# THERMOSHIELD®

thermal insulation coating

ARDENT LEISURE | kingpin BOWLING


Heat Reduction | Energy Efficiency

CORROSION control

Waterproof

THERMOSHIELD PROUDLY MADE IN AUSTRALIA

10 YEAR warranty

ISO 9001 & 14001 Certified

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## Energy Efficiency | Performance Review | Project summary

**Project Site:** KingPin - Townsville

**Site address:** 16 High Range Dr, Thuringowa Central QLD 4817

## Executive summary

KingPin Townsville was isolated as being a site of concern for excess electricity consumption.

The key points of concern were usage charges being applied on the landlords imbedded networks & seasonal peaks in consumption during hotter months. With year round heat, the need to run the site HVAC more efficiently was a standout area of concern, for overall site electrical reduction.

The Building Management System (BMS) was installed in order to track & isolate spikes in the metered consumption, as well as provide the ability to better tailor the sites

The Thermoshield coating was applied with the view to assist reducing the load on the HVAC system that runs at near peak capacity for the vast majority of the year.

The report will show the coating has been highly successful in reducing total kWh usage.

Total site electricity usage is consistently down per month, on a year on year comparative basis in the vicinity of 15%-20%. Project payback is on target to be achieved inside 2 years.

KinPin centres consume a lot of electricity for general operations during evenings, when HVAC usage is at its lowest requirements. As a result, a 15-20% reduction in total site usage, equates to an approximate 50% reduction in HVAC usage.

Section 1: **Background | Electricity review:**

The below table collates all the 2014 electricity usage for KingPin, Townsville:

| Bill cycle | | | Month | Total kwh | Daily AVG | Cost per kWh | Usage Costs | Demand charge p/kW | Demand Cost | Service fee p/day | Service fee cost | TOTAL COST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02-Jan-14 | 03-Feb-14 | 32 | Jan-14 | 100,550 | 3,142 | $0.1167 | $11,731 | $32.1981 | $8,017 | $27.08163 | $867 | $20,615 |
| 03-Feb-14 | 03-Mar-14 | 28 | Feb-14 | 81,417 | 2,908 | $0.1167 | $9,499 | $28.1734 | $7,297 | $27.08163 | $758 | $17,554 |
| 03-Mar-14 | 01-Apr-14 | 29 | Mar-14 | 80,627 | 2,780 | $0.1167 | $9,407 | $29.1796 | $7,237 | $27.08163 | $785 | $17,429 |
| 01-Apr-14 | 02-May-14 | 31 | Apr-14 | 86,194 | 2,780 | $0.1167 | $10,056 | $31.1919 | $7,205 | $27.08163 | $840 | $18,101 |
| 02-May-14 | 02-Jun-14 | 31 | May-14 | 76,886 | 2,480 | $0.1167 | $8,970 | $31.1919 | $7,299 | $27.08163 | $840 | $17,109 |
| 02-Jun-14 | 30-Jun-14 | 28 | Jun-14 | 69,828 | 2,494 | $0.1167 | $8,147 | $28.1734 | $5,691 | $27.08163 | $758 | $14,596 |
| 30-Jun-14 | 01-Aug-14 | 32 | Jul-14 | 69,414 | 2,169 | $0.1167 | $7,234 | $36.359 | $4,363 | $168.07334 | $5,378 | $16,975 |
| 01-Aug-14 | 01-Sep-14 | 31 | Aug-14 | 72,000 | 2,323 | $0.1042 | $7,502 | $35.000 | $3,500 | $168.07334 | $5,210 | $16,213 |
| 01-Sep-14 | 01-Oct-14 | 30 | Sep-14 | 75,835 | 2,528 | $0.1042 | $7,903 | $34.083 | $2,965 | $168.07334 | $5,042 | $15,910 |
| 01-Oct-14 | 01-Nov-14 | 31 | Oct-14 | 80,898 | 2,610 | $0.1042 | $8,430 | $35.2187 | $3,451 | $168.07334 | $5,210 | $17,092 |
| 01-Nov-14 | 01-Dec-14 | 30 | Nov-14 | 87,727 | 2,924 | $0.1042 | $9,142 | $34.0826 | $3,613 | $168.07334 | $5,042 | $17,797 |
| 01-Dec-14 | 02-Jan-15 | 32 | Dec-14 | 94,633 | 2,957 | $0.1042 | $9,862 | $36.3548 | $4,399 | $168.07334 | $5,378 | $19,639 |
| | | 365 | | 976,009 | 2,674 | total usage: | **$107,883** | demand charges: | $65,037 | service fees: | $36,109 | **$209,029** |

Findings:

- The site consumes nearly 1 million kWh annually.
- Being on a landlord's imbedded network presents many issues & frustrations for the tenant. Besides the volume of kWh usage (976,000 consumed) - most obvious points to note are the very high demand charges & service fee costs.
- Around July, the price p/kwH was reduced by 10% - but service fee was raised by 520%!
- It appears the landlord wishes to appear '*cheap*' by charging low rate per kWh but this is more than offset by exceptionally high demand & service fees.
- There is no differentiation between peak & off peak rates.
  Tenant pays a flat rate per/kWh regardless of peak or off peak usage.
- There is a clear seasonal increase and decline in total kWh consumption.
  This would indicate HVAC operation accounts for the seasonal trend of increased usage in hotter months.

