

Sustainable Solutions Challenge

Green Roof

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Extensive Green Roof

- Simple and do not require much structural support
- Provides ecological benefits like heat insulation
- Plants for cold environments are usable
 - Sedums, succulents, hardy plants
- Most colleges use extensive roofs

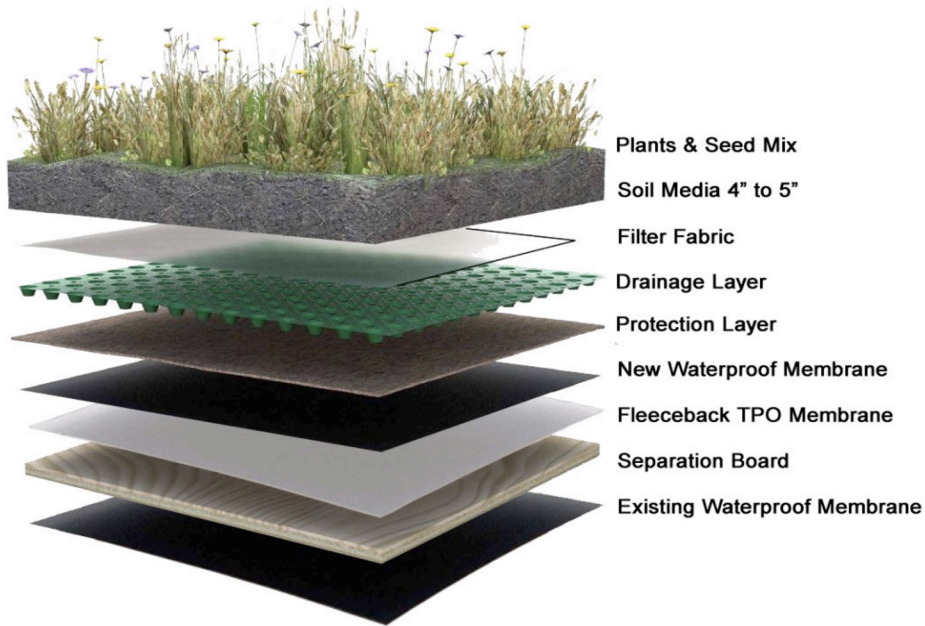


Intensive Green Roof

- Similar to a conventional garden
- Provides ecological benefits and a recreational function
- Suitable for smaller plants as well as trees and shrubs
- Much higher maintenance costs and roof support needed



Technology Used

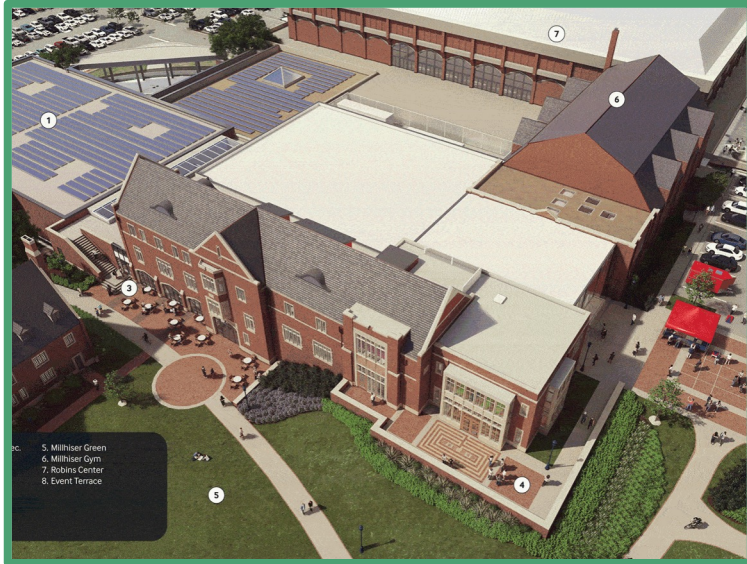


- Living roof systems are usually about 6 inches deep
- Extensive systems affect roof stability much less than intensive systems
 - Typically 18 pounds per square foot
 - Easier to install onto existing structures
- Layers function as either thermal insulators or hydrologic filters

