# Exploring Trends in Renewable Energy Production

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## Introduction

This study examines the UK's shift to renewable energy from 1990 to 2020, motivated by environmental concerns. Using Python visualizations, it analyzes key renewable sources—wind, solar, hydro, landfill gas, and biofuels—to showcase progress in sustainable energy solutions.

## Description of the Data

The dataset contains annual figures detailing the UK's renewable energy output from 1990 to 2020. It is ideal for analyzing trends over time, as it encompasses various sources, including hydro, wind, solar, landfill gas, wood, and biofuels, all using consistent units.

## Summary Statistics

Table 1: Summary statistics for key renewable energy sources in the UK (1990–2020).

| Source | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| Hydroelectric power | 4.93 | 0.63 | 4.04 | 5.94 |
| Wind, wave, tidal | 13.7 | 5.92 | 5.93 | 24.31 |
| Solar photovoltaic | 10.9 | 6.24 | 0.69 | 19.39 |
| Landfill gas | 3.78 | 1.25 | 2.02 | 5.95 |
| Wood | 4.0 | 1.68 | 1.38 | 6.32 |
| Liquid bio-fuels | 2.58 | 1.45 | 0.63 | 5.15 |

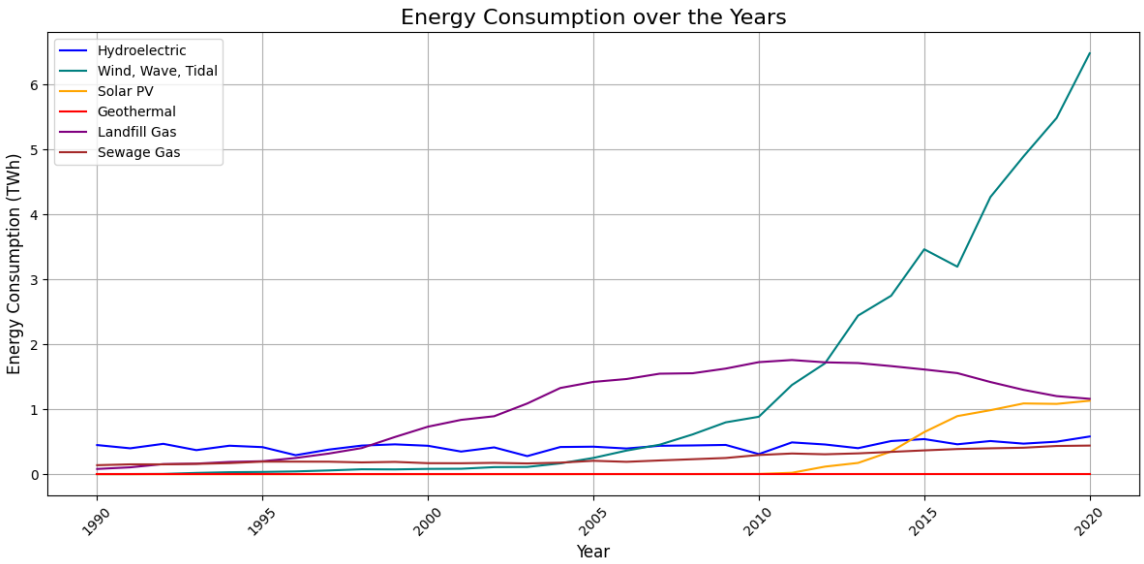


Figure 1: Title: Trends in Renewable Energy Consumption by Source (1990–2020)

This multi-line time series plot illustrates the annual energy consumption (in TWh) from six different renewable sources in the UK from 1990 to 2020.