## Section 2: **Overview –** building original condition & project methodology

Below is an aerial photo of the original condition of the site:

The site itself appears to be a large low pitched roof, with aged (& stained) zincalume steel sheeting. The roof area is approximately 3,900m$^2$ & would absorb extreme solar radiation exposure.

The key variant in surface would be the ability for the ceramic coating to re-radiate heat away from the surface (emissivity) whereas the stained zincalume steel sheeting absorbs nearly all the solar radiation it's exposed to, causing sheet temperatures to soar and transfer into the building:

| Zincalume sheeting (weathered) | | Thermoshield coating | |
|---|---|---|---|
| Emissivity | 0.10 | Emissivity | 0.90 |
| Solar Absorbtance | 0.65 | Solar Absorbtance | 0.18 |

**Project methodology**

The 2 major implementations were the installation of a building management system (BMS) & application of the Thermoshield, ceramic insulation coating.

The BMS system allows HVAC equipment to run off temperature sensors that are placed in more realistic areas of the building. This allows the system to provide cooling more accurately as it is tailored to patron comfort.

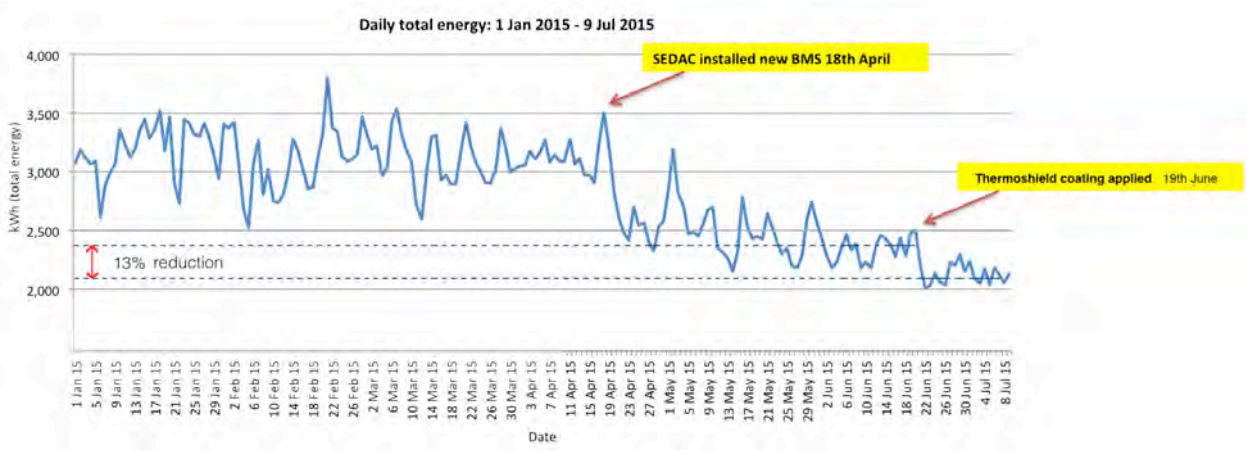
The Thermoshield, ceramic insulation coating is to be applied to the roof & prevent heat transfer into the building envelope itself. This is designed to reduce the cooling load of the existing HVAC system.

The BMS provides a direct feed to the site meter & allows to download past & live data.

