Designing for Sustainability in the Glass & Glazing Industry

Course Number: **EL301**a | Thursday June 21, 2018 10:30am-11:30am

Course Number: **EL301**b | Thursday June 21, 2018 4:00pm-5:00pm

Course Number: **EL301**c | Friday, June 22, 2018 10:30am-11:30am

Learning Units: **1 HSW LU**

A'18 AIA Conference on Architecture 2018
June 21-23, New York City

Acknowledgements/Credits

Kawneer Company, Inc.

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Norcross, Georgia 30092

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Speakers List

Presentation(s):

- (EL301a) Designing for Sustainability in the Glass & Glazing Industry
  6/21/2018 10:30 AM - 11:30 AM
- (EL301b) Designing for Sustainability in the Glass & Glazing Industry
  6/21/2018 4:00 PM - 5:00 PM
- (EL301c) Designing for Sustainability in the Glass & Glazing Industry
  6/22/2018 10:30 AM - 11:30 AM

Jenelle Sams, PMP, LEED Green Associate
Sustainability Specialist
Kawneer Company, Inc.

Donnie Hunter
Director of Global Product Management,
Kawneer Company, Inc.

Course / Learning Objectives

- Learn how a framing system's energy performance impacts whole-building sustainability performance.
- Understand how architectural aluminum-framing systems can be used to create a sustainable green building regardless of the certification.
- Evaluate strategies for daylighting, views, shading, and sound transmission in relation to their impact on sustainability performance.
- Explore the human health benefits of utilizing aluminum framing systems.

Designing for Sustainability

Architectural aluminum-framing systems can be used to create a high-performance sustainable building.

Three main characteristics that impact whole-building performance:

- Energy Efficiency
- Material Utilization
- Occupant Wellbeing

Green Building Certifications
LEED® v4 BD+C
LBC v3.1
WELL v1.0
CHPS

LEED is a registered trademark of the U.S. Green Building Council (USGBC).

Energy Efficiency

1. Optimizing Performance
2. Incorporating Renewables

Lindsey-Flanigan Courthouse
LEED® Gold

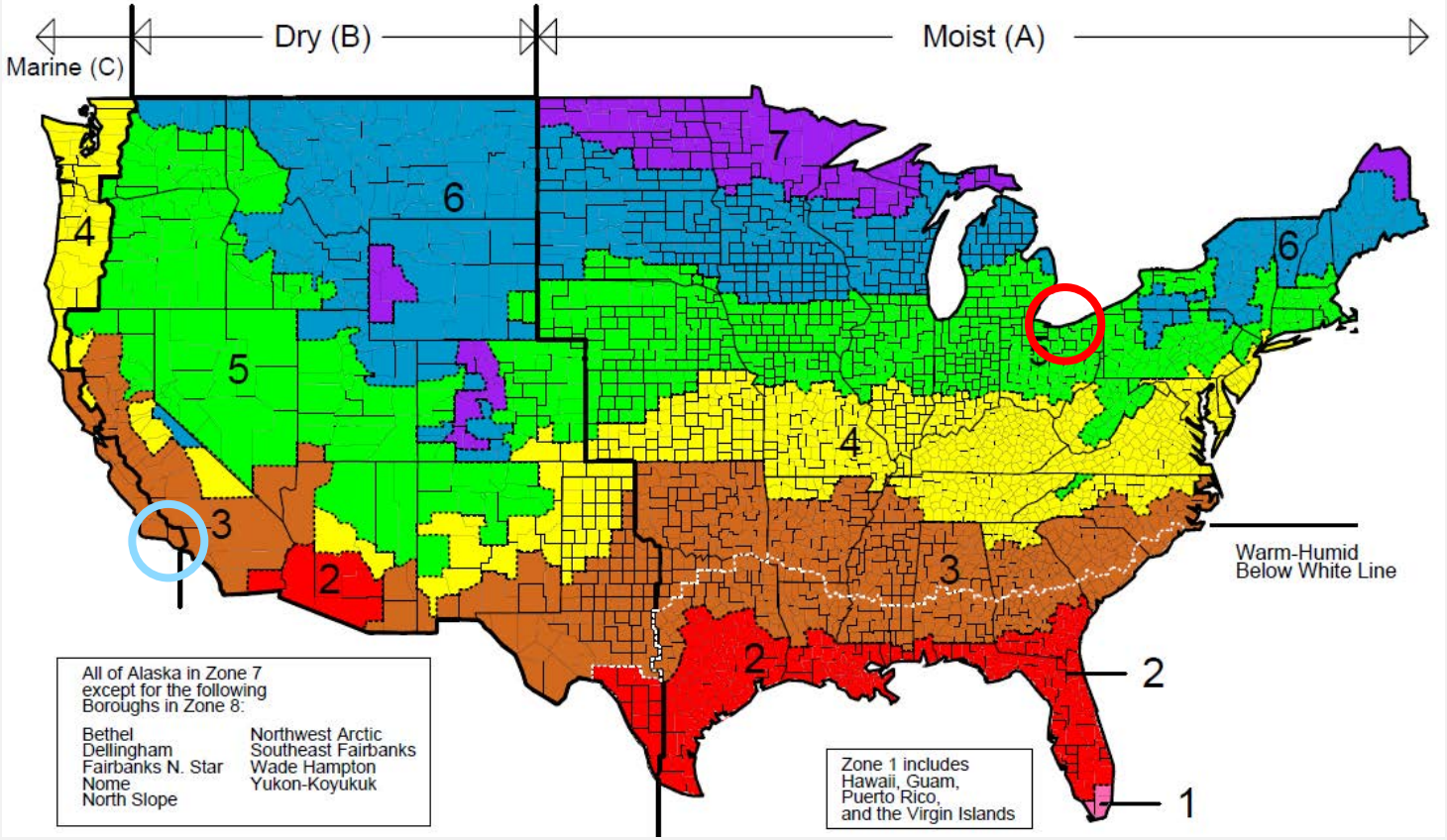
Green Building Certifications	Category
LEED v4 BD+C	Energy & Atmosphere
LBC v3.1	Energy Petal
WELL v1.0	X
CHPS	Energy

Energy Efficiency

1. Optimizing Performance
    - Establish baseline energy model
    - ANSI/ASHRAE/IESNA 90.1
2. Incorporating Renewables

Green Building Certifications	Category
LEED v4 BD+C	• EA - Optimize Energy Performance
LBC v3.1	• Imperative 06 - Net Positive Energy
WELL v1.0	X
CHPS	• EE 1.0 Energy Performance • EE1.1 Superior Energy Performance

Energy Efficiency



Energy Efficiency

			Los Angeles		Cleveland				
Climate Zone	**1**	**2**	**3**	**4 except Marine**	**5 and Marine 4**	**6**	**7**	**8**	
Nonmetal framing	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35	ASHRAE 90.1-2010
	0.50	0.40	0.35	0.35	0.32	0.32	0.32	0.32	ASHRAE 90.1-2013
	IECC removed separate nonmetal category – now same as metal framing fixed or operable								2012 IECC
Metal framing, fixed	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40	ASHRAE 90.1-2010
	0.57	0.57	0.50	0.42	0.42	0.42	0.38	0.38	ASHRAE 90.1-2013
	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29	2012 IECC
Metal framing, operable	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45	ASHRAE 90.1-2010
	0.65	0.65	0.60	0.50	0.50	0.50	0.40	0.40	ASHRAE 90.1-2013
	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37	2012 IECC
Metal framing, entrance door	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80	ASHRAE 90.1-2010
	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77	ASHRAE 90.1-2013
	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77	2012 IECC

Energy Efficiency

Three Methods Of Heat Transfer:

1. **Conduction**: Molecule to Molecule
2. **Convection**: Via Rotation
3. **Radiation:** Electromagnetic Waves

Energy Efficiency

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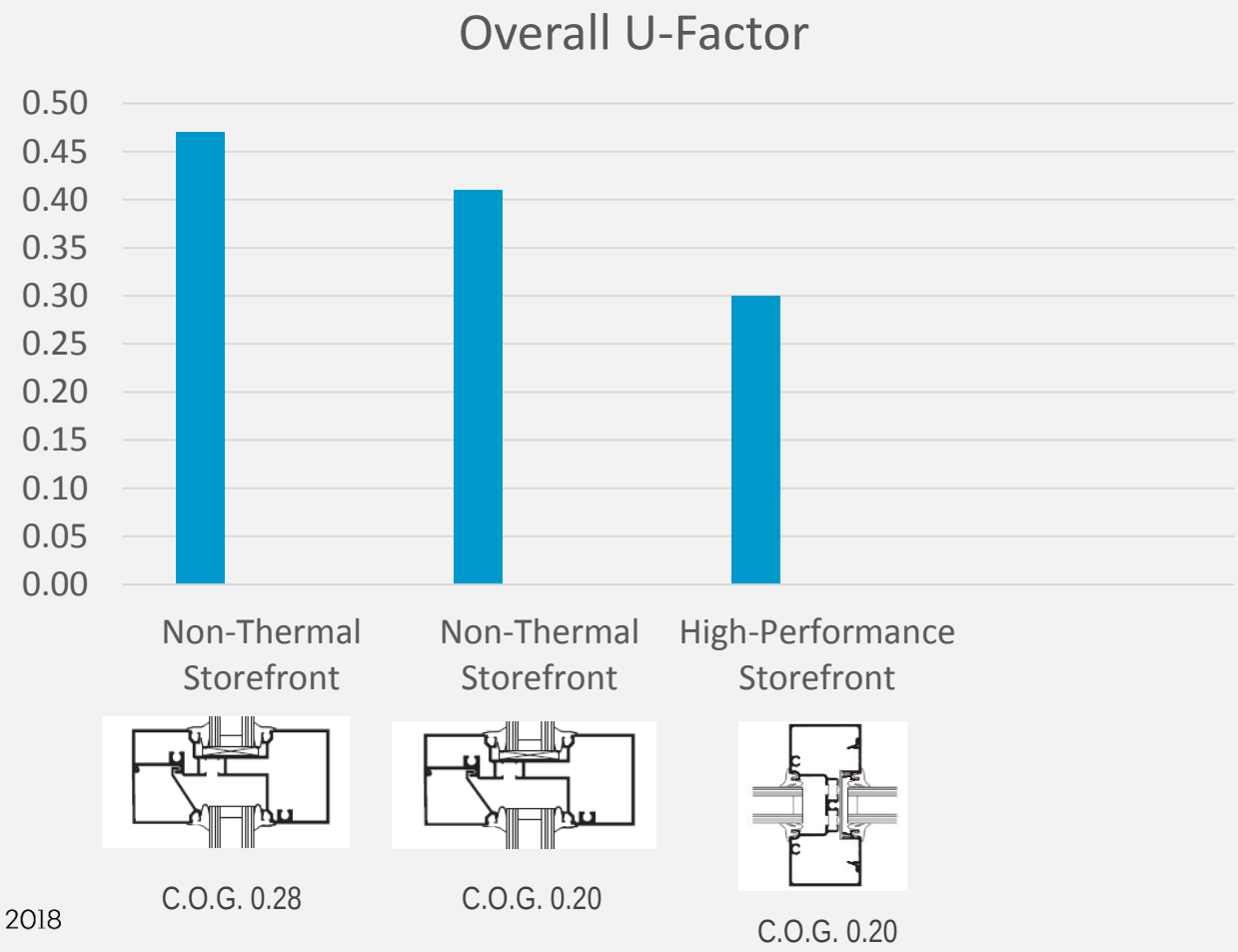
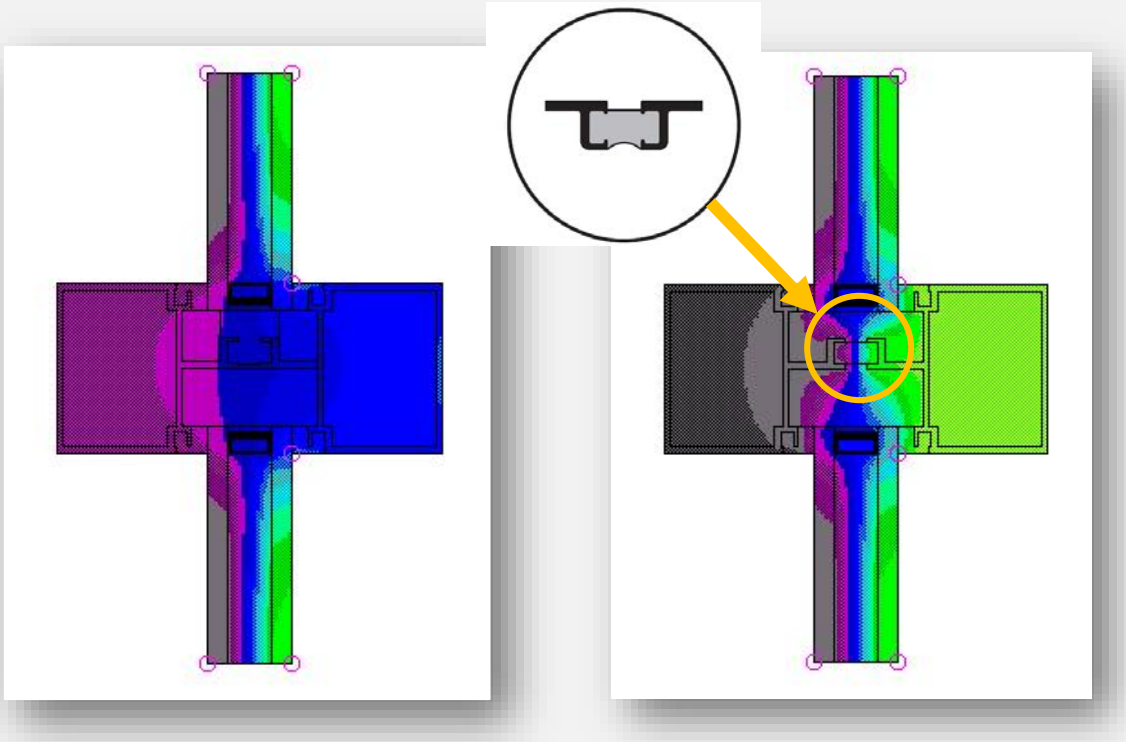
Energy Efficiency

