

3M Renewable Energy Division

# 3M Sun Control Window Films



3M Window Films  
Delivering  
on Your  
Bottom Line

10/21/15



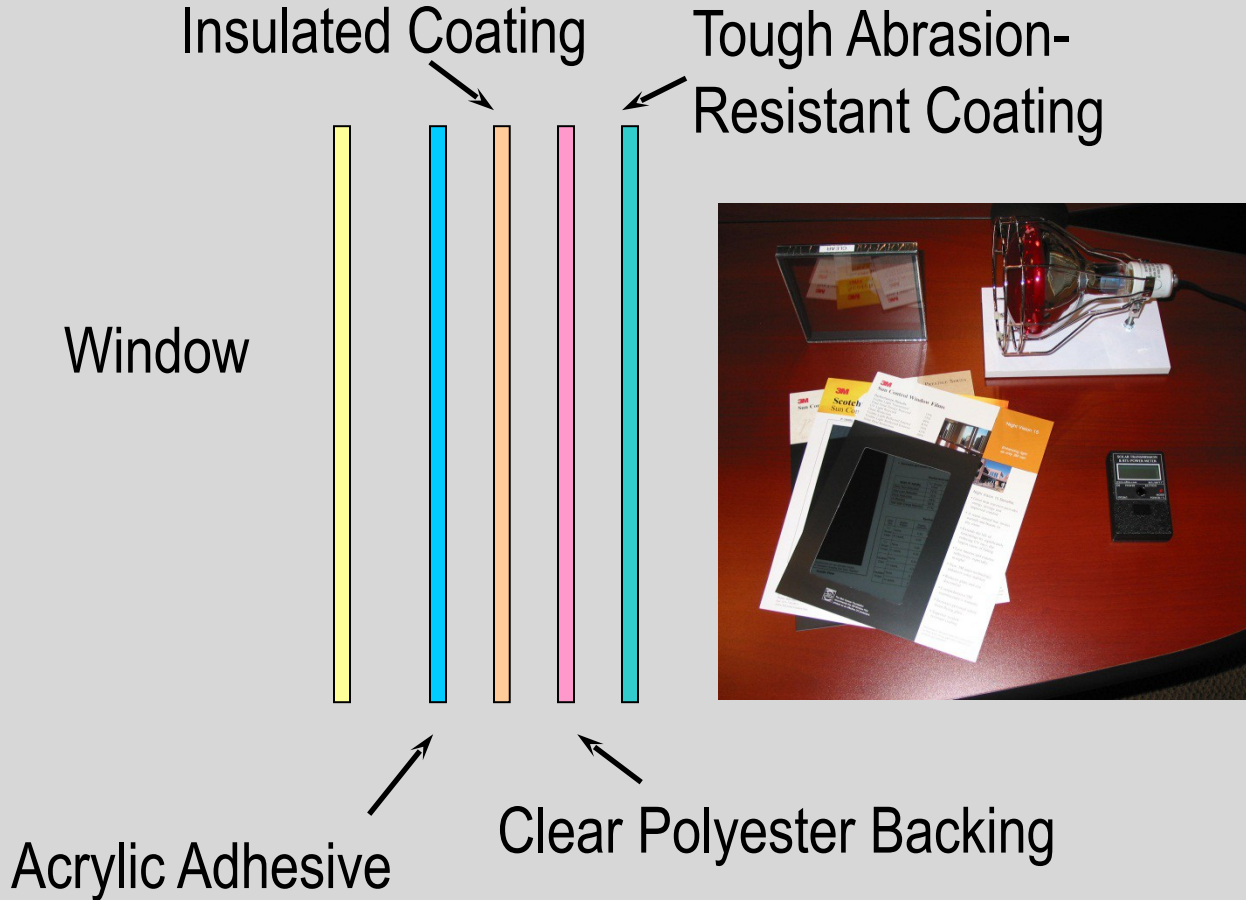
# Windows are inefficient...

