Overview
Penn State, through different sustainability efforts has a goal of reducing their carbon footprint by 20 percent by 2030. One of the major emission sources that Penn State faces is through the purchasing of electricity and natural gas. These purchases have upstream carbon emissions before the end use. By creating a life-cycle assessment and determining the levelized cost of energy for each of these sources, the optimal generation mix was determined for purchased electricity.

Objectives
By finding the current greenhouse gas emissions of Penn State’s fuel and electricity purchases, we were able to find different ways to reduce the total emissions to meet the carbon reduction goals. By setting limits on the amount of carbon that can be released and not exceeding the current cost of electricity, we found a set of generation mixes that would suit Penn State’s energy future.

Approach
• Determined the customer needs through meetings with the sponsor
• Defined the scope of the design project and brainstormed different methods to portray the results
• Concept generation and selection was performed by the team to determine the best methodology
• Reviewed other large scale carbon reduction efforts: Cornell and Nanjing Universities, Vermont
• Data gathered from sponsor to determine current electricity and fuel demand
• Gathered information on emission sources for electricity generation and natural gas recovery
• Began plotting known pounds of carbon equivalent emissions against the levelized cost of energy
• Set limits of Penn State’s carbon reduction goals and current price
• Ran several optimization scenarios to determine boundary at current limitations
• Analyzed the results by comparison with current electricity usage
Outcomes

- This unique electricity purchasing technique will set a standard for future installed generation sources to meet customers’ new demands.
- At the ideal scenario, Penn State will save $750,000 on purchased electricity per year.
- And reduce carbon emissions by 30 percent.