

3M Science.
Applied to Life.

3M™ Thinsulate™ Climate Control 75 Window Film

3M Renewable Energy Division

May 2016

At 3M we are guided by one vision

Our Vision

3M Technology Advancing Every Company

3M Products Enhancing Every Home

3M Innovation Improving Every Life

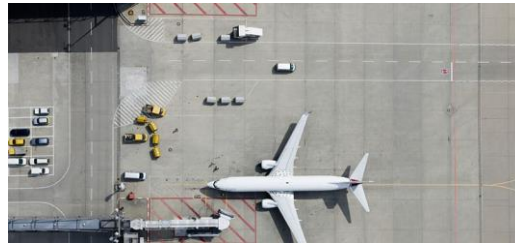
3M Science is the foundation for our 40+ core technologies...

Ab Abrasives										
Ad Adhesives	Fi Films									Md Medical Data Management
Am Advanced Materials	Fl Fluoro-materials								Ec Energy Components	Mf Mechanical Fasteners
Ce Ceramics	Nt Nano-technology							Ac Acoustic Control	Fe Flexible Electronics	Mi Microbial Detection and Control
Co Advanced Composites	Nw Nonwoven Materials	Mo Molding	Pe Predictive Engineering & Modeling	Rp Radiation Processing	An Analytical	Fc Flexible Converting & Packaging	Pr Process Design & Control	Bi Biotech	Fs Filtration, Separation, Purification	Op Opto-electronics
Do Dental & Orthodontic Materials	Po Porous Materials & Membranes	Mr Micro-replication	Pm Polymer Processing	Su Surface Modification	As Application Software	In Inspection & Measurement	Se Sensors	Dd Drug Delivery	Im Imaging	Tt Track and Trace
Em Electronic Materials	Sm Specialty Materials	Pd Particle & Dispersion Processing	Pp Precision Processing	Vp Vapor Processing	Es Electronics & Software	Is Integrated Systems & Design	We Accelerated Weathering	Di Display	Lm Light Management	Wo Wound Management

...and it is applying this science, across our organization, that makes us who we are



Automotive



Commercial Solutions



Communication



Consumer



Design + Construction



Electronics



Energy



Health Care



Manufacturing



Mining, Oil & Gas

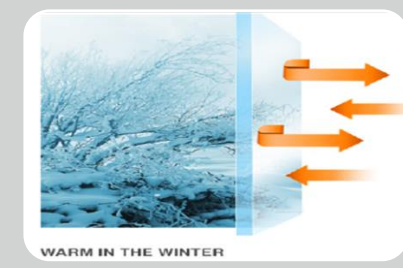
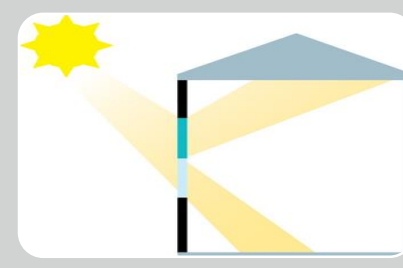


Safety



Transportation

Portfolio Window Films



Sun Control

- Prestige Series
- Ceramic Series
- Night Vision Series
- Traditional Series

Exterior Sun Control

- Prestige Exterior Series
- Traditional Exterior Series

Safety & Security

- Ultra Solar Series
- Ultra Series
- Solar Safety Series
- Safety Series
- Anti Graffiti