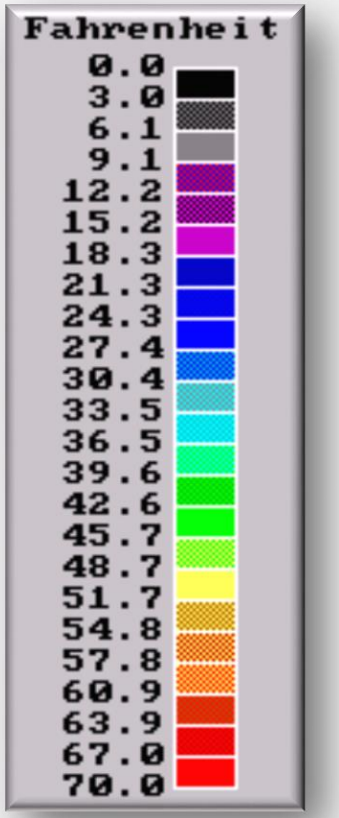


Energy Efficiency

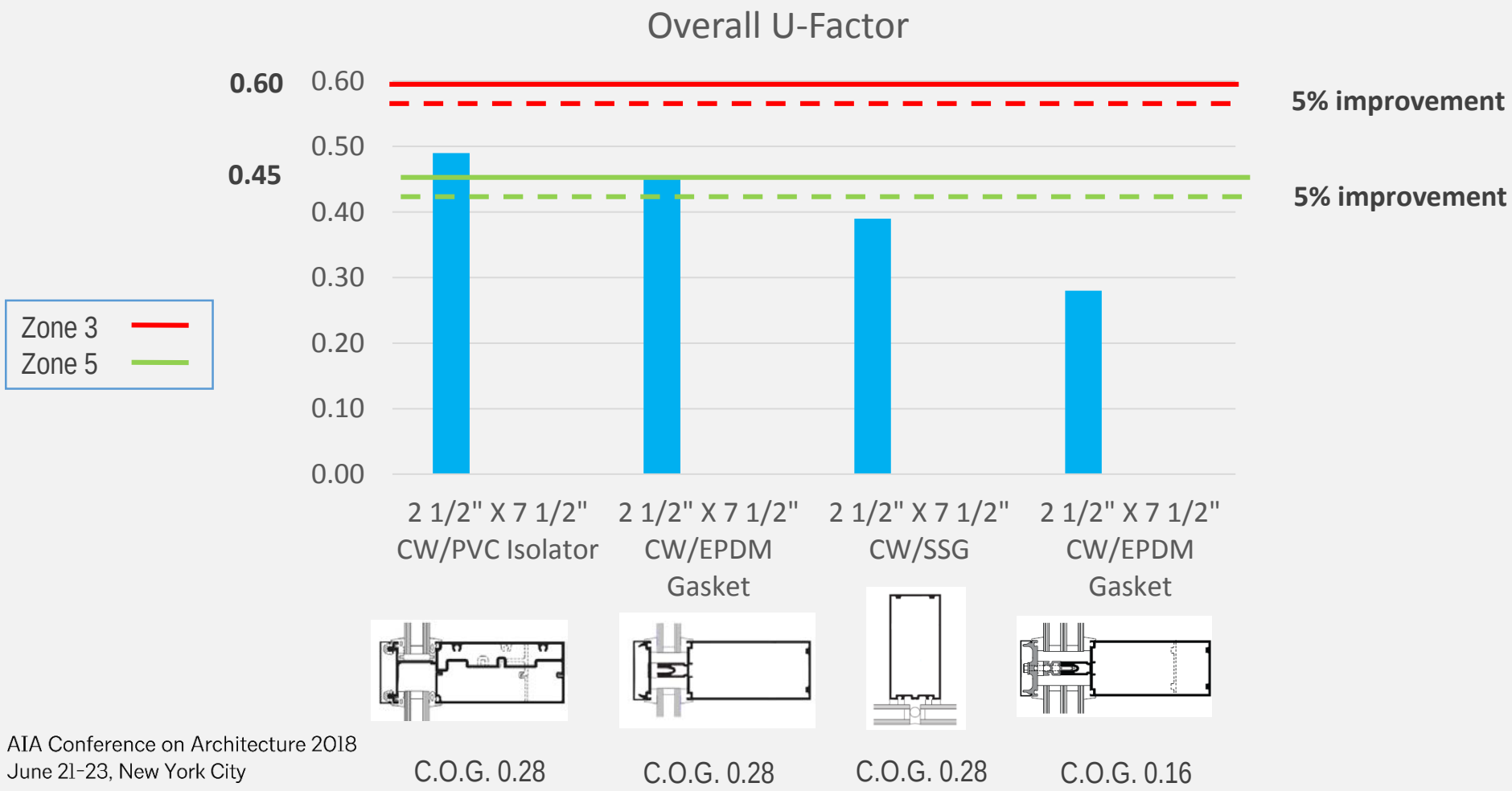


2" x 4.5"
Non-Thermal Frame

2" x 4.5"
Thermal Frame



Energy Efficiency

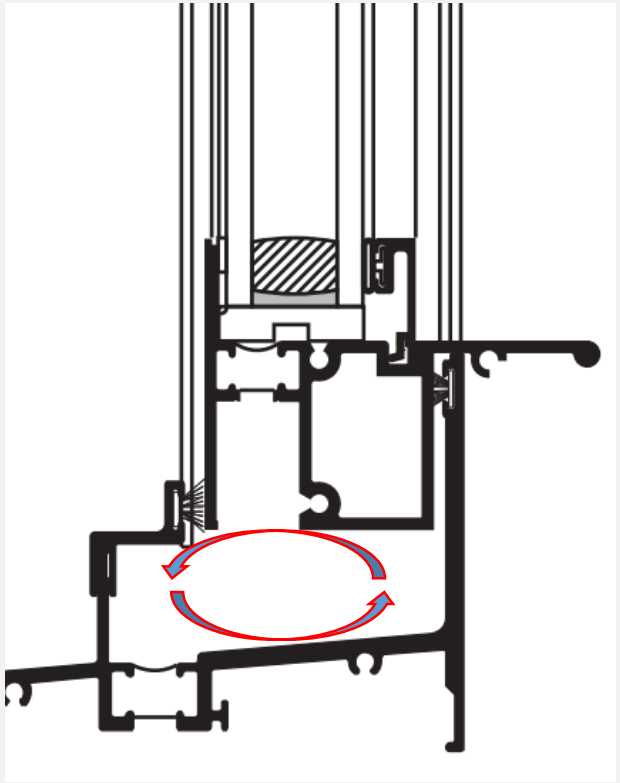


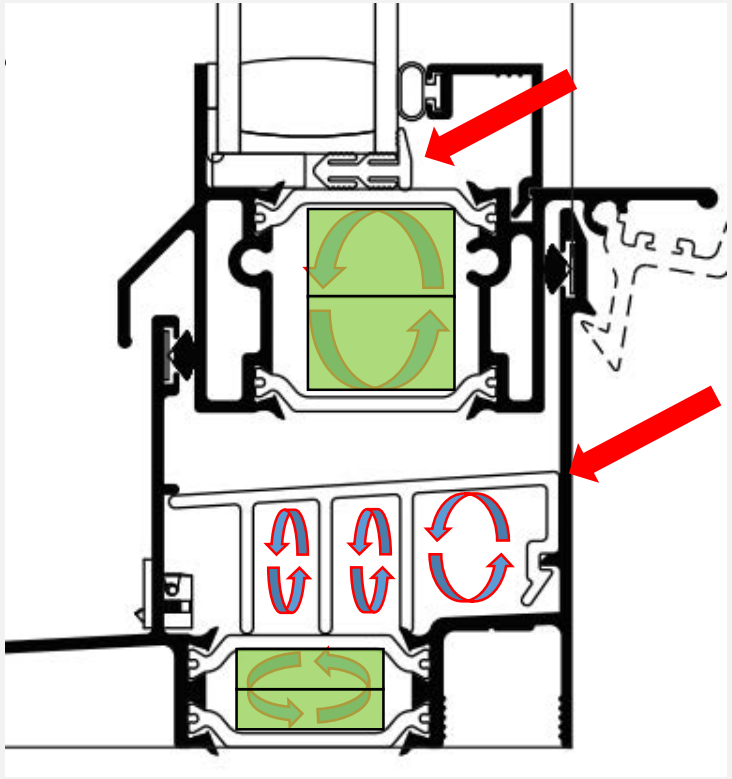
Energy Efficiency

Three Methods Of Heat Transfer:

