EmiratesGBC Technical Workshops

EGBC X KNAUF

Green Sustainable Solutions – Landscaping, Green Walls, and Green Roofs with Case Studies

Note to online attendees:
Your microphone is muted – if you wish to submit a question, please use the questions box in the control panel.

10th March 2023
### Global Challenges

<table>
<thead>
<tr>
<th>Urban heat island effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air pollution (CO₂, PM particles ...)</td>
</tr>
<tr>
<td>Energy loss due to heating and cooling of buildings</td>
</tr>
<tr>
<td>Rainwater detention &amp; retention</td>
</tr>
<tr>
<td>Low biodiversity</td>
</tr>
<tr>
<td>Wellbeing</td>
</tr>
</tbody>
</table>
Clean air and noise pollution - contributing to safe and healthy living conditions

Water resources - efficient management and conservation of water resources

Biodiversity, habitats and cultural heritage - conserved for current and future generations

Green spaces and recreational areas will be developed and are expected to double in size. Nature reserves and rural areas are forecasted to constitute more than 60 per cent of the emirate’s total land area. Several green corridors will be established to link service, residential and commercial areas.
Avg. global temperature on Earth is 1.1 °C higher than in 1980.

<table>
<thead>
<tr>
<th>Temperature in °C</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 °C</td>
<td>Extinction of amphibians</td>
</tr>
<tr>
<td>1.0 °C</td>
<td>Ice is melting, penguins are endangered</td>
</tr>
<tr>
<td>1.6 °C</td>
<td>50% of tundra disappears, moose, lynx and brown bear on extinction</td>
</tr>
<tr>
<td>2.2 °C</td>
<td>Extinction of all large mammals in Africa</td>
</tr>
<tr>
<td>2.6 °C</td>
<td>Loss of all tropical forests and all tropical forest inhabitants</td>
</tr>
<tr>
<td>4.0 °C</td>
<td>70% of all living things subject to extinction, desert across the whole region</td>
</tr>
</tbody>
</table>

* Extracted from Ends of the World by Peter Brannen is published by Oneworld Publications, 2017
Our Mission

From Grey to Green
Green Wall on Garage
And more…

Outdoor solutions

Indoor solutions

Knauf Insulation
Green Solutions

Urbanscape
GREEN SOLUTIONS - RIYADH
CASE STUDY
# Pilot Project

<table>
<thead>
<tr>
<th>10,000 m²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Greening Ratio 1:1</strong></td>
</tr>
<tr>
<td><strong>Target:</strong></td>
</tr>
<tr>
<td>4000 m² Green Roofs</td>
</tr>
<tr>
<td>500 m Green Walls</td>
</tr>
<tr>
<td>5000 m² Landscaping – Grass</td>
</tr>
<tr>
<td>100 nos Trees</td>
</tr>
<tr>
<td>200 nos Shrubs</td>
</tr>
</tbody>
</table>

| **Goals:** |
| Lower temperature |
| Reduced Pollution |
| Energy Savings |
| Water Savings |
| ROI |
Considered Targets

<table>
<thead>
<tr>
<th>Green roofs [m²]</th>
<th>4,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green walls [m²]</td>
<td>500</td>
</tr>
<tr>
<td>Landscaping – grass [m²]</td>
<td>5,000</td>
</tr>
<tr>
<td>Landscaping – trees [nos]</td>
<td>100 nos*</td>
</tr>
<tr>
<td>Landscaping – shrubs [nos]</td>
<td>200 nos</td>
</tr>
</tbody>
</table>

* 100 trees are considered equivalent to 500 m²
Asphalt temperatures have been measured to run 40-60 degrees hotter than the surrounding air.

The climate of the Middle East is warming and extreme hot temperature events are becoming common, as observed by the significant upwards trends in mean and extreme temperatures during the last few decades.

Built infrastructure may alter heat hazard. Constructing a significant piece of infrastructure can significantly alter the thermal properties of the area, generally inducing higher temperatures. Any newly built infrastructure covering large enough areas (e.g., new city quarter or harbor zone) should be undertaken with consideration as to how this will influence the local microclimate.


# Urban heat island effect - solutions

<table>
<thead>
<tr>
<th>Urban Heat Island Effect</th>
<th>Pilot Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced temperature [°C]</td>
<td>3</td>
</tr>
</tbody>
</table>

![Graph showing temperature differences between urban and rural areas](image-url)

- **Urban Heat Island Effect**: The urban heat island effect refers to the phenomenon where urban areas experience higher temperatures than surrounding rural areas due to the urban heat island effect. This is often exacerbated by factors such as high building density, reduced vegetation, and increased pavement.