Safety Exterior

- Safety Exterior Series

Daylighting

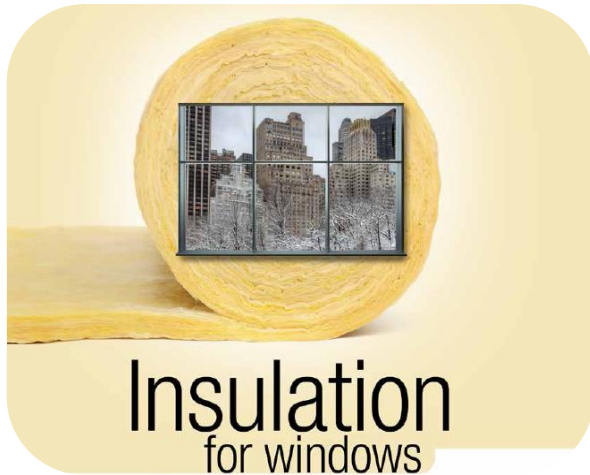
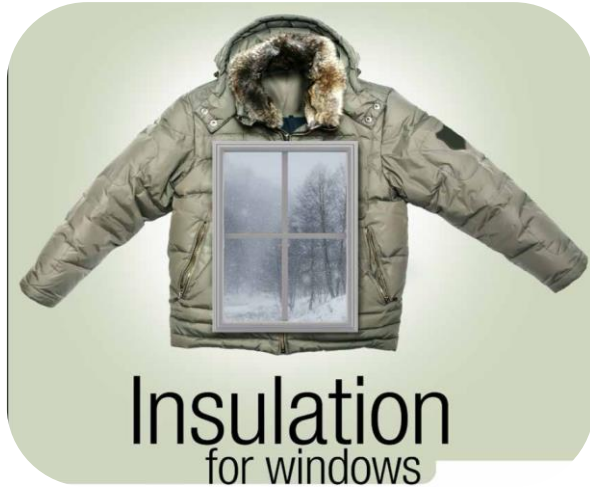
- Daylight Redirecting Film

Insulation

- Thinsulate 75
- Amber 35



3M™ Thinsulate™ Climate Control 75 Window Film



Key Benefits

- Turns your single pane windows into double pane; turns your double pane windows into triple pane
- Increases the insulation performance of your windows by 40%
- Helps retain warm during the winter and cool air during the summer
- Increases energy efficiency and savings all-year round
- Virtually invisible-does not impact window aesthetics
- Easier and more cost effective than replacing your windows with low-e windows

Key Product Differentiation vs Sun Control Films

The energy gained/lost by the sun (radiation) is different than the energy gained/lost from a temperature difference (conduction/convection)

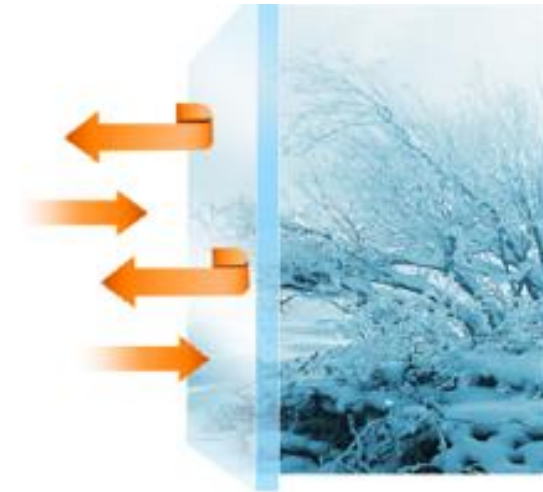
Sun Control Window Films

- Reject energy from the sun (radiation) from entering the building or home
- How much energy rejected is measured by the SHGC or G-value (solar heat gain coefficient)