1. **Conduction**: Molecule to Molecule
2. **Convection**: Via Rotation
3. **Radiation:** Electromagnetic Waves

Energy Efficiency





Energy Efficiency

Three Methods Of Heat Transfer:

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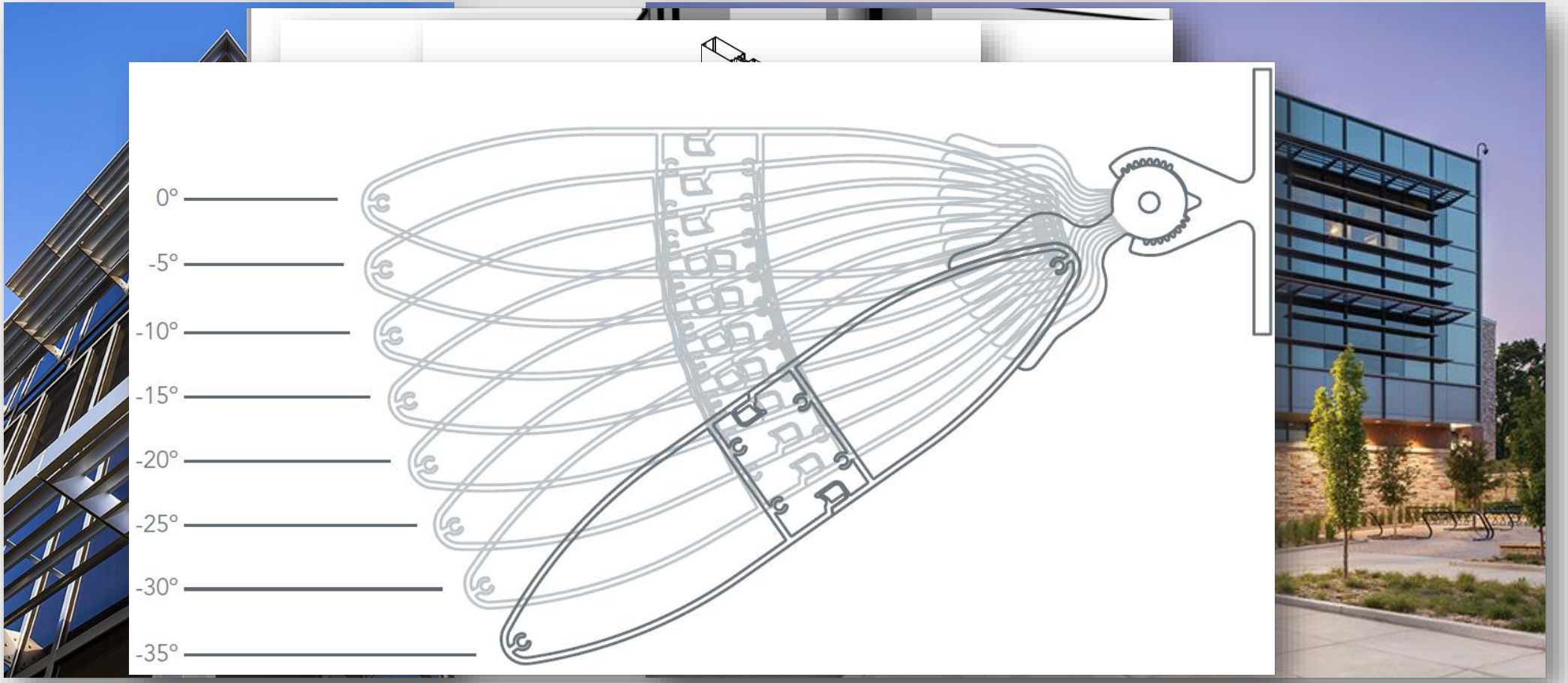
Energy Efficiency



Energy Efficiency

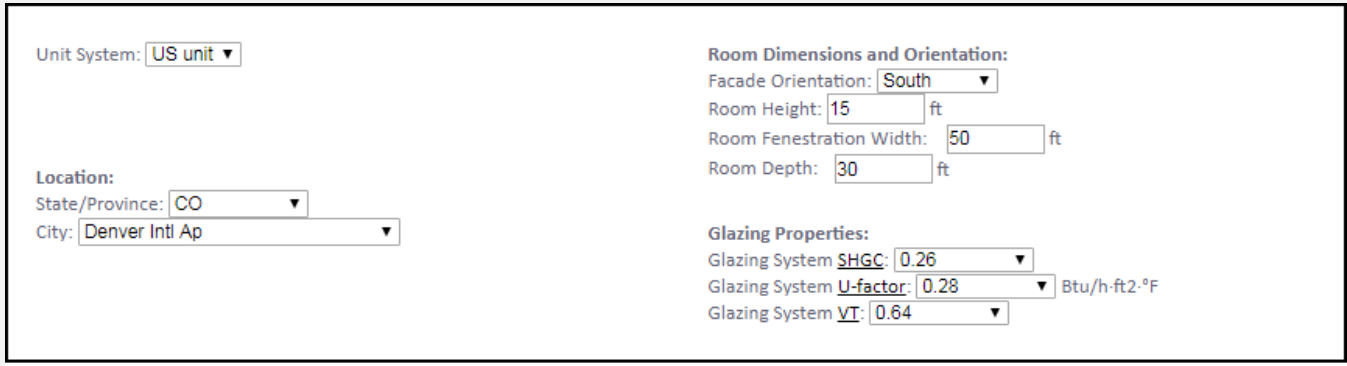
10' Curtain Wall in Denver

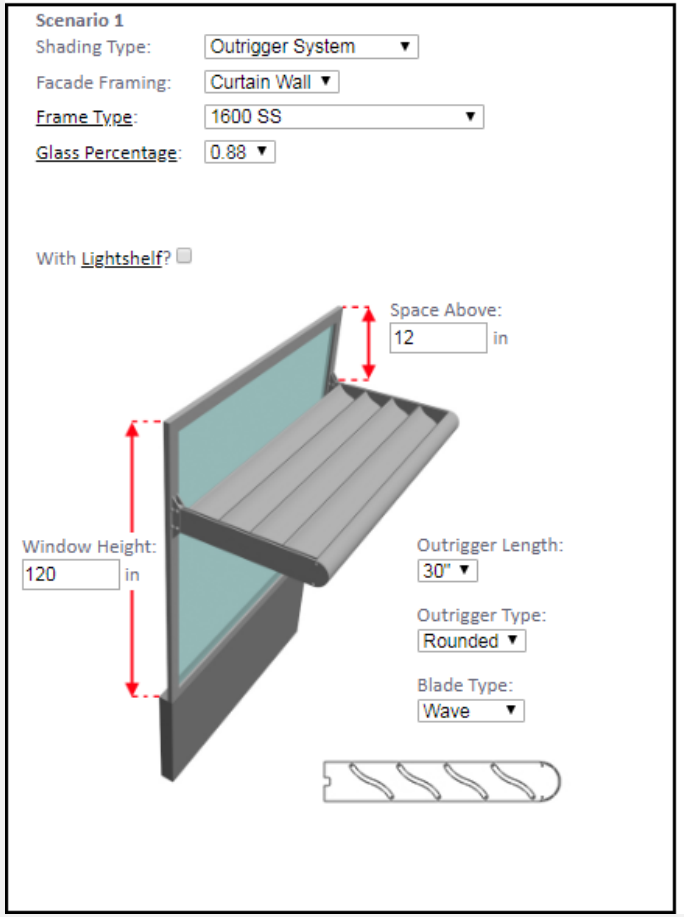
Scenario #1:

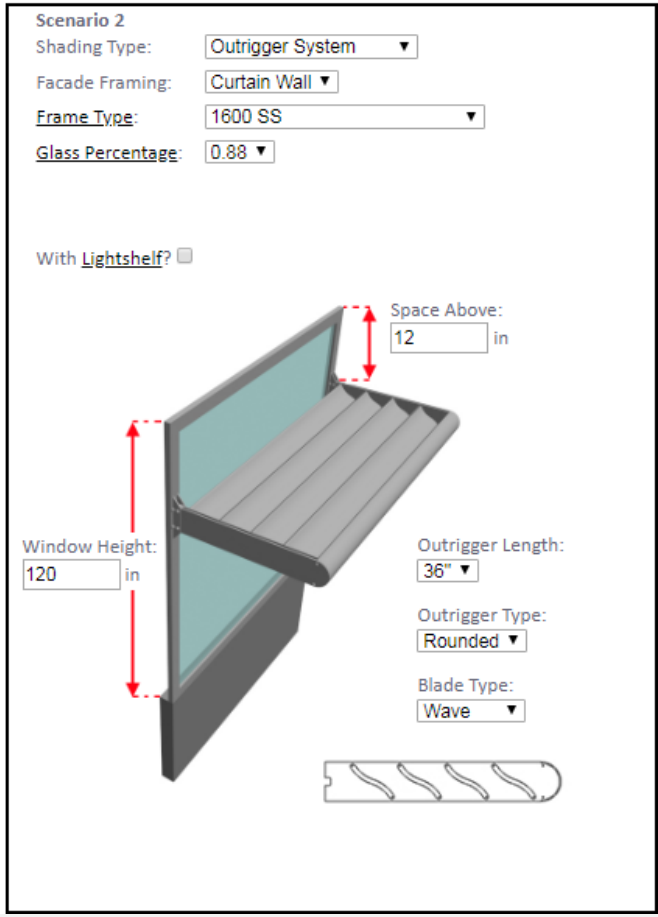
30" Projecting Sun Shade
12" Below Head

Scenario #2:

36" Projecting Sun Shade
12" Below Head







Energy Efficiency

10' Curtain Wall in Denver

Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).

Scenario #1: ***42%***
Scenario #2: ***46.93%***

Relative Comparison of Sun Control Device Performance

The design of Scenario 2 is **8.51%** better than the design of Scenario 1 in terms of annual cooling energy savings

Efficiency of Sun Control Products Compared to Baseline (No Shading)

Scenario 1	Scenario 2
Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).	Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).
42%	46.93%

Shaded Fraction

Numbers show the average shaded window fraction for each daylight hour of each month. Darker areas represent higher shaded fraction.