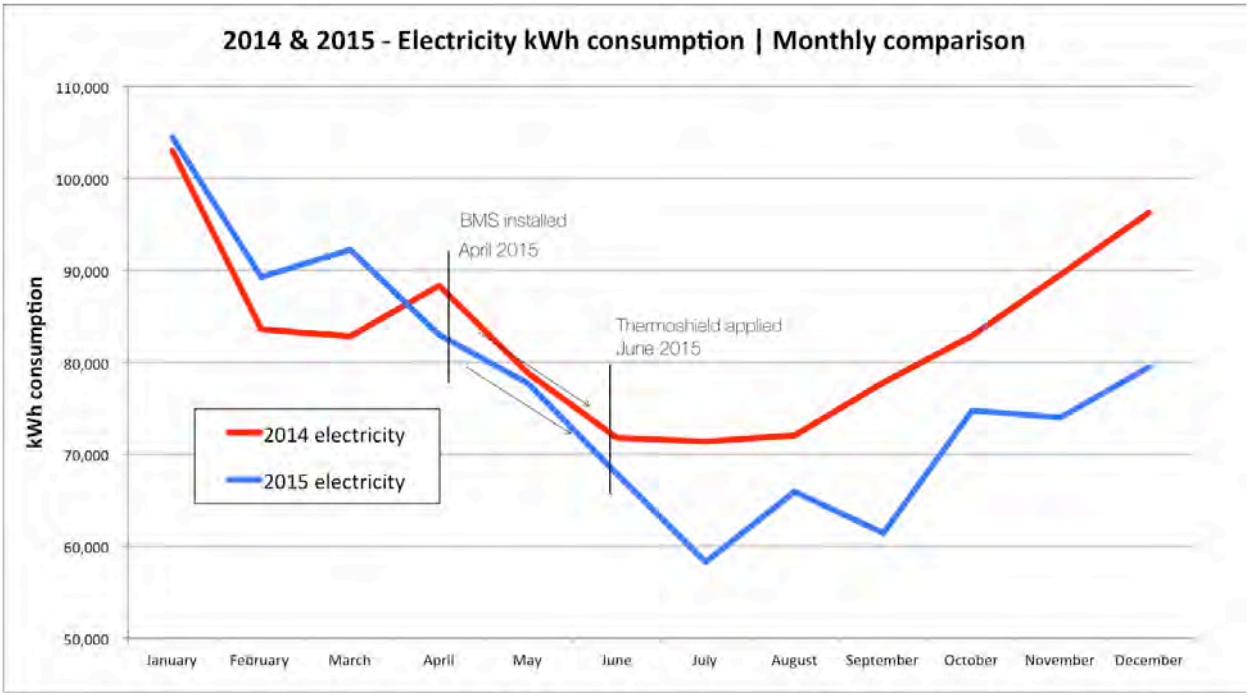
Section 3: **Performance findings –** Reductions yielded thus far

The BMS system was installed on April 18th 2015.

From the downloaded data from the BMS, it appeared to have a noticeable impact:




However when overlaying the 2014 electricity consumption with 2015, you can see the BMS installation had failed to make a noticeable decoupling from the trend or seasonal decline, whereas the Thermoshield ceramic coating made a highly noticeable reduction:



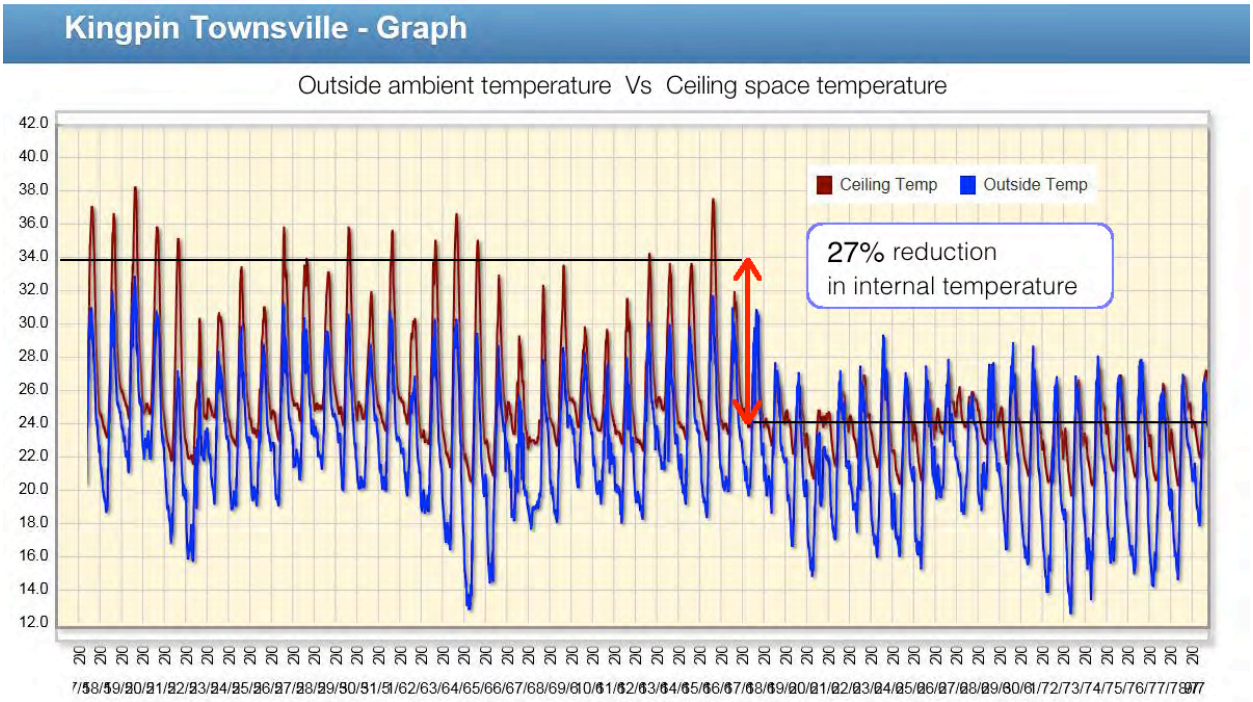

The KingPin Townsville electricity usage is highly correlated to the gradual increases and decreases in temperatures.

