



Founded 1905

THE NATIONAL UNIVERSITY of SINGAPORE

10 June 1999

Mr Chu Wing Chiu
V-KOOL HONGKONG LTD
Room 2007 Shatin 11 Plaza
No. 11 Wo Shing Street Fo Tan
Shatin N. T. Hongkong

Dear Mr Chu,

ENERGY AUDIT CALCULATION FOR SOUTH CHINA MORNING POST BUILDING

I've enclosed the energy audit calculation for South China Morning Post and all the necessary supporting documents for your perusal.

The audit calculation shows a reasonable amount of cost saving after using V-KOOL 70, given the set assumptions; the calculations suggest a saving varying from HK\$241,964 to HK\$536,364 per annum, depending on the glass types used.

I appreciate your seeking my expertise in this prestige project.

Yours sincerely

S.P. Rao
Chartered Engineer
Associate Professor
School of Architecture
National University of Singapore

cc. Cyrus Wee - GMX

Day Total Heat Gain

The Day Total Heat Gain is the sum of Solar Heat Gain and the Air/Air conducted Heat with the consideration of hours of exposure.

When the average temperature difference between outdoor and indoor is 12°C for 6 months

Skylight Elevation Consideration

① 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.87) + (5.69 \text{ W/m}^2\text{C} \times 12^{\circ}\text{C} \times 12 \text{ hrs}) \\ & = 5689.94 \text{ Wh/m}^2 + 819.36 \text{ Wh/m}^2 \\ & = 6509.30 \text{ Wh/m}^2 \\ & = \boxed{6.51 \text{ kWh/m}^2} \end{aligned}$$

② V-KOOL 70 with 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.46) + (5.63 \text{ W/m}^2\text{C} \times 12^{\circ}\text{C} \times 12 \text{ hrs}) \\ & = 3008.47 \text{ Wh/m}^2 + 810.72 \text{ Wh/m}^2 \\ & = 3819.19 \text{ Wh/m}^2 \\ & = \boxed{3.82 \text{ kWh/m}^2} \end{aligned}$$

③ 10 mm Parsol Green Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.53) + (6.07 \text{ W/m}^2\text{C} \times 12^{\circ}\text{C} \times 12 \text{ hrs}) \\ & = 3466.28 \text{ Wh/m}^2 + 874.08 \text{ Wh/m}^2 \\ & = 4340.36 \text{ Wh/m}^2 \\ & = \boxed{4.34 \text{ kWh/m}^2} \end{aligned}$$

④ V-KOOL 70 with 10 mm Parsol Green Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.35) + (5.66 \text{ W/m}^2\text{C} \times 12^{\circ}\text{C} \times 12 \text{ hrs}) \\ & = 2289.06 \text{ Wh/m}^2 + 829.44 \text{ Wh/m}^2 \\ & = 3118.50 \text{ Wh/m}^2 \\ & = \boxed{3.12 \text{ kWh/m}^2} \end{aligned}$$

East Elevation Consideration

① 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (3427 \text{ Wh/m}^2 \times 0.87) + (5.69 \text{ W/m}^2\text{C} \times 12^{\circ}\text{C} \times 12 \text{ hrs}) \\ & = 2981.25 \text{ Wh/m}^2 + 819.36 \text{ Wh/m}^2 \\ & = 3800.61 \text{ Wh/m}^2 \\ & = \boxed{3.80 \text{ kWh/m}^2} \end{aligned}$$

② V-KOOL 70 with 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (3427 \text{ Wh/m}^2 \times 0.46) + (5.63 \text{ W/m}^2\text{C} \times 12^{\circ}\text{C} \times 12 \text{ hrs}) \\ & = 1576.29 \text{ Wh/m}^2 + 810.72 \text{ Wh/m}^2 \\ & = 2387.01 \text{ Wh/m}^2 \\ & = \boxed{2.39 \text{ kWh/m}^2} \end{aligned}$$

When the average temperature difference between outdoor and indoor is 2 °C for 6 months

Skylight Elevation Consideration

① 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.87) + (5.69 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\ & = 5689.94 \text{ Wh/m}^2 + 136.56 \text{ Wh/m}^2 \\ & = 5826.50 \text{ Wh/m}^2 \\ & = 5.83 \text{ kWh/m}^2 \end{aligned}$$

② V-KOOL 70 with 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.46) + (5.63 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\ & = 3008.47 \text{ Wh/m}^2 + 135.12 \text{ Wh/m}^2 \\ & = 3143.59 \text{ Wh/m}^2 \\ & = 3.14 \text{ kWh/m}^2 \end{aligned}$$

③ 10 mm Parsol Green Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.53) + (6.07 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\ & = 3466.28 \text{ Wh/m}^2 + 145.68 \text{ Wh/m}^2 \\ & = 3611.96 \text{ Wh/m}^2 \\ & = 3.61 \text{ kWh/m}^2 \end{aligned}$$