Possible Locations

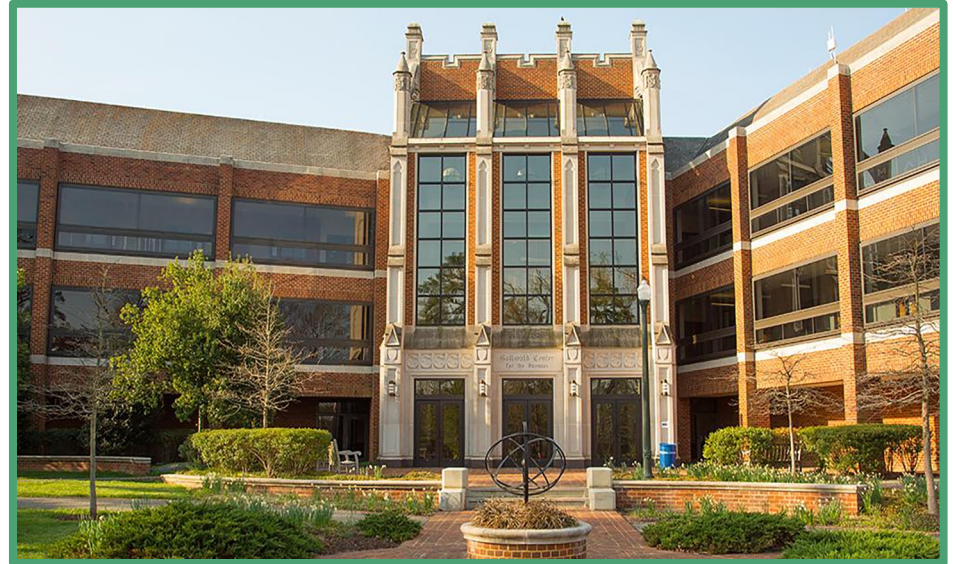
Wellness Center

Above Science Center courtyard



Gottwald

Top of the Building

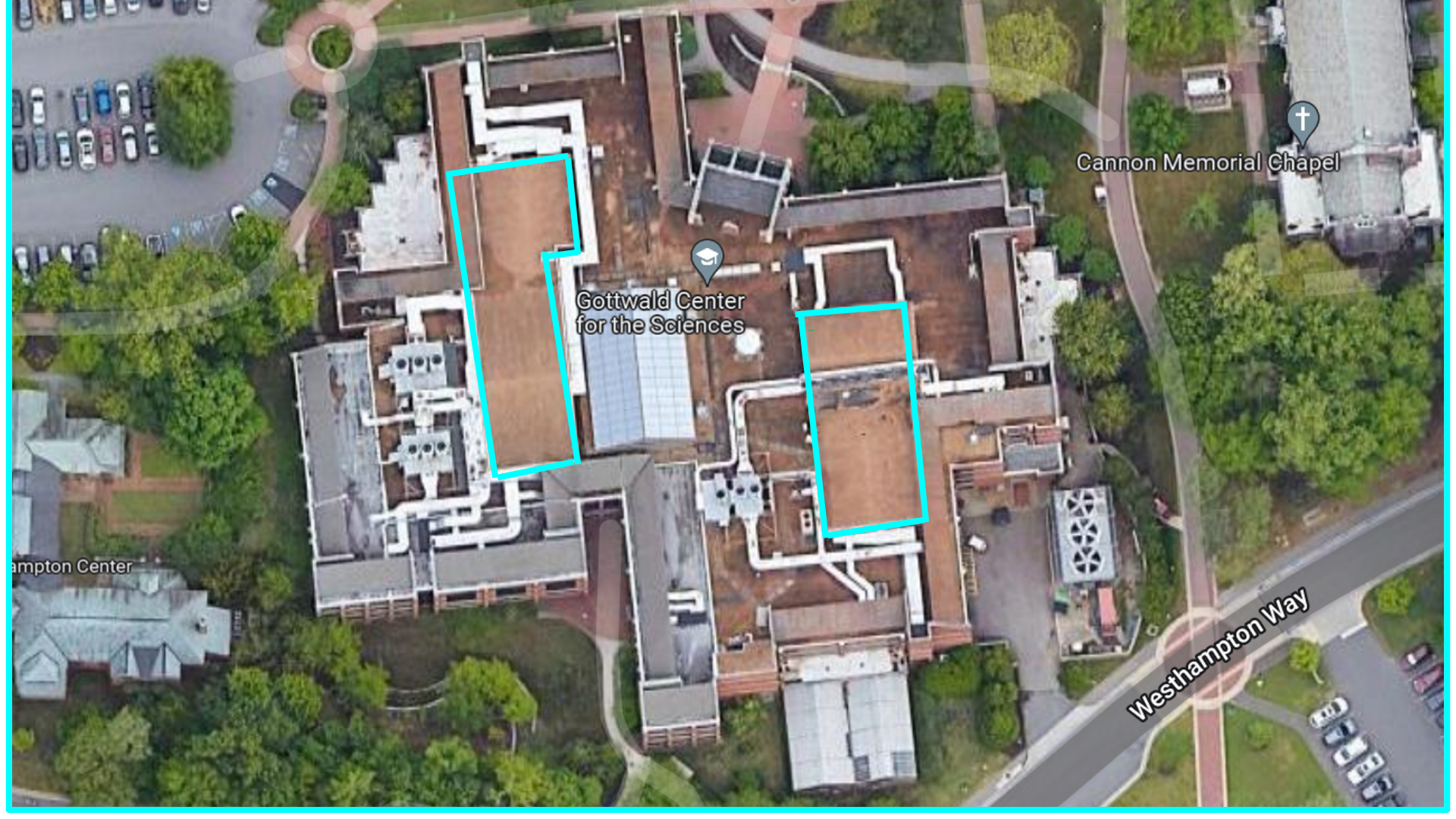




Heilman Dining Center

Gottwald Center

Maryland and Richmond Halls



Gottwald Center
for the Sciences

Cannon Memorial Chapel

Westhampton Way

ampton Center



Ohio University and Williams College

Ohio - 2020

- Stormwater management
- Air quality control
- Economic benefits



Williams - 2007

- 20% greenhouse gas emissions
- Looking to add more across campus

Potential Benefits

Reduce roof temperature

Aids insulation

Decrease energy costs & greenhouse gas emissions, air pollutants (Dry deposition & carbon sequestration)

