

Implementing Sustainability into Statistics and Beyond

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Introduction

- Engineering Probability (IE 3301) is a required class for all engineering students.
- It covers the basics of descriptive statistics, distributions, inferential statistics including Hypothesis testing, and Simple Linear Regression.
- This class has a project where students pick their own datasets (one Normal, one Exponential) with at least 100 observations perform various analytics on them.
- I modified the project by providing sustainable datasets and used the EOP framework to get the students to relate their work with sustainability.

Evaluation and Impact

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Procedure/Methods

- Provided the students with a list of sustainability datasets to choose from for their four-part class group project
 - Have them Identify the basic concepts of Sustainability and Describe the EOP framework via a Team Quiz
 - Have them Integrate Sustainability and the EOP framework into their project presentations
 - Have them Hypothesize about the sustainability implications of their work
- The Project:
- Pick datasets with over 100 observations
 - Calculate Descriptive Statistics and Produce a Graph
 - Evaluate a Goodness of Fit Test
 - Construct a Hypothesis Test
 - Construct a Linear Regression Model

<https://webfiles.asee.org/index.php/apps/files/?dir=/Public%20Docs/EOP&fileid=113824#pdfviewer>

Progress

- After going over the EOP framework, the SDG goals, and the Engineering Grand Challenges the students were encouraged to see how they related to the datasets they investigated in their projects.
- Below are some snapshots from their presentations and reports detailing how they thought sustainability related to their projects and its implications.

- Dataset 1
 - Analyze the energy usage per square footage of 100 municipal buildings in Providence, Rhode Island, from the years 1950-2009 and the Energy Star Score they received in each respective year and make a conclusion if the data models a normal distribution

- The end goal of all engineers is to improve the living conditions of the world
- The UN laid out a blueprint on how to achieve that
- The collection and analysis of our data can be used to provide city planners and architects a guideline for creating a sustainable city and community
- The energy star scoring system used globally can improve evaluations, locate inefficient energy usage, and hold planners accountable
- Environmental disasters are unavoidable and must be planned for
 - Data on the frequency of earthquakes allows architectural teams to improve their building designs accordingly

Our first data set relates to SDGs and Engineering Grand Challenges for good health and well-being. By using that information, we can determine obesity and how to prevent it. We can use methods to decrease the amount of obesity by having good health and well-being, such as eating right or exercise more often, which is stated in one of the seventeen sustainable development goals.