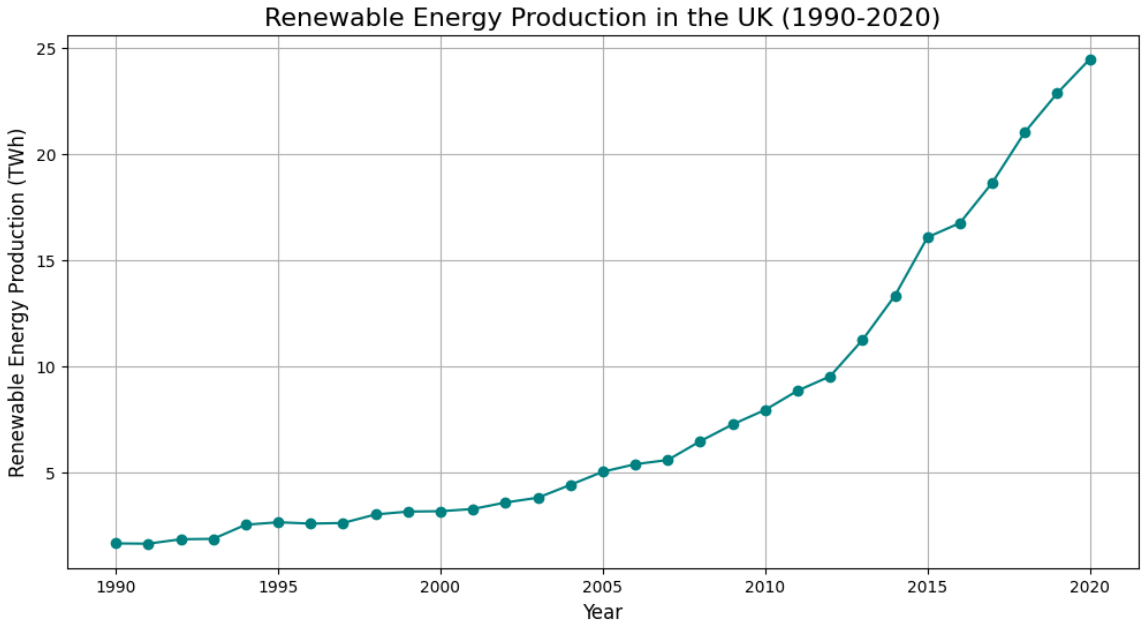


Figure 2: Trend of Renewable Energy Production in the UK (1990–2020)

This line plot illustrates the total renewable energy production in the UK between 1990 and 2020, measured in terawatt-hours (TWh).

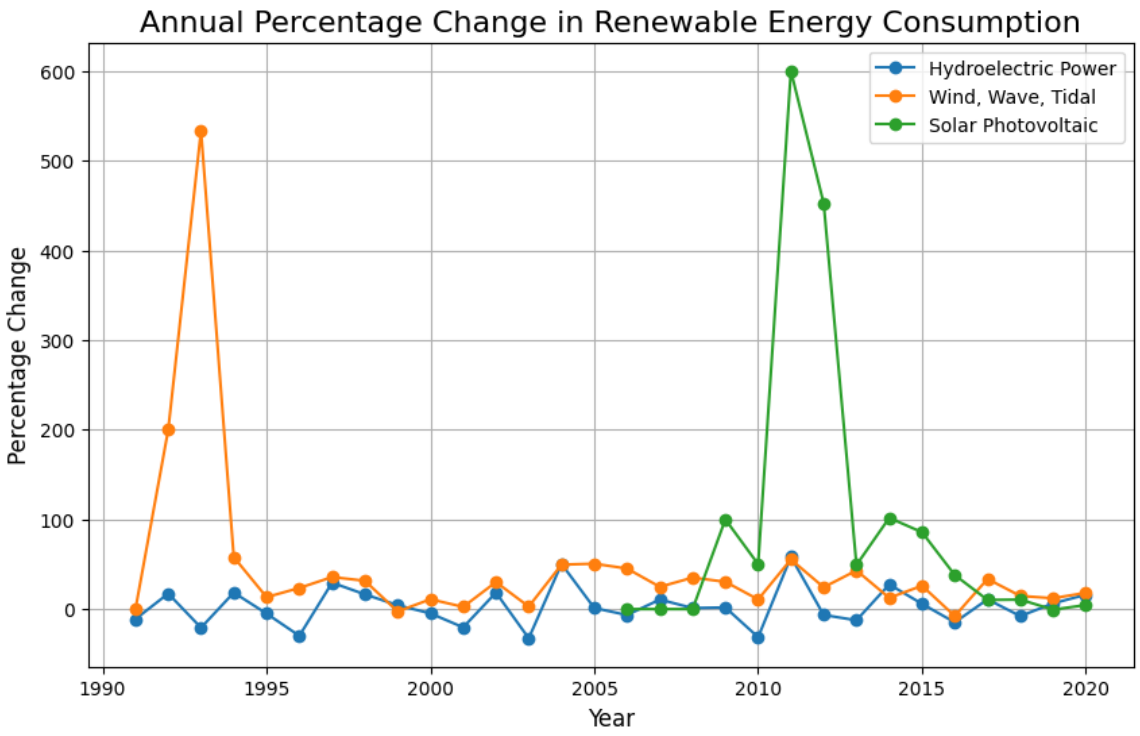


Figure 3: Annual Growth Rate of Renewable Energy Consumption by Source (1990–2020)