This makes us safely assume HVAC efficiencies can greatly reduce overall site electricity, particularly in hotter months.

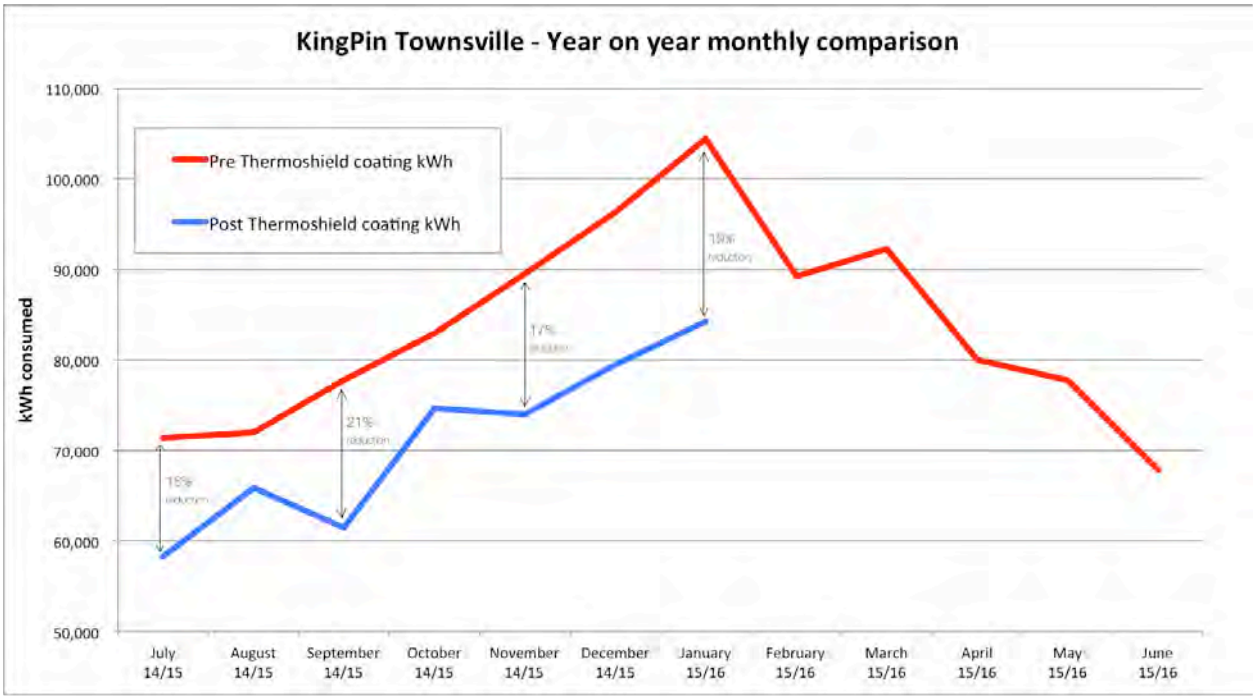
Section 3: **Performance findings –** continued:

If we focus on the Thermoshield coating alone, its core function is to prevent radiant & convection heat caused by solar radiation from entering into the building itself.

From the a BMS temperature logger installed in the ceiling cavity – we can see that the coating made an immediate impact on reducing the internal temperature:




Once we have determined that the coating is achieving its core function by removing heat, we can see if it is correlating to less kWh consumption:




***data sourced from billing, not BMS data***

Section 3: **Performance findings –** continued:

