Green Art Studio
IPRO 335
MISSION STATEMENT

To deliver a visionary yet realistic building design to the public, demonstrating the full potential and importance of using Green Solutions
STAKEHOLDERS

• The public

• Developers

• Engineering / Design firms

• Government
THE PROBLEM STATEMENT

• Buildings leave a huge impact on the environment

• Most of the Green Solutions are Value Engineered out

• The Initial Investment in “Green” Building is very high
SEMESTER OBJECTIVES

• Design and estimate a Green Building that has very low impact on the environment
• Develop an innovative building, “Green Art Studio”, as a prototype for public use building
• Analyze the cost and payback time for return on investment
• To build team work experiences
DEFINITIONS

• LEED — Leadership in *Energy and Environmental Design*

• USGBC – U.S. Green Building Council

• HVAC— Heating, Ventilating and Air Conditioning

• iGroups – collaboration website for students to work on IPRO Projects
Compiled groups included members from various fields
WORKFLOW SCHEDULE

- Enthusiastic Beginning

IPRO 335 Green Building Design Schedule  Weeks

- Architectural Design
- Project Plan
- Building Envelope
- Building Model
- Water Use, Plumbing System and Drainage
- Midterm Report
- Solar Energy HVAC/Electrical Systems
- Geothermal/ Ice Energy HVAC system
- Landscaping/Green Roof
- Final Report
- Presentation
- Brochure
- Poster
- Fire Protection System
- Cost Estimating and Scheduling
- Energy Modeling
WORKFLOW SCHEDULE

Reality!
SOLAR SUN STUDY
**SunPower 315 Solar Panel Data**

- **19.3% Efficiency**
- **315 Watts peak per panel**
- **61.39” x 41.18” x 1.81”**

### BENEFITS

- **Highest Efficiency**
  - Panel efficiency of 19.3% is the highest commercially available.

- **More Power**
  - SunPower 315 delivers 50% more power per unit area than conventional solar panels and 100% more than thin film solar panels.

- **Reduces Installation Cost**
  - More power per panel means fewer panels per install. This saves both time and money.

- **Reliable and Robust Design**
  - Proven materials, tempered front glass, and a sturdy anodized frame allow panel to operate reliably in multiple mounting configurations.

### Electrical Data

- **Measured at Standard Test Conditions (STC):** Irradiance of 1000 W/m², air mass 1.5g, and cell temperature 25°C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Power (+/-5%)</td>
<td>Pmax</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>Vmp</td>
</tr>
<tr>
<td>Rated Current</td>
<td>Imp</td>
</tr>
<tr>
<td>Open Circuit Voltage</td>
<td>Voc</td>
</tr>
<tr>
<td>Short Circuit Current</td>
<td>Isc</td>
</tr>
<tr>
<td>Maximum System Voltage</td>
<td>IEC, UL</td>
</tr>
<tr>
<td>Temperature Coefficients</td>
<td>Power, °C</td>
</tr>
<tr>
<td></td>
<td>Voltage (Voc), mV/°C</td>
</tr>
<tr>
<td></td>
<td>Current (Isc), mA/°C</td>
</tr>
<tr>
<td>Series Fuse Rating</td>
<td>15 A</td>
</tr>
<tr>
<td>Peak Power per Unit Area</td>
<td>193 W/m², 17.9 W/ft²</td>
</tr>
<tr>
<td>CEC PTC Rating</td>
<td>291.6 W</td>
</tr>
</tbody>
</table>

### SunPower 315 Solar Panel

The SunPower 315 Solar Panel provides today’s highest efficiency and performance. Utilizing 96 next generation SunPower all backcontact solar cells, the SunPower 315 delivers an unprecedented total panel conversion efficiency of 19.3%. The 315 panel’s reduced voltage-temperature coefficient and exceptional low-light performance attributes provide outstanding energy delivery per peak power watt.

### SunPower’s High Efficiency Advantage - Up to Twice the Power

<table>
<thead>
<tr>
<th>Comparable systems covering 1000 m² / 10,750 ft²</th>
<th>Thin Film</th>
<th>Conventional</th>
<th>SunPower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watts / Panel</td>
<td>65</td>
<td>165</td>
<td>315</td>
</tr>
<tr>
<td>Efficiency</td>
<td>0.0%</td>
<td>12.0%</td>
<td>19.3%</td>
</tr>
<tr>
<td>LWs</td>
<td>00</td>
<td>120</td>
<td>193</td>
</tr>
</tbody>
</table>
Photovoltaic Placement
- Air gap increases PV efficiency by allowing passive cooling
- Operable panel allow for greater sunlight capture
- 25kW electricity generated at peak
HEAT & COOLING

- Worked with an Industry Professional (McQuay Representative)
- Effective in Winter and Summer
- Choose a vertical closed well system
- Up to 70% possible year-to-year savings over conventional system
ENERGY SAVINGS VS. COST
GREEN ETHICS

• Is saving a planet worth the additional upfront building cost?

• Contractors have bias about green solutions as “something fancy” vs. “something efficient”

• Consumer ignorance
INDUSTRY FACTS

• Demolition and construction produce 136 million tons of waste in the U.S. (2.8 lb/person/day).

• Buildings use 40 percent (3 billion tons annually) of the raw materials consumed globally.

• Buildings use 40 percent of the world’s energy, 75 percent of the world’s wood, and 16 percent of the world’s water.
POSSIBLE SOLUTIONS

• Constantly improve available technologies
• Educate the consumer (USGBC)
• Promote professional accreditation (LEED AP)
• Government Regulations
  – Building Codes
  – Tax Credits
  – Grants
EXISTING GREEN LEEDers

Jewish Reconstruction Congregation  
Evanston, Illinois  
LEED Platinum Certification  
Built 2008

111 South Wacker Drive  
Chicago, Illinois  
LEED Gold Certification  
Built 2005
MAJOR ACHIEVEMENTS

• Designed and integrated major Green technologies into a single innovative LEED Platinum building in Chicago

• Analyzed the cost associated with design and construction vs. the time for return on investment

• We all worked collectively in goal oriented teams
PROFESSIONAL REVIEW

• David DeBord, PE, Senior Engineer
  Environmental Systems Design, Inc
  “This is a great project. Students have done a tremendous job!”

• CP Management Corp. –Real Estate Company
  “It’s a great project to build, and we will be happy to assist in design phase as well”
Thank you

Questions