Scenario 1:

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6:00	0%	0%	0%	0%	0%	0%	0%	0%	13%	0%	0%	0%
7:00	0%	4%	28%	68%	0%	0%	0%	32%	49%	15%	5%	0%
8:00	9%	15%	30%	69%	90%	27%	58%	84%	40%	21%	13%	9%
9:00	14%	19%	31%	55%	87%	90%	90%	71%	38%	23%	16%	13%
10:00	16%	21%	32%	50%	79%	90%	88%	60%	37%	25%	18%	15%
11:00	18%	23%	32%	48%	72%	89%	82%	56%	37%	25%	19%	17%
12:00	18%	23%	32%	47%	70%	87%	78%	55%	37%	25%	19%	17%
13:00	18%	23%	32%	48%	73%	90%	81%	56%	37%	25%	19%	16%
14:00	17%	22%	32%	50%	80%	90%	87%	60%	37%	24%	17%	15%
15:00	15%	20%	31%	56%	88%	90%	90%	69%	38%	22%	15%	13%
16:00	11%	17%	31%	70%	90%	3%	84%	83%	40%	18%	10%	8%
17:00	1%	10%	29%	58%	0%	0%	0%	38%	52%	8%	0%	0%
18:00	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Scenario 2:

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6:00	0%	0%	0%	0%	0%	0%	0%	0%	15%	0%	0%	0%
7:00	0%	4%	33%	71%	0%	0%	0%	32%	56%	17%	5%	0%
8:00	10%	17%	35%	77%	90%	27%	58%	88%	47%	24%	14%	10%
9:00	16%	22%	36%	66%	90%	90%	90%	79%	45%	27%	19%	15%
10:00	19%	25%	37%	59%	87%	90%	90%	71%	44%	29%	21%	18%
11:00	20%	26%	37%	57%	83%	90%	89%	66%	43%	30%	22%	19%
12:00	21%	27%	37%	56%	82%	90%	88%	65%	43%	30%	22%	19%
13:00	21%	26%	37%	57%	84%	90%	89%	66%	43%	29%	22%	19%
14:00	19%	25%	37%	60%	88%	90%	90%	71%	44%	28%	20%	17%
15:00	17%	23%	37%	66%	90%	90%	90%	79%	45%	26%	17%	14%
16:00	12%	19%	36%	77%	90%	3%	84%	88%	48%	21%	11%	9%
17:00	2%	11%	34%	61%	0%	0%	0%	38%	58%	9%	0%	0%
18:00	0%	0%	9%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Energy Efficiency

10' Curtain Wall in Key West

Scenario #1:

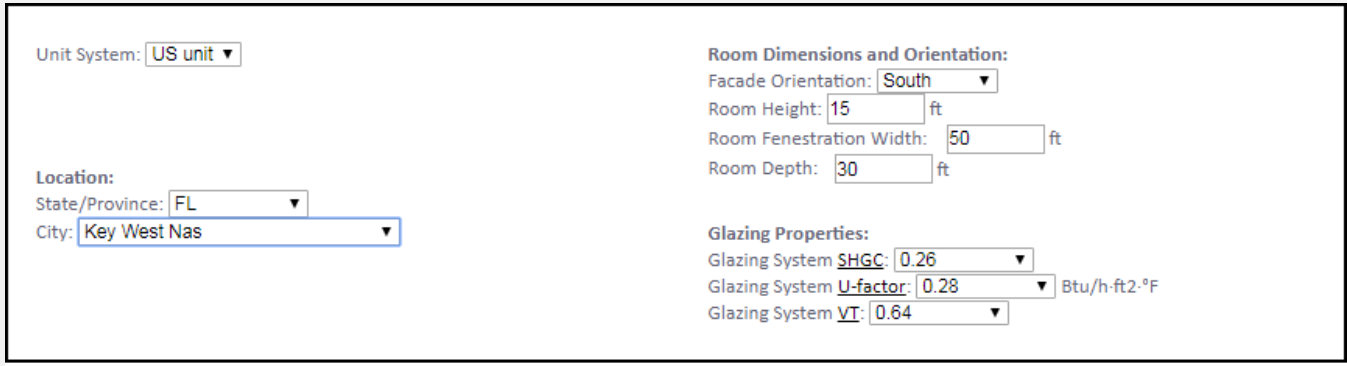
30" Projecting Sun Shade

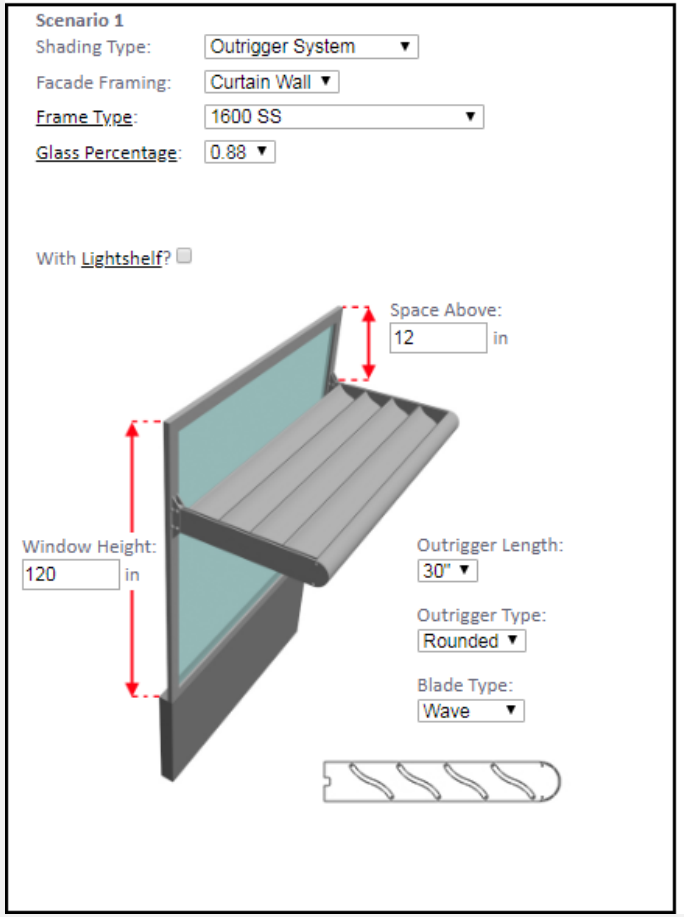
12" Below Head

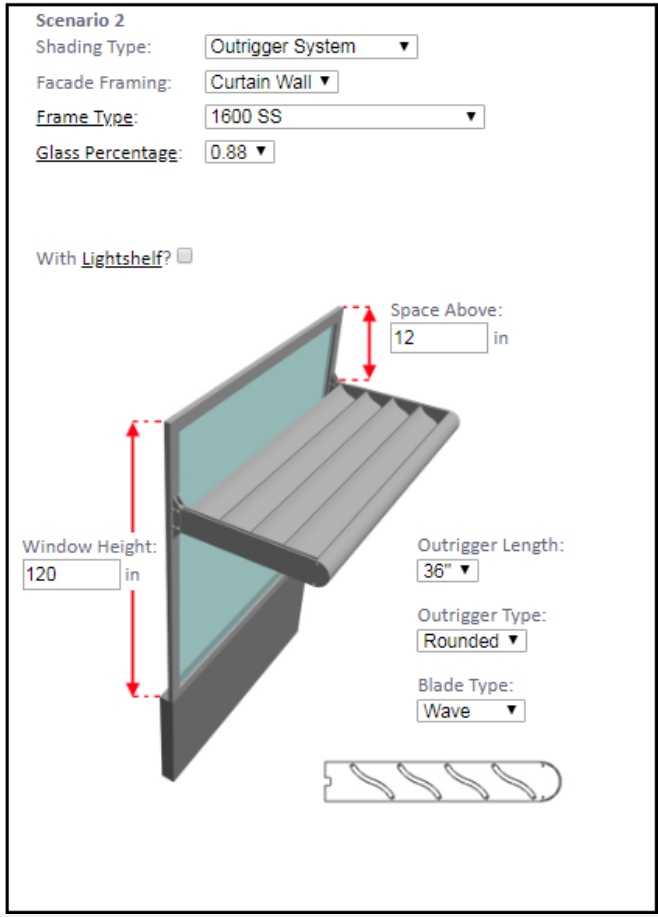
Scenario #2:

36" Projecting Sun Shade

12" Below Head







Energy Efficiency

10' Curtain Wall in Key West

Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).

Scenario #1: ***33.41%***
Scenario #2: ***37.41%***

Relative Comparison of Sun Control Device Performance

The design of Scenario 2 is **5.44%** better than the design of Scenario 1 in terms of annual cooling energy savings

Efficiency of Sun Control Products Compared to Baseline (No Shading)

Scenario 1	Scenario 2
Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).	Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).
33.41%	37.04%

Shaded Fraction

Numbers show the average shaded window fraction for each daylight hour of each month. Darker areas represent higher shaded fraction.

Scenario 1:

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7:00	0%	1%	38%	0%	0%	0%	0%	0%	45%	17%	7%	0%
8:00	13%	19%	50%	51%	0%	0%	0%	17%	71%	30%	18%	13%
9:00	20%	28%	52%	89%	15%	0%	0%	64%	70%	36%	24%	19%
10:00	25%	32%	53%	88%	64%	0%	20%	90%	68%	39%	28%	23%
11:00	27%	35%	54%	87%	90%	30%	78%	90%	67%	40%	30%	26%
12:00	29%	36%	54%	86%	90%	90%	90%	90%	66%	41%	30%	27%
13:00	29%	36%	54%	86%	90%	90%	90%	90%	66%	41%	30%	27%
14:00	28%	36%	54%	87%	90%	18%	81%	90%	67%	40%	29%	25%
15:00	25%	33%	54%	88%	52%	0%	26%	90%	68%	37%	26%	23%
16:00	21%	30%	53%	89%	3%	0%	0%	67%	70%	32%	21%	18%
17:00	14%	23%	52%	45%	0%	0%	0%	15%	71%	23%	12%	11%
18:00	2%	10%	43%	0%	0%	0%	0%	0%	26%	2%	0%	0%
19:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Scenario 2:

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
7:00	0%	1%	42%	0%	0%	0%	0%	0%	48%	20%	8%	0%
8:00	14%	22%	58%	51%	0%	0%	0%	17%	77%	35%	20%	15%
9:00	23%	32%	62%	90%	15%	0%	0%	64%	77%	42%	28%	22%
10:00	29%	38%	63%	90%	64%	0%	20%	90%	77%	46%	32%	27%
11:00	32%	41%	64%	90%	90%	30%	78%	90%	77%	48%	35%	30%
12:00	34%	43%	64%	90%	90%	90%	90%	90%	77%	48%	36%	31%
13:00	34%	43%	64%	90%	90%	90%	90%	90%	77%	48%	35%	31%
14:00	32%	42%	64%	90%	90%	18%	81%	90%	77%	47%	33%	30%
15:00	30%	39%	63%	90%	52%	0%	26%	90%	77%	44%	30%	26%
16:00	25%	35%	62%	90%	3%	0%	0%	67%	77%	38%	24%	21%
17:00	17%	27%	60%	45%	0%	0%	0%	15%	77%	27%	14%	12%
18:00	2%	11%	47%	0%	0%	0%	0%	0%	29%	2%	0%	0%
19:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Energy Efficiency