- According to the DOE, the energy used to offset unwanted heat losses and gains through windows in residential and commercial buildings costs the United States \$20 billion (25% of all the energy used for space heating and cooling)
- According to the DOE, an average household spends over 40% of its annual energy budget on heating and cooling costs
- According to the DOE, windows are responsible for as much as 30% of the total cooling load in commercial buildings
- According to Energy Efficiency and Renewable Clearinghouse, advanced glazings with spectrally selective coatings can reduce the electric space cooling requirements in hot climates by more than 40%

## 3M Window Film can reduce those inefficiencies

- Reduce utility bills 2%-10% (Heating & AC)
- Reduce temperatures 5°-16°F
- Receive 2-11 LEED points
- Improve E\* Portfolio Manager Score
- May be eligible for prescriptive rebates and custom incentives

# Window Film is a multi-layered product



3M Sun Control Window Films stop much of the sun's heat before it enters your building.



3M All Season Window Films reduce heat loss by reflecting radiant heat back inside the building envelope.

# Why do people buy 3M Window Film?

## Why the need for 3M Window Film?

- Reduce A/C bills
- Reduce heating bills
- Increase Tenant Comfort / Reduce Temperature Imbalances
- Increase HVAC equipment life
- Reduce glare and eye discomfort
- LEED Sustainable Design

## Other product benefits:

- Protect tenants from a nearby explosion
- Help prevent unwanted entry
- Reduce Fabric Fade



- Reduces Peak Loads
  - Passive System
- No Maintenance Required
- Life Expectancy > 20 years
- Eligible for tax credits & rebates

# Third parties believe in window film

## DOE Study

- Conducted in 2011
- Evaluated Top 50 commercial available energy conservation technologies
- Determined Window Film to be a Top Tier solution (based on payback, probability of success and overall energy savings)
- One of four technologies with fastest payback AND highest probability of success (PC power management, condensing water heaters, air side economizers and filters for data centers)

## CONSOL Study

- CONSOL is a leading consulting firm
- Using DOE's Energy Plus modeling software determined the following
  - *Payback for single pane glass in as little as 1.4 years*
  - *Payback for double pane glass in as little as 2.1 years*
  - *Savings of 19 kWh / sq ft of installed film*
  - *If every home in California had window film installed carbon emissions would be reduced by 8.8%*
- This study prompted California to update their building code to include window film

Incentivized by many utility companies across the United States

# Where has 3M Window Film been installed?

## Before 3M Window Film

- Two 44-story towers
- Consistent heating and cooling a challenge
- Building management seeking sustainability

