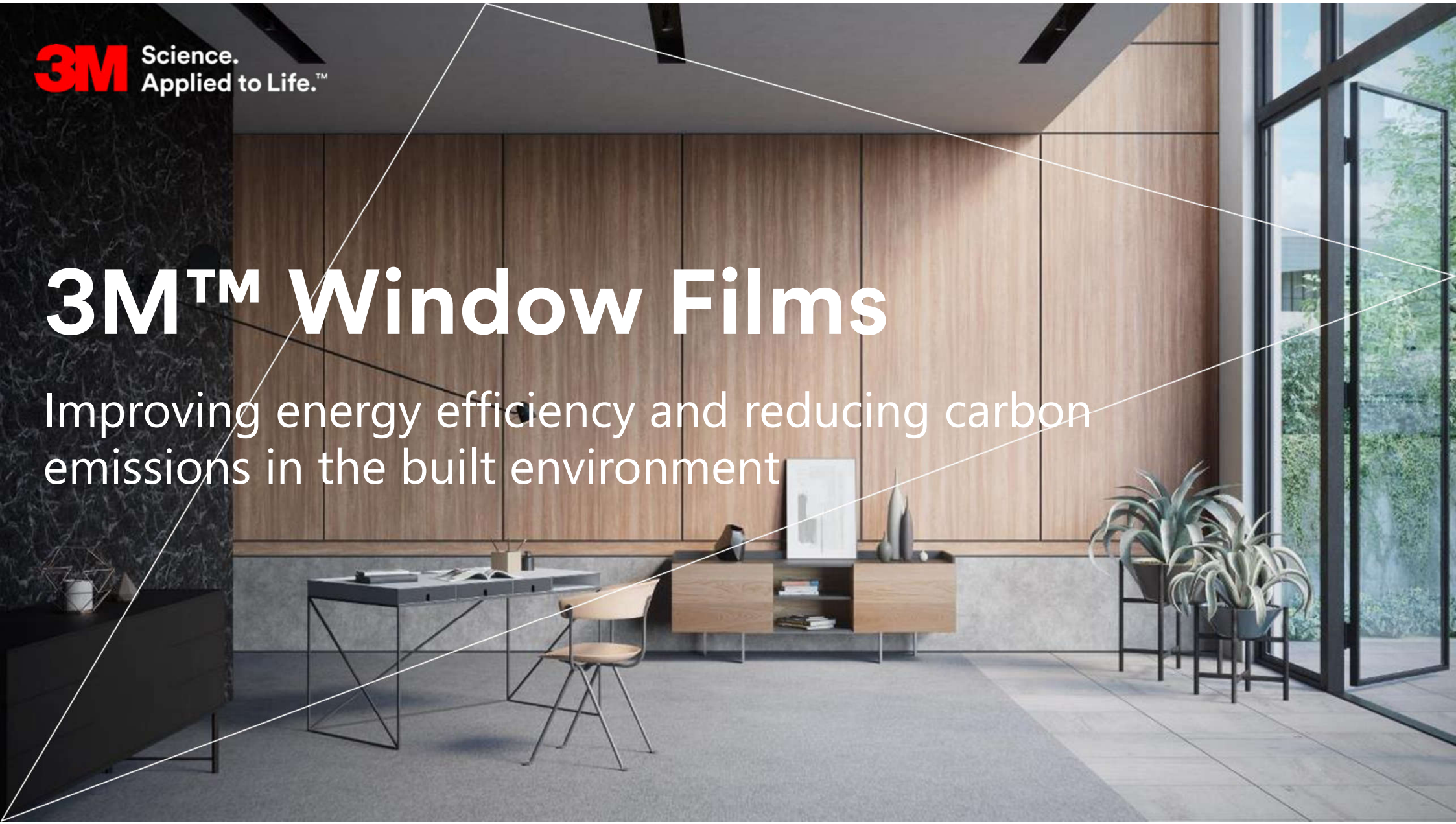
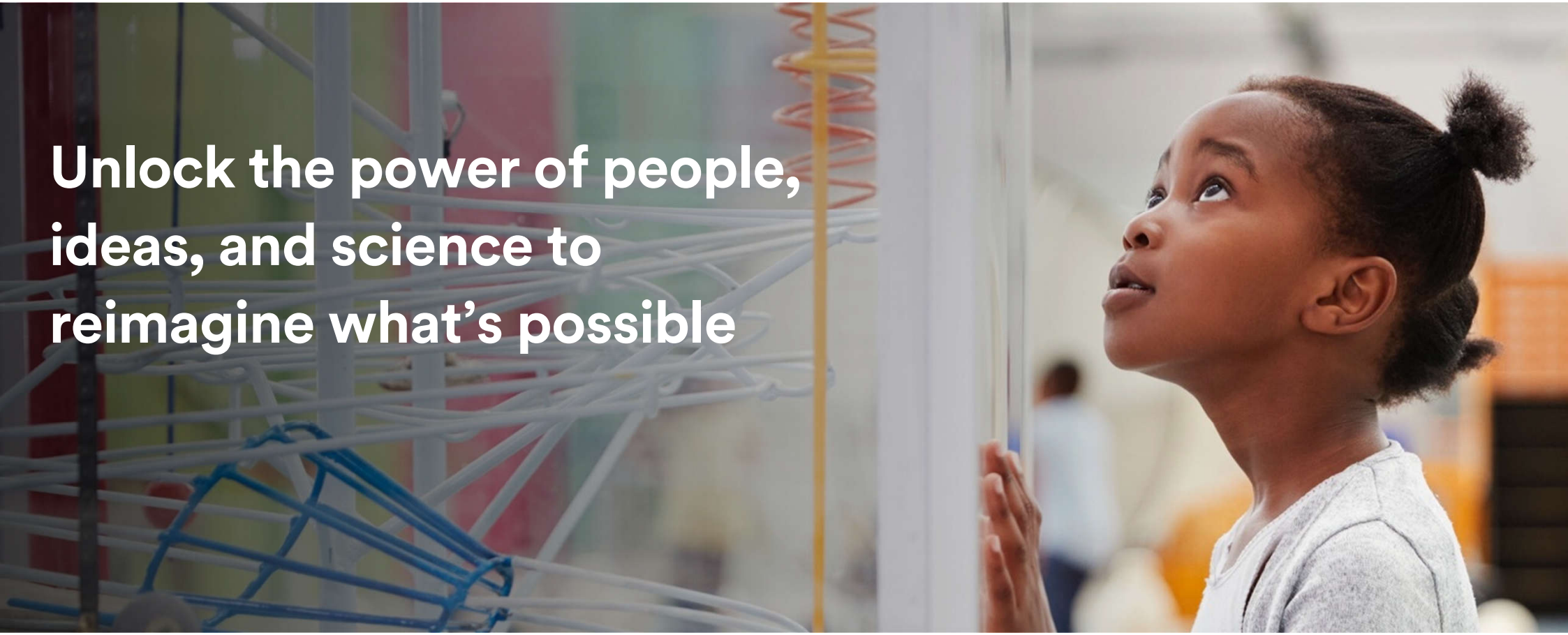