- **Pilot Project**: A pilot project aimed at reducing the temperature in urban areas by 3°C. The graph illustrates the temperature differences between various areas, with urban areas showing significantly higher temperatures compared to rural areas.
Challenge #Urban heat island effect - solutions

Green roofs, green walls, landscaping

Green walls: urban air - 1.37 °C
[Manso et al. 2021]

Trees: outside 9.2 °C & indoors 4 °C
[Rashid et al. 2014 & Misni et al. 2018]

Considered area – Dubai  10,000 m²
Green area  10,000 m²
Ratio  100 %
Lowered temperature to 3 °C
Pollution

Green roofs, green walls, landscaping

1 m² of green roof catches up to 0.22 kg of dust particles each year

1 m² green roof = 1.3 kg CO₂/year

Average urban voice insulation with green roofs & walls is 5.5 dB

<table>
<thead>
<tr>
<th>Reduced Pollution Pilot Project #2</th>
<th>Area [m²]</th>
<th>CO₂ [kg/year]</th>
<th>PM10 [kg/year]</th>
<th>O₃ [kg/year]</th>
<th>NO₂ [kg/year]</th>
<th>SO₂ [kg/year]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green roofs</td>
<td>4,000</td>
<td>5,200</td>
<td>4.5</td>
<td>18</td>
<td>9.3</td>
<td>2.6</td>
</tr>
<tr>
<td>Green walls</td>
<td>500</td>
<td>1,150</td>
<td>1.3</td>
<td>1.0</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Landscaping – grass</td>
<td>5,000</td>
<td>6,500</td>
<td>5.6</td>
<td>22.5</td>
<td>11.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Landscaping – trees</td>
<td>100 nos</td>
<td>2,500</td>
<td>557</td>
<td>2,835</td>
<td>702</td>
<td>53</td>
</tr>
<tr>
<td>Landscaping – shrubs</td>
<td>200 nos</td>
<td>146</td>
<td>0.1</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15,496</td>
<td>568.5</td>
<td>2,877</td>
<td>723.7</td>
<td>59.3</td>
</tr>
<tr>
<td>Total [t/year]</td>
<td></td>
<td>15.5</td>
<td>0.6</td>
<td>2.9</td>
<td>0.7</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Challenge #Energy loss due to heating and cooling of buildings

Due to a rapidly escalating population and a high level of economic growth, UAE is experiencing a vigorous infrastructure expansion, especially with respect to residential buildings. As a result, energy demand for residential buildings is of a very high level.
Challenge #Energy loss due to heating and cooling of buildings - solutions

4000 m²:
Reference roof: -126,800 kWh
Urbanscape roof: -73,200 kWh
Savings 53,600 kWh
Challenge #Photovoltaics on green roofs

- Yearly sun energy in Dubai: 2200 kWh/m²
  - https://meteo.arso.gov.si/
  - η: 22 %; S of solar cells: 5.000 m²;

- Produced energy: 2.420 MWh

- Enhanced en. production due to green roofs: 8 %
  - [Shafique et al. 2020]

- Produced energy altogether: 2.614 MWh

- Difference: 39 kWh/m²

- Savings: 38.500 AED/year
  - 7.7 AED/m²
Green roofs, green walls, landscaping

Roofs are an important source of biodiversity

1,02 pollinator/m²

4,000 m² green roofs = 4,080 pollinators

[raziskava Bevk et al. 2019]
Health and well-being in green environment

Employees missed work 23% less often
[Atup et al. 2014]

Lower asthma rate for ¼ on each ~350 trees/km²
[Lovasi et al. 2008]

3,3-times increased likelihood of exercise frequency in a green environment
[Forestry Commission et al. 2010]

Table 3. Physiologically equivalent temperature (PET) range for different grades of human thermal perception and associated physiological stress [31].