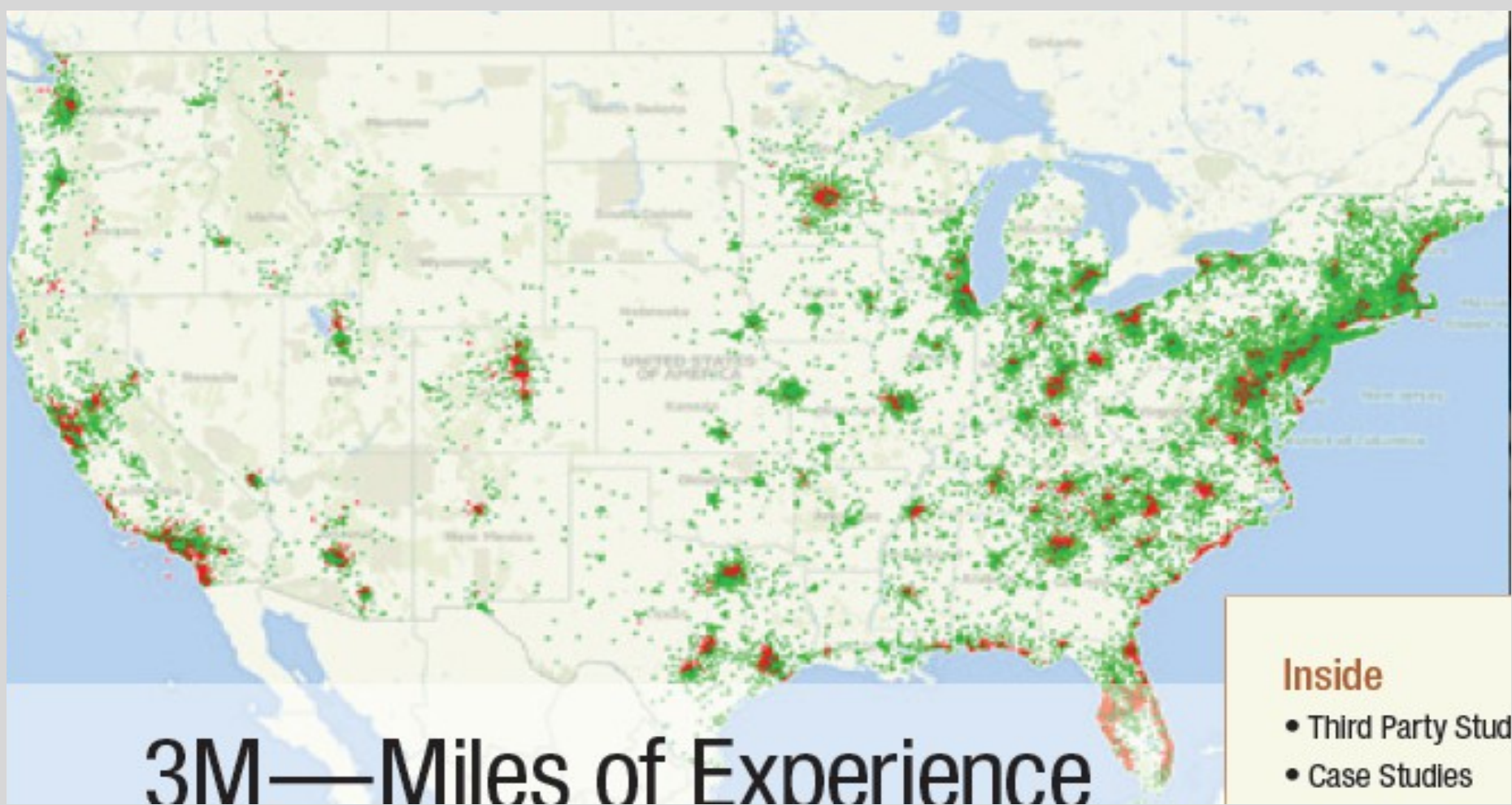
## After 3M Window Film

- Neutral 35 installed on 11,000 windows
- Completed in just four months
- 155,000 KWH savings / month
- < 8 month payback





# Where else has 3M Window Film been installed?





# How can we show that window film will work?

- **EFILM**

- *Software based on DOE's Energy Plus*
- *Estimates energy savings from window film*
- *Input variables specific to a given building*
- *Necessary to apply for utility rebates*
- *Typical payback is 3 to 7 years*

- **Temperature Loggers**

- *Used to track temperature trends over time*
- *Use in two identical rooms (one with film, one without film)*
- *Need to shut off A/C in both rooms*
- *Typical temperature reduction is 5 to 9 degrees Fahrenheit*

- **BTU Loggers**

- *Used to track BTU trends over time*
- *Use in two identical rooms (one with film, one without film)*
- *Use over temperature loggers when automatic thermostat setting cannot be controlled*
- *BTU reduction up to 50%*

# What is EFILM?

- Estimates a window film project's payback
- User friendly interface of DOE's Energy Plus developed by IWFA
- User establishes a "base case" by inputting variables specific to the building
- EFILM compares the base case to the post window film building to estimate a project's payback
- A multipage report is generated as the output

