Cool Surfaces Project
Introduction
What Problems are we Solving?

- Climate Change Mitigation – RSA commitments
- Reduce Electricity Loads on fragile grid
- Reduce Cost of cooling – HVAC & A/C
- Social Upliftment – Indoor thermal Comfort
- Health for vulnerable
- Reduce Building Maintenance
  - Waterproof,
  - Fire Retardant
  - Inexpensive Low-tech
- Unemployment & unskilled
- Too few RSA owner Manufacturers
What Problems are we Solving?

Climate Change Mitigation – RSA commitments

Energy Security

Cost

Jobs

Carbon Tax

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What Problems are we Solving?

Social Upliftment – Indoor thermal Comfort

Standard of Living

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What Problems are we Solving?

- Reduce Electricity Loads on fragile grid
- Reduce Cost of cooling – HVAC
What Problems are we Solving?

Health of the Vulnerable

- Sick
- Infants
- Elderly
- Overheated work places and schools
What Problems are we Solving?

- Reduce Building Maintenance
- Waterproofing
What Problems are we Solving?

Fire Retardant
What Problems are we Solving?

Unemployment – low tech, easy to apply

Skills Development

JOBS
Cool Surfaces can create Sustainable & Resilient Urban Areas

| Building Scale | • Up to 20% reduction in cooling demand on top floors  
|               | • Improve thermal comfort and productivity in un-air conditioned buildings (eg. Homes, warehouses, schools etc) |
| Urban Scale   | • Improved air quality – an opportunity for a $10 billion ZAR energy & health cost reduction in USA alone.  
|               | • Reduced peak electricity demand and avoided adoption of air conditioning.  
|               | • Great resiliency to heat events and climate change. |
| Global Scale  | • Offset warming effects of 24 gigatons of CO₂ - equivalent to taking 500 coal power plants offline for 20 years.  
|               | • Every 100 square meters of white roof – equivalent to 0.6 tons of CO₂ offset per year. |
Understanding Cool Surfaces

Cool Roofs – Coating on roofs and walls

When sunlight hits a black roof:
- 38% heats the atmosphere
- 52% heats the city air
- 5% is reflected
- 4.5% heats the building

Black Roof
80°C (177°F)

When sunlight hits a white roof:
- 10% heats the atmosphere
- 8% heats the city air
- 80% is reflected
- 1.5% heats the building

White Roof
44°C (111°F)
HVAC Efficiency & Cool Roofs

Without

- Gets hotter and hotter all day
- Air conditioner never stops
- SUPER HOT: 66°C

With

- Hot Air Out
- Cool Air In
- COOL: 32°C

- Attic temperature penetrates living space.
- SUPER HOT: 66°C

- Attic air is cooler.
- COOL: 34°C cooler

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Reading Cool Surface quality

Cool surfaces’ efficacy is rated by how much light - solar reflectance (SR) & heat thermal emittance (TE) is prevented from passing the coating.

Both SR and TE are rated on a scale from 0.0 to 1.0.

<table>
<thead>
<tr>
<th>Hot</th>
<th>Cold</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.6 - 0.7 - 0.8 - 0.9 – 1 fraction</td>
<td></td>
</tr>
</tbody>
</table>

Solar reflectance (SR) + Thermal Emittance (TE) = Solar Reflectance Index (SRI) normally expressed as a percentage

<table>
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<tr>
<th>Hot</th>
<th>Cold</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 – 100 %</td>
<td></td>
</tr>
</tbody>
</table>
Proposed Rating Label SRI (0-100%)

- **A+++**: 95 to 100
- **A++**: 90 to 95
- **A+**: 85 to 90
- **A**: 80 to 85
- **B**: 75 to 80
- **C**: 70 to 75
- **D**: 65 to 70

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### International Cool Coating Label

<table>
<thead>
<tr>
<th>Solar Reflectance Index</th>
<th>Minimum SRI</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>0.65</td>
<td>0 to 100 %</td>
</tr>
<tr>
<td>Thermal Emittance Heat</td>
<td>Minimum TE</td>
<td>Fraction 0.0 to 1.0</td>
</tr>
<tr>
<td></td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>Solar Reflectance Light</td>
<td>Minimum SR</td>
<td>Fraction 0.0 to 1.0</td>
</tr>
<tr>
<td></td>
<td>0.65</td>
<td></td>
</tr>
</tbody>
</table>
Example of a Cool Coating Label

