_2

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Yes | No

Have you conducted a blower door test?

Building Airtightness Value

1.07 scfm/ft²

Yes | No

Have you taken any additional steps to improve the airtightness of your building?

A 10% improvement in airtightness has been assumed.

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and acknowledge

Advanced Options

Yes No

Would you like access to advanced inputs?

Thermostat Setpoint Options

Heating Setpoint		Cooling Setpoint	
70.0	°F	75.0	°F

Heating Setback		Cooling Setback	
60.0	°F	80.0	°F

Input data for the Building Envelope Campaign tool

Building Description

Building Type

Climate

Geometry

Building Components /Material Properties

Advanced Options

Review and Acknowledge

Review and acknowledge

Yes No

Click 'Yes' here to indicate that you have reviewed the Security & Privacy Notice.

Yes No

The information collected over the course of the campaign will be accessible only by the campaign team, and will only be published without identifying information and/or in aggregate (with the exception of case studies developed in partnership with the building owner/manager). Click 'Yes' to indicate that you agree to share your data.

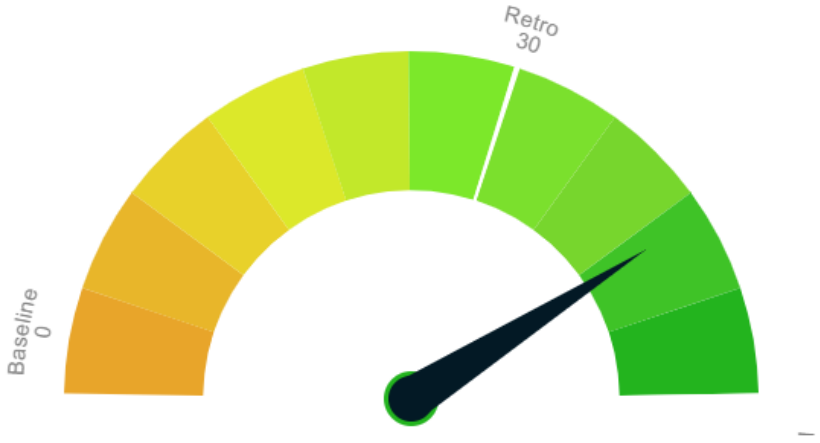
Check Results | Save Building

Building Envelope Performance Summary

Building Characteristics | Summary | Saved Buildings

New Building | Print Page

My Building



Building Envelope Performance (BEP)

🎉 Congratulations! you meet the requirements to receive the Retro 30 award.

41% Improvement

	Existing Building *Baseline*	Retrofit *Improvements*
BEP *kBtu/ft²*	**46.9**	**27.9**
Wall *R*-Value	**6.3**	**20**
Wall Facade Material	**Light Painted Surface**	**Light Painted Surface**
Roof *R*-Value	**18.8**	**30**
Roof Surface Material	**Black Membrane**	**Black Membrane**
Window U-Factor	**0.59**	**0.3**
Window SHGC	**0.39**	**0.39**
Air Leakage Rate *scfm/ft²*	**1.07**	**0.96**

Update Inputs

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Building Envelope Performance Summary

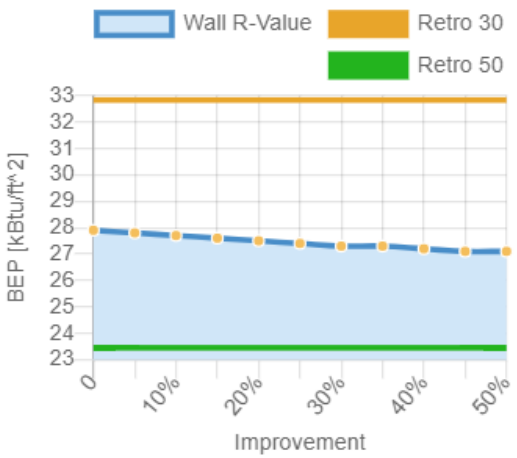
Energy Performance Breakdown

Charts below indicate improvement potentials for various building characteristics. Improvements are displayed using the BEP-value together with award criteria.

