

FML FINAL REPORT

By: Praneeth Simha

Summary:

The information in this report is based on research that was done on fuel contracts, purchases, and expenses as they are detailed in EIA-923 Schedule 2, Part A. The study looks at the role that petrochemicals like mercury, ash, and sulphur play in the production of electricity.

In order to improve electricity generation in the United States, this report explores alternate uses for environmentally friendly chemicals as well as the possible advantages of lowering the importation of combustible materials. To enhance the nation's power producing processes, the research advises looking into these possibilities.

Goal:

The goal of this project is to maximize the insights that may be from the data and improve the observations produced from clustering.

Problem Statement:

- Overall analysis of the data
- The research examines how this result could impact the power production system in the United States and notes that Ash content in the fuel is considerably greater than Sulphur and Mercury level.
- In order to evaluate the data and derive actionable insights from it, this study examines the best strategies for modelling to apply.

Task:

The main finding obtained from the data is that the elements contained in the fuel have the greatest influence on fuel usage. Coal, natural gas, and petroleum were the three categories that the study divided based on the varied fuel types reported on the same date and fuel group code.

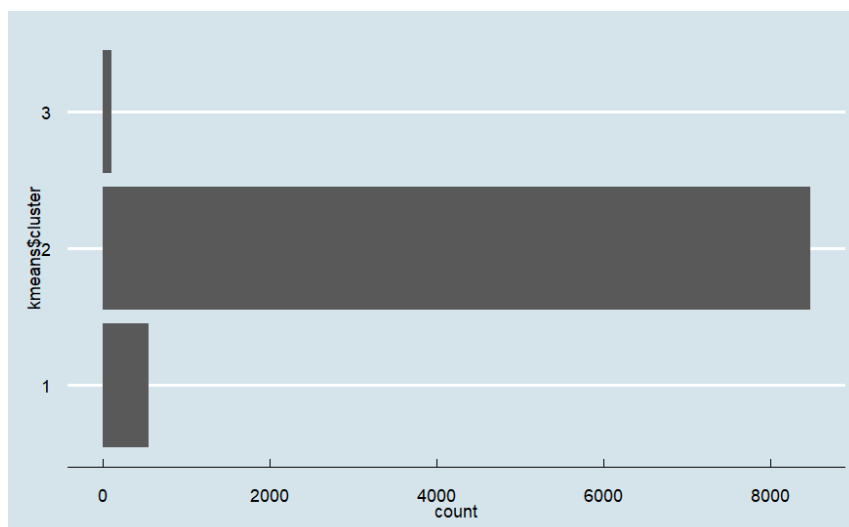
Sulphur, ash, and mercury content in these fuels varies. The study concluded that a significant factor influencing fuel usage is the composition of the fuel, namely the amounts of sulphur, ash, and mercury.

Analysis:

- The study found a negative correlation between fuel MMBtu cost and fuel MMBtu per unit.
- Out of the 1001 rows analysed, 562 rows are made up of coal that exclusively contains Sulphur and Ash. The fuel value of the coal is 24 MMBtu per unit with an average cost of \$2.5 per MMBtu.
- The analysis found 325 rows of natural gas that were made entirely of sulphur. One MMBtu of gasoline is typically ordered for a price of \$7.5 per MMBtu. Depending on the transfer's final destination, natural gas can be transported in one of two ways: firmly or intermittently.
- There are 116 rows of petroleum that are made entirely of petrochemicals including sulphur. The gasoline has a 4 MMBtu value per unit and costs \$18 on average per MMBtu.
- According to the analysis, coal has an average ash concentration of 15%, which is the highest. Ash in the fuel can be an issue since it can result in ashfall, which can choke off-site power sources and generator air intakes. For power production systems that burn coal as a fuel, this can cause power outages or shutdowns and is a major worry.
- This type of coal loses calorific value and carbon content when ash is present, which necessitates the employment of extra fluxes to remove the ash as slag. This procedure alters the blast furnace's thermal equilibrium which may result in decreased productivity and higher fuel usage.
- As a result, even if coal is generating less, more coal will be needed to attain the requisite productivity level.
- Coal and natural gas naturally contain mercury, which is discharged into the environment when these fuels are used. Moreover, all fuels are abundant in sulphur which is required for engine lubricants to prevent the build up of sulphur oxide.
- Engine oils are used to coat coated parts to provide a protective coating which lowers the rate of corrosive wear.

Plot:

Ash (8477), Sulphur (546) And Mercury (105).



The Clustering of the data:

K-means clustering with 3 clusters of sizes 8477, 105, 546

Cluster means:

	rowid	plant_id_eia	fuel_received_units	fuel_mmbtu_per_unit	sulfur_content_pct	ash_content_pct
1	298051.3	17040.97	86050.3	9.4429755	0.5487767	3.937276
2	368379.0	32911.59	5113157.8	0.9828476	0.0000000	0.000000
3	362256.8	38176.42	1945453.5	1.0311245	0.0000000	0.000000

Within cluster sum of squares by cluster:

[1] 5.053238e+14 3.187239e+14 2.560048e+14
(between_SS / total_SS = 79.9 %)

Available components:

[1]	"cluster"	"centers"	"totss"	"withinss"	"tot.withinss"	"betweenss"	"size"
[8]	"iter"	"ifault"					

Conclusion:

The US PUDL power generating system might be controlled to protect the economy and the environment at the same time. As coal's ash content lowers productivity which eventually results in an increase in its use this might be accomplished by optimizing the use of natural gas or petroleum. The US PUDL might lower its fuel costs while simultaneously protecting the environment by switching to a more efficient use of natural gas or petroleum.