# Exploratory Analysis of Global Biogas Production Dataset

## INTRODUCTION

Biogas, a renewable energy source generated from organic materials such as agricultural waste, food scraps, and sewage, holds significant promise as a sustainable alternative to fossil fuels. Analyzing datasets related to biogas production provides valuable insights into optimizing its efficiency and environmental benefits. This report presents an analysis of a biogas production dataset, exploring key variables and patterns to understand factors influencing biogas yield and quality. By shedding light on the dynamics of biogas production processes, this analysis aims to inform decision-making for renewable energy strategies and contribute to global sustainability efforts.

## MATERIALS

1. **Python :** Used as the primary programming language for data processing and analysis.
2. **Pandas :** Utilized for data cleaning, transformation, and exploratory analysis due to its efficient data structures and functionalities.
3. **Jupyter :** Employed for interactive data analysis and report generation, facilitating collaboration and documentation of analysis workflows.
4. **CSV File :** The dataset was provided in CSV format, containing raw data on biogas production, which was loaded and analyzed using Python and Pandas.

## 1.Biogas production from cow manure

This dataset was granted by professor **Jackson Milano**, from Universidade Positivo, as part of his essay with BGS domestic biodigesters, in a ranch, for 14 months, experimenting 4 different biodigestor configurations to obtain continuous biogas production from cow manure all over the year in south of Brazil.

## 2021 Data Analysis

### Monthly data over 2021

| Data | tempSubst | tempSolo | umidAmb | tempAmb | umidGas | tempGas | decDeBiogas | volumeTotal |
|---|---|---|---|---|---|---|---|---|
| 1899-12 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 2021-05 | 18.739791 | 19.000816 | 78.521592 | 18.150846 | 70.405085 | 19.335463 | 0.000229 | 0.026289 |
| 2021-06 | 15.993154 | 16.297194 | 87.809091 | 13.713518 | 86.493304 | 14.042885 | 0.000000 | 0.000000 |
| 2021-07 | 15.054787 | 15.169759 | 83.152048 | 13.228996 | 90.339598 | 13.045430 | 0.000000 | 0.000000 |
| 2021-08 | 15.469959 | 15.458460 | 86.802282 | 15.661288 | 83.150204 | 15.319910 | 0.000008 | 0.001557 |
| 2021-09 | 18.894286 | 18.655934 | 87.372527 | 18.768132 | 82.245165 | 19.667857 | 0.000000 | 0.000000 |
| 2021-10 | 18.502378 | 18.712865 | 92.589189 | 16.842703 | 83.987514 | 17.591946 | 0.000000 | 0.000000 |
| 2021-11 | 19.731682 | -14.675628 | 77.753935 | 21.854079 | 80.419755 | 23.942758 | 0.000087 | 0.010440 |
| 2021-12 | 21.739521 | 22.396669 | 78.167607 | 22.772295 | 803.897779 | 787.789031 | 0.000123 | 0.000000 |

## Annual average

| Data | tempSubst | tempSolo | umidAmb | tempAmb | umidGas | tempGas | decDeBiogas |
|---|---|---|---|---|---|---|---|
| 1899 | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 2021 | 18.663255 | 10.301185 | 81.496427 | 18.901011 | 266.994729 | 215.391367 | 0.000075 |

# 2022 Data Analysis

## Monthly data over 2022

| Data | tempGasB2 | tempAmb | tempGas | umidGasB2 | TempSoloB2 | umidGas | tempSubst | umidAmb |
|---|---|---|---|---|---|---|---|---|
| 1899-12 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 2022-01 | 947.209589 | 23.306350 | 924.410527 | 950.476235 | 21.682611 | 928.340209 | 22.301797 | 84.494808 |
| 2022-02 | 998.000000 | 24.022617 | 654.147924 | 998.000000 | 22.206638 | 674.702713 | 23.126129 | 80.238248 |
| 2022-03 | 998.000000 | 22.548078 | 171.047005 | 998.000000 | 22.704936 | 222.904446 | 23.459299 | 88.310762 |
| 2022-04 | 998.000000 | 18.774207 | 984.769973 | 998.000000 | 21.025854 | 985.633558 | 20.584159 | 90.051992 |
| 2022-05 | 998.117709 | 15.069671 | 856.368643 | 998.111877 | 18.719417 | 867.845567 | 17.988499 | 87.953128 |
| 2022-06 | 998.122075 | 13.977609 | 838.043896 | 998.116382 | 16.297306 | 840.004377 | 15.604206 | 91.120304 |
| 2022-07 | 998.000000 | 15.821315 | 998.000000 | 998.000000 | 15.895319 | 998.000000 | 15.567371 | 83.403785 |

## Annual average

| Data | tempGasB2 | tempAmb | tempGas | umidGasB2 | TempSoloB2 | umidGas | tempSubst | umidAmb | VolumeTotalB2 | decDeBiogasB2 | decDeBiogas | volumeTotal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1899 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 2022 | 988.205858 | 20.324834 | 693.862138 | 988.836263 | 20.71215 | 712.048563 | 20.936283 | 86.341951 | 0.002678 | 0.001321 | 0.000548 | 0.000432 |

# REFERENCES


1. Biogas production by **Jackson Milano**

## Other public dataset on biogas production

| | contributor / author | link |
|---|---|---|
| 1 | Madhumita Jaganmohad | **Production of biogas worldwide from 2000 to 2020** |
| 2 | Gustavo Mockaitis, Guillaume Bruant,Serge R. Guiot,Eugenio Foresti,and Marcelo Zaiat | **Biogas production and metagenomic data** |
| 3 | Anthony Onokwai | **Data on Biogas Production using Domestic Waste and Weed** |
| 4 | Heike Sträuber | **https://zenodo.org/records/3461520** |
| 5 | Lucia fernandez | **Leading biogas producing countries in 2014** |
| 6 | Daniel Slota | **Energy generated from biogas in China from 2010 to 2021** |
| 7 | Fabio Monforti Ferrario<br>Nicolae Scarlat<br>Fernando Fahl<br>Jean-François Dallemand | **Potential of biogas production from livestock manure in Europe** |
| 8 | IVAN DAUDT | **Biogas production from cow manure** |
| 9 | United nations Statistics division | **https://data.un.org/Data.aspx?d=EDATA&f=cmID%3ABI%3BtrID%3A0914** |