



**ASSETCOOL**  
THERMAL METAPHOTONICS

TECHNOLOGY  
PRIMER

2019





## INCREASING ELECTRICITY NETWORK CAPACITY AT SIGNIFICANTLY LOWER COST

AssetCool have developed an innovative, durable photonic coating which lowers the operating temperature of overhead power lines. This coating addresses the energy trilemma in three ways:

1. Increasing the current carrying capacity of conductors
2. Reducing power losses and associated carbon emissions
3. Lowering cost from both a CAPEX and OPEX perspective.



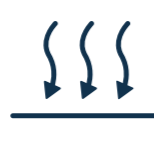
Reduces overhead line temperature



Increases conductor ampacity



Reduces carbon emissions



Reduces losses



Consistent conductor ampacity across all levels of solar radiation - increased day time peak capacity

By coating and cooling the power line, the AssetCool technology offers many benefits:

- Increase in ampacity and a reduction in solar instability precisely when it is needed most, on low wind days with high solar radiation and low cloud where overhead line peak capacity can otherwise be 20% lower.
- Significant financial savings; increasing the overhead line static thermal rating reduces the need to install new assets to cope with increasing demand.
- Reduction in power losses and CO2 emissions; the coating on a conductor rated for the same ampacity can reduce power losses due to the conductor having lower resistance, in turn reducing the carbon footprint of the transmission asset.
- Reduction in corrosion; the outer coating is inherently corrosion resistant and can protect the outer conductor strands from degradation in harsh environments.



Our coatings work to increase electricity network capacity at reduced cost, by exploiting a limitless cooling resource: outer space.

## A PROBLEM WORTH SOLVING

### Working with the Power Network Challenge

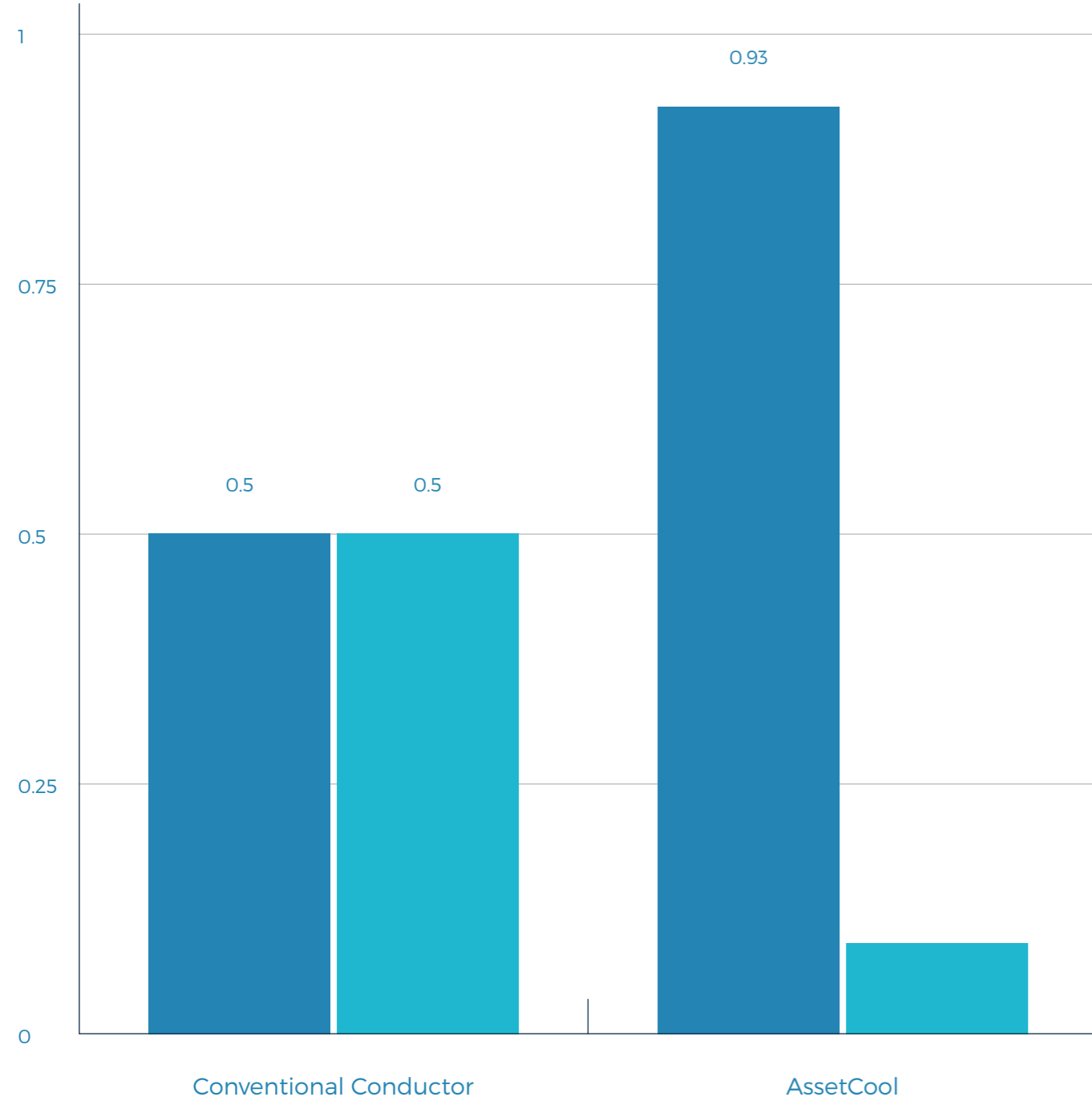
Electricity transmission is becoming increasingly challenging. Network operators are faced with the triple challenge of mass electrification, population growth and economic development. Cost efficient methods to increase network capacity and address this challenge are required to meet this challenge.