This line plot illustrates the annual growth rate of renewable energy consumption by source from 1990 to 2020. year-over-year percentage change in energy consumption for three major renewable energy sources in the UK

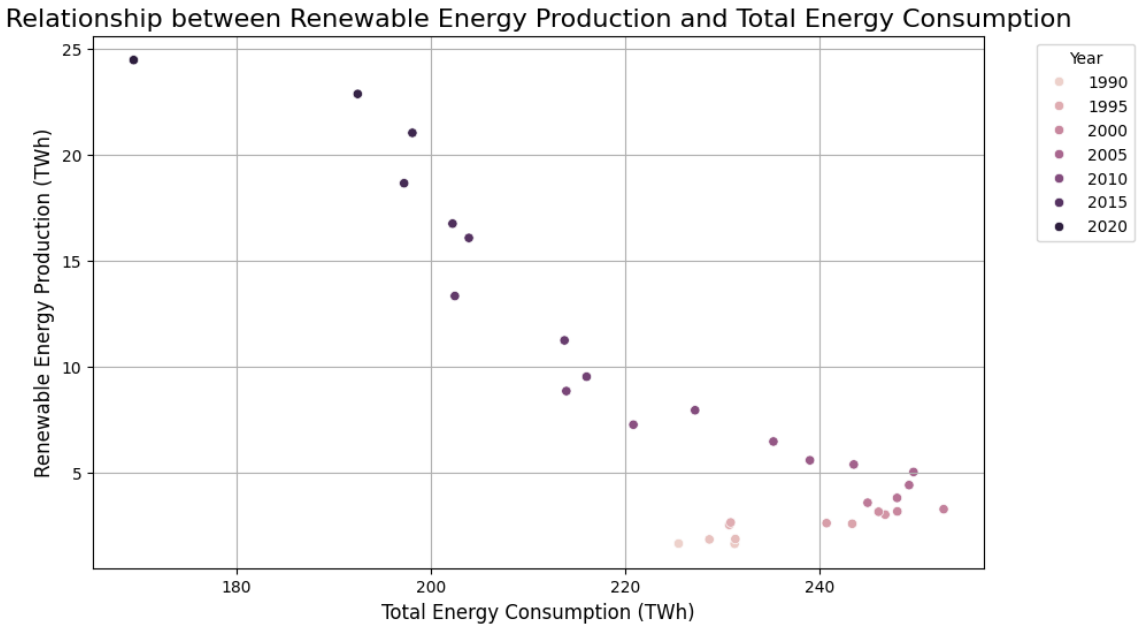


Figure 4: Scatter Plot of Renewable Energy Production vs Total Energy Consumption (1990–2020)

This scatter plot shows the relationship between total energy consumption (x-axis) and renewable energy production (y-axis) in the UK from 1990 to 2020, with dots representing each year, ranging from light pink for 1990 to dark purple for 2020.