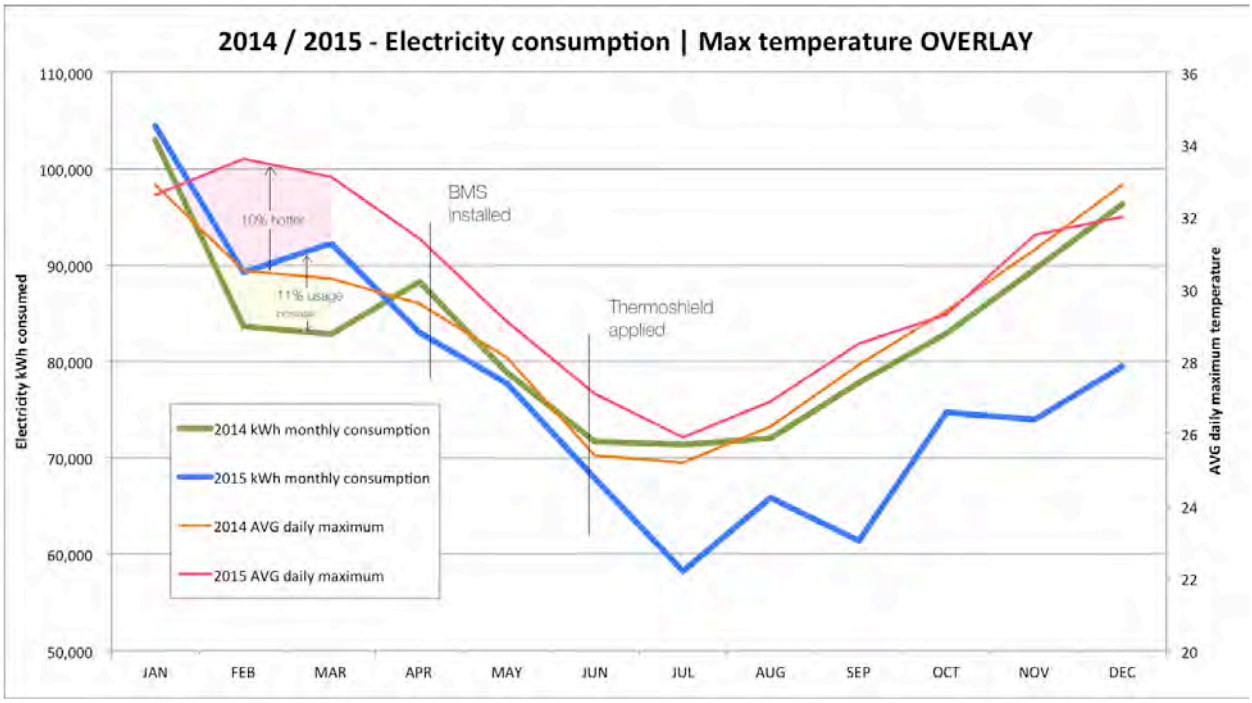
Before signing off as successful & quantifying the savings, it is important to gauge if the weather is providing a significant impact.

A 1-2 degree increase in average daily maximum can greatly effect HVAC load.

The same can be said about adjusting a thermostat. Lowering internal temperature requirement from 24d C to 23d C to increase comfort, can make a huge impact on baseline comparison.

Below graph overlays:

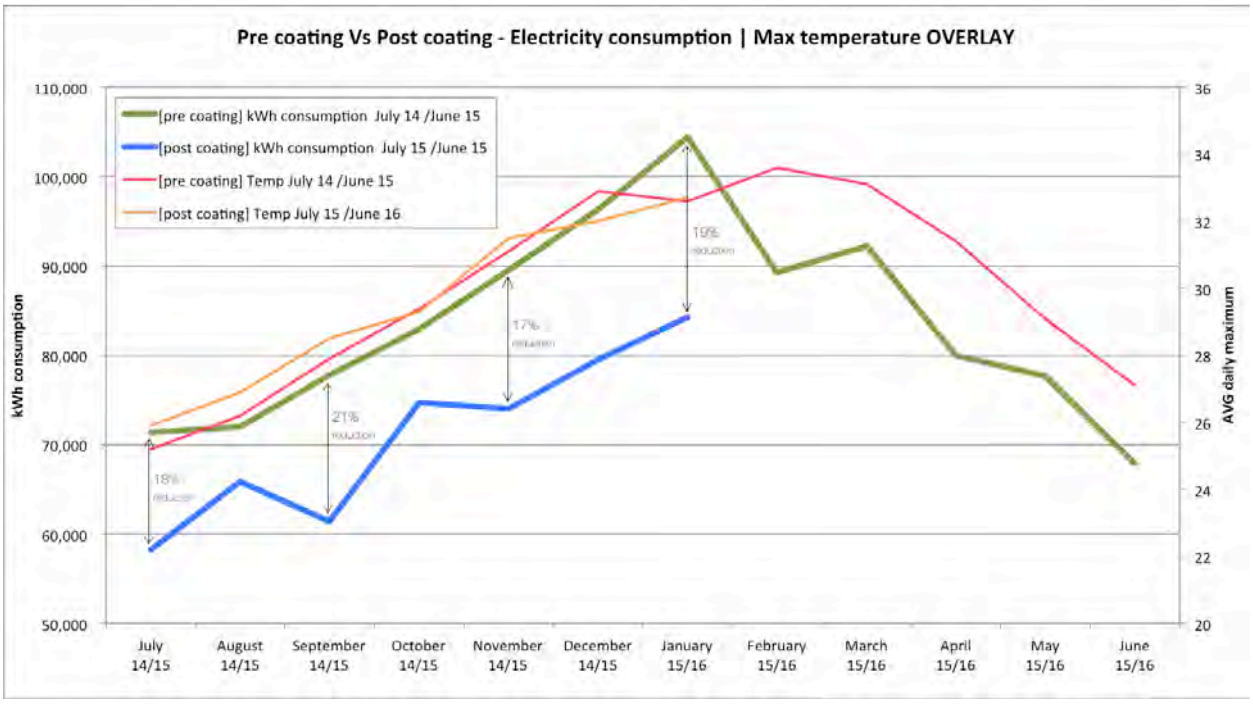
- 2014 Townsville maximum daily average temperature
- 2015 Townsville maximum daily average temperature
- 2014 KingPin electricity consumption
- 2015 KingPin electricity consumption