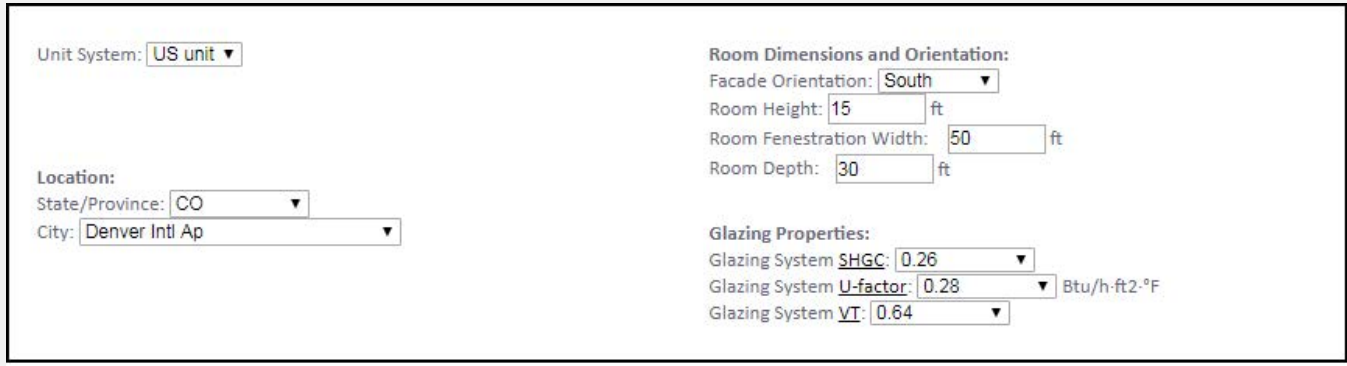
10' Curtain Wall in Denver

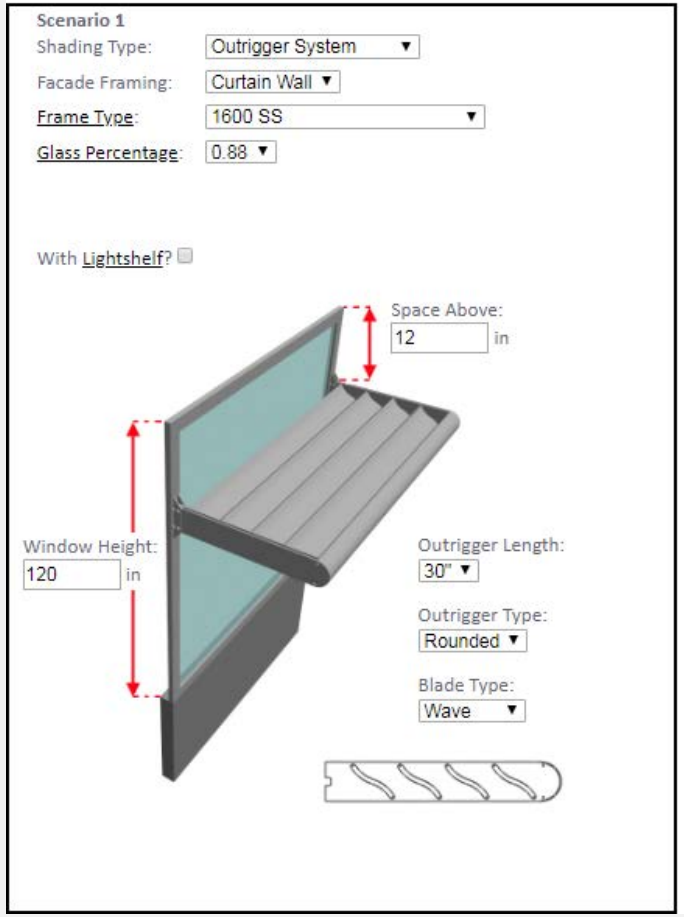
Scenario #1:

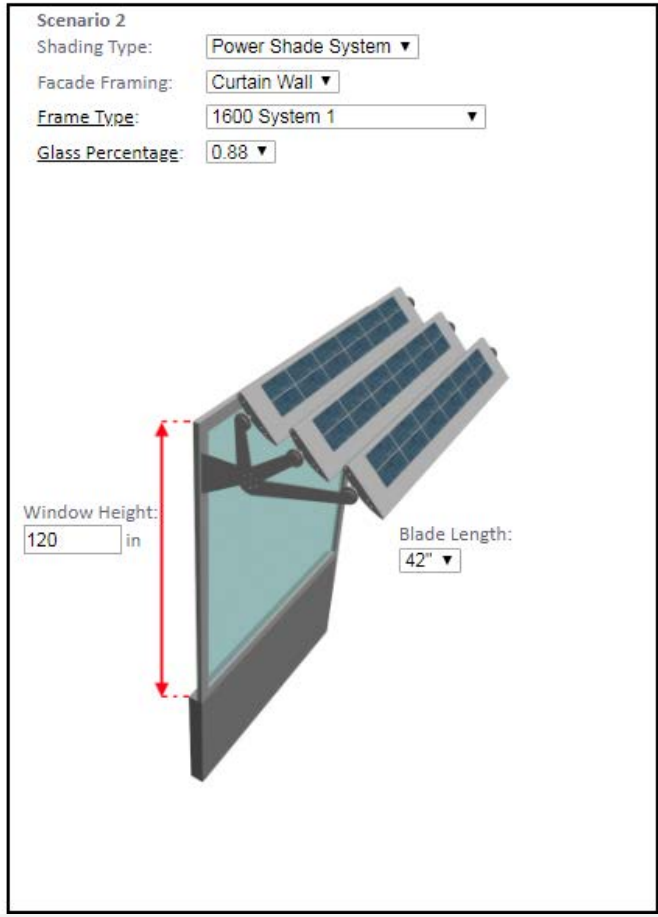
30" Projecting Sun Shade
12" Below Head

Scenario #2:

42" Projecting Power Shade
12" Below Head







Energy Efficiency

10' Curtain Wall in Denver

Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).

Scenario #1: ***42%***
Scenario #2: ***52.69%***
annual ***kWh 319.76***

Relative Comparison of Sun Control Device Performance

The design of Scenario 2 is **18.68**% better than the design of Scenario 1 in terms of annual cooling energy savings

Efficiency of Sun Control Products Compared to Baseline (No Shading)

Scenario 1	Scenario 2
Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).	Annual cooling energy savings due to reduction in solar gains (compared to "no shading" for selected glazing/framing options).
42%	52.69%

Power Shade Performance

Annual power production is **319.76** KWh

Shaded Fraction

Numbers show the average shaded window fraction for each daylight hour of each month. Darker areas represent higher shaded fraction.

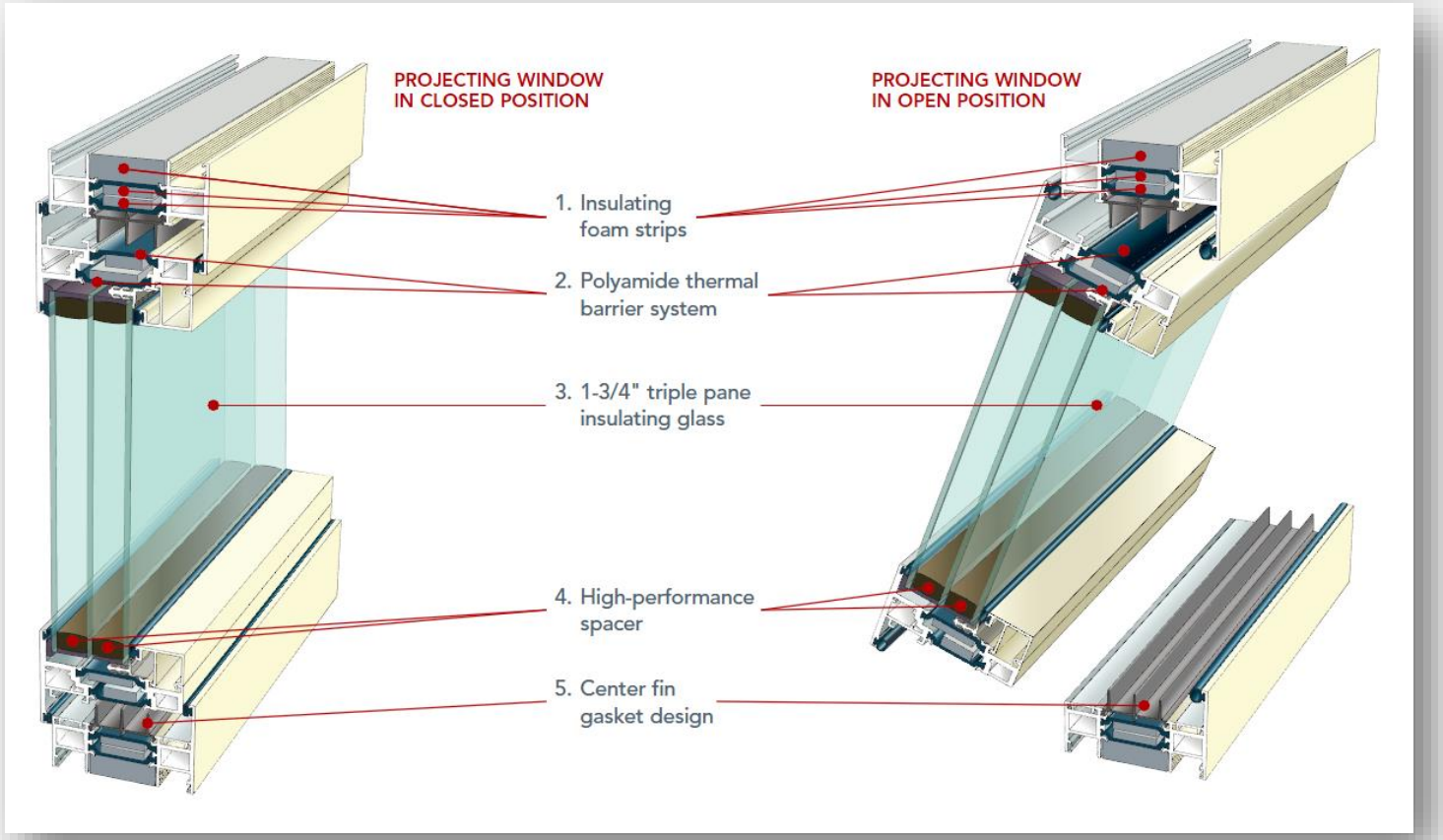
Scenario 1:

