Green Roofs for Sustainable Buildings

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Outline

- Energy Issue
  - Consumption
  - Role of Buildings
- Green Roofs
  - Storm Water Run-off
  - Thermal Benefits
- Conclusion
• Energy Issue
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Total Energy Consumption

Source: U.S. Department of Energy
Residential Energy Consumption

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Buildings represent...

- 40% of total energy consumption
- 70% of total electrical energy consumption
- 33% of total CO₂ emission

Source: U.S. Department of Energy
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Introduction: What are they?
Turf houses from Iceland

A flat roof in USA

A mansard roof in Turkey
Why consider them?
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Run-off Quantity
Mean storm water retention (%) for study period 09/05-04/07 for green roof systems with 5, 10, 15, and 20 cm planted medium depths. (C=Control, P=Planted. Bars with same letter not significantly different at the p<0.05 level. Error bars + 1se) (Forrester 2008).
Run-off Quality – Solids
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Thermal Benefits

HVAC

Heat Island Effect

Late Afternoon Temperature

<table>
<thead>
<tr>
<th>Rural</th>
<th>Commercial</th>
<th>Urban Residential</th>
<th>Suburban Residential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Residential</td>
<td>Downtown</td>
<td>Park</td>
<td>Rural Farmland</td>
</tr>
</tbody>
</table>

°F  

°C
Vegetation

S. kamtschaticum   S. spurium   S. sexangulare
# Growth Media

<table>
<thead>
<tr>
<th>Media</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkalyte</td>
<td>Clay heated to 1000 °C</td>
</tr>
<tr>
<td>Haydite</td>
<td>Shale heated to 1000 °C</td>
</tr>
<tr>
<td>Lava</td>
<td>Volcanic rock</td>
</tr>
</tbody>
</table>
Temperature Readings

August 3rd, 2011
Cooling Costs*

* Energy unit price: 8¢/kWh
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Conclusion

- Green roofs, as one of the key elements of sustainable buildings, have benefits of reduced storm water run-off, reduced CO$_2$ emission, improved thermal performance, and increased lifespan.
- When saturated, storm water retention of green roof systems is approximately 40-50%.
- TSS values decrease over time.
- Thermal insulation performance of the roofs depend on plant coverage as well as growth media depth, color, pH, and porosity.
- Tested growth media-plant combinations yielded daily air-conditioning energy savings of 23-60% w.r.t. EPDM roofs.
Questions?

www.green-siue.com