



WINDOW FILMS • PHOTOVOLTAICS • CUSTOM COATINGS

Tropi-cool Window Tinting  
11 Stanton Rd  
Smithfield, QLD, 4878

21 November 2013

Re: **Building Energy Saving Project – Sample Residential House**

Dear Scott,

Thankyou for the opportunity to perform a thermal energy analysis on the potential solar control window film requirements for the building under consideration for a Sample Residential House.

Your brief to us was to analyse the building energy efficiency advantages available from window film installation on the existing glass areas. In assessing the site we have considered the following main issues:

1. Glass thermal stress limits
2. Thermal modelling of glass areas proposed for window film installation
3. Effect on GHG emissions and Carbon Footprint
4. Effect of temperature versus productivity
5. Fade Reduction

#### **1. Glass Thermal Stress Limits**

Each of the three types of glass used in building construction, annealed (float), heat strengthened and toughened (tempered), have maximum permissible stress limits beyond which fracture is possible. One source of additional stress is thermal energy (or heat) into the glass. All window films will absorb some of the Sun's heat which in turn results in extra heat absorption into the glass itself. It is possible to thermally fracture glass if an incorrect window film is installed onto some glass types.

We use proprietary and external calculation software to simulate the as-built windows with specific Solar Gard window film types to calculate the likely thermal stress risk. There are many factors taken into account such as glass type, thickness, size, climate, orientation, frame type & colour, seal resilience, external and internal shading etc. Within our calculations we assume that the glass has been installed to a professional glazing standard and so free of edge defects which we cannot observe under the frame itself.

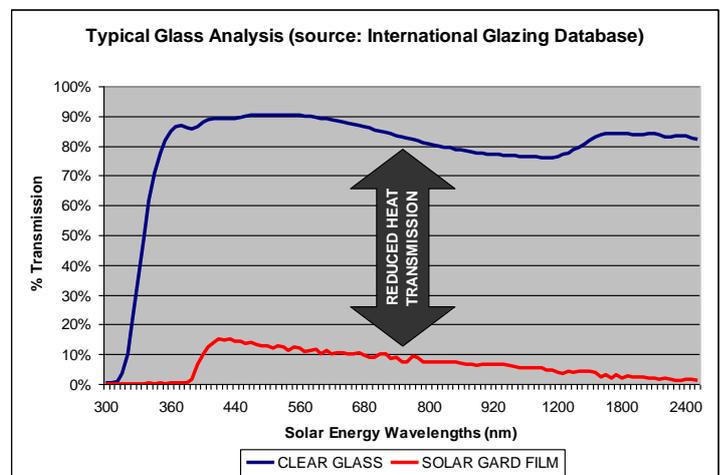


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## 2. Thermal Modelling

There are a number of ways to estimate the energy efficiency of a building. As you'd appreciate, to do a thorough whole of building analysis requires information about the whole building including all materials, dimensions, HVAC details and building utilisation. With your help we have been able to get a good understanding of the glass types, areas and orientations which will enable us to do a specific type of analysis called a Capshot analysis which focuses only on the glazed areas where window film is being considered.

Capshot is a proprietary software which provides an estimate of how many kW of direct solar energy per square meter of glazed area will be stopped from entering the building which would otherwise need to be removed by the HVAC system. Capshot also takes into account reductions in winter heat losses as well as losses in passive solar heat gains. Capshot uses real world climate data from a global climate data provider called Meteonorm. It is sensitive to window orientation and has inbuilt sunlight hours per day based on local historical weather patterns.