At present, the thermal rating of overhead conductors significantly caps transmission network capacity. Higher conductor temperatures increases power losses and the likelihood of causing irreparable conductor damage, often shortening asset lifetime.

This problem is made worse when low wind speeds fail to cool the power lines and solar radiation heats the lines further. Aluminium conductors are not particularly reflective (i.e. it absorbs approximately 50-80% of solar radiation), nor is aluminium particularly effective at emitting heat, consequently the conductors heat up substantially. This leads to significant drops in capacity often, when power is needed most.

To date, no reliable technologies have been available to allow conductors to excel in conditions of full sunlight and low wind and across all conductor temperature ranges. Network owners need conductors that can thrive and give extra current carrying capacity (ampacity) when it's needed most, in order to improve the continuous static line rating throughout the year.





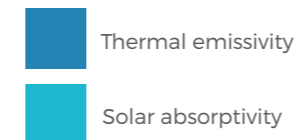
## A SIMPLE SOLUTION

### AssetCool's Photonic Solution: Spectrally Selective Passive Radiative Cooling

Bringing together expertise in nanotechnology and coating formulation we have developed a novel photonic coating to solve the problem of conductor thermal rating by passively cooling overhead power lines. Our solution works in two ways.

Firstly, by increasing infrared heat dissipation of conductors, and secondly, by minimising the amount of solar heat absorbed from the sun. This approach is based upon recent advances in nanotechnology, allowing the coating to simultaneously reflect over 90% of incident solar radiation, which prevents the line from heating up, whilst emitting large amounts of infrared, which cools it down.