# Window Film typically has a 3-7 year payback

## Results Summary

Option	Gas	Electricity	Total (Site)	Total (Source)	Savings
<i>Energy Totals</i>					
Base Case	2,459 MBTU	2,182,931 kWh	9,907 MBTU	26,245 MBTU	
P18	2,202 MBTU	1,771,506 kWh	8,246 MBTU	21,523 MBTU	4,721 MBTU
NV25	2,368 MBTU	1,991,822 kWh	9,165 MBTU	24,083 MBTU	2,161 MBTU
NV35	2,415 MBTU	2,057,728 kWh	9,437 MBTU	24,846 MBTU	1,399 MBTU
<i>Energy/Area</i>					
Base Case	24.12 kBtu/ft <sup>2</sup>	21.4 kWh/ft <sup>2</sup>	97.2 kBtu/ft <sup>2</sup>	257.47 kBtu/ft <sup>2</sup>	
P18	21.6 kBtu/ft <sup>2</sup>	17.37 kWh/ft <sup>2</sup>	80.9 kBtu/ft <sup>2</sup>	211.16 kBtu/ft <sup>2</sup>	46.32 kBtu/ft <sup>2</sup>
NV25	23.23 kBtu/ft <sup>2</sup>	19.53 kWh/ft <sup>2</sup>	89.91 kBtu/ft <sup>2</sup>	236.27 kBtu/ft <sup>2</sup>	21.2 kBtu/ft <sup>2</sup>
NV35	23.69 kBtu/ft <sup>2</sup>	20.17 kWh/ft <sup>2</sup>	92.58 kBtu/ft <sup>2</sup>	243.75 kBtu/ft <sup>2</sup>	13.72 kBtu/ft <sup>2</sup>
<i>Peak Demand</i>					
Base Case	1,985 kBtu/hr	475 kW			
P18	1,883 kBtu/hr	407 kW			
NV25	1,940 kBtu/hr	443 kW			
NV35	1,964 kBtu/hr	453 kW			
<i>Energy Cost</i>					
Base Case	\$ 35,162	\$ 305,635	\$ 340,797		
P18	\$ 31,485	\$ 248,031	\$ 279,516		\$ 61,281
NV25	\$ 33,868	\$ 278,878	\$ 312,745		\$ 28,052
NV35	\$ 34,538	\$ 288,105	\$ 322,643		\$ 18,154
<i>Energy and HVAC Equipment Cost</i>					
Base Case	\$ 45,716	\$ 347,523	\$ 393,238		
P18	\$ 41,920	\$ 278,036	\$ 319,956		\$ 73,283
NV25	\$ 44,394	\$ 315,272	\$ 359,666		\$ 33,572
NV35	\$ 45,100	\$ 326,399	\$ 371,499		\$ 21,739



## Simple Payback

Option	Project Cost	Simple Payback Period
Base Case	\$ 0	
P18	\$ 94,750	1.55 years
NV25	\$ 115,011	4.09 years
NV35	\$ 115,011	6.33 years

# Long-term Savings Projection

Total Project Cost \$ 205,000  
 Annual Utility Savings \$ 36,000  
 Simple Payback (years) 5.69