3M Science. Applied to Life.™
3M™ Window Films
Improving energy efficiency and reducing carbon emissions in the built environment

Agenda

- 3M
- Changing market - Why does efficient glazing matter?
- Typical building needs and challenges and why glazing matters
- Science of Window Films
- NABERS benefits and energy savings
- Estimating the potential savings for your building

Our purpose – Why 3M exists



Innovative solutions for brand owners and facilities

Origins	Established	Emerging

Film Solutions

Branding & Safety/Energy Management

Digital Print Films

Window Films

Car Wrap Films

Architectural Finishes

Surface Hygiene Solutions

Next Generation Security Films

Multi-Functional & Energy Mgmt Films

Cleaning Solutions

Facility care solutions for cleaning, safety and beauty

Cleaning Chemicals including Disinfectants

Floor Care Systems

Hand & Floor Pads

Floor Safety

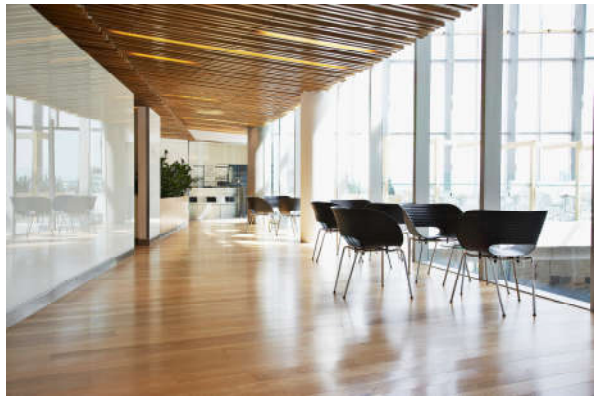
Next Generation Personal Auto Customization Films