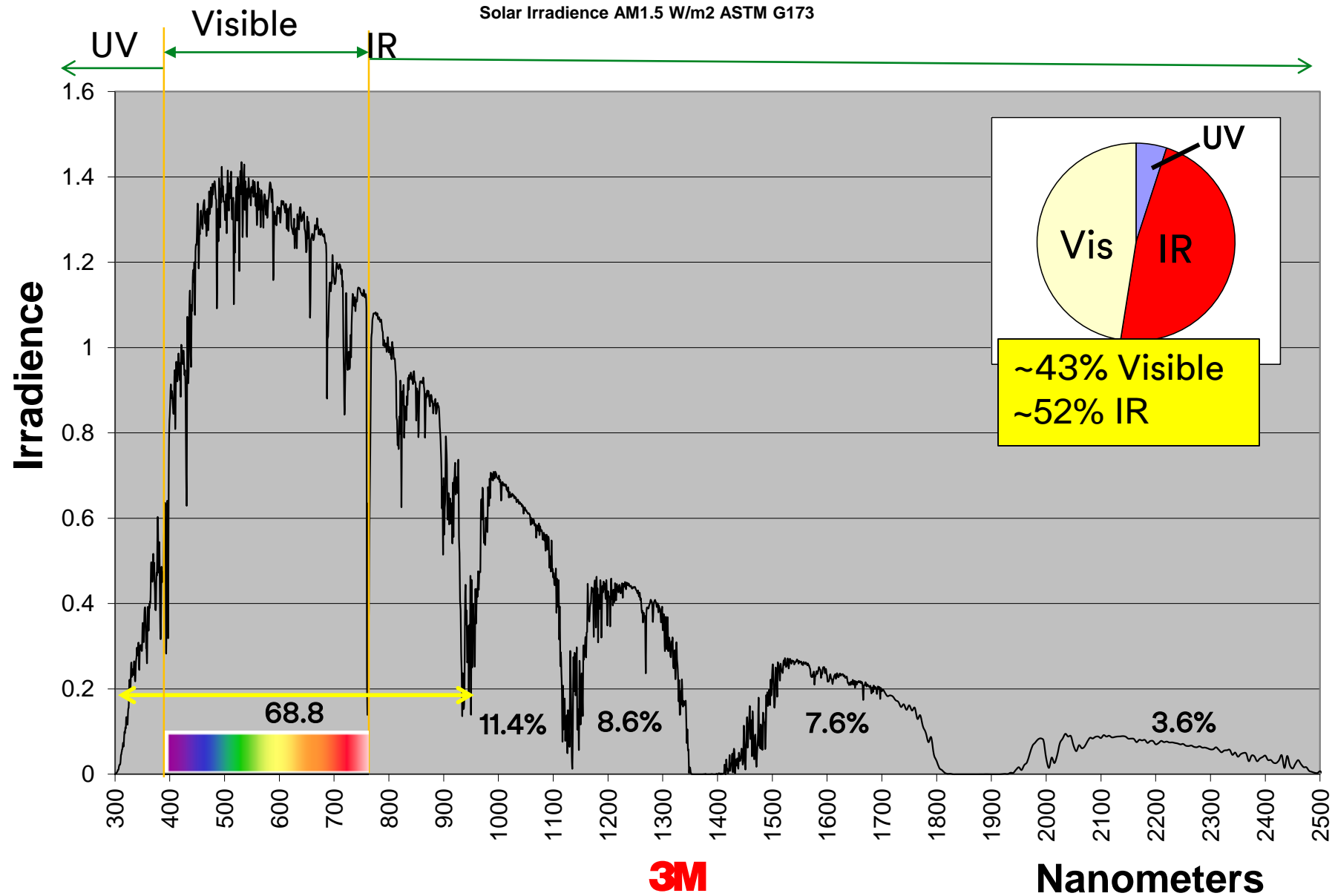
Insulating Window Films (Thinsulate)

- Retain heat inside the building typically generated by a heating system (conduction/convection)
- The rate at which the heat inside the building transmits through the window is measured by the U value
- Also rejects energy from the sun (radiation) from entering the building or home