Building Type: largeOffice
Climate Zone: 5B

Wall Performance

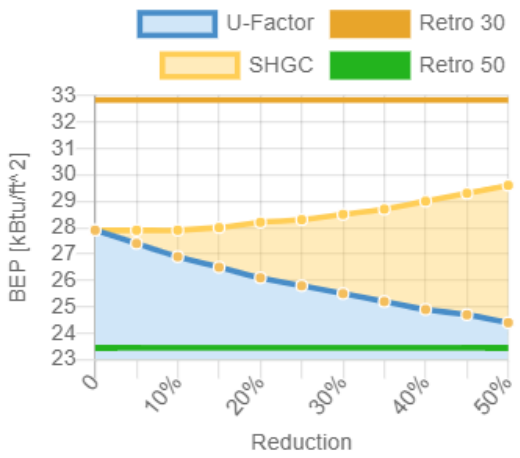
Calculated



Building Type: largeOffice
Climate Zone: 5B

Window Performance

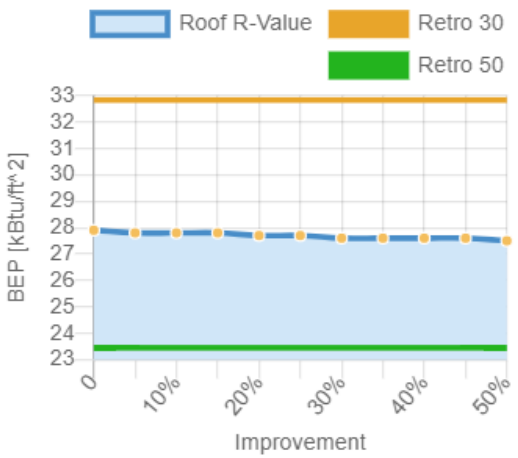
Calculated



Building Type: largeOffice
Climate Zone: 5B

Roof Performance

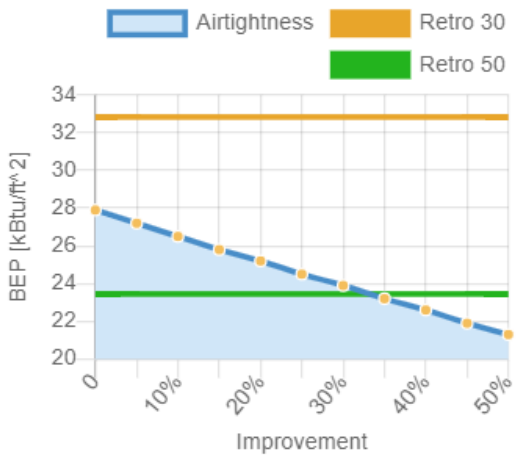
Calculated



Building Type: largeOffice
Climate Zone: 5B

Airtightness

Calculated



Boulder Associates Architects

Kristi Ennis, AIA

Principal/Director of Sustainable Design

Boulder Associates Architects

do good work
enjoy the journey

Boulder Associates Architects

Modern Healthcare

RANK/COMPANY		DOLLAR VOLUME[1] ($ IN MILLIONS) 2018	DOLLAR VOLUME[1] ($ IN MILLIONS) 2017	SQUARE FEET[1] (IN MILLIONS) 2018	SQUARE FEET[1] (IN MILLIONS) 2017	PERCENTAGE OF WORK[2]
1	HDR Architecture	$9,207.6	$9,019.2	30.0	31.7	58%
2	Stantec Architecture	7,519.7	6,899.1	12.4	10.9	21
3	AECOM	7,493.0	9,500.0	22.4	27.1	4
4	CannonDesign	5,917.7	5,380.0	18.8	16.7	50
5	HOK	6,973.4	6,040.1	10.7	9.8	38
6	HKS	4,157.0	5,304.0	16.4	21.0	43
7	NBBJ	3,475.0	2,391.0	5.4	4.5	45
8	Perkins & Will	2,996.1	2,244.6	7.4	4.4	24
9	Cathryn Bang & Partners Architects	2,739.7	2,570.0	3.8	3.3	100
10	SmithGroup	2,367.6	1,526.0	9.4	2.6	34
11	Leo A Daly	2,242.6	1,656.8	7.5	5.5	19
12	HGA	1,551.8	584.6	2.8	1.9	50
13	Earl Swensson Associates	1,375.5	1,221.0	4.3	3.3	75
14	Page	978.0	1,888.9	1.9	4.7	35
15	ZGF Architects	798.0	850.8	2.9	1.8	35
16	Boulder Associates	764.8	232.8	1.9	1.0	100
17	Flad Architects	635.4	707.4	1.3	1.6	38
18	EwingCole	541.8	285.7	1.2	0.9	36