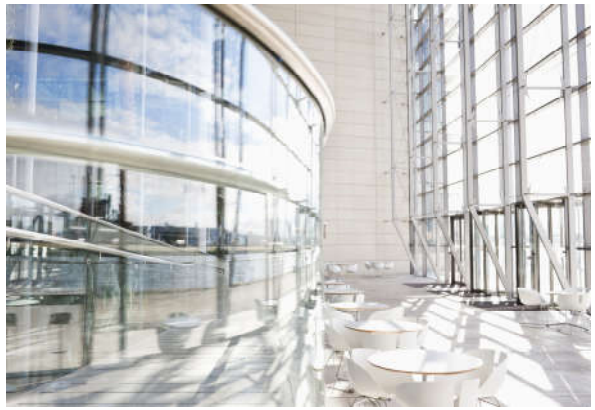
Graphics for a Greener World; Sustainable Films & Liners

Communications Infrastructure Films

Changing market - Why does efficient glazing matter?

- Australia can expect more **heat extremes** in the years to come.
- Energy makes up **10-15% of the operational cost** of office buildings[1] with ~48% of the average commercial building electricity consumed by HVAC.[2]
- Energy prices are continuing to increase exponentially
- Rental discounts apply for lower NABERS energy rated assets.[1] A NABERS Energy rated 4.0 Star office building has a **6% rental discount** when compared to a 5.0 Star rated office building in the same city.[1]
- Office buildings rated NABERS Energy 5.0 Star and above have an **8% higher occupancy rate** when compared with 4.0 Star and less rated office buildings.[1]
- **ESG and energy efficiency** is becoming an increasingly significant consideration for **investors.**[1]