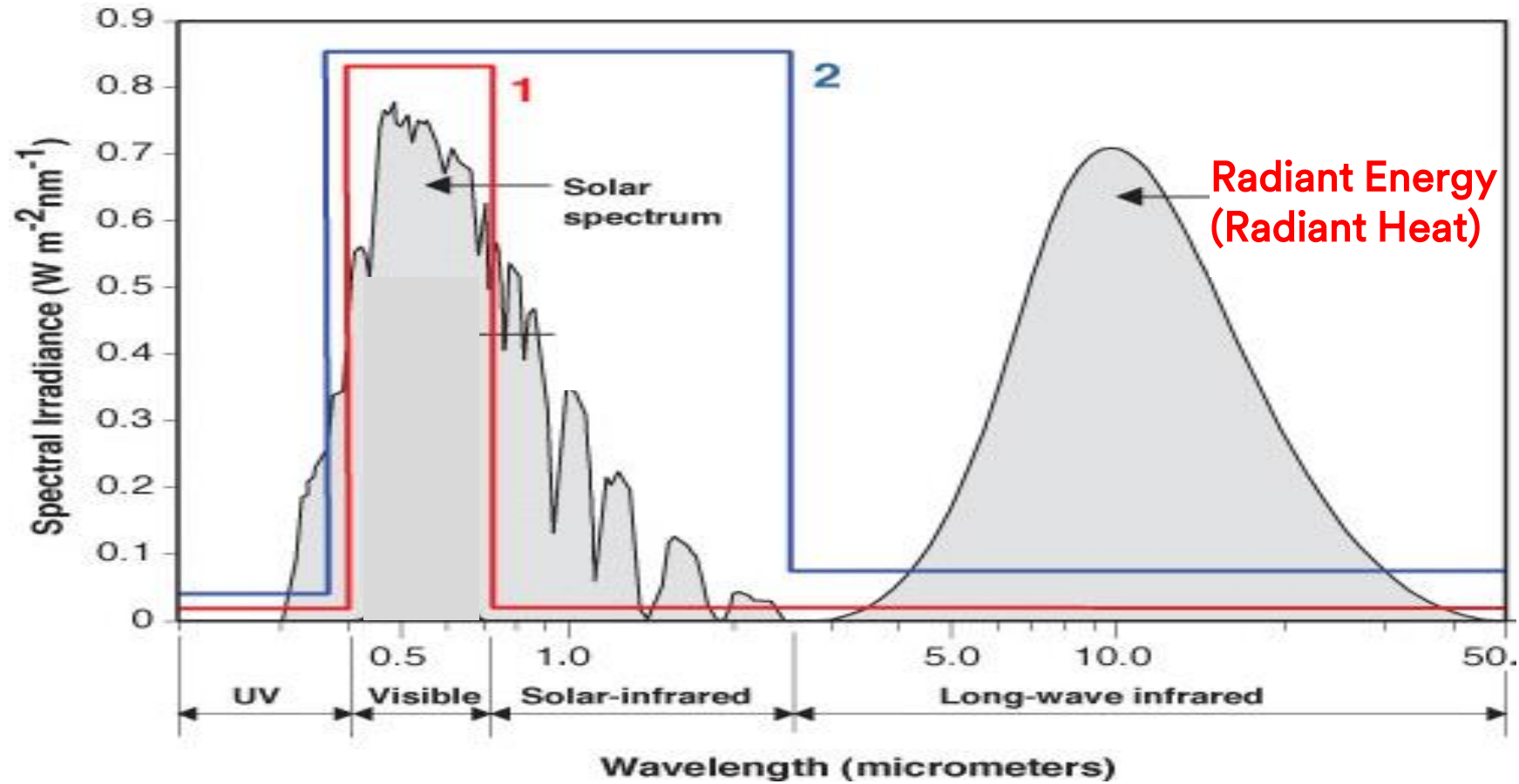


Product is virtually invisible and does not impact window aesthetics or views

Solar Spectrum – Where is the Sun's Energy?