BCH Lafayette Community Medical Center MOB 2

BCH Lafayette Community Medical Center MOB 2

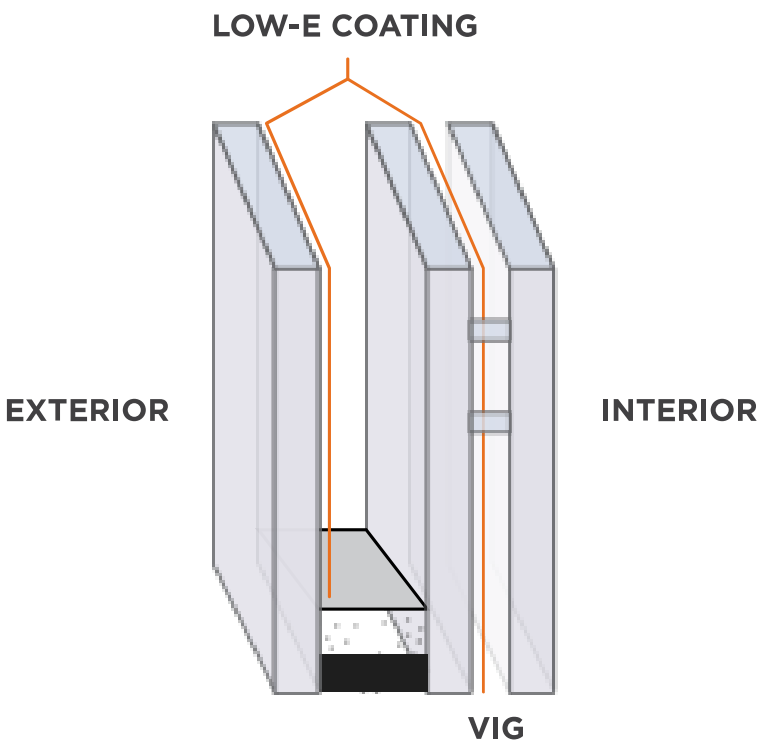
- Medical Office Building in Lafayette, CO
- 30,000 s.f., 2-story New Construction
- Built in 2019
- Climate Zone 5B
- Tenants include:
  - Colorado Retina Eye Clinic
  - Premier Eye Ambulatory Surgery Center

BCH Lafayette Community Medical Center MOB 2

- Hybrid Vacuum Insulated Glass
- Composition:
  - 6 mm clear
  - ½” airspace
  - VIG (4mm SNX 62/27 Clear (#4) over 4 mm clear)