3M

Typical Australian building needs and challenges

Aesthetics

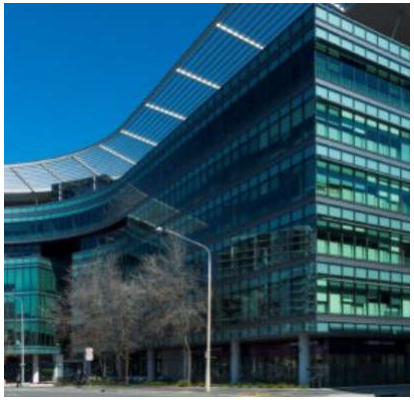
Glare Reduction

Safety and Security

OH&ES and Fade Protection

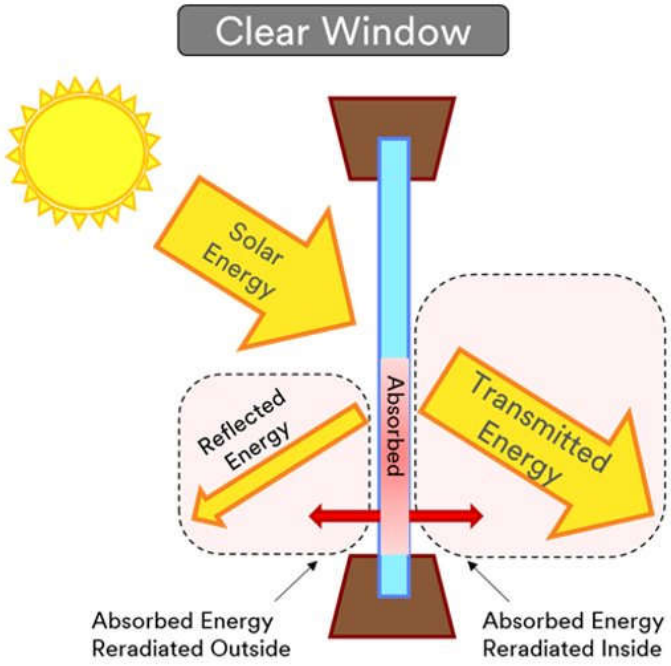
Occupant Comfort

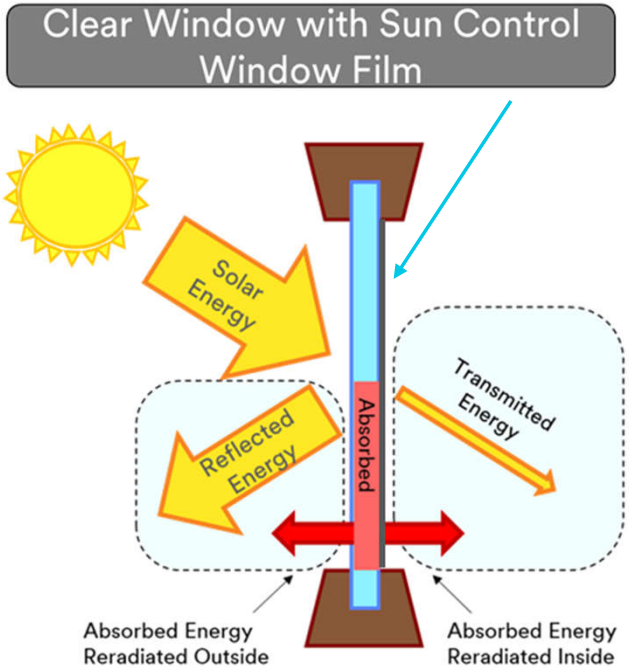
Energy Savings and CO_2 Reduction



3M

Science of Window Films





- Most of the energy is transmitted through
- Some energy is reflected outside
- A small amount of the energy is absorbed and reradiated outside and inside
- The net result: most of the energy is admitted inside the building as heat

- The reflected energy is **increased**
- The absorbed energy is **increased**
- The energy transmitted is **decreased**
- The net result: most of the energy is rejected and **does not** enter the building as heat (higher Total Solar Energy Rejection or TSER)

Window Film Technology benefits

Less expensive than window replacement.

Minimal disruption to operations and occupants during installation – less downtime

Climate positive & carbon negative (reduce C02 emissions over life in use)

Improve energy efficiency and reduce C02 emissions.

Improve building grade in market and high occupant retention

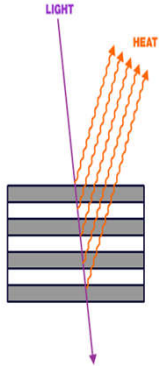
Reduce temperature imbalances, and hot and cold spots in the building.

Help to **reduce use of air conditioning systems.**

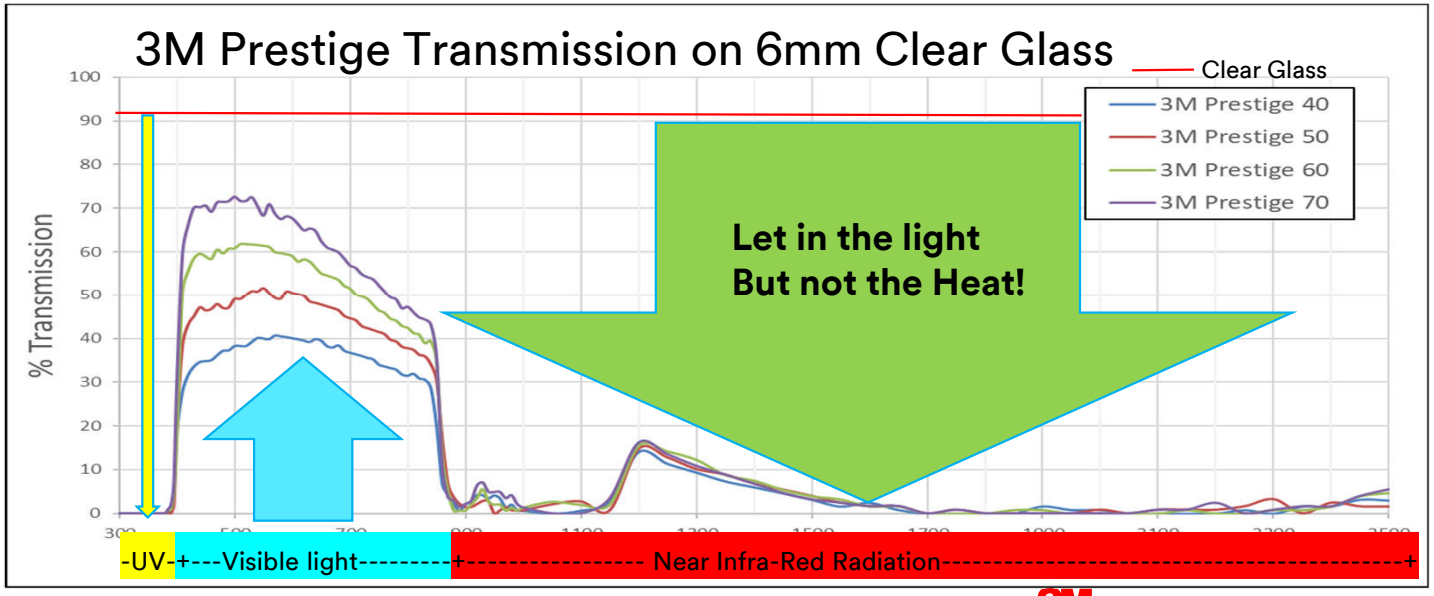
Minimal reduction in daylight while rejecting up to **99.9% UV rays** and **97% infrared* light**