We have assumed the following information in the Capshot analysis:

- North face, 10sqm clear glass area
- East face, 10sqm clear glass area
- South face, 10sqm clear glass area
- West face, 10sqm clear glass area
- Solar Gard True Vue 15 film modelled
- The HVAC system has a CoP 2.9
- Electricity is the assumed power used for both cooling and heating
- Electricity costs are 22c/kWh (average over peak and non peak times)

**The Capshot analysis showed a net annual saving of over \$1,700 or 8,000 kWh of electricity.**



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There is another aspect to energy saving which is not taken into account by the Capshot software, that is peak electricity usage. It is common for power providers to charge significantly higher tariffs for electricity usage during peak times. What many providers also do is retrospectively calculate the peak usage costs you will be billed based on your highest 30 minute load during peak times for that month. This means that any electricity load reductions you can accomplish during peak periods will have a cumulative effect throughout the month. The window film being proposed will drastically reduce the solar heat load the HVAC system has to deal with. This heat load reduction will of course serve to reduce the load during the peak periods and it is feasible to expect further significant savings above what has been estimated by Capshot simply from peak reductions.

It is important to note that different window films will handle solar & non solar heat and visible light energy differently and window films are not necessarily comparable based solely on comparing select specifications. What we mean by this is that when solar energy strikes a window with film installed that energy is reflected, transmitted and absorbed & reradiated in different proportions and it is the combined effect of these actions that provide the net benefits. Capshot also takes into account the significantly more complex effects of U Value which importantly considers internal heat escaping through windows in cold periods. It is impossible to compare different window films without running an energy analysis using the actual set of film specifications.

### 3. GHG emissions and Carbon Footprint

Of course reduced electricity usage also means reduced carbon dioxide Green House Gas emissions from electricity generation. Using average emission factors we have calculated that the installation of Solar Gard window film to the Sample Residential House will prevent **7 tons of CO<sub>2</sub>** from entering the atmosphere annually.

To put this into perspective the annual Carbon Dioxide emission reductions are equivalent to **17 barrels of oil saved** or the planting of **193 trees**.

Another unique advantage to Solar Gard window films, we were the first window film company to formally measure our carbon footprint and we are **the only window film company to register a formal Environmental Product Declaration**.

Following a detailed life cycle analysis looking at all regions of the globe we have proven that on average the **installation of our solar control window films are carbon neutral in less than 3 months and carbon negative after that**. That means that a Solar Gard solar control window film installation will *reduce* the carbon emissions for a building. Our EPD Flyer is attached.

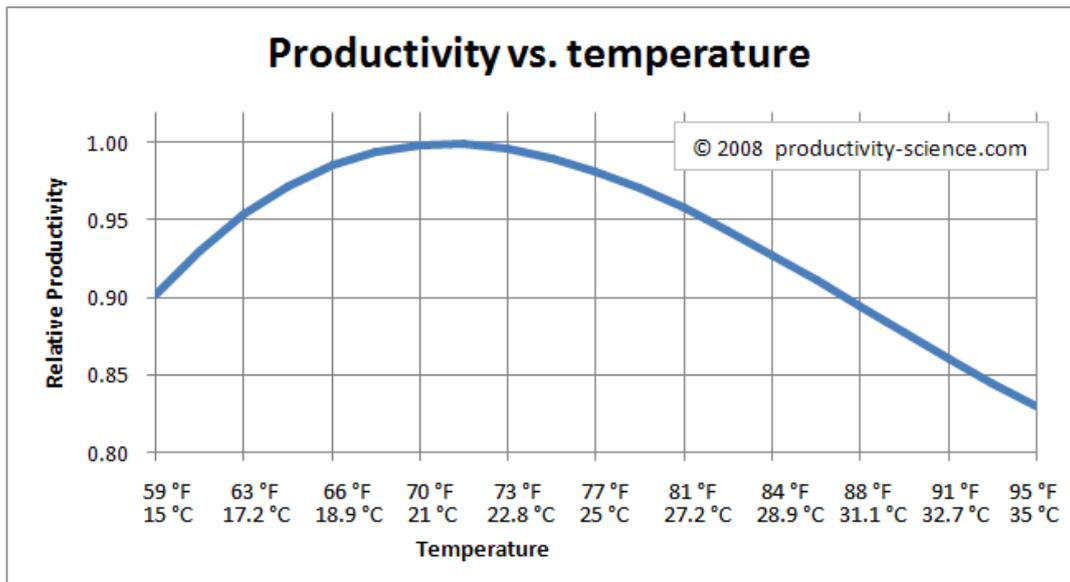


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#### 4. Effect of Temperature vs Productivity

Scientific studies confirm that indoor temperature can significantly impact on productivity and the highest performing 'comfort zone' lays between 22°C and 25°C. The graph below is from research by Helsinki University of Technology and Lawrence Berkeley National Laboratory. Read report here <http://energy.lbl.gov/ied/pdf/60946.pdf>.