- You can see the 2014 electricity consumption is almost perfectly correlated to the 2014 average daily maximum temperature.
- You can see the first 3-4 months of 2015, temperatures in Townsville were 5-10% hotter on average.
- February & March 2015 were significantly warmer than 2014 – resulting in electricity usage for these months to spike by around the same percentage amount
- BMS installation failed to make a noticeable impact on reduction in excess to regular seasonal decline.
- *Following Thermoshield application, site electrical usage reductions begin to decouple significantly from seasonal & temperature trends. Showing very strong results.*

Section 3: **Performance findings –** continued:

If we isolate & compare the 12 month period pre coating & post coating against the season temperature overlay, we are able to fully verify the findings thus far:




You can see Townsville have incurred near identical temperature exposure for the period of review. If 2015 were to have been cooler than 2014 – the reductions in electrical usage would be as much (or more) to do with lower temperatures, as it would be to do with the coating.

**Point to note:**

February 2015 appeared to have a significant fall in electricity consumption, during a period where February 2015 was in fact hotter than January 2015. This demonstrates a strong reversal against the long term trend which would indicate that operationally, the site used less electricity.

This could be a downturn in laser skirmish (school holidays over?), less bowling (in between seasons?) or something of this nature to explain the reversal of trend.

**Performance findings conclusion:**

The core function of the BMS & coating is to reduce kWh consumption. This appears to have been met to our levels of expectations.

A 15% reduction in site use, is estimated at being an approximate 50% reduction in the HVAC usage specifically.

A very pleasing result.

Section 4: **Financial benefits**

With site operations being consistent & temperature exposures being identical, we can ascertain the below savings have been yielded:

| Pre coating | | Post coating | | Year on year monthly reduction | kWh saved | |
|---|---|---|---|---|---|---|
| Jul-14 | 71,372 kWh | Jul-15 | 58,246 kWh | 18.39% | 13,126 | kWh |
| Aug-14 | 72,000 kWh | Aug-15 | 65,883 kWh | 8.50% | 6,117 | kWh |
| Sep-14 | 77,807 kWh | Sep-15 | 61,427 kWh | 21.05% | 16,380 | kWh |
| Oct-14 | 82,916 kWh | Oct-15 | 74,702 kWh | 9.91% | 8,214 | kWh |
| Nov-14 | 89,545 kWh | Nov-15 | 74,014 kWh | 17.34% | 15,531 | kWh |
| Dec-14 | 96,329 kWh | Dec-15 | 79,531 kWh | 17.44% | 16,798 | kWh |
| Jan-15 | 104,413 kWh | Jan-16 | 84,282 kWh | 19.28% | 20,131 | kWh |
| | | | | TOTAL kWh SAVED: | 96,296 | kWh |

Based on the above 7 months savings & extrapolating the current seasonal savings trends, below table combines savings thus far, with anticipated savings for the 12 month period following the BMS & coating installation:

| | Price p/kWh | kWh saved | Savings generated |
|---|---|---|---|
| Savings under [redacted] - July \| December 2015 | $0.1048 | 76,166 | $7,982.20 |
| ***New rates*** under [redacted] - January 2015 | $0.22436 | 20,131 | $4,516.51 |
| Anticipated reductions - February \| June 2016 | $0.22436 | 68,783 | $15,432.18 |
| | | **Year 1 - On target savings:** | **$27,930.89** |

| | Price p/kWh | kWh saved | Savings generated |
|---|---|---|---|
| Anticipated reductions - July 2016 \| June 2016 | $0.22436 | 165,079 | $37,037.23 |
| | | **Year 2 - On target savings:** | **$37,037.23** |

Section 4: **Financial benefits** continued:

Based on the performances yielded thus far, the 2 year target for savings is on track to yield:

- Year 1 to yield $27,930
- Year 2 to yield $37,037
- **2 year return** **$64,967**