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6:00	0%	0%	0%	0%	0%	0%	0%	0%	13%	0%	0%	0%
7:00	0%	4%	28%	68%	0%	0%	0%	32%	49%	15%	5%	0%
8:00	9%	15%	30%	69%	90%	27%	58%	84%	40%	21%	13%	9%
9:00	14%	19%	31%	55%	87%	90%	90%	71%	38%	23%	16%	13%
10:00	16%	21%	32%	50%	79%	90%	88%	60%	37%	25%	18%	15%
11:00	18%	23%	32%	48%	72%	89%	82%	56%	37%	25%	19%	17%
12:00	18%	23%	32%	47%	70%	87%	78%	55%	37%	25%	19%	17%
13:00	18%	23%	32%	48%	73%	90%	81%	56%	37%	25%	19%	16%
14:00	17%	22%	32%	50%	80%	90%	87%	60%	37%	24%	17%	15%
15:00	15%	20%	31%	56%	88%	90%	90%	69%	38%	22%	15%	13%
16:00	11%	17%	31%	70%	90%	3%	84%	83%	40%	18%	10%	8%
17:00	1%	10%	29%	58%	0%	0%	0%	38%	52%	8%	0%	0%
18:00	0%	0%	8%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Scenario 2:

Time	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
5:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6:00	0%	0%	0%	0%	0%	0%	0%	0%	16%	0%	0%	0%
7:00	0%	4%	37%	79%	0%	0%	0%	35%	64%	19%	6%	0%
8:00	11%	19%	40%	87%	100%	30%	65%	98%	54%	27%	16%	11%
9:00	18%	25%	42%	76%	100%	100%	100%	90%	51%	31%	21%	17%
10:00	21%	28%	43%	68%	98%	100%	100%	82%	50%	33%	24%	20%
11:00	23%	30%	43%	65%	95%	100%	100%	77%	50%	34%	25%	22%
12:00	24%	30%	43%	65%	94%	100%	99%	75%	50%	34%	25%	22%
13:00	23%	30%	43%	66%	95%	100%	100%	77%	50%	33%	25%	21%
14:00	22%	29%	43%	69%	98%	100%	100%	82%	50%	32%	22%	20%
15:00	19%	27%	42%	77%	100%	100%	100%	90%	52%	29%	19%	16%
16:00	13%	22%	41%	88%	100%	3%	94%	98%	55%	24%	12%	9%
17:00	2%	13%	39%	68%	0%	0%	0%	42%	66%	9%	0%	0%
18:00	0%	0%	10%	0%	0%	0%	0%	0%	0%	0%	0%	0%
19:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
20:00	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Energy Efficiency



Energy Efficiency

1. Optimizing Performance
2. Incorporating Renewables
   - BIPV

Green Building Certifications	Category
LEED v4 BD+C	• EA - Renewable Energy Production
LBC v3.1	• Imperative 06 - Net Positive Energy
WELL v1.0	X
CHPS	• EE 2.1 Zero Net Energy (ZNE) Bonus

Energy Efficiency

Aluminum Frames used as a Platform for Building Integrated Photovoltaics

Energy Efficiency

Aluminum Frames used as a Platform for Building Integrated Photovoltaics

Material Utilization

1. Environmental Impact
2. Circular Economy
3. Responsible Production

Green Building Certifications	Category
LEED v4 BD+C	Materials & Resources
LBC v3.1	Materials Petal
WELL v1.0	Air Mind
CHPS	Materials & Waste Management

Material Utilization

1. Environmental Impact
    - Environmental Product Declarations (EPDs)
2. Circular Economy
3. Responsible Production

Green Building Certifications	Category
LEED v4 BD+C	• MR BPDO – Environmental Product Declarations
LBC v3.1	X
WELL v1.0	X
CHPS	• MW 7.1 Multi-Attribute Material Selection

Material Utilization

CERTIFIED
ENVIRONMENTAL PRODUCT DECLARATION
UL.COM/EPD

EPD **Transparency Summary**

COMPANY NAME [redacted]

PRODUCT TYPE **ALUMINUM STOREFRONT FRAMING SYSTEMS**

PRODUCT NAME TRIFAB™ FRAMING SYSTEMS AND STOREFRONT FRAMING SYSTEMS

PRODUCT DEFINITION The Kawneer Trifab™ Framing System platform and Storefront Framing Systems are designed to add increased thermal performance and value. The Trifab™ Framing System platform and Storefront Framing Systems give you more flexibility, more thermal options, and more design choices and are flexible enough for a wide range of building projects.

PRODUCT CATEGORY RULE (PCR) Earthsure. "Cradle to Gate Window Product Category Rule. September 2015.

CERTIFICATION PERIOD **November 16, 2015 - November 16, 2020**

DECLARATION NUMBER **47868332121.104.1**

LIFECYCLE IMPACT CATEGORIES

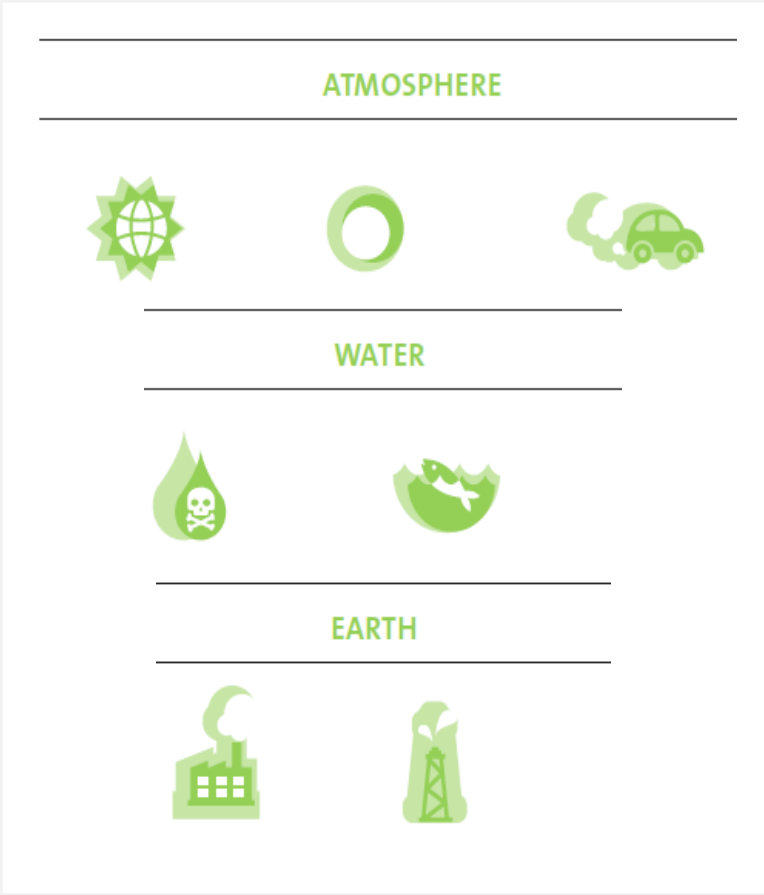
The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

	ATMOSPHERE			WATER		EARTH	
	Global Warming Potential refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.	**Ozone Depletion Potential** is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.	**Photochemical Ozone Creation Potential** happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.	**Acidification Potential** is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.	**Eutrophication Potential** occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.	**Depletion of Abiotic Resources (Elements)** refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.	**Depletion of Abiotic Resources (Fossil Fuels)** refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.
TRACI	1.77E+02 kg CO2 equivalent	4.35E-08 kg CFC-11 equivalent	9.04E+00 kg O3 equivalent	1.09E+00 kg SO2 equivalent	2.80E-02 kg N equivalent	NA	NA
CML							

FUNCTIONAL UNIT per 1m2; Manufacturing Impact (cradle to gate)

[redacted]

Environment



Material Utilization

1. Environmental Impact
2. Circular Economy
   - Sourcing
   - Waste Minimization
3. Responsible Production

Green Building Certifications	Category
LEED v4 BD+C	• MR BPDO – Sourcing of Raw Materials • MR Construction and Demolition Waste Mgmt.
LBC v3.1	• Living Economy Sourcing (Imp 13) • Net Positive Waste (Imp 14)
WELL v1.0	X
CHPS	• MW 2.1 Construction Site Waste Management • MW 3.1 Single Attribute Recycled Content

Material Utilization

Recycled Content = Post-Consumer + Pre-Consumer
2

Material Utilization

Unitized Systems: Fabricated off-site and delivered in pre-assembled modules

Material Utilization

Material Utilization

1. Environmental Impact
2. Circular Economy
3. Responsible Production
    - Corporate Responsibility
    - Product Health

Green Building Certifications	Category
LEED v4 BD+C	• MR BPDO – Material Ingredients • MR PBT Source Reduction
LBC v3.1	• Red List (Imp 10) • Responsible Industry (Imp 12)
WELL v1.0	• 01 Air Quality Standards • 04 VOC Reduction • 25 Toxic Material Reduction • 26 Enhanced Material Safety • 97 Material Transparency • 98 Organizational Transparency
CHPS	• MW 10.1 Health Product Related Information

Material Utilization

Global Reporting Initiative™

SUSTAINABLE DEVELOPMENT GOALS

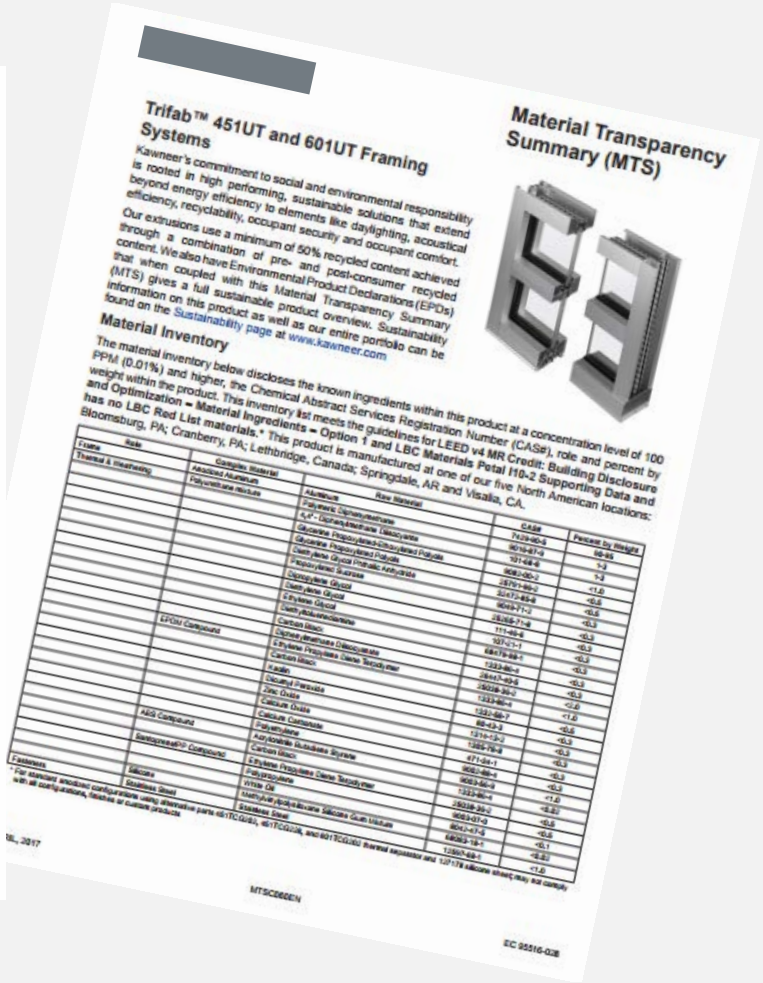
8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Material Utilization



***"Declare" is a registered trademark of the International Living Future Institute (ILFI).*

+"Cradle to Cradle" is a registered trademark of McDonough Braungart Design Chemistry (MBDC).