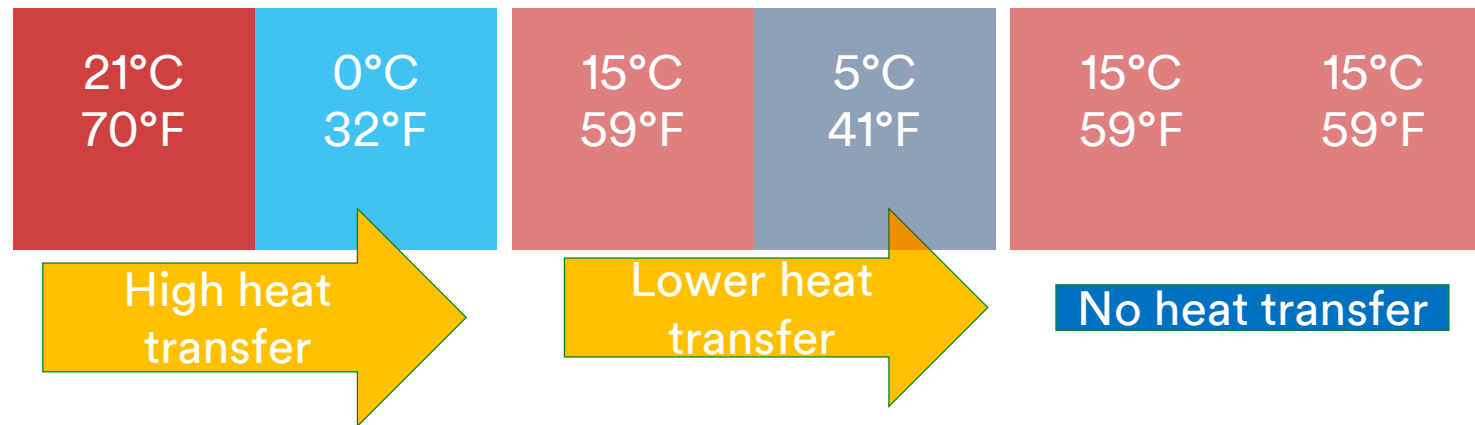


There's more to the IR spectrum



Radiant Heat Transfer

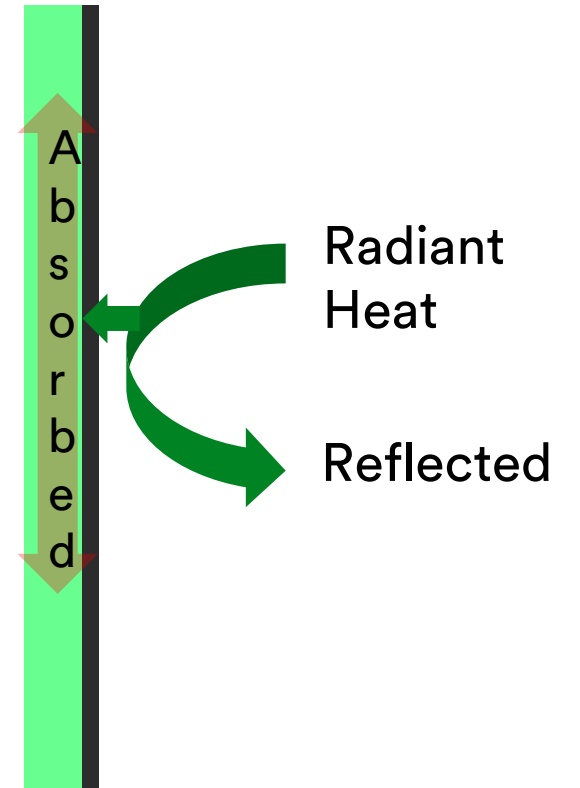
- Radiant Heat will only transfer from warm to cold
- We use insulation to prevent heat transfer
 - Keeps hot tea warm
 - Keeps iced tea cold



Emissivity

The capability of a surface to release (emit) heat, is called emissivity

- It is the same as the materials ability to absorb radiant heat.
- It is the opposite of a material's ability to reflect radiant heat.