Increase oxygen production & lowers carbon dioxide levels

Reduce stormwater runoff

Increase roof life expectancy

Aesthetically pleasing

Benefits Being Researched

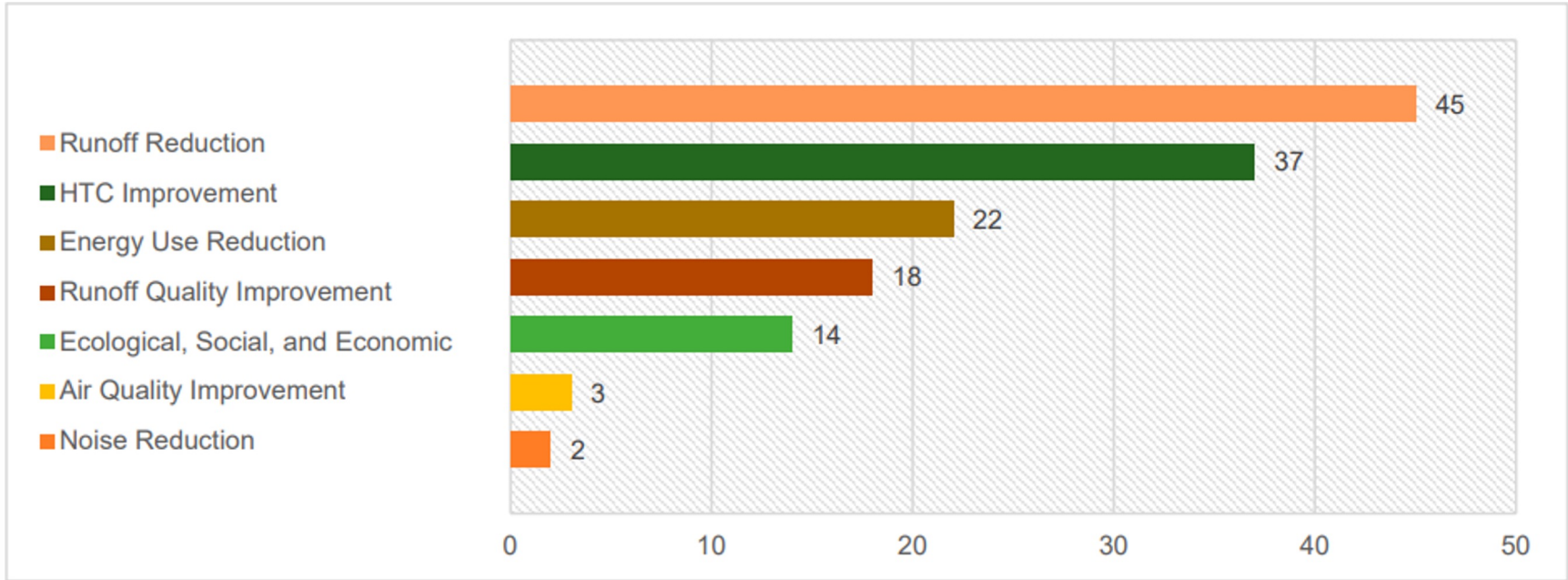


Figure 5. The break-down of papers as per the ecosystem services provided by GRs.