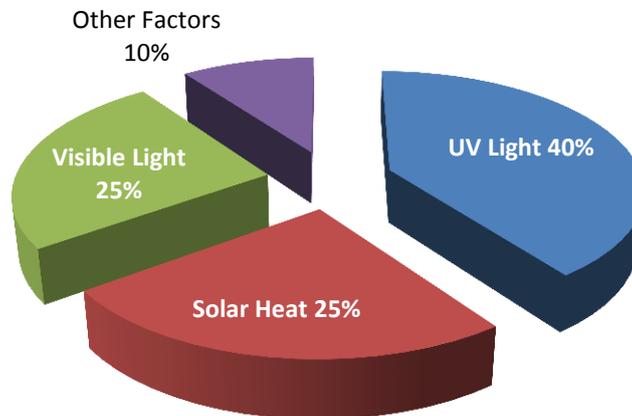
Solar Gard architectural film can help reduce the incoming Solar Energy and Heat inside a building which can help reduce your cooling load, allow the air conditioning system to keep pace with the internal heat load and help keep occupants more comfortable and productive. 'Effect of Temperature on Task Performance in Office Environment' below shows how relative productivity changes with the temperature.



## 5. Fade Reduction

Solar Gard energy control film also reduces fading by blocking up to 99% of ultraviolet radiation (UV light). Fade reduction will reduce the rate at which interior furnishings such as carpeting, furniture and window dressings need to be replaced. Solar Gard films help by filtering visible light, rejecting solar heat and blocking over 99% of harmful UV light – significantly reducing fading damage potential.

### The Causes of Fading



The installation of Solar Gard solar control window film will reduce fading by approximately **80%**. This means it will take over 4 years to experience the same amount of fading as is occurring in 1 year presently

### In Conclusion

The Solar Gard window film we have used in this analysis will provide the following benefits which we believe will be of importance;

- The film has passed the thermal stress analysis and is safe for the existing glass
- The film will reduce electricity consumption by significant amounts
- The film will provide annual electricity savings of over \$1,700
- The film will prevent up to 7 tons of CO<sub>2</sub> from entering the atmosphere each year
- The film will actually reduce the building's Carbon Footprint after only a matter of months
- The occupant comfort will be improved as the temperature inside will be within limitations of the HVAC system



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- The film will provide glare rejection which again assists occupant comfort and can be a problem for staff health in headaches and eye strain
- The film will reduce interior fading to less than a quarter of what it is now. This means that it will take more than 4 years to experience the same interior fade as currently occurs in 1 year
- The film will provide a neat uniform façade appearance. As is often the case, blinds and curtains are set at different heights and opening amounts based on individual occupant need and these furnishings will be harder to see from the outside

For your interest I have attached a case study of a commercial building in Melbourne where similar heat load problems were faced, albeit on a larger building. This case was particularly interesting because the client worked with us a year after the window film installation to verify the electricity savings.

For more general information on Solar Gard window films and our past installations visit <http://www.solargard.com.au>.

Best regards,

Robert Hamilton,  
Managing Director



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Footnote: Please note only limited building information is available and so this Capshot report is offered in good faith as an estimate only for the benefit of your customer's ROI analysis. The Capshot analysis methodology takes into account building thermal dynamic actions of incoming solar energy, internal heat losses, losses in passive solar heat gain and internal free heat. Having only limited information available we have made input assumptions based on typical building actions and attributes.

Solar Gard also offers the additional service of higher detailed energy analysis which will take into account the whole of building materials and services. Please don't hesitate to enquire with us if your client wishes to conduct a more detailed energy analysis.

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