3M Prestige Series

- Multilayer optical film – 3M innovation
- No metalized layers, therefore, no mobile signal interference or corrosion issue.
- Spectrally selective, polarization, and angle selectivity to increase Total Solar Energy Rejection (TSER) by up to 10% at 60^{O}



- Low reflectivity, minimal aesthetic change.
- Reduces interior reflection to preserve views out.
- 15-year 3M commercial warranty
- Environmental Product Declaration (EPD) are available.



SOLAR (VLT%)	SOLAR External	SOLAR SECURITY
Prestige 20	PR20X Exterior	
Prestige 40	PR40 Exterior	
Prestige 50		ULTRA Prestige 50
Prestige 60		
Prestige 70	PR 70 Exterior	ULTRA Prestige 70
	PR 90 Exterior	

NABERS benefits and energy savings - DeltaQ-3M Study

The Impact of 3M Window Film on NABERS Ratings

- 3M commissioned DeltaQ, a leading Australian energy management consultancy, to model 3M Window Film on a NABERS Energy rating for mid-tier office buildings.

- DeltaQ used a building model that was determined to be representative of a typical office building in different ABCB climate zones from 2, 5 & 6.

- Full window SHGC and Uw values based on Optics and Window outputs were used for the glazing, and complete building modelling was completed using **IES software**

- **Two** different HVAC systems were used;
  - Centralized chilled water plant & air handling system.
  - Air-cooled chiller which is more typical of a mid-tier, older building (less efficient!).

DELTA Q

NABERS

3M

NABERS benefits and energy savings - Sydney

Representative modelling: Building A

Building A	
Total floor area	12,000m2 (840 Sq. m of Glass)
Total floors	10 levels
Window to wall ratio	60%
NABERS Rating	4.5 stars
HVAC System	Air-cooled chillers
Glazing Type	10mm laminated clear
Location	Climate Zone 5 (Sydney)

- Total Solar Energy Rejection (TSER) of the windows can be improved by **32%** with Prestige 40 or **48%** using Affinity 15
- Summer Cooling Savings of up to **7.7%** can be achieved
- NABERS rating improvement increase of **+0.16 stars** using Affinity 15

Window System	SHGC	TSER	Glare Reduction	Heat Gain Reduction	Annual Energy Savings	NABERS Energy Impact	Annual CO2 Savings (tonnes CO2)	Summer Cooling Savings
Base Glass: 10.38mm Clear Laminated	**0.74**	26%	N/A	N/A	N/A	N/A	N/A	N/A
+ 3M Affinity 15	**0.26**	74%	87%	66%	2% ($17.5K)	**+0.16 Stars**	58	7.7% ($25.5K)
+ 3M Prestige 40	**0.42**	58%	55%	44%	2% ($12.7K)	**+0.11 Stars**	41	5.3% ($17.5K)

*Estimated energy savings and water savings were calculated using 28.53c/kWh and $2.896/kL, respectively.
**DeltaQ – Modelled these generic Commercial building with IES

NABERS benefits and energy savings - Sydney

Representative modelling: Building B

Building B	
Total floor area	12,000m2 (840 Sq. m of Glass)
Total floors	10 levels
Window to wall ratio	60%
NABERS Rating	4.5 stars
HVAC System	Water-cooled chillers
Glazing Type	Double pane Low E glass
Location	Climate Zone 5 (Sydney)

- On higher-performing double pane Low E windows, TSER improved by **41%** with Prestige 40 Exterior
- Annual Energy Savings of **6% (~$20K)**
- NABERS Energy rating improvement increase of **+0.19 stars**
- NABERS Water rating improvement of **+0.18** stars and a **10%** annual water savings achieved

Window System	SHGC	TSER	Glare Reduction	Heat Gain Reduction	Annual Energy Savings	NABERS Energy Impact	Annual Water Savings	NABERS Water Impact	Annual CO2 Savings (tonnes CO2)	Summer Cooling Savings
Base Glass: Double Pane Low E	**0.67**	33%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
+ 3M Prestige 40 Exterior	**0.26**	74%	52%	66%	$23K (6%)	**+0.19 Stars**	$2K (10%)	+0.18 Stars	65	$25K (7.5%)

*Estimated energy savings and water savings were calculated using 28.53c/kWh and $2.896/kL, respectively.