Material Utilization

Occupant Wellbeing

1. Air Controllability
2. Natural Connection
3. Interior Comfort

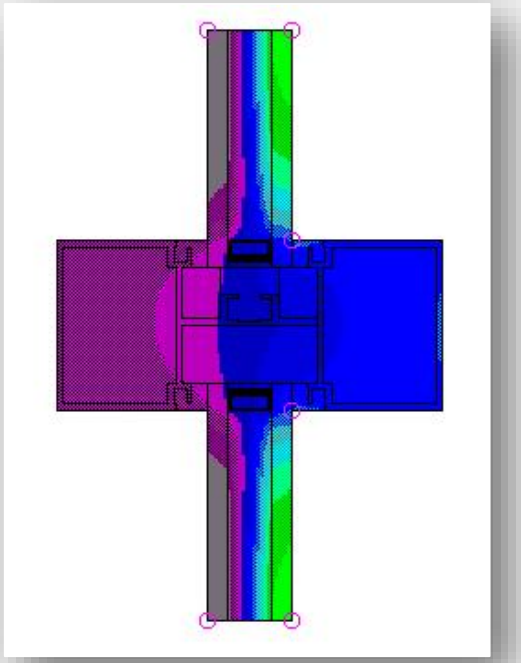
Green Building Certifications	Category
LEED v4 BD+C	Indoor Environmental Quality
LBC v3.1	Health & Happiness Petal Equity Petal
WELL v1.0	Air Lighting Comfort
CHPS	Indoor Environmental Quality

Occupant Wellbeing

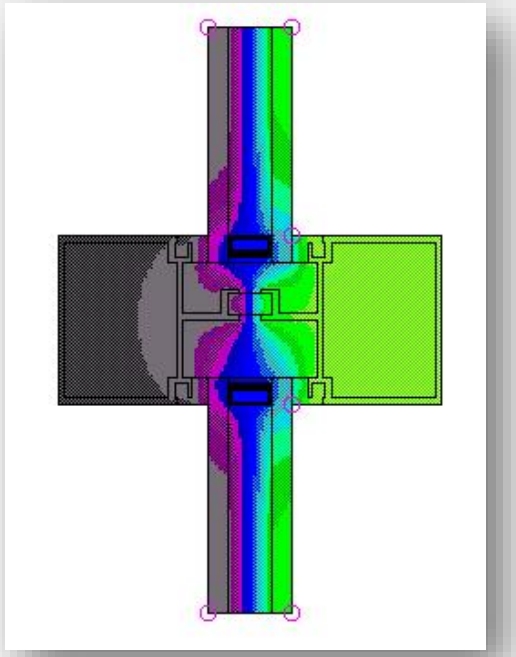
1. Air Controllability
    - Thermal Comfort
    - Ventilation
2. Natural Connection
3. Interior Comfort

Green Building Certifications	Category
LEED v4 BD+C	• IEQ Thermal Comfort
LBC v3.1	• Civilized Env. (Imp 07) • Healthy Interior Env. (Imp 08)
WELL v1.0	• 03 Ventilation Effectiveness • 08 Healthy Entrance • 12 Moisture Mgmt. • 14 Air Infiltration Mgmt. • 15 Increased Ventilation • 19 Operable Windows • 28 Cleanable Env. • 76 Thermal Comfort
CHPS	• EQ 9.1 Thermal Comfort • EQ 10.2 Controllability of Systems • EE 6.1 Natural Ventilation

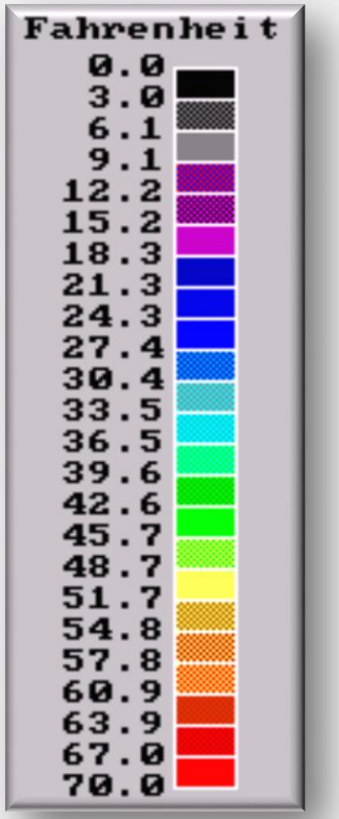
Occupant Wellbeing



2" x 4.5"
Non-Thermal Frame



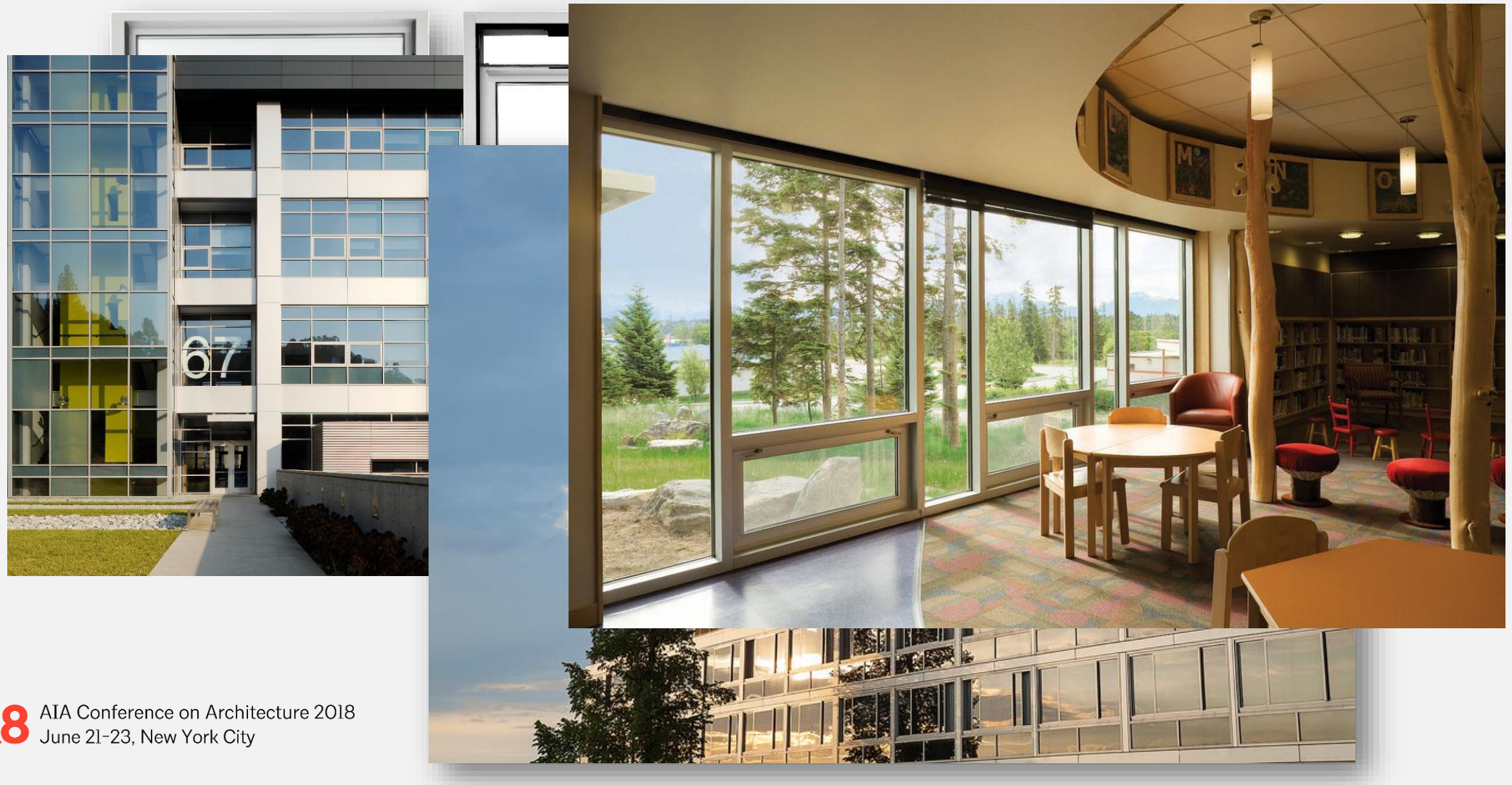
2" x 4.5"
Thermal Frame



Occupant Wellbeing

**LEED is a registered trademark of the U.S. Green Building Council (USGBC).*

Occupant Wellbeing



Occupant Wellbeing

1. Air Controllability
2. Natural Connection
    - Daylighting
    - Views
3. Interior Comfort

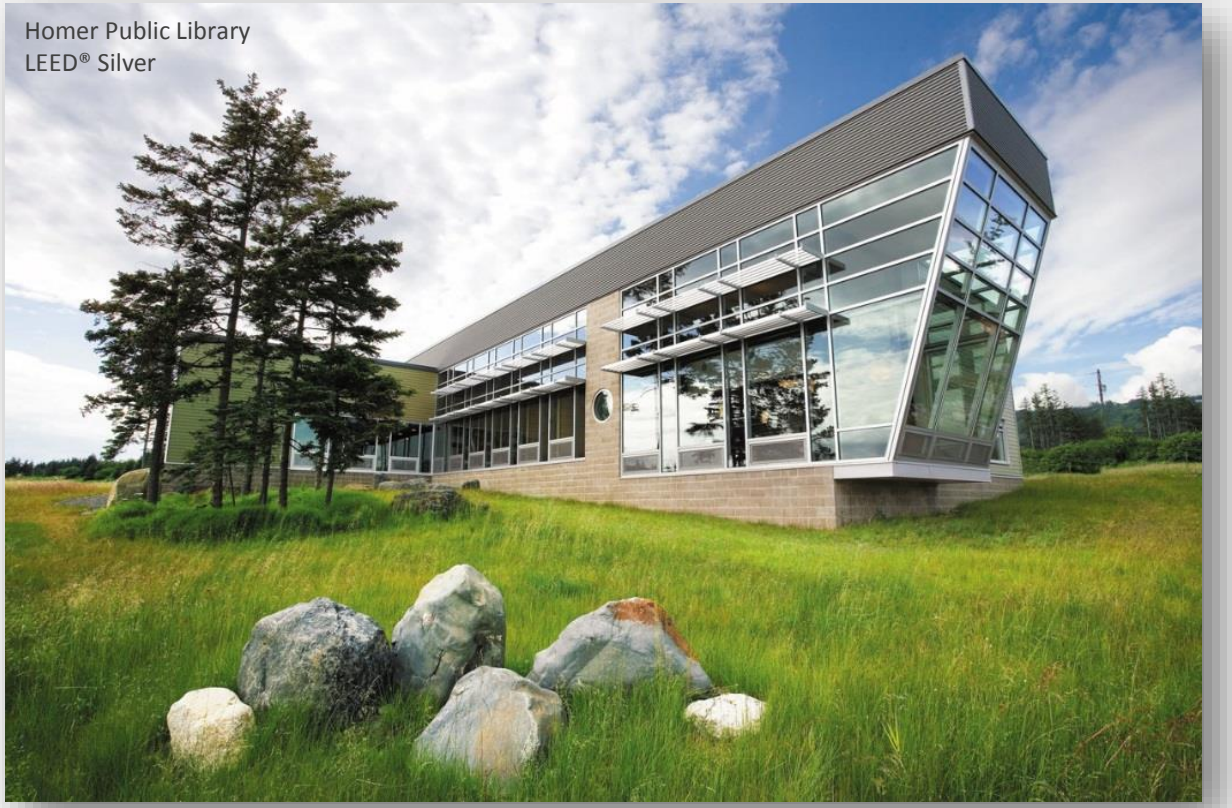
Green Building Certifications	Category
LEED v4 BD+C	• IEQ Daylighting • IEQ Quality Views
LBC v3.1	• Civilized Env (Imp 07) • Biophilic Env (Imp 09)
WELL v1.0	• 54 Circadian Lighting Design • 56 Solar Glare Control • 61 Right to Light • 62 Daylight Modeling • 63 Daylighting Fenestration
CHPS	• EQ 12.1 Views • EQ 11.0 Daylighting