**Based on these figures, project payback is on target at being 2 years**

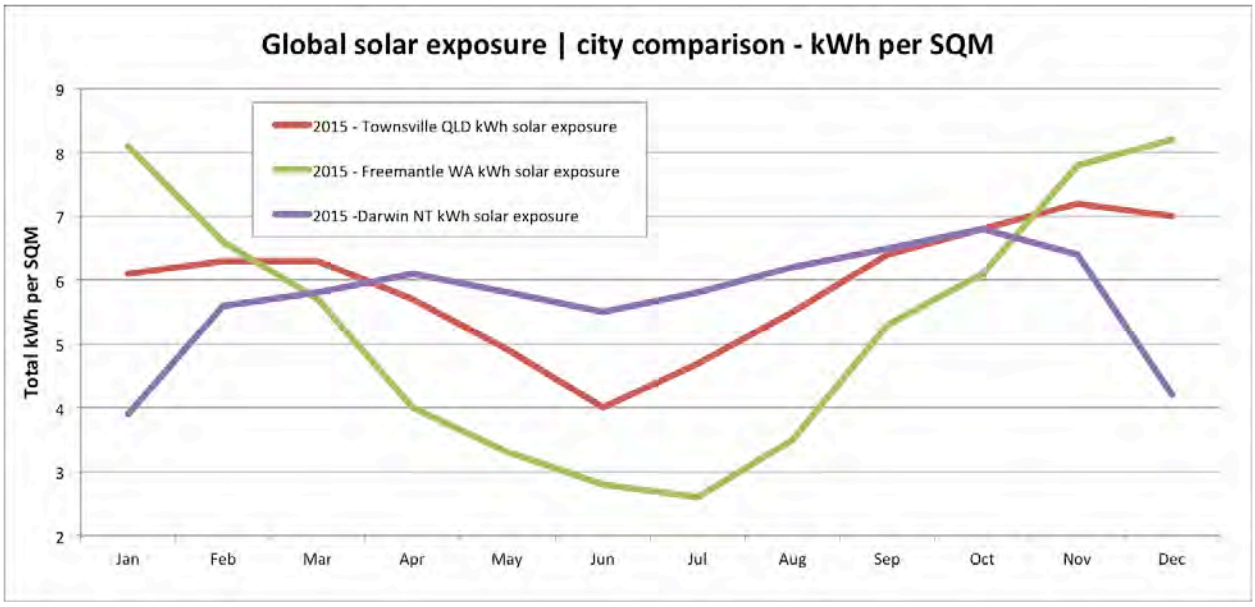
If the tenant were on the current landlord pricing (higher cost p/kWh & zero fixed costs), the payback would have been on target for 18 months.

Section 4: **Conclusions, findings & recommendations:**

Townsville is an excellent region for energy efficient investment, as it encounters 'year round' heat. However, ambient temperature & HVAC efficiency are not as strongly correlated as **solar exposure**. Cloud cover or "*hazy*" air quality can both assist it keeping heat off a roof, therefore out of a building due to reducing peak solar radiation. The amount of direct sunlight causes the roof sheet metal to soar & emit the heat into the building envelope itself.

On a 25 degree day with peak solar radiation *can* provide more stress on HVAC than a cloud 35 degree humid day, as the roof temperatures a prevented from reaching the 80-90dC mark.

The below graph demonstrates this point. The below cities all experience high temperatures, but differ in their patterns for direct solar exposure. This needs to be considered when reviewing future projects:



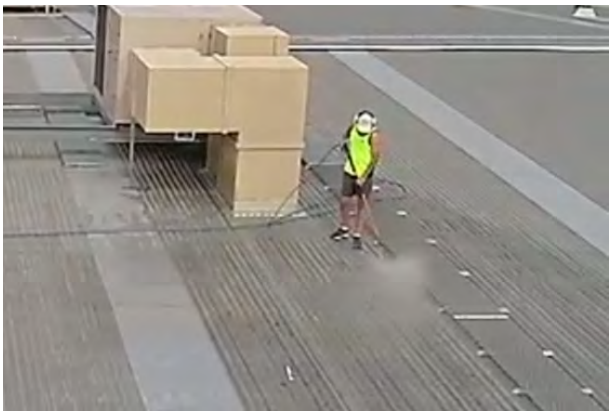

Global solar exposure is the total amount of solar energy falling on a horizontal surface.

The daily global solar exposure is the total solar energy for a day. Typical values for daily global solar exposure range from 1 to 10 kWh/m2.

Section 5: **Coating application | Project delivery:**

**Power washing:**

Roof cleaning was carried out to remove all loose debris, dirt & grime:



**Etch primer coating:**

Applied prior to coating to ensure maximum adhesion. Goes on light green, dries clear:

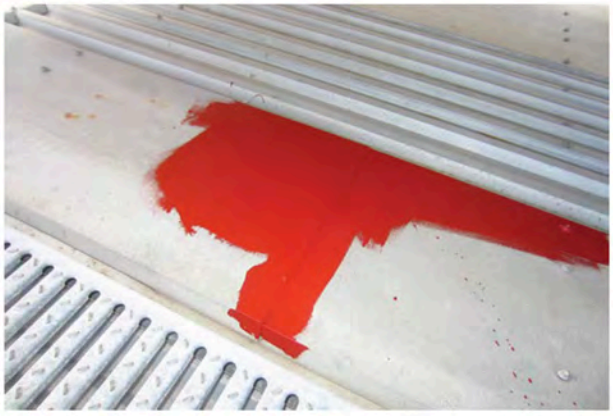
Re-coating zincalume alloy sheeting can often incur issues with adhesion.