<table>
<thead>
<tr>
<th>PET (°C)</th>
<th>Thermal perception</th>
<th>Physiological stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-23</td>
<td>Comfortable</td>
<td>No thermal stress</td>
</tr>
<tr>
<td>23-29</td>
<td>Slightly warm</td>
<td>Slightly heat stress</td>
</tr>
<tr>
<td>29-35</td>
<td>Warm</td>
<td>Moderate heat stress</td>
</tr>
<tr>
<td>35-41</td>
<td>Hot</td>
<td>Strong heat stress</td>
</tr>
<tr>
<td>&gt;41</td>
<td>Very hot</td>
<td>Extreme heat stress</td>
</tr>
</tbody>
</table>

[Matzarakis et al. 1999]
Urbanscape® solutions

Trees & Raised gardens

Green roof

Green wall
How do we achieve this?
Application of Rock Mineral Wool in different Green Solutions

The main benefits of the Rock Mineral Wool:

1. Significant water savings
2. Reduction in mortality rate
3. Perfect water absorption and distribution
4. Providing GREEN spaces in demanding environment
5. Pure volcanic rock, sustainable, no additives, no chemicals
How RMW is made?

Volcanic rock
are converted into super absorbent mineral fibers.

No additives
100% pure mineral growing media made of rock mixture (diabase, dolomite, basalt).

Reusable
Can be further used as soil enhancer.

How it works?
Innovative and easy to install system designed for various landscaping applications.

Unique solution
for growing plants in the most demanding of environments.

Better root distribution
which in turn encourages good plant growth and development.

Superior water absorption
and water retention properties, releasing water when required and reducing evaporation at higher temperatures.
From nature to nature
1. Landscaping

Applications for Landscaping
Benefits:

Green areas in cities, such as parks, gardens, and urban forests, can provide numerous benefits to the environment, the community, and the individuals living in urban areas. Some of the benefits of green areas in cities include:

1. **Improved air quality**: Plants absorb carbon dioxide and other pollutants from the air and release oxygen, improving the air quality in urban areas.
2. **Climate regulation**: Green areas help to regulate the temperature of urban areas by reducing the heat island effect caused by the concentration of buildings and pavement.
3. **Increased biodiversity**: Green areas provide habitats for various species of plants and animals, increasing the biodiversity of urban areas.
4. **Noise reduction**: Plants can absorb and reflect sound, reducing noise pollution in urban areas.
5. **Improved mental and physical health**: Access to green areas has been linked to improved mental health, reduced stress levels, and increased physical activity.
6. **Community building**: Green areas provide a space for community members to gather, socialize, and engage in outdoor activities together.
7. **Economic benefits**: Green areas can increase property values and attract businesses, tourism, and investment to urban areas.

Overall, green areas are essential components of healthy and sustainable cities, providing a range of benefits to both the environment and the people living in urban areas.
Applying Rock Mineral Wool in Landscaping

Without an irrigation system:
- Plant cover/vegetation cover
- Sweet soil mix min. 10 cm
- Urbanscape® Green Roll layer 2cm/4cm
- Base ground with drainage capacity

With subsurface irrigation:
- Plant cover/vegetation cover
- Sweet soil mix min. 10 cm
- Inline drop emitter outlet
- Subsurface dripline
- Urbanscape® Green Roll layer 2cm/4cm
- Tie down stake with bend
- Base ground with drainage capacity

With sprinkler irrigation:
- Plant cover/vegetation cover
- Sweet soil mix min. 10 cm
- Urbanscape® Green Roll layer 2cm/4cm
- Base ground with drainage capacity
- uPVC lateral pipe
- Tie down stake with bend
Applying Rock Mineral Wool in Landscaping

- Groundcovers/shrubs
- Sweet soil mix with Urbanskape Green Flocks min. 10%
- Base ground with drainage capacity

- Tree trunk
- Sweet soil mix with Urbanskape Green Flocks min. 10%
- Base ground with drainage capacity

- Urbanskape Green Flocks
- Planting pit
- Soil/commercial substrate/sweet soil mix

Urbanskape Landscaping solutions

Knauf Insulation Green Solutions
Grass
TEST RESULTS: Week 18 – Grass *without* RMW

Roots: 5 – 7 cm  
Grass: Brown spots, Fungus
TEST RESULTS: Week 18 – Grass with RMW

Roots: 15 – 20 cm
Grass healthy
50% less water for irrigation
Case Study Kuwait

Kuwait is a small, desert country, situated at the northeast corner of the Arabian Peninsula and is famous for its very dry and hot climate. The flat, sandy Arabian Desert covers most of Kuwait. The summer months (April to October) are extremely hot and dry (it never rains during the summer months) and while the usual day temperatures are 33°C, during the months of June, July and August they rise up to 51°C i.e. 124°F. Winters (November to March) are cool with limited rain. Due to these weather conditions in which only drought tolerant plants can survive without additional irrigation, you will find very little vegetation in Kuwait.