NABERS benefits and energy savings - Brisbane

Representative modelling: Building A

Building A	
Total floor area	12,000m2 (840 Sq. m of Glass)
Total floors	10 levels
Window to wall ratio	60%
NABERS Rating	4 stars
HVAC System	Air-cooled chillers
Glazing Type	10mm laminated clear
Location	Climate Zone 2 (Brisbane)

- Total Solar Energy Rejection (TSER) of the windows can be improved by **32%** with Prestige 40 or **48%** using Affinity 15
- Summer Cooling Savings of up to **9.8%** can be achieved
- NABERS rating improvement increase of **+0.50 stars** using Affinity 15

Window System	SHGC	TSER	Glare Reduction	Heat Gain Reduction	Annual Energy Savings	NABERS Energy Impact	Annual CO2 Savings (tonnes CO2)	Summer Cooling Savings
Base Glass: 10.38mm Clear Laminated	**0.74**	26%	N/A	N/A	N/A	N/A	N/A	N/A
+ 3M Affinity 15	**0.26**	74%	87%	66%	$28K (7%)	**+0.50 Stars**	100	$33.5K (9.8%)
+ 3M Prestige 40	**0.42**	58%	55%	44%	$19.5K (5%)	**+0.34 Stars**	69	$23K (7.5%)

*Estimated energy savings and water savings were calculated using 28.53c/kWh and $2.896/kL, respectively.

NABERS benefits and energy savings - Brisbane

Representative modelling: Building B

Building B	
Total floor area	12,000m2 (840 Sq. m of Glass)
Total floors	10 levels
Window to wall ratio	60%
NABERS Rating	4 stars
HVAC System	Water-cooled chillers
Glazing Type	Double pane Low E glass
Location	Climate Zone 2 (Brisbane)

- On higher-performing double pane Low E windows, TSER improved by **41%** with Prestige 40 Exterior
- Annual Energy Savings of **7% (~$23K)**
- NABERS Energy rating improvement increase of **+0.38 stars**
- NABERS Water rating improvement of **+0.16** stars and a **12%** annual water savings achieved

Window System	SHGC	TSER	Glare Reduction	Heat Gain Reduction	Annual Energy Savings	NABERS Energy Impact	Annual Water Savings	NABERS Water Impact	Annual CO2 Savings (tonnes CO2)	Summer Cooling Savings
Base Glass: Double Pane Low E	0.67	33%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
+ 3M Prestige 40 Exterior	0.26	74%	52%	66%	$23.4K (7%)	**+0.38 Stars**	$3K (12%)	+0.16 Stars	77	$25K (7.5%)

*Estimated energy savings and water savings were calculated using 28.53c/kWh and $2.896/kL, respectively.

NABERS benefits and energy savings - Melbourne

Representative modelling: Building B

Building B	
Total floor area	12,000m2 (840 Sq. m of Glass)
Total floors	10 levels
Window to wall ratio	60%
NABERS Rating	3.5 stars
HVAC System	Water-cooled chillers
Glazing Type	Double pane Low E glass
Location	Climate Zone 6 (Melbourne)

- On higher-performing double pane Low E windows, TSER improved by **41%** with Prestige 40 Exterior
- Annual Energy Savings of **6% (~$14K)**
- NABERS Energy rating improvement increase of **+0.14 stars**
- NABERS Water rating improvement of **+0.20** stars and a **7%** annual water savings achieved

Window System	SHGC	TSER	Glare Reduction	Heat Gain Reduction	Annual Energy Savings	NABERS Energy Impact	Annual Water Savings	NABERS Water Impact	Annual CO2 Savings (tonnes CO2)	Summer Cooling Savings
Base Glass: Double Pane Low E	0.67	33%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
+ 3M Prestige 40 Exterior	0.26	74%	52%	66%	$11K (4%)	+0.13 Stars	$1.2K (9%)	+0.20 Stars	56	$14K (6.3%)

*Estimated energy savings and water savings were calculated using 28.53c/kWh and $2.896/kL, respectively.