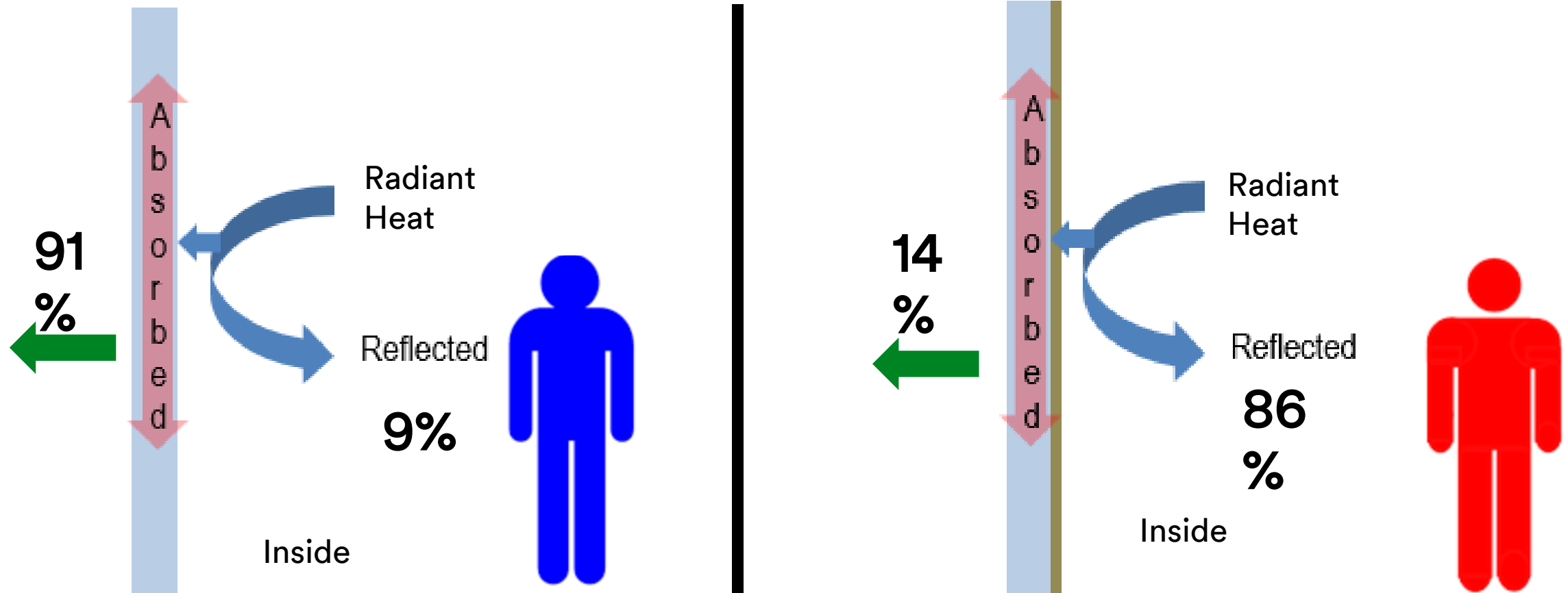
$$\text{Absorption (emissivity)} + \text{Reflection} = 1 (100\%)$$

Emissivity and thermal reflectivity of various materials

MATERIAL	EMISSIVITY	REFLECTIVITY
Gold (polished)	0.02	0.98
Aluminum Foil	0.04	0.96
3M Thinsulate	0.14	0.86
Glass	0.91	0.09
Wood	0.92	0.08
Asphalt	0.93	0.07

- Lowest emissivity materials on the list are metals. 3M Thinsulate is a metalized film
- Thinsulate reflects radiant heat much better than plain glass. Glass absorbs the radiant heat

