# Heat Rejection Sheets

## Product Testing Report

Heat Rejection Sheets were installed in 3 rooms of Building B at ERPH in June 2016. These sheets were installed as a test case to analyze effectiveness in reducing HVAC electricity consumption in comparison with the normal glazed windows currently installed in all KE buildings. Data loggers were also installed in parallel to these heat rejection sheets and also in a sample room without the heat rejection sheets to have reliable data to support the energy reduction claims by Bonwyke, the OEM of these sheets.

## Introduction

Air conditioning loads take roughly 50% of the total energy bill for a building. A building loses its cooling due to air leakages, heat transfer from roof, walls and windows which increase the temperature of the conditioned space. This temperature rise and cooling loss is offset by additional work by the HVAC system. In commercial buildings which have glass fronts or large windows heat transfer through windows/ glass can be as high as 50% of the total heat input to the conditioned space. This calls for looking into alternatives that are techno-commercially feasible.

Heat Rejection Sheets are one of a kind solution that assist existing buildings minimize their existing HVAC loads. The Heat Rejection Sheets are easily retrofitted on existing windows and their benefits are not only limited to the reduced HVAC bill:

- Blocks 99% of UV rays thus preserving office furniture
- Allows 67% of the visible light
- Reduces suns glare into the room making a more comfortable working environment.
- Have a transparent look and therefore do not affect the aesthetics of the building

## Comparison

Bonwyke has four categories of heat rejection sheet that it offers its consumers:

- Silver 20
- Silver 35
- E lite 45
- E lite 70

These sheets have different optical properties and can be chosen as per requirement of the location.

Solar Heat Gain Coefficient is the main property of the film that relates to the percentage of striking sun energy that is transmitted through the window and causes heating in the conditioned space.

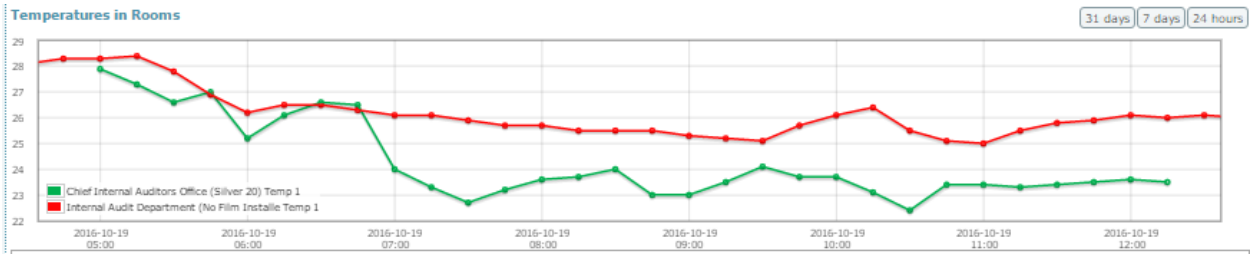
Visible light transmission is the portion of the visible light that the sheet effectively allows inside and is of importance considering day time light usage is affected by it. Within KE offices it is observed due to

glare and direct sunlight most of the rooms have their blinds drawn down and thus depending on the office lighting for day work.

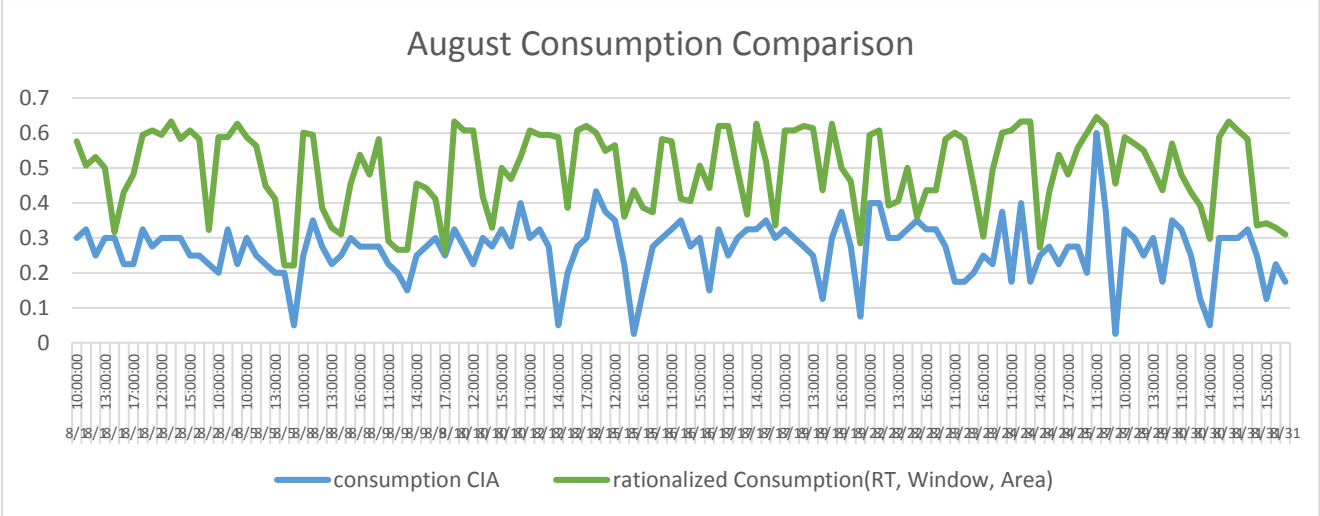
| | Silver 20 | Silver 35 | e-lite 45 | e-lite 70 |
|---|---|---|---|---|
| **Solar Heat Gain Coefficient** | 0.22 | 0.35 | 0.41 | 0.48 |
| **Visible Light Transmitted** | 18% | 33% | 44% | 67% |

| | Sheet Installed |
|---|---|
| **Chief Internal Auditor** | Silver 20/35 |
| **Director Safety & Security** | e-lite 45/70 |
| **Room 3** | No sheet installed |

During the day the temperature of chief internal auditor's office which has sheets silver 30 and silver 35 installed is 2-3 degrees lower than the room without the sheets installed.




This drop in temperature is translated into reduced electricity consumption for air conditioning. According to the assessment below average electricity savings of **41%** was achieved in the month of August. It can further be noted that the savings are highest during 10 a.m. – 3 p.m. when the sun energy is highest and the conditioned space is prone to heat transfer due to the temperature difference between the outside and the inside.



## Measurement Methodology

The three test rooms are installed with room temperature sensors and transmitters along with energy meters that monitor the consumption of these units. The measurement and monitoring are done by a third party UNIQ Solutions which is also based in UK. UNIQ solutions provides reliable energy monitoring equipment and are widely used in different industries for energy management purpose worldwide

The occupants of these rooms were briefed on keeping the AC thermostat at 24 °C so as to accurately monitor the consumption and reduce variability in the analysis. Further the AC units installed in the two test rooms under consideration are of different cooling capacities and therefore the consumption for the 2 RT AC in Internal Audit Department had to be scaled down for 1.5 RT. Consumption was noted for periods when both units were operational to avoid any over statement in claiming for excessive energy saving. The effect of room size, window and occupancy are also incorporated in calculating the **41%** saving in HVAC electricity consumption.

## Financial Analysis

| | |
|---|---|
| **CAPEX for Chief Int. Aud Room (PKR)** | **12600** |
| **Average units saved for 1.5 RT AC in a month** | 42 |
| **Saving in PKR/month/1.5RT** | 840 |
| **Yearly Saving (PKR)** | 10080 |
| **IRR** | 43% |
| **Pay back period (Years)** | 1.3 |

This shows that the small initial investment leads to high energy savings and results in a short pay back period of only **1.3 years**