Green Roof Energy

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5 Benefits of a Green Roof

Who designed this tool?

- Researchers and Staff
 - Portland State University
 - University of Toronto
 - Green Roofs for Healthy Cities
- Funded by
 - US Green Building Council
 - > Those stated above
 - Environment Canada

When was it designed?

- ❖ 2004-2006 Dr. Sailor & colleagues at Portland
- In April 2007 module became part of standard release of the US Department of Energy's EnergyPlus model

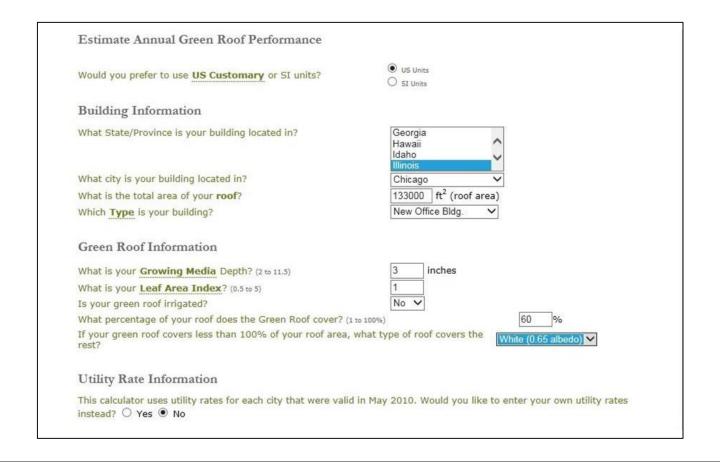
In what situation can we use this tool?

To compare annual <u>energy performance</u> and <u>cost benefit</u> of a building with green roofing to the same building with either dark roof or white roof

What are the requirements to use this tool?

Access Online

Minimal Site Data



How to use this tool?

Impact of a Green Roof

You specified a New Office Building in Chicago, IL with a total roof area of 133000 ft². The Green Roof you specified for this building has a Growing Media Depth of 3 inches, a Leaf Area Index of 1, covers approximately 60% of the total roof area (the rest being a white roof), and is not irrigated. For reference, the annual whole building electricity consumption for the specified green roof was 5608378 kWh and the annual gas consumption of this green roof was 16329 Therms

Annual Energy Savings compared to a Dark Roof (albedo = 0.15) Annual Energy Savings compared to a White Roof (albedo = 0.65)

 Electrical Savings:
 28615.4 kWh
 Electrical Savings:
 7774.7 kWh

 Gas Savings:
 -111.3 Therms
 Gas Savings:
 747.6 Therms

 Total Energy Cost Savings(1):
 \$2774.09
 Total Energy Cost Savings(1):
 \$1680.75

Average Sensible Heat Flux to the Urban Environment (W/m2)

Dark Roof White Roof 60% Green Roof System
Annual Average: 55.3 6.5 26.1

Summer Average: 82.1 20.4 37.4

Summer Daily Peak Avg.: 305.1 109.7 112.0

Average Latent Heat Flux to the Urban Environment (W/m²)

Annual Roof Water Balance (in)

	Conventional Roof	60% Green Roof System
Precipitation:	31.8	31.8
Evapotranspiration:	<u>=</u>	14.9
Irrigation:	<u>20</u> 0	0.0
Net Runoff (2):	31.8	17.0

What does it tell us?

New Walmart Store #5402 Chicago, Illinois

Site Data

- > 133,000 sq ft.
- > 60% covered green roof, 40% white
- ➤ Growth Media 3 inches
- ➤ Leaf Area Index 1
- > No irrigation

Results

- ➤ Calculator [1 year] → \$1,756
- > Walmart [2006-2009] → \$6,650
- ➤ Difference → 4,894 (66% difference)

Disadvantages

- Doesn't include every city [Lubbock not included]
- Version differences between "Old" and "New"
 - ➤ Conduction Finite Difference [CFD] scheme to transfer solution
 - Precipitation schedule data
- "Old"--> doesn't use Canadian precipitation schedules
 - Similar US Cities precipitation adjusted and used instead
- No irrigation = Potential for dead Vegetation
 - By including irrigation schedule cost benefit will decrease [due to maintenance cost]

Advantages

- ❖ Generally accurate +/- 20%
- Commercial or Residential Buildings
- "NEW" or "OLD" Buildings
- Compared with conventional white and black roofs
- Predict energy and cost savings based on input

Works Cited

"A Cost-Benefit Analysis Based on Walmart's Chicago Store." <u>Green Roof Performance</u>. 31 Jan. 2013: 1-45. 13 Feb. 2015. http://cdn.corporate.walmart.com.

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