		<u>Cumulative Savings</u>	
Initial Project Cost	\$ (205,000)	N/A	
Year 1	\$ 36,000	\$ (169,000)	
Year 2	\$ 36,000	\$ (133,000)	
Year 3	\$ 36,000	\$ (97,000)	
Year 4	\$ 36,000	\$ (61,000)	
Year 5	\$ 36,000	\$ (25,000)	
Year 6	\$ 36,000	\$ 11,000	<---film has now paid for itself...PAYBACK
Year 7	\$ 36,000	\$ 47,000	
Year 8	\$ 36,000	\$ 83,000	
Year 9	\$ 36,000	\$ 119,000	
Year 10	\$ 36,000	\$ 155,000	
Year 11	\$ 36,000	\$ 191,000	
Year 12	\$ 36,000	\$ 227,000	<---end of 3M NV Warranty
Year 13	\$ 36,000	\$ 263,000	
Year 14	\$ 36,000	\$ 299,000	
Year 15	\$ 36,000	\$ 335,000	
Year 16	\$ 36,000	\$ 371,000	
Year 17	\$ 36,000	\$ 407,000	
Year 18	\$ 36,000	\$ 443,000	
Year 19	\$ 36,000	\$ 479,000	
Year 20	\$ 36,000	\$ 515,000	
Year 21	\$ 36,000	\$ 551,000	
Year 22	\$ 36,000	\$ 587,000	
Year 23	\$ 36,000	\$ 623,000	
Year 24	\$ 36,000	\$ 659,000	
Year 25	\$ 36,000	\$ 695,000	<---life expectancy of film

So at the end of 25 years, the end-user has saved almost \$700,000 in utility bills over and beyond the initial project cost.

Annual Utility Savings derived from EFILM

Analysis assumes stable (non-rising) utility rates. The savings would be greater if we assumed that utility rates rise.

Analysis assumes that occupancy rates and internal loads remain stable.

# 3M Window Film Plugins for eQuest & Trace

```

1X Clear - NV15 - Notepad
File Edit Format View Help
Window v6.3.74.0 DOE-2 Data File : Multi Band Calculation

Unit System : SI
Name : DOE-2 WINDOW LIB
Desc : 3M Night Vision
Window ID : 20
Tilt : 90.0
Glazings : 1
Frame : 1 Al w/break          5.680
Spacer : 1 Class1           2.330 -0.010 0.138
Total Height: 1500.0 mm
Total Width : 1200.0 mm
Glass Height: 1385.7 mm
Glass width : 1085.7 mm
Mullion : None

Gap      Thick  Cond  dCond  Vis  dVis  Dens  dDens  Pr  dPr
1        0      0     0      0   0     0     0     0   0
2        0      0     0      0   0     0     0     0   0
3        0      0     0      0   0     0     0     0   0
4        0      0     0      0   0     0     0     0   0
5        0      0     0      0   0     0     0     0   0

Angle   0    10    20    30    40    50    60    70    80    90  Hemis
Tsol  0.121 0.122 0.120 0.118 0.116 0.112 0.103 0.084 0.050 0.000 0.106
Abs1  0.564 0.569 0.571 0.571 0.565 0.556 0.540 0.493 0.350 0.001 0.535
Abs2  0      0     0     0     0     0     0     0     0     0     0
Abs3  0      0     0     0     0     0     0     0     0     0     0
Abs4  0      0     0     0     0     0     0     0     0     0     0
Abs5  0      0     0     0     0     0     0     0     0     0     0
Abs6  0      0     0     0     0     0     0     0     0     0     0
RFsol 0.315 0.310 0.309 0.311 0.319 0.332 0.357 0.423 0.599 0.999 0.349
Rbsol 0.173 0.166 0.165 0.168 0.177 0.193 0.223 0.303 0.516 0.999 0.216
TVis  0.148 0.149 0.147 0.145 0.142 0.137 0.126 0.103 0.062 0.000 0.130
RFvis 0.379 0.374 0.373 0.375 0.382 0.394 0.417 0.477 0.636 0.999 0.409
Rbvis 0.106 0.099 0.097 0.100 0.110 0.127 0.160 0.247 0.477 0.999 0.153
SHGC  0.285 0.287 0.286 0.284 0.281 0.274 0.260 0.226 0.150 0.000 0.261
SC: 0.32

Layer ID# 58622      0      0      0      0      0
Tir      0.000      0      0      0      0      0
Emis F   0.840      0      0      0      0      0
Emis B   0.760      0      0      0      0      0
Thickness(mm) 5.8      0      0      0      0      0
Cond(W/m2-K) 153.3     0      0      0      0      0
Spectral File NV15 ojn 501      None      None      None      None      None

Overall and Center of Glass Ig U-values (W/m2-K)
Outdoor Temperature -17.8 C      15.6 C      26.7 C      37.8 C
Solar wdsd hcout hrcut hin
(W/m2) (m/s) (W/m2-K)
0 0.00 4.00 3.52 6.75 3.48 3.48 3.48 3.48 3.54 3.54 3.90 3.90
0 6.71 30.84 3.29 6.86 5.51 5.51 5.11 5.11 5.10 5.10 5.76 5.76
783 0.00 4.00 4.15 6.85 3.48 3.48 3.48 3.48 3.54 3.54 3.90 3.90
783 6.71 30.84 3.50 6.74 5.51 5.51 5.11 5.11 5.10 5.10 5.76 5.76
    
```



