Project Statement:

Team SFI designed, built and tested two window-based photovoltaic systems.

First Unit - BIPV (Building Integrated PhotoVoltaic) system built in Fall.
- Upgraded version of BIPV system built by Team HelioTech, a previous senior projects team.

Second Unit - A newly designed BAPV (Building Adaptive PhotoVoltaic) system built in Spring.

- Both units utilize 3M Brand Prestige Series Window Film –
  - Wavelength selective films
  - Reflect infrared light and allow visible light to pass through
  - Reflected light is diverted onto PV cells & increases power output

- As power output is proportional to quantum efficiency, PV Cells produce the most power in the visible and very near-infrared light regions of the light spectrum which the 3M Brand Prestige Window Film reflects

Fall BIPV System

- BIPV incorporates PV materials to replace conventional building parts 
  during the construction of a building
- Team SFI enhanced Team HelioTech’s BIPV system:
  - Improved manufacturability
  - Reduced overall weight by 14 lbs
  - Increased vertical spacing by 1.4 inches per subassembly to reduce internal shading
  - Increased performance evaluation capabilities by emphasizing on data collection
  - Increased angle flexibility – 22.5° to 66.5°

Company Background

3M, the sponsor of this project is a global science-based innovative company with sales of over $30 billion, over 88,000 employees and a diverse range of products that improve people’s lives. One such product, 3M Brand Prestige Series Window Film, is used in this project to create novel photovoltaic systems. The Spring BAPV system will be installed at 3M, Maplewood, MN.

Little Traverse Conservancy is an organization committed to protect the natural diversity of northern Michigan. They have provided access to LSSU to conduct research activities at Vermilion Point, where Fall BIPV system will be installed.

Fall BIPV System

- Located in front of Brady Hall
- Built by Team HelioTech (2012-2013)

Spring BAPV System

- BAPV incorporates PV materials to replace conventional building parts
- Uniquely designed BAPV window blinds mounted behind existing windows
- Smaller PV subassemblies as compared to the Fall unit to fit as blinds
- Angle adjustment between 0° and 70°
- Created software simulator to optimize PV subassembly spacing, angles, and film width

Testing Shed

- Control Array versus:
  - BIPV With Film and Front Glass
  - BIPV With Front Glass But No Film
  - BIPV With Film But No Front Glass

Actual results as compared to the Control Array