Winter Comparison: Single Pane Glass to Glass with Thinsulate



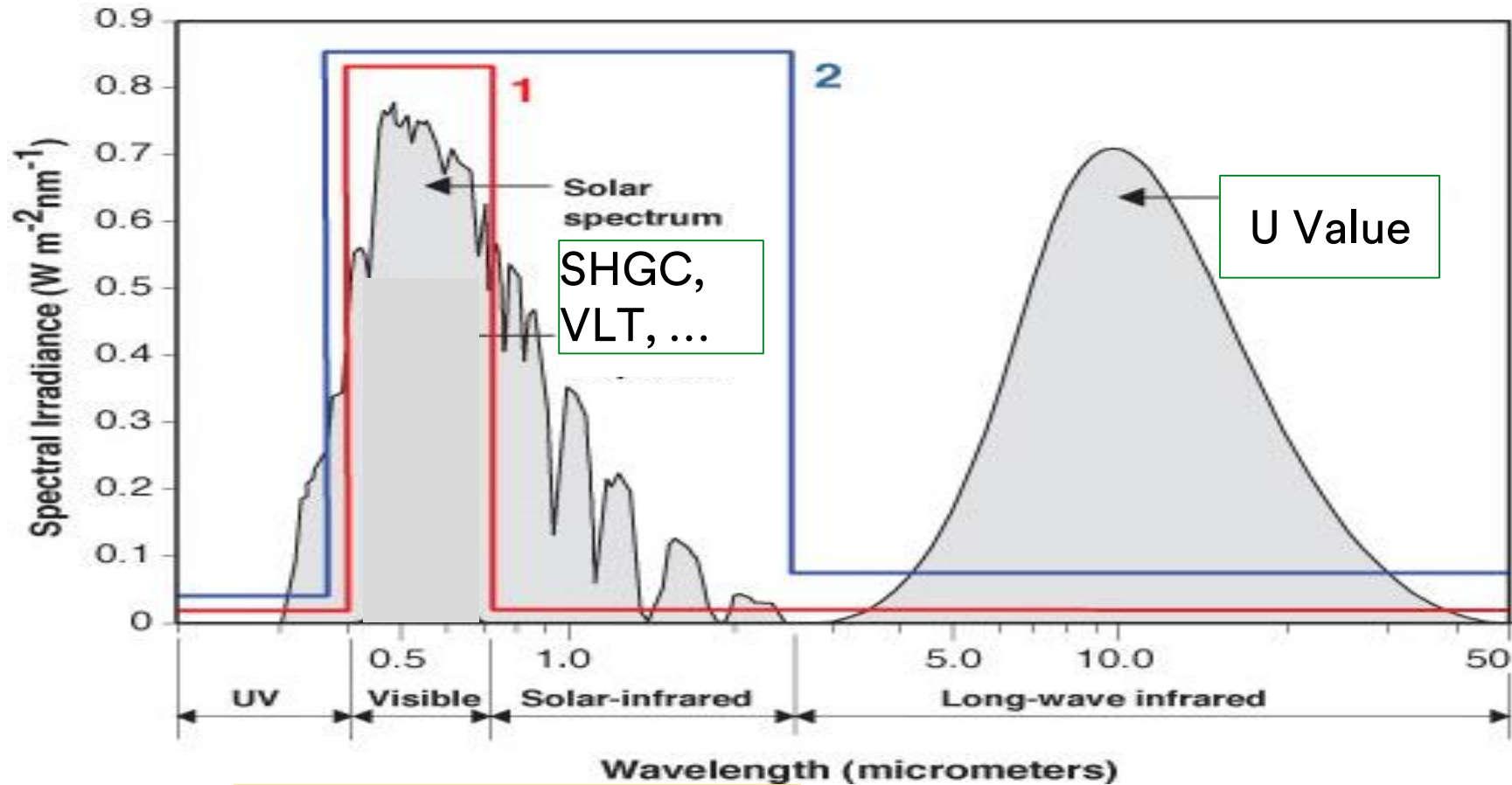
Emissivity and U Value

- U Value is calculated from the Emissivity and is what the Window industry uses to evaluate windows
- U value is the Heat transfer/unit area/degree and is related to the insulation value.
 - lower U value means lower emissivity, or better heat reflection and insulation.

CONFIGURATION	U VALUE (W/m ² -K)	U VALUE (Btu/ft ² -F)
Single Pane Clear	5.8	1.03
Single Clear with Thinsulate	3.6	0.62
Double Pane Clear	2.7	0.45
Double Clear with Thinsulate	2.0	0.35
Triple Pane Clear	1.8	0.31

Adding Thinsulate is almost like adding another pane of glass

Where Thinsulate provides an advantage



Traditional Window Films

Thinsulate Window Film



Summer Performance?

- Keeps warm air outside (reflects radiant heat outside)
- Rejects solar energy
- Reduces cooling load
- Saves energy



Thinsulate™ Insulation for your windows.