<table>
<thead>
<tr>
<th>Solar Reflectance</th>
<th>Initial 0.85</th>
<th>Weathered Pending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Emittance</td>
<td>0.92</td>
<td>Pending</td>
</tr>
</tbody>
</table>

**CRRC**

COOL ROOF RATING COUNCIL

**Rated Product ID Number**: 0001

**Licensed Seller ID Number**: 1178

**Classification**: Production Line

Cool Roof Rating Council ratings are determined for a fixed set of conditions, and may not be appropriate for determining seasonal energy performance. The actual effect of solar reflectance and thermal emittance on building performance may vary.

Manufacturer of product stipulates that these ratings were determined in accordance with the applicable Cool Roof Rating Council procedures.
Colour and the Cool Roof

Standard or dark roofs surface can reach 65°C and more in summer. A cool roof under the same conditions can be more than 10°C cooler.

Colour is important. Although lighter colours work most effectively, modern cool coatings are not dependent on colour alone. The molecular structure prevents heat ingress even with deeper colour pigment. But regular white roof paint will be more effective than cool coating in dark

Over 90% of roofs in South Africa are dark. There is great potential for energy savings by installing cool roofs.
Substrate Material and the Cool Roof

The conductivity of materials from which the substrate (roof, walls or road) is comprised plays a critical role in passive energy cooling.

Materials that are highly heat conductive absorb solar energy deeper into the substrate and hold onto that heat for much longer periods.

As more solar radiation strikes the surface the energy accumulates and becomes hotter and hotter, holding onto the heat for much longer periods of time.

Compare gravel (cooler) to metal corrugated zinc (warmer).
Cool Surfaces Project Roadmap

Achieved to Date

1. Cool Surfaces SABS adoption of Standards
2. Selection from Products Available
3. Pilot Projects and Data Collection
4. Certified skills development Training for local workforce
5. Establishment of Industry Association (SACSA)
6. EE Building Benchmarking and Simulation Modelling
7. Implement large scale project to address UHI.
8. Incrementally develop a CS Database of all rated product
9. Establishment of open source CS Studies Database Platform
On-site testing of CS coating performance
LBNL lecturing to professional architects

16 Training Courses and Workshops over the last 4 years has skilled 142 people (paint applicators, lab technicians, M&V specialists, Simulators)

Capacity building
Sharpeville Primary School GDID pilot

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Thusanang Day Care site

SANEDI WORKING FOR ENERGY

THUSANANG DAY CARE CENTER
21 JULY 2015

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Locals employed to complete project

Job creation
25000sqm of Roofs coated in Sternham

Local youth completing practical exam in !Kheis
Completed Projects

1. !Kheis Pilot project, Duineveld Township, plot 954:
   - GPS - 28°54'02.2"S  21°59'03.6"E

2. Sharpeville i. Emanuel Primary School:
   - GPS - 27.53.00.49 E  26.04.33.27 S
   - ii. Kgomoco Primary School:
     - GPS - 27.52.03.61 E  26.41.06.55 S

3. Hammanskraal: Thusanang Day Care Centre:
   - GPS - 25o22'09.85S  28o13' 20.45 E

4. Kimberley Old Magistrates' Court House:
   - GPS - 28o44'09.25S  24o45'53.68'E

5. !Kheis Municipality Offices, Groblershoop:
   - GPS - 28o53'44.03"S  21o58'59.46"E

6. !Kheis Cool Surfaces Scale up - Sternham:
   - GPS - 28o54’26.18’S  22o00’15.24”E
Established 10 nominal building types RSA

EE Modelling Simulation
Cool Surfaces Project Roadmap

1. Collaboration of Cool Coatings & Insulation project to maintain SANS 10400 XA standards for insulation and prevent R-value offset by cool coatings.

