

Austin Angel with Advising from Dr. Brent Shanks

Evaluating Energy Generation and Consumption at Iowa State University

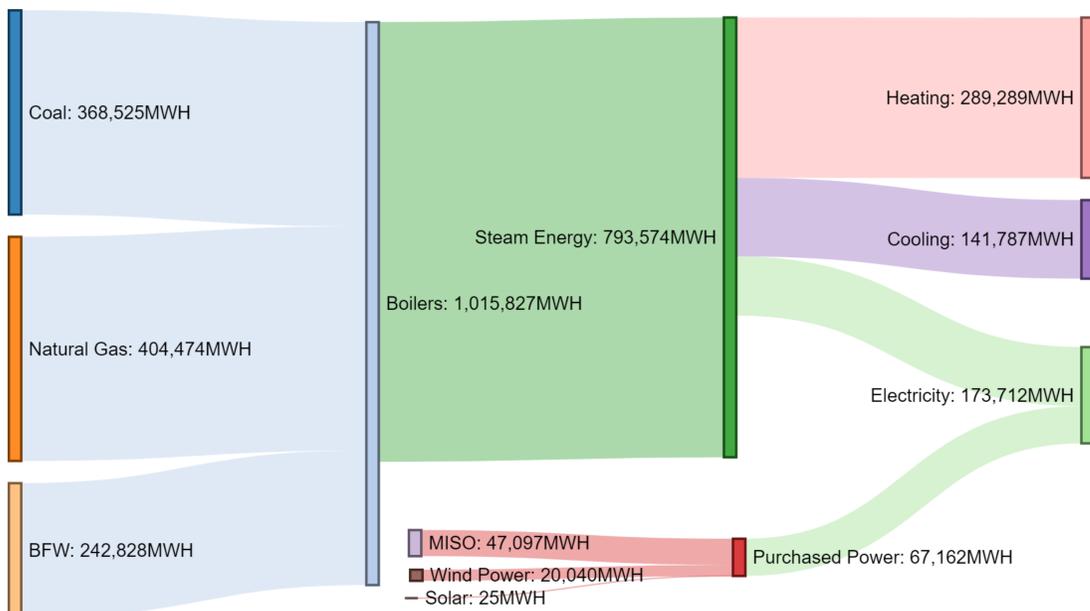
Project Abstract

The Iowa State power plant provides heating, cooling, and electricity for the main campus. The generation of these utilities releases emissions that have human health and environmental impacts. As a university, the choice of commodities and current infrastructure dictate the extent of the impact.

Assessing the flow of energy from fuel to final consumption will provide insight into the sustainability of Iowa State University. The analysis will also reveal opportunities for the university to reduce the impacts from operation. Ultimately, the project will reveal how green Iowa State University really is.

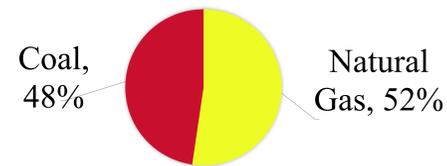
Energy Generation & Consumption

- Iowa State operates a cogeneration powerplant to maximize efficiency
- The main fuels are coal and natural gas with minimal renewables contributions
- University purchases electricity from the grid to supplement generated electricity
- Iowa State's power plant operated at approximately 52% efficiency for the year of 2019-2020
- 47% of the consumed energy was used for heating, 28% for electricity, and 23% for cooling
- 39% of electricity is purchased from the energy grid and is 100% renewable

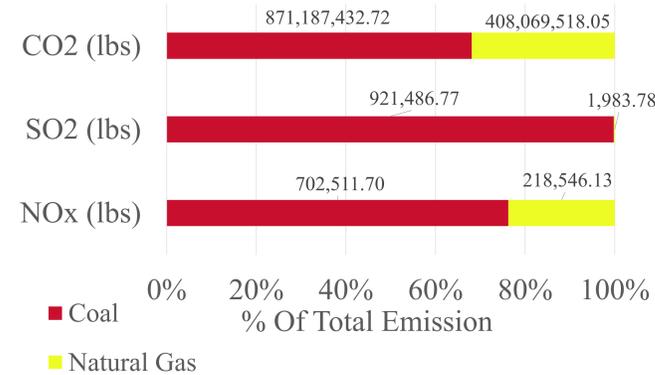


Our Estimated Carbon Footprint

ENERGY PRODUCTION BY FUEL



- Iowa State's emissions are generated from the burning of natural gas and coal to produce steam
- The main components released include NOx, SO₂, and CO₂



Effects of Emissions

Human Health Effects

- Greenhouse gases and other air pollutants react to form particulate matter in the air
- PM 2.5 presents the greatest risk as it can penetrate deep in lungs and bloodstream
- Particulate matter is linked to numerous health problems including heart and lung disease, respiratory problems, and premature death

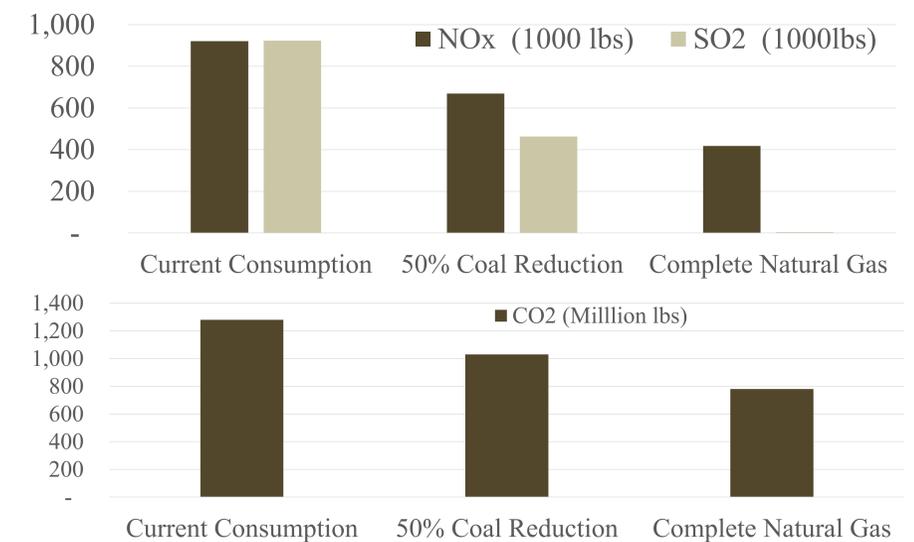
Environmental Effects

- Climate change from global warming including extreme weather patterns, decreased biodiversity, and rising oceans
- Contamination of local air, water, and soil

How can ISU improve?

Invest in Cleaner Forms of Energy

- Approximately 70% of CO₂, 80% of NO_x, and 99% of SO₂ emissions are associated with coal burning
- Iowa State is in the process of converting coal boilers to natural gas and plans to finish by 2023



Invest in Sustainable Design of Buildings and create meaningful changes on campus

- 22 buildings on campus are currently LEED certified including Student Innovation Center and Geoffrey Hall
- Invest in efficiency improvements on campus
- Join organizations with other universities to fight climate change such as President's Climate Leadership Commitment

Why not all-Natural Gas or renewables?

- Coal boilers are less susceptible to non-routine shutdowns
- Given our northern climate, Iowa State uses almost 50% of steam from cogeneration for heating. Electricity is just a byproduct
- Iowa State has made TON of improvements as a university and is still working toward many more (18% reduction in energy since 2008)