Rockland Manufacturing - Capturing Energy

Overview
Welders and plasma cutters require energy to cut and join metals. Furthermore, a high amount of energy is given off by these processes, specifically, ultra violet, infrared, and visible radiation.

Objectives
Determine the feasibility and potential return on investment of capturing energy that is emitted during welding or plasma cutting processes in a manufacturing environment. Design a prototype of the device that would capture this light when mounted on Rockland’s plasma cutting machine or welders.

Approach
- Established the needs and wants of our sponsor during a site visit
- Generated several initial concepts, two for the manual welders and one for the plasma cutter, in which photovoltaic cells are attached to the design to capture energy from the welders or plasma cutter
- Determined relative electromagnetic radiation (EM radiation) intensity emitted by each device
- Used customer needs and wants as well as EM radiation intensity calculations to choose an initial concept
- Decided to pursue the plasma cutter mount design
- Generated secondary concepts for the plasma cutter mount design in SolidWorks
- Analyzed secondary concepts using ASAP light modeling software to optimize angle of incidence of EM radiation on photovoltaic cells
- Finalized design and built plasma cutter mount prototype. This included attachment and wiring of photovoltaic cells
- Performed finite element analysis of the plasma cutter mount to determine strain on the prototype
- Tested the prototype with a halogen flood light, MIG welder, TIG welder, and the sun

Outcomes
We have concluded that the initial sponsor requirement of a 3 year return on investment is not feasible. The prototype design would offset $2.13 per year on Rockland’s electricity costs. In order to achieve a 3 year return on investment, the design would need to output 1.05 kW. This is not possible with current photovoltaic cell technology.