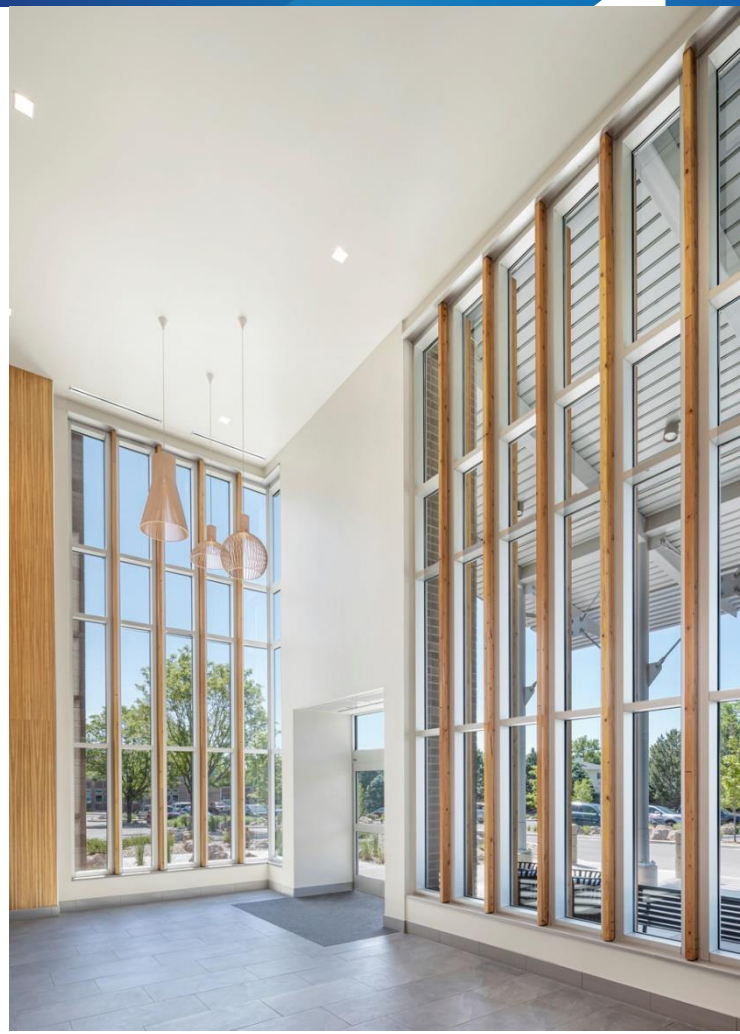
  - 6 mm SNX 62/27 (#2) clear
  - ½” airspace
  - VIG (4mm SNX 62/27 Clear (#4) over 4 mm clear)

Hybrid VIG Section



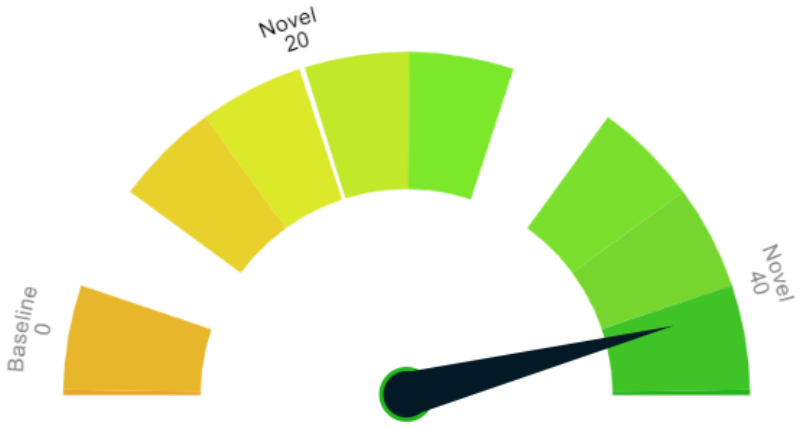
Community Medical Center Lafayette MOB

BCH Lafayette Community Medical Center MOB 2



Community Medical Center Lafayette MOB

Community Medical Center MOB 2



Building Envelope Performance (BEP)

🎉 Congratulations! you meet the requirements to receive the Novel 40 award.

46% Improvement

Building Code *Baseline*	
BEP *kBtu/ft²*	**20.1**
Wall *R*-Value	**17.3**
Wall Facade Material	**Stucco**
Roof *R*-Value	**30.5**
Roof Surface Material	**Black Membrane**
Window U-Factor	**0.52**
Window SHGC	**0.34**
Air Leakage Rate *scfm/ft²*	**0.4**

Update Inputs

New Building *Improvements*	
BEP *kBtu/ft²*	**10.8**
Wall *R*-Value	**19.2**
Wall Facade Material	**Brick**
Roof *R*-Value	**31.3**
Roof Surface Material	**Gray Membrane**
Window U-Factor	**0.14**
Window SHGC	**0.19**
Air Leakage Rate *scfm/ft²*	**0.4**

Community Medical Center Lafayette MOB

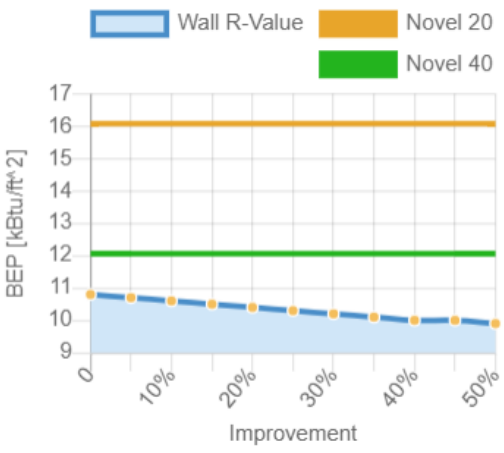
Energy Performance Breakdown

Charts below indicate improvement potentials for various building characteristics. Improvements are displayed using the BEP-value together with award criteria.