Download Plugins Here:  
<http://epdwindowfilm.com/software>

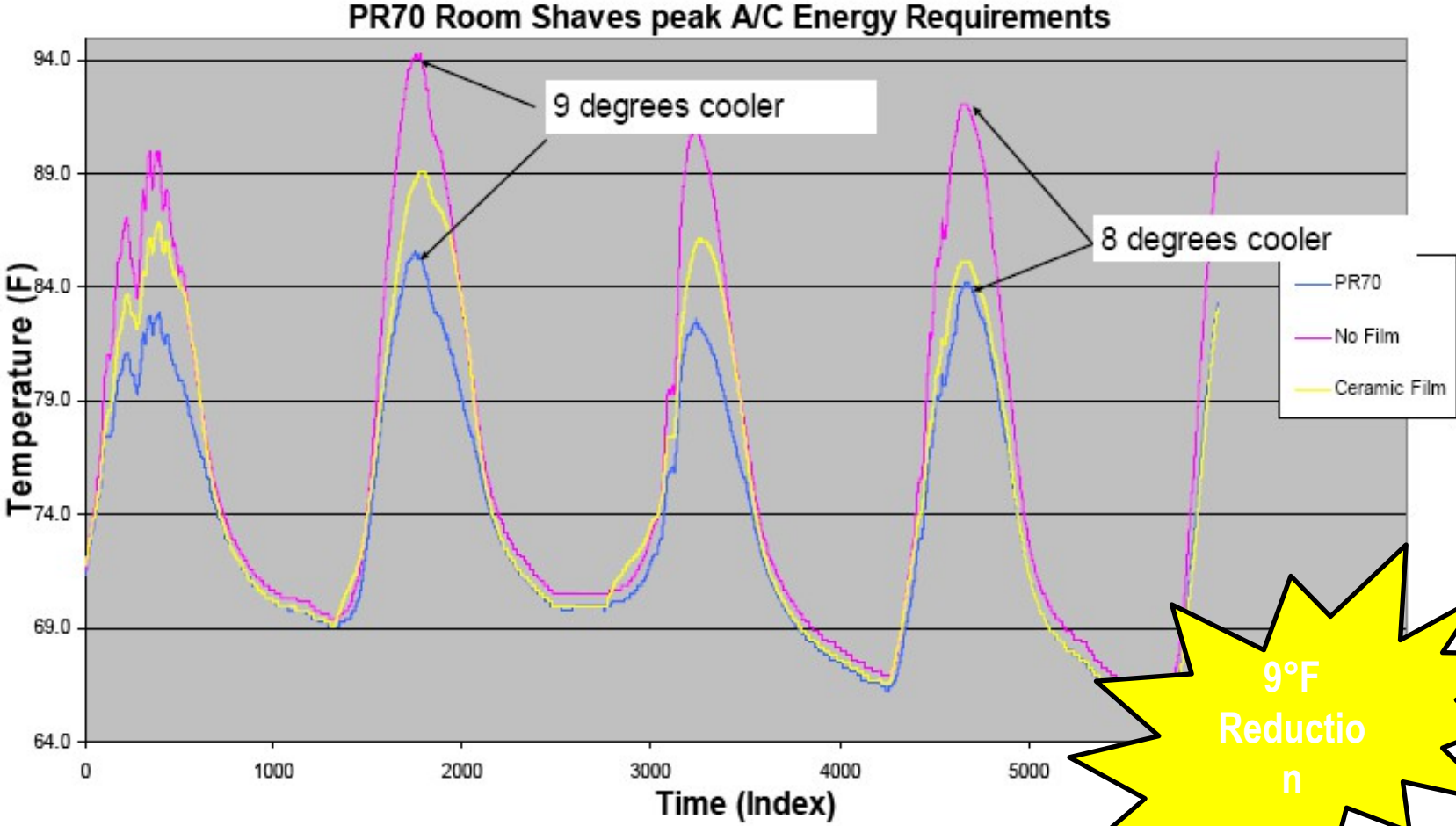


# What are Temperature Loggers?

- Show temperature reduction from window film installation
- Reads and tracks temperature over time