AssetCool's patent-pending technology passively manages the incoming and outgoing radiative energy profile to create a substantial net cooling effect. This spectrally selective coating optimisation significantly increases cooling performance compared to uncoated conductors:



## DEFINED BY DURABILITY

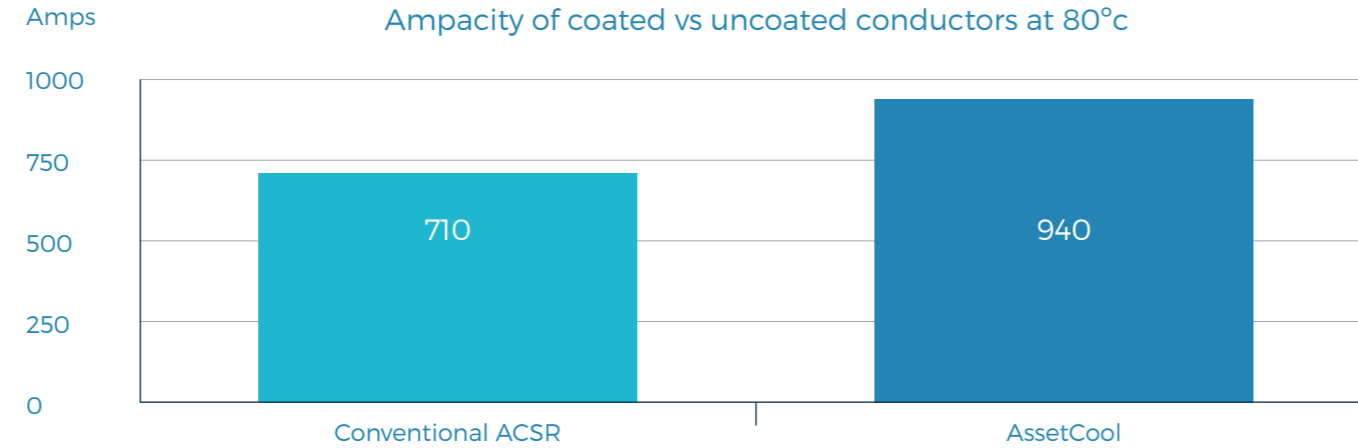
### AssetCool's Technology: Optimised for the Most Challenging Conditions

A conductor coating designed to perform well under pressure. In adverse conditions, our unique conductor coating can significantly increase the continuous static thermal rating of all overhead lines, thus delivering extra ampacity and energy security precisely when it's needed most. Our thin but robust coating can be applied to any type of overhead power line, including conventional ACSR conductors rated for 80°C, as well as high temperature conductors.

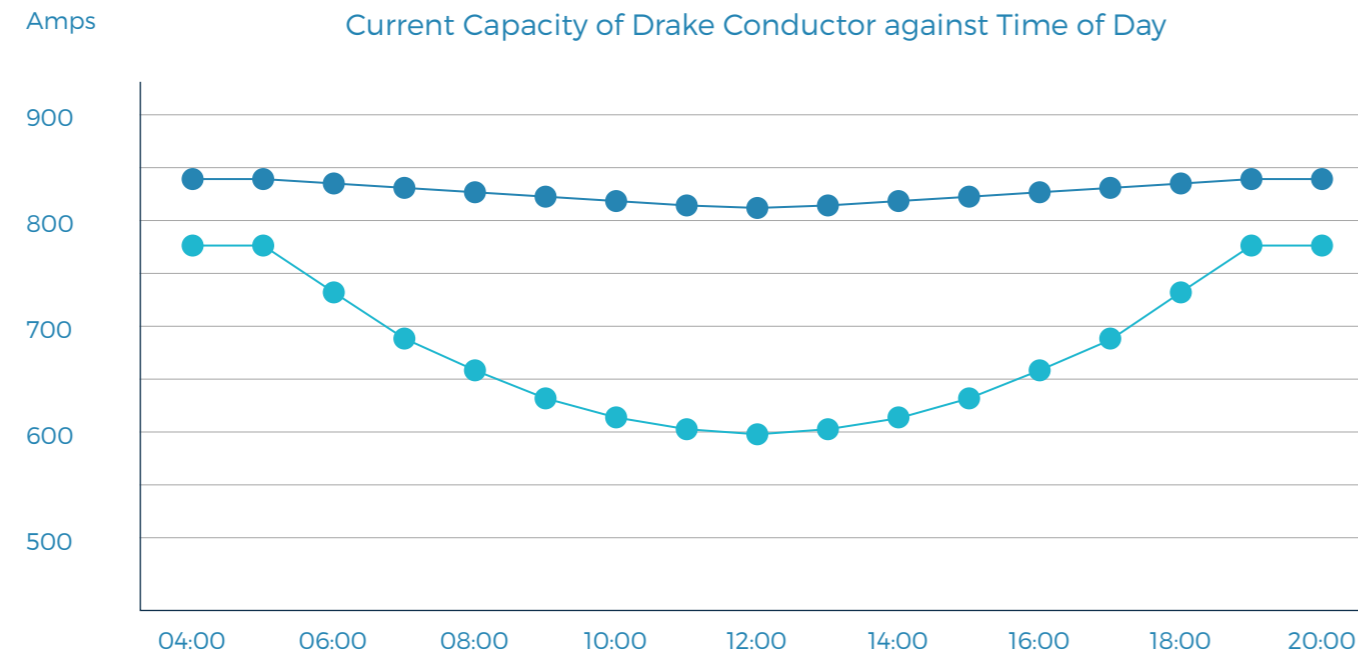
Simulations using CIGRE 601 have demonstrated that our coating offers a 33% increase in ampacity, relative to conventional conductors under full intense solar radiation when operating at 80°C.