Seasonal Benefits

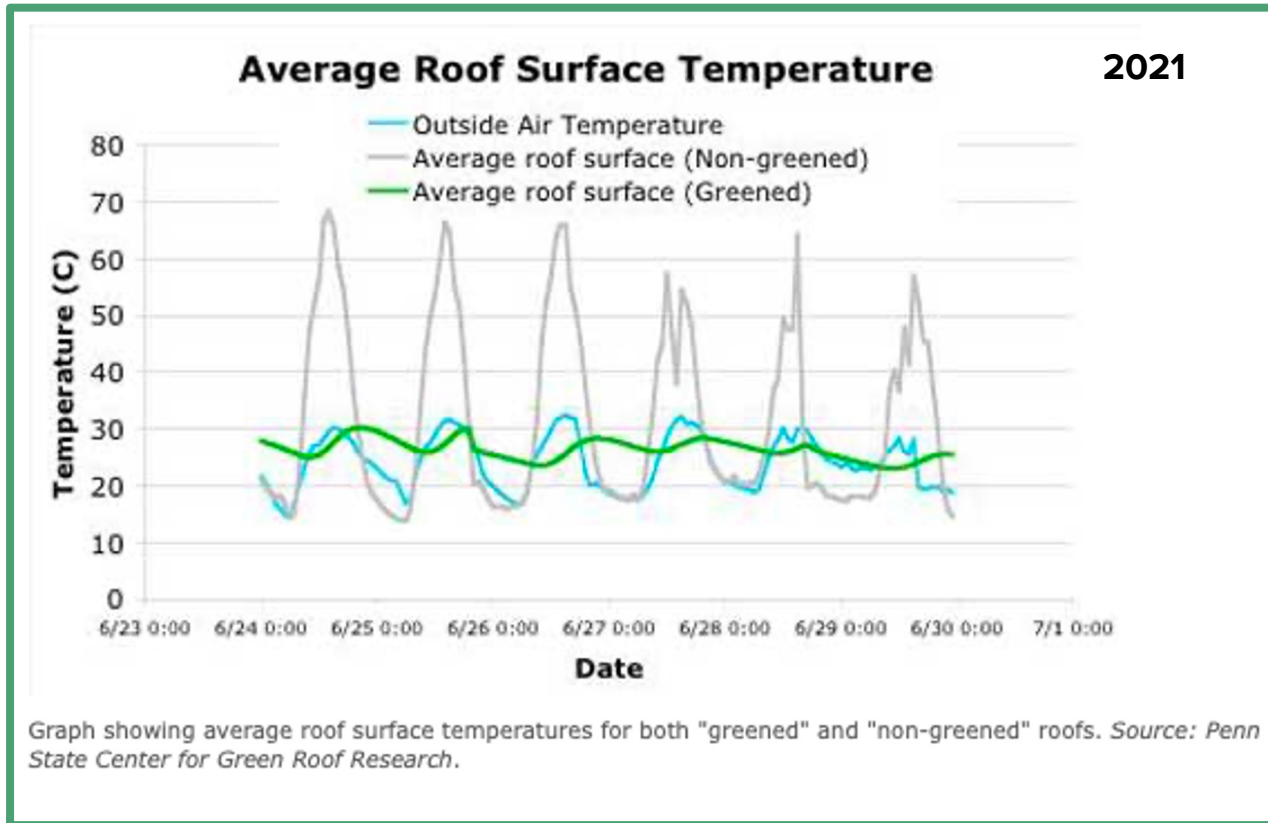
Winter

- Insulates the building to prevent heat from escaping
- Help lower heat energy costs
 - Saves about 3-10% fuel costs
- Retain 25-40% of precipitation

Summer

- Lowers temperature of roof and prevents heat from entering the building
 - Reduces air conditioning costs
 - Reduces energy demands by over 75%
- Use solar radiation to evaporate water (Evapotranspiration)
 - Retain 70-90% of precipitation

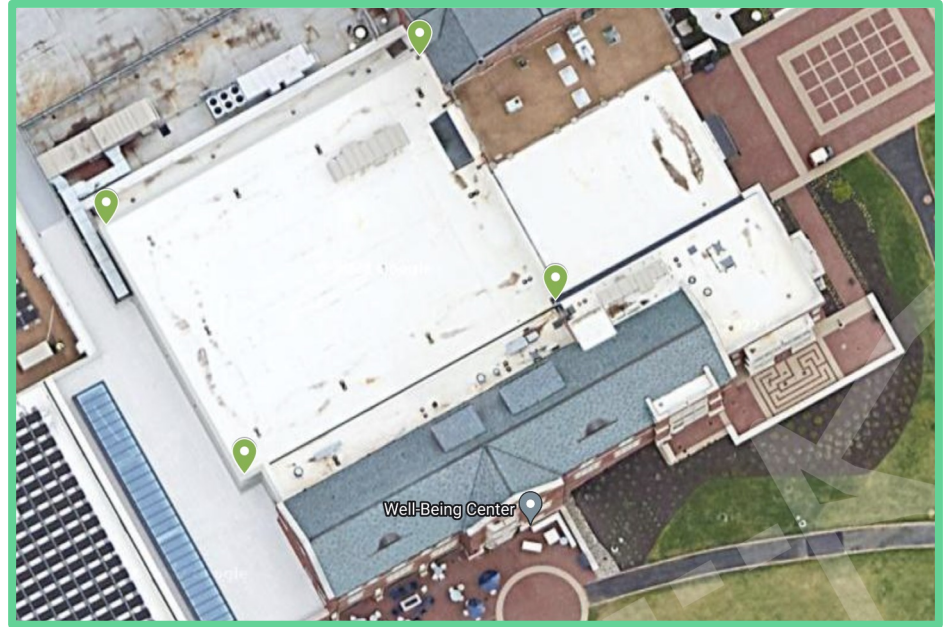
Reducing Indoor Temperatures



Placement

Benefits for on campus activities

- Organic Krush can grow small plants for use
- Experimental area for Gottwald students to use
- Collaboration between Business School, Biology, and Environmental Studies students on future projects
- Both locations can help local pollinator populations