- Window Film can reduce temperatures 5°-9°F
- Originally used in the food industry to validate that food was stored / transported at the appropriate temperature



# 3M Window Film can reduce temperatures by 9° F



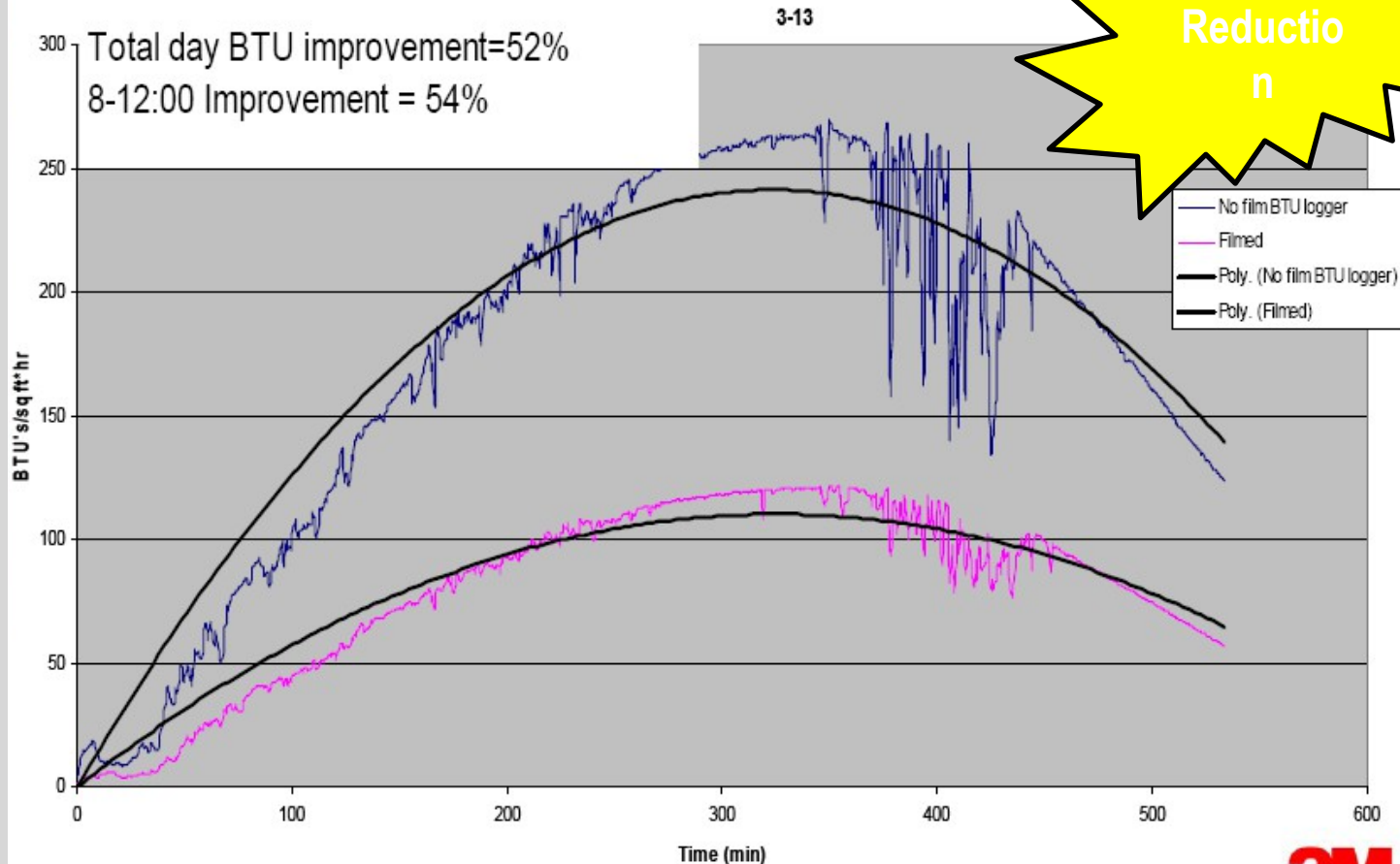
# What are BTU loggers?