Our innovative technology increases current network capacity, allowing networks to adapt to changing demands. In many solar intense regions, peak grid demand from air conditioning almost always coincides with peak solar radiation, where the conductors can have 20% lower current carrying capacity. It is under these conditions our photonic coating really excels.

With AssetCool, overhead conductors reflect over 90% of solar radiation and as a result the ampacity of the conductor remains almost constant throughout the day, even under full solar irradiation. By emitting more infrared heat, the conductor can operate at a much cooler temperature. These two performance boosts allow network operators to increase the continuous static thermal rating with confidence consistently throughout the day, over the whole year.



Assumptions: Drake 26/7 conductor, maximum allowable temperature - 80°C, ambient temperature - 40°C, Wind Speed - 0.6 m/s, wind angle of attack - 90°, clearness of atmosphere 0.8, Latitude - 23, date 21/06/2018, time 12:00, reflectance of the ground - 0.4.



Assumptions: as above with solar radiation calculated as a function of time of day using CIGRE 601 Algorithm.

As the sun rises conductor temperature increases and its ampacity decreases. This graph demonstrates the reduction in solar instability throughout the day.

## TRIED, TESTED AND PROVEN RESULTS

Our product has been subject to extensive empirical testing.

### The Experiment

AssetCool coated samples of ACSR conductor with its proprietary coating technology.