Urbanscape® Landscaping Solutions: Urbanscape® Green Roll

Vegetation used: Paspalum grass

Type/area: 3 test plots

Results

• less water usage and lower irrigation frequency was established after installation
• average water savings of up to 50% have been achieved
• lower cost of irrigation and maintenance
• prolonged average life cycle of grass in extreme conditions was observed
Landscaping Applications

Public parks

Hotels/ resorts

Highway greening

Challenging urban applications

Private villas

Desertification

Tramway greening

Agriculture in dry areas

Home & gardening

Urban farming

Roundabouts
2. Green Roofs

What are the main benefits?

- Complete solution
- Low construction height
- Improved root growth
- High water absorption and retention
- Lightweight solution
- Sustainable solution
- Rainwater purification
- Fast and easy installation
- Instant green
- Cleaner air
- Stronger vegetation
Benefits:

- **Reducing urban heat island effect:** Green roofs absorb and deflect sunlight, reducing heat absorption and urban heat island effect, which can help to cool cities. Surrounding air temperature can be potentially reduced for up to 3°C.

- **Reducing noise pollution**

- **Improving air quality:** Vegetation on green roofs filters the air by absorbing pollutants and reducing the amount of dust particles in the air:
  - Every square meter of green roof absorbs approx. 1.4 kg of CO2 per year;
  - 1,000,000 m² of green roofs = 1,400 tons of CO2 absorbed per year
  - Every square meter of green roof can clean up to 0.0015 kg of PM10 particles,
  - 0.002 kg of NO3, 0.001 kg of NO2.

- **Visual benefit (aesthetics, increasing green space)**

- **Enhancing energy efficiency:** The insulation provided by the soil and vegetation on green roofs can help to reduce energy consumption by regulating building temperatures. Urbanscape Green Roof comparing to „normal“ green roof is more efficient (less water needed)

- **Providing habitats for wildlife:** Green roofs provide habitats for insects, birds, and other small animals, which can help to increase biodiversity in urban areas

Overall, green roofs offer environmental, economic, and social benefits, making them a valuable addition to urban landscapes.
Applying Rock Mineral Wool on Green Roofs

- **Improved Water Conservation**: RMW can store excess water (rain), which can then be released gradually to plants as needed, reducing water waste and ensuring that plants receive a steady supply of moisture.

- **Reduced Irrigation Needs**: By reducing the need for frequent irrigation, water retention materials can help save time and money on landscaping maintenance.

- **Enhanced Plant Growth**: Adequate water supply is essential for plant growth, and RMW can help keep the soil moist and promote healthy root development, leading to stronger and more vibrant plants.

- **Water to Air Ratio**: provides optimal environment for the roots.

- **Better Resistance to Drought**: During periods of drought or water scarcity, RMW can help plants survive by retaining moisture in the soil, reducing stress on the plants and helping them recover more quickly after drought conditions have ended.
Green walls, also known as living walls or vertical gardens, are structures that incorporate plants and vegetation on the walls of buildings or other structures.
Benefits:

1. **Improved air quality:** Green walls can help to remove harmful pollutants from the air, improving the overall air quality in the surrounding area.

2. **Enhanced aesthetics:** Green walls can improve the visual appeal of buildings and structures, creating a more attractive and pleasant environment.

3. **Reduced energy costs:** Green walls can help to insulate buildings and reduce the amount of energy needed to heat or cool them, reducing energy costs.

4. **Noise reduction:** Plants can absorb and reflect sound, reducing noise pollution in surrounding areas.

5. **Improved mental health:** Access to green spaces has been linked to improved mental health, reduced stress levels, and increased relaxation. Green walls can provide these benefits to people who may not have access to traditional green spaces.

6. **Biodiversity:** Green walls can provide habitats for various species of plants and animals, increasing the biodiversity of urban areas.

7. **Educational opportunities:** Green walls can serve as educational tools to teach people about the benefits of plants and sustainable living.
Applying Rock Mineral Wool on Green Walls

- Light weight
- Smart system
- Instant Green
- Optimal internal water distribution
Sustainability is the key to a better future
Thank you for your attention

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