- Show BTU reduction from window film installation
- Reads and tracks BTUs over time
- Window Film can reduce BTUs by over 50%



# 3M Window Film can reduce BTUs by 50%

## Window Film Energy Savings



## How can 3M Window Film help your E\*PM Score?

- Estimate reduced kWh consumption using EFILM
- Access building's Energy Star Portfolio Manager profile
- Plug EFILM simulated kWh consumption into Energy Star Portfolio Manager
- Compare building's base case score to post window film score

3M Window Films help your building earn an Energy Star rating



# Custom Incentives

Some utility companies offer prescriptive rebates while others offer custom incentives:

- 3M performs EFILM analysis
- Present EFILM to end-user for approval
- Provide EFILM analysis to Utility Company
- Utility Company estimates rebates
- Utility Company gives end-user a commitment letter that states the rebated amount
- If end-user wants to pursue the project, Utility Company performs onsite survey
- 3M Dealer installs window film
- Utility Company performs post-project inspection
- End-user receives rebate check from Utility Company after project completion

# How is 3M Window Film warrantied?

- **Warranty between 3M Company and end-user**
  - *Up to fifteen (15) year warranty for labor and material*
  - *Labor & material warranted by 3M Company against:*
    - *Maintain Solar Reflective Properties without cracking, crazing, or peeling*
    - *Maintain Adhesion Properties without blistering, bubbling, or delaminating from the glass*
    - *Maintain Appearance without discoloration*
    - *Glass Breakage & Seal Failure*
  - *No monetary limits for film replacement*
  - *Can use ammonia-based cleaning products*

\*See warranty for specific terms and conditions

# Who is 3M? (Year End 2014)



## Mission

3M is a diversified technology company that provides innovative and practical solutions to people around the world.

## Sales

Worldwide	\$31.8 billion
International (63% of total)	\$20.1 billion

## Earnings

Net income	\$5.0 billion
Percent to Sales	15.6%

3M is one of 30 companies in the Dow Jones Industrial Average and also is a component of the Standard & Poor's 500 Index.

## R&D Expenditures

For 2014	\$1.8 billion
Total last 5 years	\$8.1 billion
3,342 Patents awarded	

## Employees

Worldwide	89,800
United States	35,581
Operations in 70 countries	

Thank You

Any Questions?

## 3M Daylight Redirecting Film

- Redirect 80% of sunlight toward ceiling 40' into a room
- Reduce artificial light – up to 52% electrical savings
- Works even when sun is at a low angle
- No special maintenance required
- Savings of up to 1.5 kWh/Sq Ft