Increased
comfort



Increased
efficiency

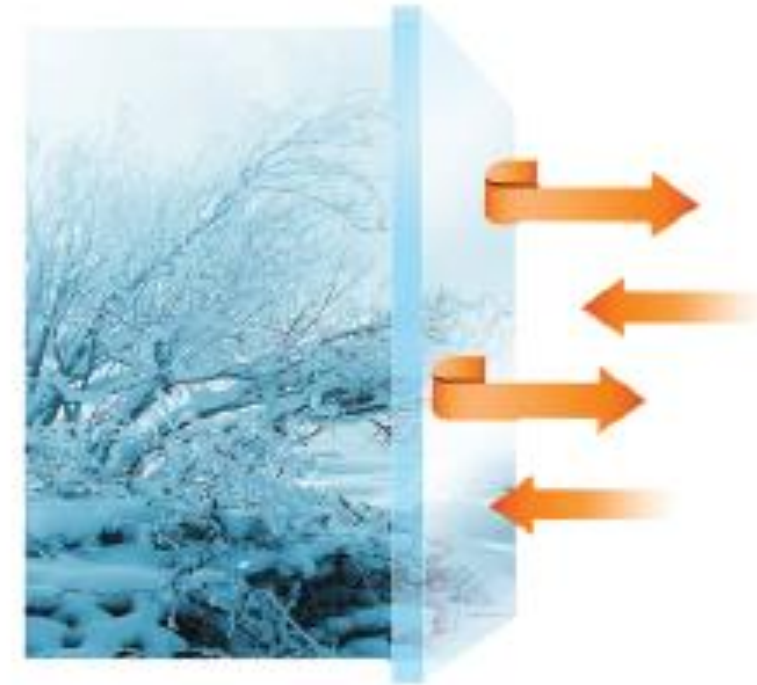


More
savings

Learn more at [3M.com/thinsulatewindowfilm](https://www.3M.com/thinsulatewindowfilm)

Winter Performance

- Keeps warm air inside during cold months (Reflects radiant heat back inside)
- Reduces feeling of draftiness
- May allow you to lower thermostat setting
- Helps reduce heating load
- Helps save energy



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Our Results – Thinsulate CC75

- High VLT
- Low U Value
- Low SHGC (compared to other 75 VLT products)
- Good Aesthetics
- Good durability
- Price competitive

Product Performance & Technical Data

<u>Thinsulate</u> <u>CC75</u>								
	Single Pane		Tinted		Double Pane		Double tinted	
Film	1/4" Clear	<u>Thinsulate</u> CC75	1/4" tint	<u>Thinsulate</u> CC75	Dual 1/4" Clear	<u>Thinsulate</u> CC75	Dual 1/4" tint	<u>Thinsulate</u> CC75
Solar Heat Gain Coefficient	0.82	.52	0.63	0.40	0.70	0.51	0.51	0.37
Visible Light Transmitted	89%	75%	53%	45%	79%	68%	47%	40%
Visible Light Reflected Interior	9%	13%	6%	11%	15%	18%	13%	16%
Visible Light Reflected Exterior	8%	15%	6%	8%	15%	20%	8%	10%
U Value	1.03	0.62	1.03	0.62	0.47	0.34	0.47	0.34
UV Block	38%	99.9%	NA	99.9%	NA	99.9%	NA	99.9%
Total Solar Energy Rejected	19%	48%	37%	60%	30%	49%	49%	63%
Glare Reduction	NA	16%	NA	15%	NA	14%	NA	15%
Heat Loss Reduction	NA	40%	NA	40%	NA	28%	NA	28%
Solar Heat Reduction	NA	37%	NA	37%	NA	27%	NA	27%



Thinsulate Advantages

- High VLT
- Excellent aesthetics
 - Transmission
 - Reflection
 - Less iridescence
- Competitive
 - SHGC
 - U value
- Easier to apply than competitive films



Where are the best opportunities?

- Locations with:
 - Government requirement for low E window performance
 - Large temperature difference between inside and outside
 - Commercial and Residential applications:
 - When you must maintain building aesthetics and want both increased insulation and good solar performance (SHGC).
 - Desire for High VLT product

Thank You!