2. Cool Paving pilot to address black tar roads

3. Duplicate scaled-up project in each energy zone. (25000m2 roof area coated per project)

4. Establish EE Building Lab in RSA for Testing, Rating and Labelling
Cool Surfaces Project Roadmap

1. **Collaboration of Cool Coatings & Insulation** project to maintain SANS 10400 XA standards for insulation and prevent R-value offset by cool coatings.
# Cool Roofs vs Insulation

<table>
<thead>
<tr>
<th>Cool Coatings</th>
<th>Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relatively inexpensive and easy to apply.</td>
<td>Relatively expensive and can be complicated to install.</td>
</tr>
<tr>
<td>Most effective for <strong>Cooling</strong> – heat reduction with no insulating effect.</td>
<td>Most effective for <strong>Heating</strong> – heat gain with excellent insulation effect.</td>
</tr>
<tr>
<td>Applied on only outside of building</td>
<td>Can be applied on outside or inside of building depending on insulation type.</td>
</tr>
<tr>
<td>Prevents absorption of heat via solar reflectance and thermal emittance</td>
<td>Retains heat in a contained space by acting as a barrier to heat transfer.</td>
</tr>
<tr>
<td>Cool Coatings are waterproof so condensation is not of great concern, for application in climate zones like S Cape Condensation zone.</td>
<td>External insulation especially, may need to be treated separately to waterproofing and needs to avoid moisture, for application in climate zones like S Cape Condensation zone.</td>
</tr>
<tr>
<td>Addresses Climate Change mitigation and indoor thermal comfort</td>
<td>Does not address climate change only indoor thermal comfort</td>
</tr>
</tbody>
</table>

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**ENERGY INNOVATION FOR LIFE**
# Cool Roofs vs Insulation

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<th>Cool Coatings</th>
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<tbody>
<tr>
<td>Assume min SRI-value of 0.65 or greater</td>
<td>Assume min R-value of 48 derived from 46mm thickness.</td>
</tr>
<tr>
<td>ROI: once-off payment, renewal every 10 years. Energy savings applicable where</td>
<td>ROI: Insulation thickness if doubled, takes 13 years to recover, triple = 17 years, quadruple 19 years to achieve similar cooling.</td>
</tr>
<tr>
<td>electricity and HVAC is used.</td>
<td></td>
</tr>
<tr>
<td>Can add to undesirable heat loss in extreme cold weather. The increase in</td>
<td>The cost of insulation to achieve cooling in summer temperatures is</td>
</tr>
<tr>
<td>fuel used on heating night and winter cold temperatures is similar to that of</td>
<td>substantial.</td>
</tr>
<tr>
<td>uncoated roofs.</td>
<td></td>
</tr>
</tbody>
</table>

**Cool Coatings and Insulation used together:**

1. More effectively regulates thermal comfort in buildings than either technology, alone.
2. Installation costs of both technologies are more speedily recovered if used together.
3. Environmental impact and climate change mitigation is significantly improved.
2. Cool Paving pilot to address black tar roads
Cool Surfaces Project Roadmap

3. Duplicate scaled-up project in each climate /energy zone. (25000m² roof area coated)
Cool Surfaces Project Roadmap

4. Establish EE Building Testing Lab in RSA for Testing, Rating, Labelling
With this in mind, the Kigali Clean Energy Program (K-CEP) in collaboration with the Global CoolCities Alliance (GCCA), Sustainability for All (SEforALL), and Nesta’s Challenge Prize Centre have initiated the Million Cool Roofs Challenge. It’s part of a broader effort to accelerate global action on cooling.

In 2019, projects have received $100,000 to help them deploy their solutions; each must cost less than $5 per square meter. In 2020, projects will receive $250,000.

SANEDI in the Running to win K-CEP Grand Prize of R15m

The award was announced on November 5, 2019, and winners will be announced in January 2020.

The award winners will be announced in January 2020.
How to take Cool Surfaces Further?

- Appropriate measurement and evaluation methods for meaningful data
- Accurate accredited measuring instruments
- Accurate, sufficient 3rd-party, data collection
- Certified M&V/ M&E specialist for reliable, purposeful analysis, conclusions and recommendations.
THANK YOU

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