Building Type: outpatientHealth
Climate Zone: 5B

Wall Performance

Calculated



Building Type: outpatientHealth
Climate Zone: 5B

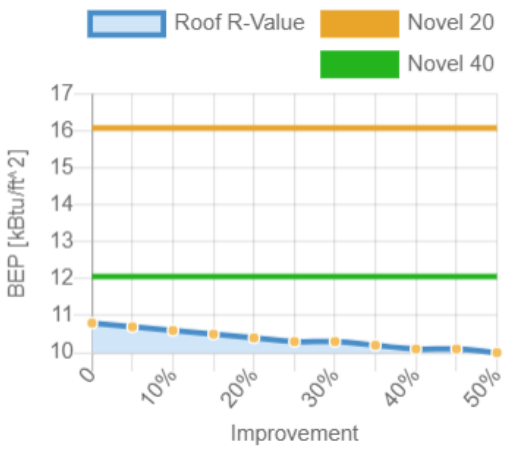
Window Performance

Calculated

Building Type: outpatientHealth
Climate Zone: 5B

Roof Performance

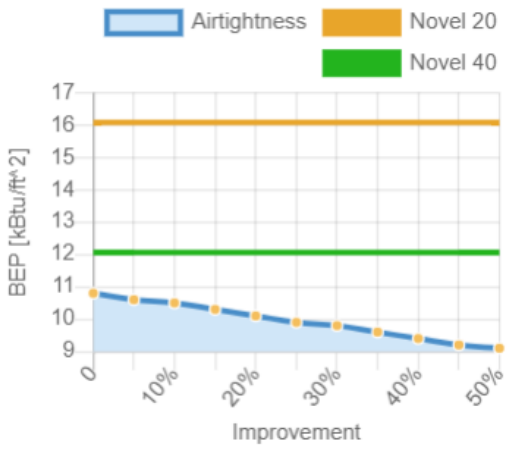
Calculated



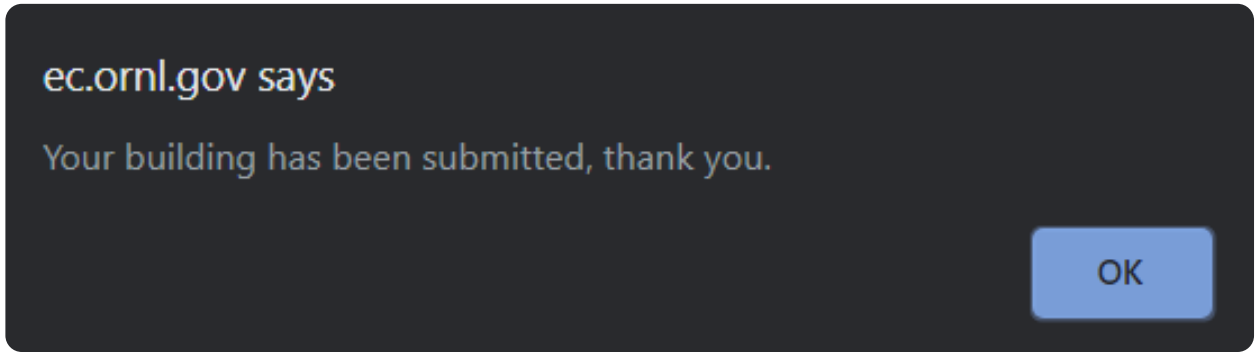
Building Type: outpatientHealth
Climate Zone: 5B

Airtightness

Calculated



Community Medical Center Lafayette MOB



BCH Lafayette Community Medical Center MOB 2

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Poll 2

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Thank you to our Organizers!

The American Institute of Architects

IFMA™
International Facility Management Association

IBEC
International Institute of Building Enclosure Consultants

Thank you!

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- *EC.ORNL.GOV, envelopecampaign@ornl.gov*

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