TMP Manufacturing 1-2: Energy Efficiency

Overview
Originally, this project was intended to develop a test procedure involving a better combination of refrigeration components for a walk-in cooler to improve the overall energy efficiency. This energy efficiency improvement is needed because the Department of Energy has mandated a change to a less energy efficient refrigerant. Because of an inability to test the components, and other unforeseen issues, the goals of the project changed towards a theoretical analysis of the current refrigerant used (R404A) and the new refrigerant (R407A) that the industry will be using next.

Objectives
The objective for the new project goal was to look at how each refrigerant performs under ideal conditions, and then compare the two to determine which one has a higher energy efficiency.

Approach
- The customer presented the problem statement to the team during the project introduction
- The team visited the manufacturing site and gathered background information from sponsor
- A concept map was generated to organize the ideas and define the relationships between them
- Upcoming environmental regulations declared by the DOE and EPA were reviewed
- We received binders from the sponsor containing freezer data
- We did an analysis to determine the CO2 emitted for the lifetime of the freezer unit assuming
- Results were validated by comparison to EIA data
- Using basic CO2 emission equations we determined that R-407A and R-404A are almost equivalent emitters of CO2 when looking at GWPs and amount of CO2 produced from electricity generation.

Outcomes
- R-404A produces less CO2 than R-407A if a coal plant is powering the freezer
- The customer will be paying significantly more for the electricity needed to power the freezer.
- At lower ambient temperatures R-407A actually does produce less CO2/lifetime than R-404A