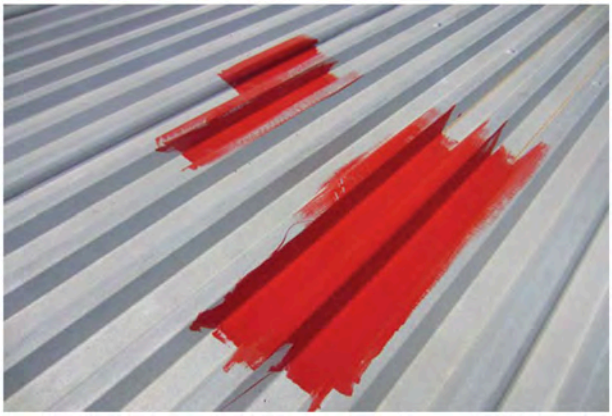
Primer removes any potential issues that could occur & will ensure coating longevity.

Section 5: **Coating** continued:

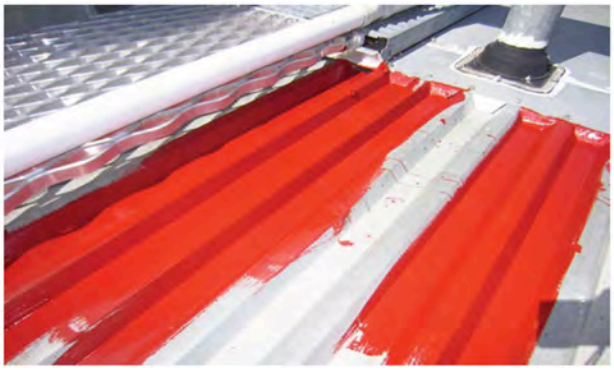
In addition to etch priming, we noticed there we many areas of isolated corrosion.

Prior to coating, we applied a thick layer of rust converter. This was not included in the scope of works, but we felt it would greatly assist the overall longevity of the roof:







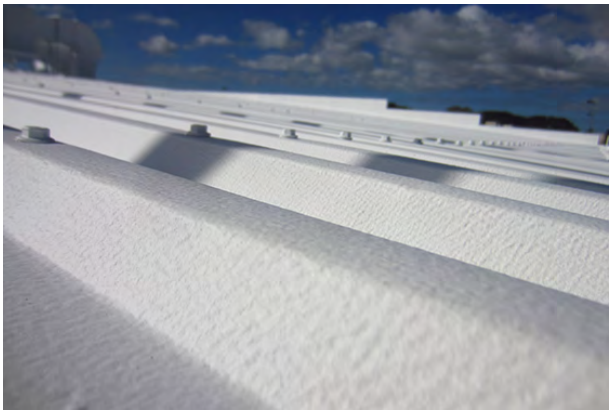
**Section 5: Coating continued:**

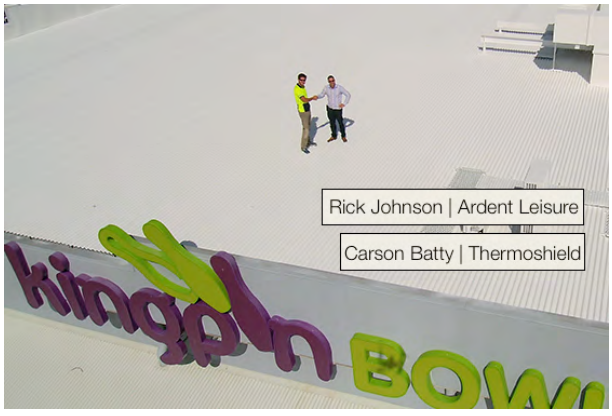
**First Coat |** commencement & completion:



**Section 5: Coating continued:**

**Second Coat |** commencement & completion:



**Section 5: Coating completed:**

**Before & after:**



**Section 6: Closing Summary | Benefits achieved:**

- Internal ceiling temperatures reduced by up to 27%
- 96,000 kWh saved in 7 months – compared to year prior monthly usage
- Approximately 85 tonnes of carbon emissions prevented
- Townsville temperatures have been hotter post coating – fortifying the savings
- Metal sealed beneath a 350micron membrane barrier.
  Resulting in the underlying metal being shielded from all water & oxygen exposure, eliminating the ability to rust – significantly prolonging the expected life of the roof.
- Due to lower use, the coating will lower maintenance requirements for the A/C system
- Prolonging the life of the A/C system
- Mitigating your community's 'Urban Heat Island Effect'
- Increase ecological sustainability factor – making your building "greener"

## Section 7: Next steps & closing:

As new bills are received, the resulting data will be added to the ongoing evaluation.

With the tenant due to move off the landlord imbedded network & due to move to a retailer of their choice – the basis for billing design will likely change.

The total kWh charged will continue to be recorded & savings logged.

## Closing:

For any more information regarding the Townsville KinPin project – please don't hesitate in contacting us.

For more information please, please refer to our website:

www.thermoshield.com.au

Thanks & kind regards

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