NABERS benefits and energy savings – Auckland, NZ

Representative modelling: Building B

Building B	
Total floor area	12,000m^2
Total floors	10 levels
Window to wall ratio	60%
NABERS Rating	3.5 stars
HVAC System	Water-cooled chillers
Glazing Type	Double pane Low E glass
Location	Climate Zone 1 (Auckland)

- On higher-performing double pane Low E windows, TSER improved by **41%** with Prestige 40 Exterior
- Annual Energy Savings of **4% (~$6K)**
- NABERS Energy rating improvement increase of **+0.10 stars**
- NABERS Water rating improvement of **+0.14** stars and a **9%** annual water savings achieved

Window System	SHGC	TSER	Glare Reduction	Heat Gain Reduction	Annual Energy Savings	NABERS Energy Impact	Annual Water Savings	NABERS Water Impact	Annual CO2 Savings (tonnes CO2)	Summer Cooling Savings
Base Glass: Double Pane Low E	0.67	33%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
+ 3M Prestige 40 Exterior	0.26	74%	52%	66%	$6K (4%)	+0.10 Stars	$1.1K (9%)	+0.14 Stars	N/A	$15K (7.8%)

*Estimated energy savings and water savings were calculated using 28.53c/kWh and $2.896/kL, respectively.

The energy efficiency upgrade cycle.

Optimize your building with envelope improvements.

It is essential to choose the right products but also, complete upgrades in a **sequential order!** such that you can maximize the benefits.

Envelope upgrades (WF) are often overlooked Owners jump right to optimizing the HVAC system.

If you create a more efficient building envelope Before HVAC improvements, you can downsize your HVAC equipment in the future! enabling you to reach the maximum possible performance!

4 Tools 3M offer to determine Energy Benefits

1. **Glass Analysis -** Determine the Glass Performance with 3M Window Film applied SHGC, VLT etc. - LBNL Software, IGDB Database

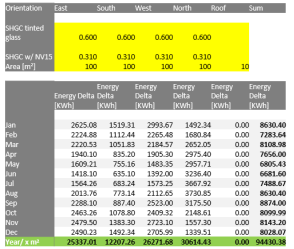
2. **3M Solar Load Reduction** calculations – regional glazing performance analysis of energy reduction (Watts per Sq.M reductions).

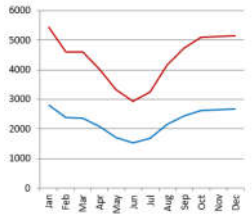
3. **Field monitoring** of Heat transfer through the existing glazing using data logging Solar Power Meters.

4. **Energy Plus Energy Analysis** - Project Simulation using **E-Film**, giving Potential Energy Savings & ROI

BERKELEY LAB
LAWRENCE BERKELEY NATIONAL LABORATORY

Glass	SHGC	VLT	Visible Reflection		U Value (W/m2-k)	UV Block	SC	TSER	Glare Reduction	Heat Gain Reduction	Heat Loss Reduction	Light to Solar Gain
			Exterior	Interior								
Base Glass: Double Pane Low E - 6mm Viridian Evantage Grey//12A Argon//6mm VFloat Clear	0.56	61%	27%	29%	1.68	99.9%	0.64	44%	N/A	N/A	N/A	1.1
3M Prestige 20 Exterior	0.17	14%	7%	28%	1.68	99.9%	0.20	83%	77%	69%	0%	0.8
3M Prestige 40 Exterior	0.22	29%	10%	28%	1.68	99.9%	0.25	78%	56%	60%	0%	1.3
3M Prestige 70 Exterior	0.30	49%	19%	29%	1.68	99.9%	0.30	70%	25%	46%	0%	1.6





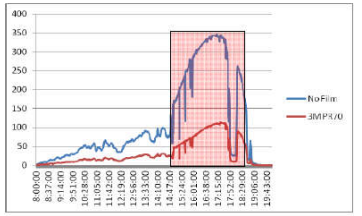
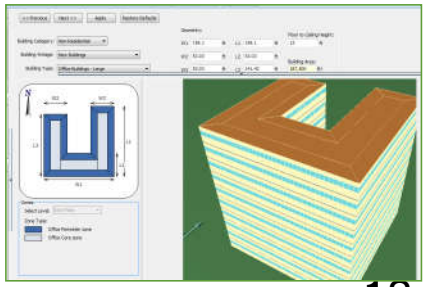
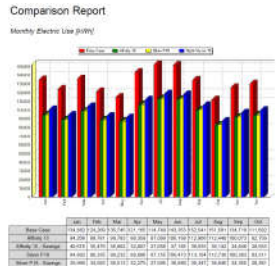


Figure 5: Detailed data from 8am to 8pm on 28th March. The highlighted area shows the highest heat load through the glazing between 2.00 PM and 6.30 PM. The sharp drop in W/m² seen identically on both Data Streams represent small periods of cloud cover over the Solar Meters.