④ V-KOOL 70 with 10 mm Parsol Green Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (6540 \text{ Wh/m}^2 \times 0.35) + (5.76 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\ & = 2289.06 \text{ Wh/m}^2 + 138.24 \text{ Wh/m}^2 \\ & = 2427.30 \text{ Wh/m}^2 \\ & = 2.43 \text{ kWh/m}^2 \end{aligned}$$

East Elevation Consideration

① 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (3427 \text{ Wh/m}^2 \times 0.87) + (5.69 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\ & = 2981.25 \text{ Wh/m}^2 + 136.56 \text{ Wh/m}^2 \\ & = 3117.81 \text{ Wh/m}^2 \\ & = 3.12 \text{ kWh/m}^2 \end{aligned}$$

② V-KOOL 70 with 10 mm Clear Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (3427 \text{ Wh/m}^2 \times 0.46) + (5.63 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\ & = 1576.29 \text{ Wh/m}^2 + 135.12 \text{ Wh/m}^2 \\ & = 1711.41 \text{ Wh/m}^2 \\ & = 1.71 \text{ kWh/m}^2 \end{aligned}$$

③ 10 mm Parsol Green Glass

$$\begin{aligned} & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\ & (3427 \text{ Wh/m}^2 \times 0.53) + (6.07 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\ & = 1816.16 \text{ Wh/m}^2 + 145.68 \text{ Wh/m}^2 \\ & = 1961.84 \text{ Wh/m}^2 \\ & = 1.96 \text{ kWh/m}^2 \end{aligned}$$

This copy of document is for a reference only. It is not valid unless this certificate being certified by Winhop Projects (HK) Limited after our "supply & installation" of the V-KOOL® Film

③ V-KOOL 70 with 10 mm Parsol Green Glass

$$\begin{aligned}
 & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\
 & (3427 \text{ Wh/m}^2 \times 0.35) + (5.76 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\
 & = 1199.35 \text{ Wh/m}^2 + 138.24 \text{ Wh/m}^2 \\
 & = 1337.59 \text{ Wh/m}^2 \\
 & = \boxed{1.34 \text{ kWh/m}^2}
 \end{aligned}$$

► West Elevation Consideration

③ 10 mm Clear Glass

$$\begin{aligned}
 & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\
 & (3421 \text{ Wh/m}^2 \times 0.87) + (5.69 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\
 & = 2975.89 \text{ Wh/m}^2 + 136.56 \text{ Wh/m}^2 \\
 & = 3112.45 \text{ Wh/m}^2 \\
 & = \boxed{3.11 \text{ kWh/m}^2}
 \end{aligned}$$

③ V-KOOL 70 with 10 mm Clear Glass

$$\begin{aligned}
 & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\
 & (3421 \text{ Wh/m}^2 \times 0.46) + (5.63 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\
 & = 1573.46 \text{ Wh/m}^2 + 135.12 \text{ Wh/m}^2 \\
 & = 1708.58 \text{ Wh/m}^2 \\
 & = \boxed{1.71 \text{ kWh/m}^2}
 \end{aligned}$$

③ 10 mm Parsol Green Glass

$$\begin{aligned}
 & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\
 & (3421 \text{ Wh/m}^2 \times 0.53) + (6.07 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\
 & = 1812.90 \text{ Wh/m}^2 + 145.68 \text{ Wh/m}^2 \\
 & = 1958.58 \text{ Wh/m}^2 \\
 & = \boxed{1.96 \text{ kWh/m}^2}
 \end{aligned}$$

③ V-KOOL 70 with 10 mm Parsol Green Glass

$$\begin{aligned}
 & (\text{Solar Heat Gain Factor} \times \text{Shading Coefficient}) + (\text{U-Factor} \times \text{Temp. Difference} \times \text{Hours of Exposure}) \\
 & (3421 \text{ Wh/m}^2 \times 0.35) + (5.76 \text{ W/m}^2\text{°C} \times 2 \text{ °C} \times 12 \text{ hrs}) \\
 & = 1197.20 \text{ Wh/m}^2 + 138.24 \text{ Wh/m}^2 \\
 & = 1335.44 \text{ Wh/m}^2 \\
 & = \boxed{1.34 \text{ kWh/m}^2}
 \end{aligned}$$

The Day-Long Heat Reduction, In this consideration is:

V-KOOL 70 with 10 mm Clear Glass

2.68 kWh/m ²	Skylight Elevation Consideration (46%)
1.41 kWh/m ²	East Elevation Consideration (45%)
1.40 kWh/m ²	West Elevation Consideration (45%)

V-KOOL 70 with 10 mm Parsol Green Glass

1.18 kWh/m ²	Skylight Elevation Consideration (33%)
0.62 kWh/m ²	East Elevation Consideration (32%)
0.62 kWh/m ²	West Elevation Consideration - (32%)

This copy of document is for a reference only. It is not valid unless this certificate being certified by Winproj Projects (HK) Limited after our "supply & installation" of the V-KOOL® Film

Sketch of South China Morning Post Building Glass Profile

