Case Study:
Energy use & light transmission in machine shops, Sunsky vs. FRP sheets

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Energy use & light transmission in machine shops, SunSky® vs. FRP sheets

Purpose:
Evaluate lifecycle energy savings & lumen depreciation of Standard FRP (Fiberglass Reinforced Plastic) Sheets available in the market & SunSky polycarbonate sheet produced by Palram, Ltd.

Method:
For our detailed study, we selected a pair of near identical machine shop sheds, which had an area of approximately 12,910 sq. ft.

The units operated for 24 hours a day and for 300 days a year and were illuminated by 200 Watt metal halide lamps. By installing an energy meter in the Main Lighting Distribution Board of the respective units, we measured power consumption over a week before sheets were installed on the roof covering to provide daylight in the shed. We took an identical set of measurements to record the illuminance level at different times of day at various places. The SunSky sheets were installed on the roof of one of the sheds while standard FRP sheets were installed on the roof of the other shed. We installed a timer to note and monitor the period during which the lamps were actually switched off.

We monitored the energy consumption as well as off time of the lamps by noting the requisite data on a day-to-day basis. The illuminance levels were measured once per week at different times of the day in both sheds at the same time intervals; the test continued for five years. After five years there was virtually no savings in the unit with the FRP sheets due to reduced light transmission of the FRP sheets over time.

Observations & Findings:
**Case Study**

**Quick Reference for Installation Details**

<table>
<thead>
<tr>
<th>Unit 1: 12,910 sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width of the premises ft.</td>
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<tr>
<td>Length of the premises ft.</td>
</tr>
<tr>
<td>Area of the premises ft²</td>
</tr>
<tr>
<td>Height of fitting from working level ft</td>
</tr>
<tr>
<td>Operation Hr/day</td>
</tr>
<tr>
<td>Operation Day/year</td>
</tr>
<tr>
<td>Type of lamp</td>
</tr>
<tr>
<td>Rating of the lamp W</td>
</tr>
<tr>
<td>Number of fittings</td>
</tr>
<tr>
<td>Average Illuminance Lux</td>
</tr>
<tr>
<td>Duration of the measurement hr</td>
</tr>
<tr>
<td>Annual power consumption kWh</td>
</tr>
<tr>
<td>Cost of Translucent sheets USD</td>
</tr>
</tbody>
</table>

**Unit 2: 12,910 sq. ft.**

- Width of the premises ft: 98.4
- Length of the premises ft: 131.2
- Area of the premises ft²: 12910
- Height of fitting from working level ft: 14.8
- Operation Hr/day: 24
- Operation Day/year: 300
- Type of lamp: Metal Halide
- Rating of the lamp W: 250
- Number of fittings: 20
- Average Illuminance Lux: 200
- Duration of the measurement hr: 24
- Annual power consumption kWh: 36000
- Cost of Translucent sheets USD: $1,489.20

**Economics**

- Year 1: Savings $1,427.15
- Year 2: Savings $2,997.02
- Year 3: Savings $4,709.61
- Year 4: Savings $6,564.90
- Year 5: Savings $8,562.92

**Comparison with FRP Sheets**

- Year 1: Savings $62.05
- Year 2: Savings $459.75
- Year 3: Savings $1,139.82
- Year 4: Savings $2,351.95
- Year 5: Savings $4,025.65

**Lighting Specs**

- Bulb: Metal Halide
- Wattage: 250
- Avg. Illum.: 200 Lux

**Operating Time and Duration of Measurement**

- 24 Hours/Day
- 300 Days/Year

**Actual Measurements**

*Duration of the test: April 2007 through September 2012*

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>FRP Sht. Year 1</th>
<th>SunSky Year 2</th>
<th>FRP Sht. Year 3</th>
<th>SunSky Year 4</th>
<th>FRP Sht. Year 4</th>
<th>SunSky Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illuminance Lux</td>
<td>185</td>
<td>472</td>
<td>448</td>
<td>465</td>
<td>115</td>
<td>461</td>
<td>87</td>
</tr>
<tr>
<td>Time - Lamp Off Hr/day</td>
<td>11</td>
<td>11.5</td>
<td>9.2</td>
<td>11.5</td>
<td>7.6</td>
<td>11.5</td>
<td>7.6</td>
</tr>
<tr>
<td>Days - Lamp Off Days</td>
<td>300</td>
<td>300</td>
<td>280</td>
<td>300</td>
<td>257</td>
<td>300</td>
<td>225</td>
</tr>
<tr>
<td>Lamp On All Day Days</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Energy Savings kWh</td>
<td>16500</td>
<td>17250</td>
<td>12880</td>
<td>17250</td>
<td>10400</td>
<td>17250</td>
<td>5980</td>
</tr>
<tr>
<td>USD</td>
<td>1,365.10</td>
<td>1,427.15</td>
<td>1,172.17</td>
<td>1,569.87</td>
<td>1,032.51</td>
<td>1,712.58</td>
<td>643.17</td>
</tr>
</tbody>
</table>
Observation & Conclusion:

- **SunSky** provided a higher and more uniform illuminance level than standard FRP sheets over the entire period of five years. The illuminance level of SunSky averaged at 450 Lux whereas FRP sheets averaged approximately 125 Lux during the same period.

- The unit with FRP Sheets observed lumen depreciation of 66% as against approximately 5% for the unit with SunSky during the period of five years.

- The unit with FRP sheets was forced to switch on the artificial light during daytime on rainy/cloudy days right from day one; switching on the artificial light kept increasing over the test period. The unit with SunSky never switched on the artificial light during day time during entire period of five years.

- The unit with FRP sheets required switching to artificial lighting in twilight zones - evening as well as morning; but no such concern was felt by the unit with SunSky. The “Lamp on Period” kept on increasing during twilight period as the days passed by.

- At the end of third year/beginning of fourth year, the unit with FRP sheets switched on lamps throughout the day to illuminate critical areas; requirement of artificial illuminance increased as the days passed. The unit with SunSky required no artificial illumination to supplement the lighting.

- At the end of fifth year the unit with FRP sheets had to switch on all the lamps since the sheets became practically opaque whereas the unit with SunSky could easily rely on natural daylight.

### About PALRAM

With 50 years of expertise in the industry, PALRAM has established manufacturing, distribution and sales operations across seven continents and 120 countries around the world. Palram markets its products to the sign and graphics market, as well as to the commercial, industrial, residential, marine, and do-it-yourself construction markets.

Palram corrugated polycarbonate products are sold under the trade name Suntuf® (and SunSky in North America). Palram also offers the MetalMatch™ technology, allowing the use of SUN-TUF polycarbonate panels for daylighting options with virtually any metal profile available. Suntuf is offered in a range of colors, including a soft white to eliminate glare. Palram also offers Sunlite®, a multi-wall polycarbonate sheet for skylights, roof lights, or side-lighting applications.

### About SENERGY Consultants

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Senergy was founded with this concept in early 1990 and has grown up with the same. Senergy believes that ultimate aim of energy study is actual realization of the savings. Senergy provides frank and practical solutions. A base of over 1000 satisfied Clients with many repeat orders from their Sister / Associate Concerns serves as testimony of Senergy’s capabilities and results. Senergy is empanelled Consultant with Maharashtra Energy Development Agency (MEDA) & Gujarat Energy Development Agency (GEDA).

Senergy has Accredited and Certified Energy Auditors by Bureau of Energy Efficiency.