Biodiesel and Ethanol regression line graph

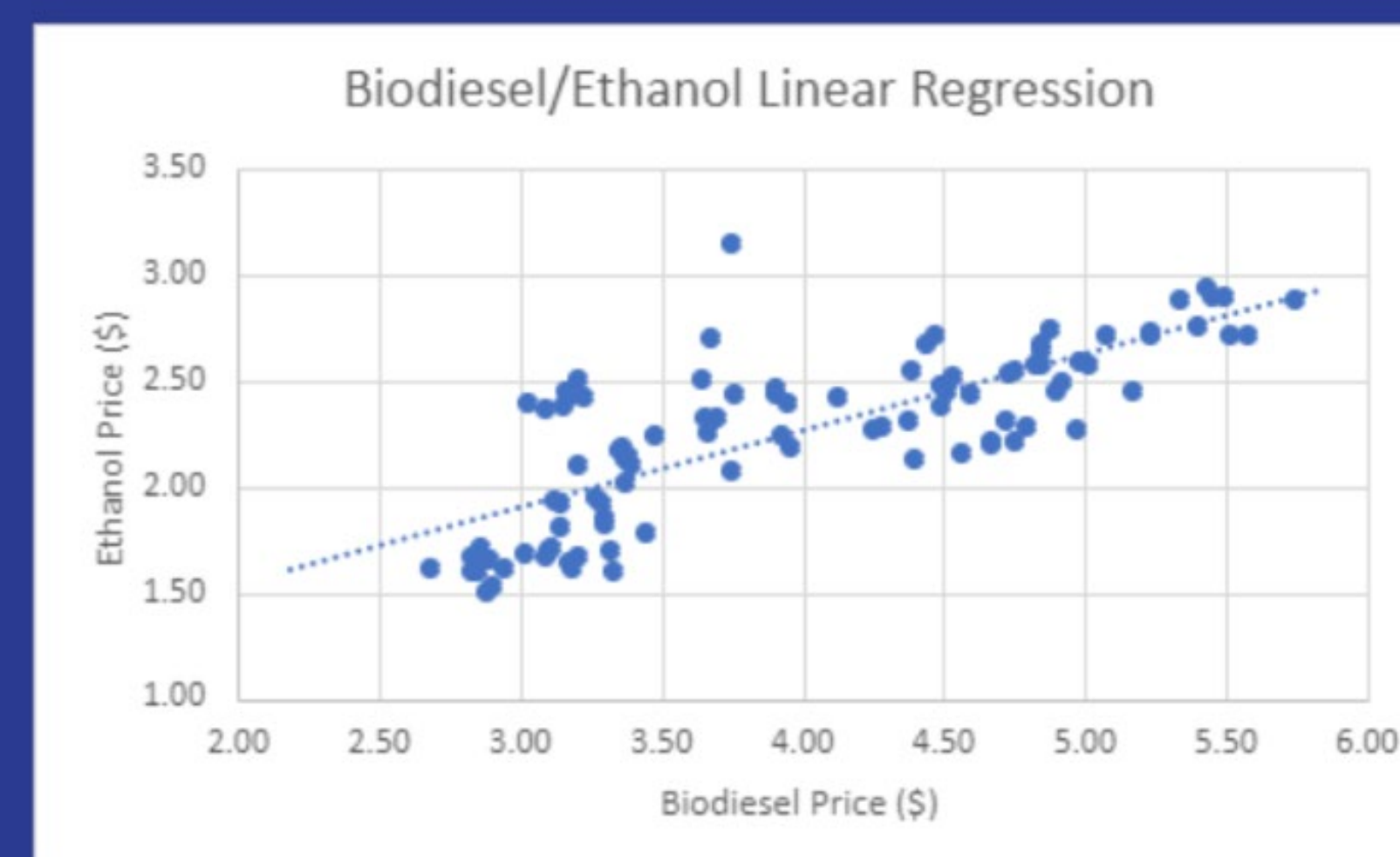


Figure 1. Linear Regression graph of Biodiesel and Ethanol



THERE IS A GREATER AVERAGE POWER USAGE BY THE CHICAGO SCHOOLS THAN THE PHILADELPHIA AVERAGE POWER USAGE SUGGESTING THAT CHICAGO SHOULD APPLY POLICIES FROM PHILADELPHIA SCHOOL DISTRICT TO INCREASE ENERGY EFFICIENCY.



WHILE MOST SCHOOLS HAVE A CERTAIN ENERGY USAGE, THIS DATA MAY HAVE IMPLICATIONS THAT OTHERS ARE BEING UNNECESSARILY WASTEFUL.



OVERALL, THIS DATA CAN BE USED TO IDENTIFY TRENDS IN ENERGY EFFICIENT SCHOOLS COMPARED TO LESS EFFICIENT SCHOOLS IN ORDER TO SPOT DIFFERENCES AND MAKE BENEFICIAL CHANGES RELATED TO ENERGY CONSUMPTION, GENERATION, AND SUSTAINABILITY.

Plan For Scaling Up

Plans for Post Pilot Expansion

At UTA we are having a big push towards sustainability.

- We are updating our sustainable plan for the school
- Just created a new degree called Resource and Energy Engineering
- Have Faculty Advisory Network for Sustainability (FANS)
- And have tried to implement projects like this before

This pilot project can serve as proof of concept on how to integrate sustainability into existing courses even ones as mathy as statistics without changing the curriculum and still having students get a lot out of it

Potential Barriers/Obstacles/Challenges to Implementation

- While there is a big sustainability push it is still on an instructor-by-instructor basis
- At UTA we have the Maverick Advantage which is a list of courses and instructors which cover 5 different areas.
- Pushing to add sustainability to the logo and this has seen a lot of student interest
- Furthermore, UTA has a great service-learning program combining the service-learning program with sustainable teaching could pay huge benefits beyond the classroom and into the community
- Beyond that having the FANS program have instructors share best practices and have a common output to evaluate the integration of sustainability

References

United Nations, The 2030 Agenda and the Sustainable Development Goals: An opportunity for Latin America and the Caribbean (LC/G. 2681-P/Rev. The Lemelson Foundation (2022). The Engineering for One Planet Framework: Essential Sustainability-focused Learning Outcomes for Education (2022). Grand Challenges for Engineering: Imperatives, Prospects, and Priorities: Summary of a Forum. Washington, DC: The National Academies Press. <https://doi.org/10.17226/23440>.

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