

Abstract

Whether it is electricity, natural gas, or other fuels, the use of energy is by far the largest source of greenhouse gas emissions, which is why so much emphasis is placed on energy conservation to combat climate change. Apart from making electricity generation less dependent on fossil fuels, which emit large quantities of greenhouse gases, significant effort is dedicated to reducing building energy use. The Cooper Union is subject to carbon emissions limits for its campus buildings beginning in 2024 in line with progressive energy legislation in New York City. Cooper Union students and faculty, as well as an external consulting firm, have utilized data analytics to develop strategies for meeting emissions targets while balancing financial costs. To ensure that Cooper Union meets its energy and carbon emissions goals, better insight into historical, current, and future energy consumption is needed. Issues with reliability, numerical and temporal accuracy, and prospective assessment in the context of Cooper Union's energy goals, impede the development of measures promoting more efficient building operation. This thesis presents three data analysis tools and strategies which address these issues by providing more detailed insight into the historical, current, and future energy performance of 41CS. A data stream is developed to collect natural gas consumption data in a more granular manner, a machine learning model is developed to predict real-time electricity consumption, and a web application is developed to evaluate future carbon emissions and cost projections in the context of Cooper Union's financial goals and greenhouse gas emissions limits. The tools developed as part of this thesis research demonstrate the need for electrification to meet Cooper Union's emissions targets and can impact other important decisions affecting the institution's energy use and operational costs.