Bio-Solar Roof

Using Solar Power and Green Roof in Fells Point to Improve Climate Resiliency

Maya Savory, Victoria Ines, Giulian Laudisa, Gianna Murphy, Juny Lee

JOHNS HOPKINS
WHITING SCHOOL *of* ENGINEERING

Introduction

BACKGROUND

Fells Point, a historic waterfront neighborhood in Baltimore, is **increasingly vulnerable to climate-related risks including tidal flooding, storm surge, extreme precipitation, and rising groundwater.** These hazards threaten both critical infrastructure and building performance.

PROJECT FOCUS

This project centers on the **Brown Advisory Building**, a representative waterfront site, to evaluate scalable solutions that improve neighborhood-wide resilience.

Objectives

1. Reduce **stormwater runoff**
2. Improve **energy resilience** during extreme events
3. Provide a **scalable model** for similar buildings in Fells Point

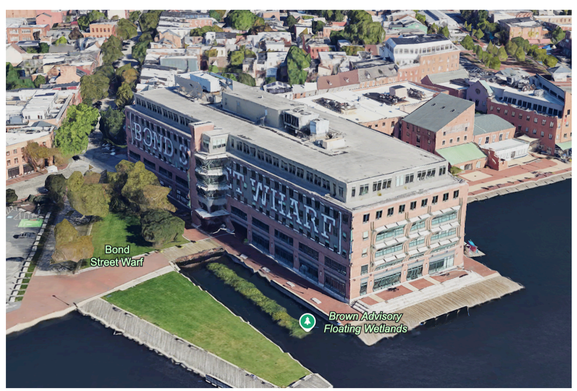


Fig 1. 3-D Rendering of Brown Advisory Building

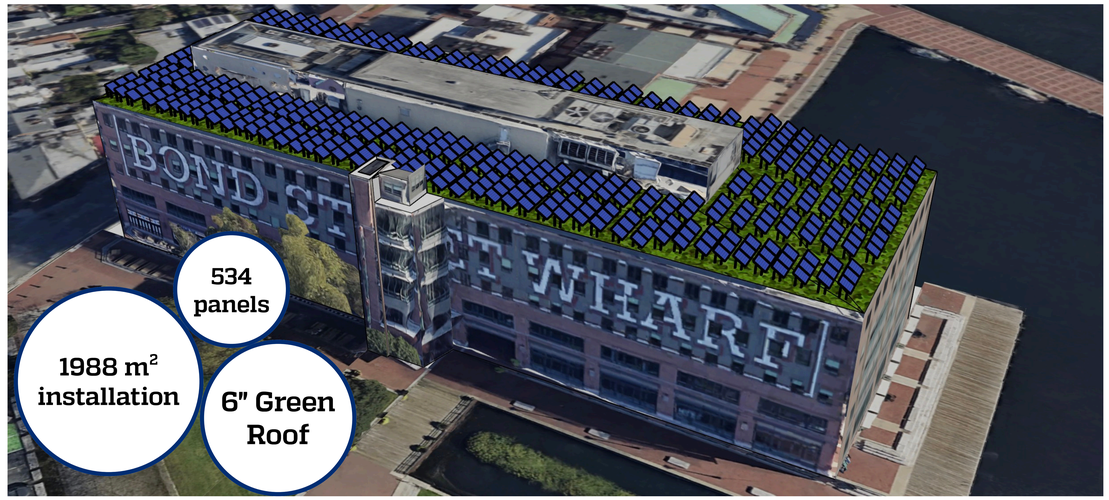


Fig 2. Biosolar Roof Design

Our Findings

Green Roof

Impervious Area ↓
100% → ~39%

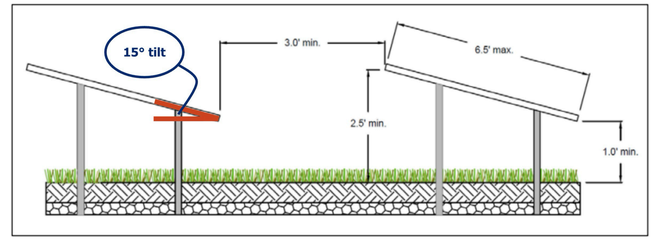
Reduced HVAC load
Cooling Demand
↓ 10-50%
Winter Heat Loss
↓ 8-14%

Solar Array

240-262 kW capacity

288-390 MWh/yr
(40-60 U.S. homes)

280-380 metric tons **CO_2 avoided** per year



Source: Washington, DC's Department of Energy and Environment (DOEE) Stormwater Management Guidebook, Section 3.2.4, Figure 3.3

1. Reducing wind uplift **2. Less shading on plants**

Fig 3. D.C.'s DOEE design requirements for structures constructed above green roofs

Costs + Returns

INSTALLATION:
$1.3 MILLION

RETURN PERIOD:
10–15 YEARS

LIFETIME:
25+ YEARS

RETURNS:

- **Renewable Energy Credits:** 1.5/MWh generated
- **12–17%** of building's energy generated
- **15–25%** decrease in cooling energy in summer
- **Roof 2x** lifetime of regular roof

25 YEARS OF RETURNS:
$2.6–3.1 MILLION

Key Takeaways

Integrated Climate Solution
Reduces runoff (100$ → ~39%), while generating clean energy

High Energy & Efficiency Gains
288-390 MWh/year + HVAC Demand ↓10-50%

Strong Long-Term Value
Pay back in 10-15 years

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