Instasol Technology LLC 1: CPV module

Overview
The intent of this project was to generate an innovative CPV (Concentrated Photo Voltaic) module design. A CPV module concentrates solar energy on a solar cell to increase its power output. The team was tasked with designing the concentrator, concentrator mount, solar cell housing, and cooling system of the CPV module. The team was also expected to technically and economically evaluate our design.

Objectives
The team objective was to design a CPV module that outperforms conventional solar panels in both power output and cost savings. The team’s mechanical engineer, electrical engineer, and materials science engineer were responsible for mechanical/cooling system design, electrical connection design/testing, and materials selection respectively.

Approach
• The team approached the design problem by first researching current CPV products and patents
• The team then generated a list of questions regarding project objectives and general design approaches for the sponsor to make sure team and sponsor were “on the same page”.
• The next step involved individual and team brainstorming sessions to generate concept solutions.
• After concept generation, the team used concept screening techniques to eliminate, refine, combine, and finally, select the best concept for development.
• Final concept heat transfer calculations served as the basis for the cooling system design.
• To reduce prototype production time, a six foot dish was purchased as the concentrator.
• CAD solid models and shop drawings were generated for the CPV module aluminium housing.
• The team participated in a design review of the CAD models. Team members offered improvements to the design. The CAD model was not approved until all team members were satisfied with design.
• A fabrication process plan of the prototype CAD models was devised and the prototype completed.
• Prototype was designed so that several test parameters could be adjusted. Testing was performed with different concentration factors, cooling system configurations, and weather conditions.
• Results showed that concentration was possible but heavenly dependant and dish placement and weather conditions.

Outcomes
• The concept prototype was successfully fabricated and can be used to test new designs in addition to the team’s design.
• The sponsor will save thousands of dollars on new product development
• The team produced innovative cooling system designs such as implementing infrared radiation blocking window films and recirculative water cooling that can possibly be patented.