3M

Estimating the potential savings for your building

Capture your building information

End User Needs

Glass and Building Information

3M analyze and model potential savings

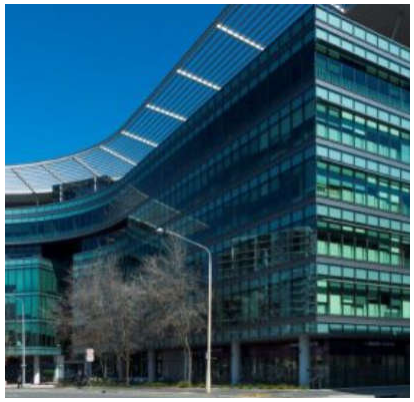
3M model potential energy, carbon and water savings from using 3M Window Films

Review results

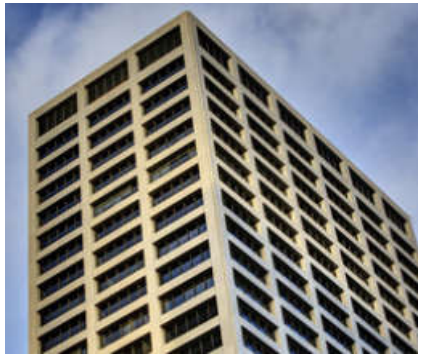
Review modelling results and discuss potential 3M Window Film solutions with your 3M representative.

High profile Australian 3M Window Film projects

477 Pitt St
Sydney NSW
Completed date: 2021
Application: Façade Windows
Product: Prestige PR40
Area: 2,900 m^2



7 London Circuit
Canberra ACT
Issue: Heat & Energy Efficiency
Product: Prestige PR40 & PR70
Area: 1,000 m^2

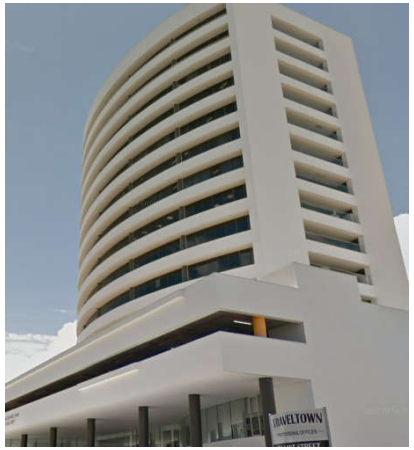


367 Collins St
Melbourne VIC
Completed date: 2018
Application: 15+ Full Floors, Solar Control
Product: Prestige PR70
Area: 4,000+ m^2

Chadstone Shopping Centre
Melbourne VIC
Completed date: Stage 1, 2020
Application: Skylight Windows
Product: Prestige PR70X
Area: 1,000 m^2

High profile Australian 3M Window Film projects

ATCO Gas
Perth WA
Completed date: 2016
Application: Windows
Product: Prestige PR40X
Area: 1,000 m^2



HGD
Cairns QLD
Completed date: 2019
Application: External Glass Awning, Western Façade.
Product: Prestige PR40
Area: 400 m^2

50 Lonsdale St
Melbourne VIC
Completed date: 2020
Application: Windows
Product: Low E & Solar
Area: 2,664 m^2

2 Lonsdale St
Melbourne VIC
Completed date: 2020
Application: Façade Windows
Product: Prestige PR40
Area: 3,432 m^2

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High profile Intl. 3M Window Film projects

Project: Marina Bay Sands, Singapore
Completed date: 2018
Application: Lobby Entrance Canopy, SkyPark Restaurants, CEO Office, Lobby, Skylight
Product: PR40X 1,000 Sq.m
PR40 2,500 Sq. m

Project: Rock & Roll Hall of Fame, Ohio, USA
Issue: Heat & UV Protection
Product: Prestige PR40X
Area: 5,100 Sq. m

Project: GIC at Capital Tower (14 floors) Singapore
Completed date: 2017
Application: Windows
Product: Prestige PR70
Area: 4,400 Sq. m.

Project: Myzeil Shopping Centre, Frankfurt, Germany
Issue: Heat reduction
Product: Prestige PR40X - No metals!
Area: 2,200 Sq. m

Thank You

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Email: ahadair@mmm.com

Q & A