Desired layout for a 10,800 square foot green roof

Ecological Impacts

- Combined research from GRIT Labs and University of Toronto has shown that green roofs can be great areas for pollinators including bees
 - Help make up for environmental fragmentation
 - Toronto has included green roofs as possible avenues to increase the population
- Typical green roof plants like sedums attract bees and butterflies
 - A green roof would allow us to plant flowers that are available in late spring and summer when pollinators need them the most



Costs and Savings

University of Michigan Study

20,000 sq ft green roof energy savings

- \$20 per square foot installation costs
 - \$1 maintenance per year
- \$600,000 vs \$415,000 Net Present Value after investment
- Projected to save \$175,000 in energy costs over 40 years

Roof Lifetime Expectancy

- 50 years vs. 15 lifetime
- \$5 per square foot every 15 years
 - Gottwald: \$130,000
 - Well-Being Center: \$250,000

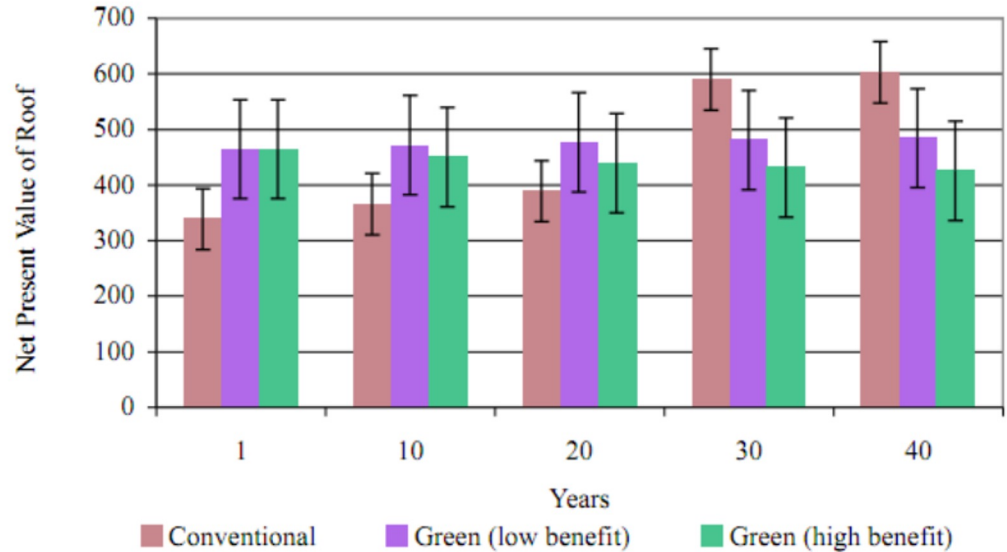


Figure taken from source: Clark, C.E. (2008) "Energy Emissions Mitigation using Green Roofs: Probabilistic Analysis and Integration in Market-Based Clean Air Policies"

Implementation



- Consult with Richmond's facilities department
 - Discuss available spending or potential shareholder investment for the project
 - Plan for long-term maintenance costs - including eventual roof replacement costs
- Initial investment would be roughly \$200,000 for each 10,000 square foot green roof area
 - Around \$11,000 in yearly maintenance costs
- Construction would take less than a month, and it will be well established and growing plants within a year
- Consult with the Biology department to decide which plants to use.
- Consult UR landscaping services about garden upkeep and labor

Final Thoughts

- Green roofs have proven to reduce energy costs year-round
- The short term investment will result in long term benefits on campus
- Many other colleges and universities have implemented green roofs and have seen the expected benefits