Occupant Wellbeing

ement Home

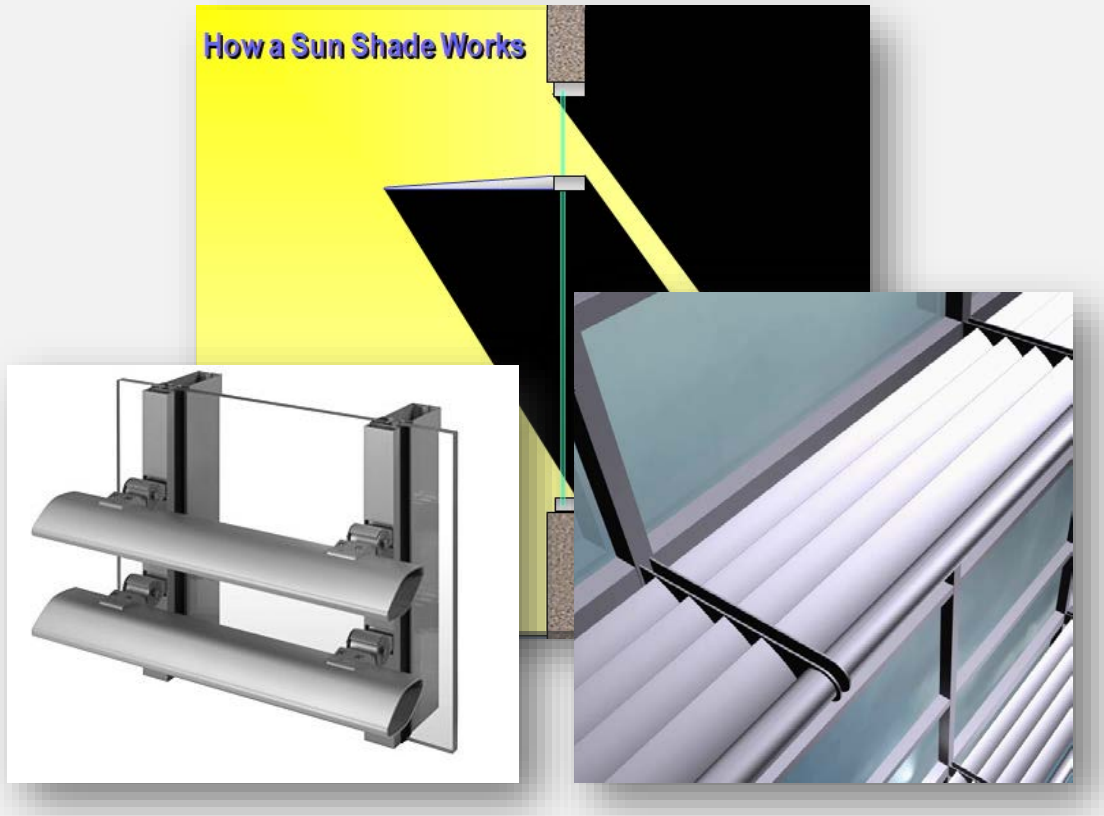
Missouri Department of Natural Resources
LEED® Platinum

Occupant Wellbeing


Homer Public Library
LEED® Silver


Frontier Project
LEED® Platinum

Occupant Wellbeing



Occupant Wellbeing

Occupant Wellbeing

Georgia Gwinnett College Library
and Learning Center
LEED® Gold

North American Headquarters
Registered with the certification goal of LEED® Silver

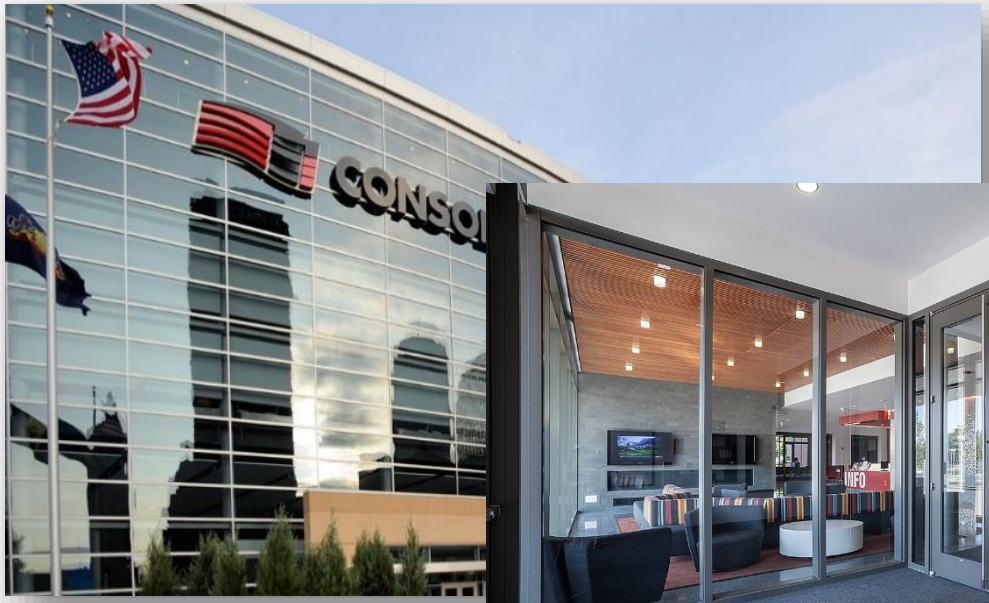
Ohlone Community College Newark Center for
Health Sciences and Technology
LEED® Platinum

Occupant Wellbeing

1. Air Controllability
2. Natural Connection
3. Interior Comfort
    - Acoustic Performance
    - Accessibility

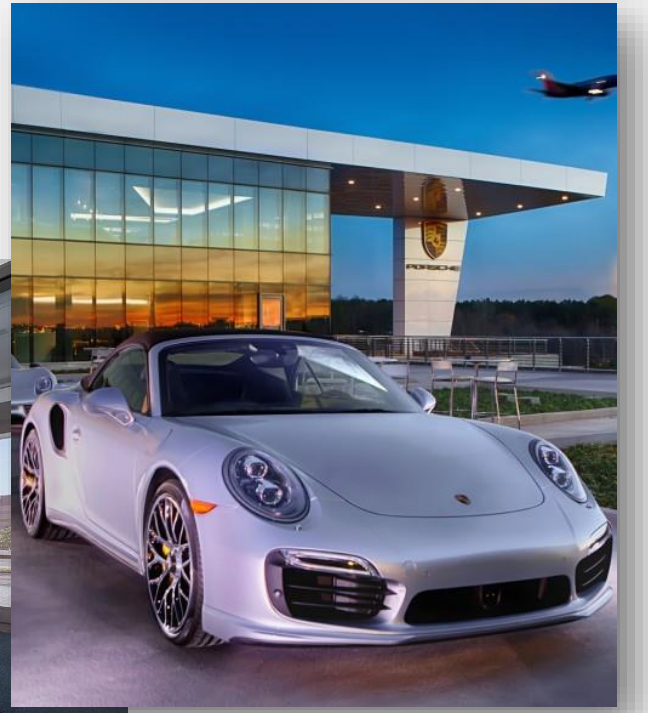
Green Building Certifications	Category
LEED v4 BD+C	• IEQ Acoustic Performance
LBC v3.1	• Universal Access (Imp 16)
WELL v1.0	• 72 Accessible Design • 74 Exterior Noise Intrusion
CHPS	• EQ 14.0 Acoustical Performance

Occupant Wellbeing



Consol Energy Center
LEED® Gold

Community College of Denver - Confluence Building
LEED® Gold



Porsche Cars North America HQ
LEED® Gold

Occupant Wellbeing

1" Overall:
1/4" glass, 1/2" air,
1/4" glass

STC: 35
OITC: 30

1 3/4" Overall
1/4" glass, 1/2" air,
1/4" glass, 1/2" air,
1/4" glass

STC: 39
OITC: 31

1 1/16" Overall:
1/4" glass, 1/2" air,
1/8" glass, 0.60 PVB 1/8"
glass

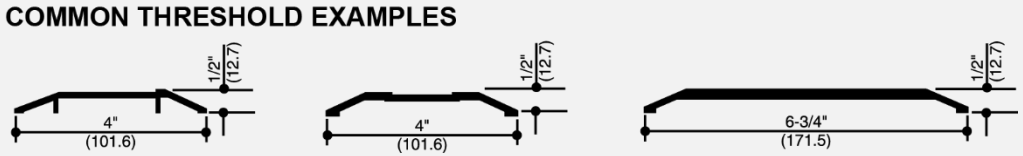
STC: 41
OITC: 32

1" Overall:
1/8" glass 0.30 PVB 1/8" glass
1/2" air,
1/8" glass 0.03 PVB 1/8" glass

STC: 42
OITC: 33

Occupant Wellbeing

Newberg Center – Portland Community College
Newberg, Oregon, U.S.



Designing for Sustainability

Architectural aluminum-framing systems can impact whole-building performance:

- Energy Efficiency
- Material Utilization
- Occupant Wellbeing

Loyola University Chicago
Niehoff School of Nursing
LEED® Gold

Green Building Certifications
LEED v4 BD+C
LBC v3.1
WELL v1.0
CHPS

*LEED is a registered trademark of the U.S. Green Building Council (USGBC).

Questions?

Thank you for Joining Us

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donnie.hunter@arconic.com

Thank you!