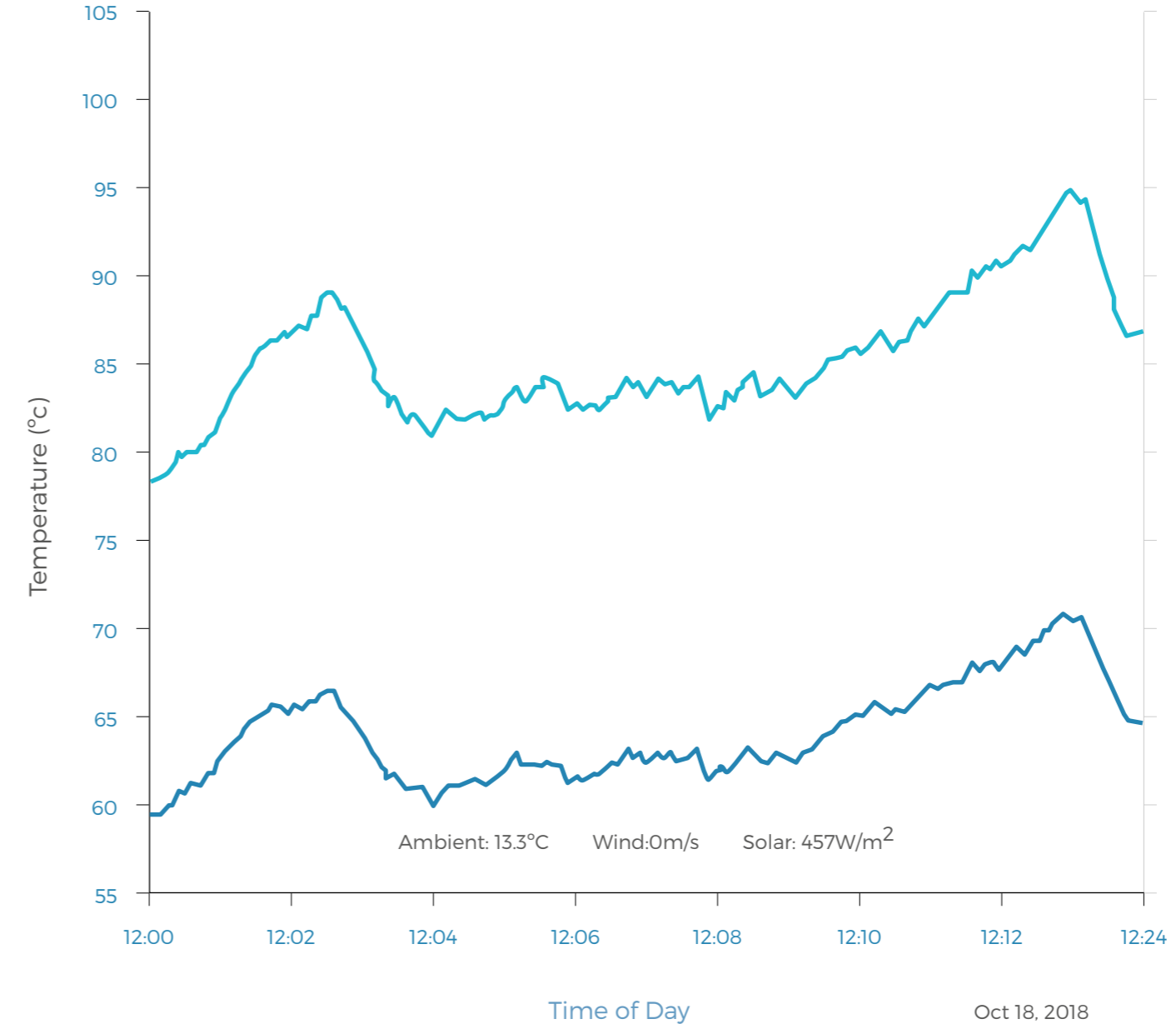
Temperature sensors were inserted into the core of the conductor which was connected to a DC power supply. The temperature of the conductor core was then measured over time and compared to that of an uncoated conductor. This experiment was independently conducted in Autumn in the UK, with ambient temperature at around 13°C and full solar radiation with no clouds. The results are shown to the left.

### The Results

- The coated line is visibly cooler under direct sunlight at 80°C.
- Average temperature of the uncoated line: 84.56°C
- Average temperature of the coated line: 62.98°C
- 21.58°C degree temperature reduction
- This either provides 25% extra ampacity or
- A power loss reduction of 4.7%



Graph of Conductor Temperature vs Time for Coated and Uncoated ACSR Conductors



## TO DISCOVER MORE

For further information on our coating's performance and more detail on its technology, you can download and read our white paper at [www.assetcool.com](http://www.assetcool.com)

For partnership enquiries or further technical information, please feel free to contact us at [info@assetcool.com](mailto:info@assetcool.com)