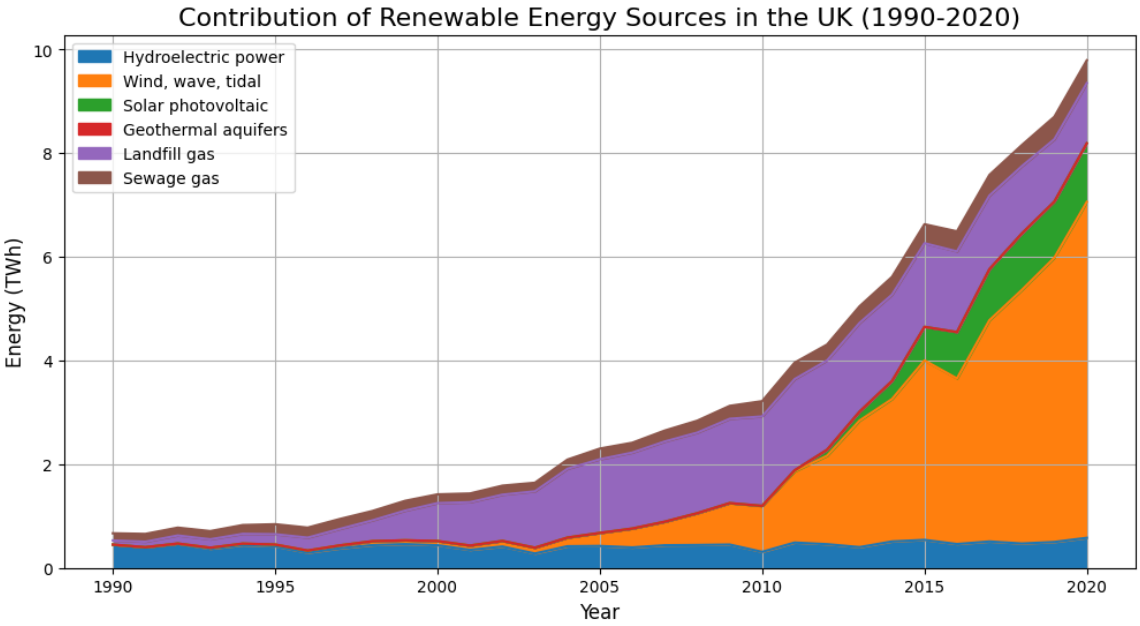

Figure 5: Stacked Area Chart of Renewable Energy Contributions in the UK (1990–2020)

This stacked area chart illustrates the contributions of various renewable energy sources to the total renewable energy production in the UK from 1990 to 2020.

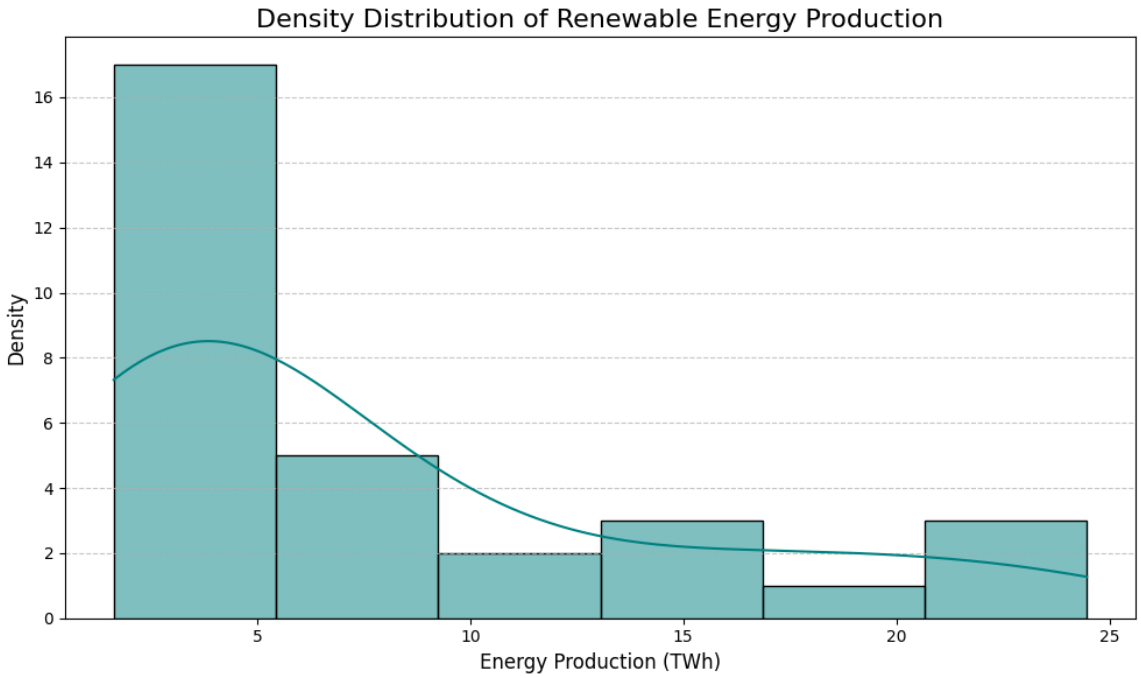


Figure 6: Distribution of Renewable Energy Production (1990–2020)

This histogram includes a kernel density estimate (KDE) curve, illustrating the distribution of renewable energy production values (in TWh).) across the years 1990 to 2020.

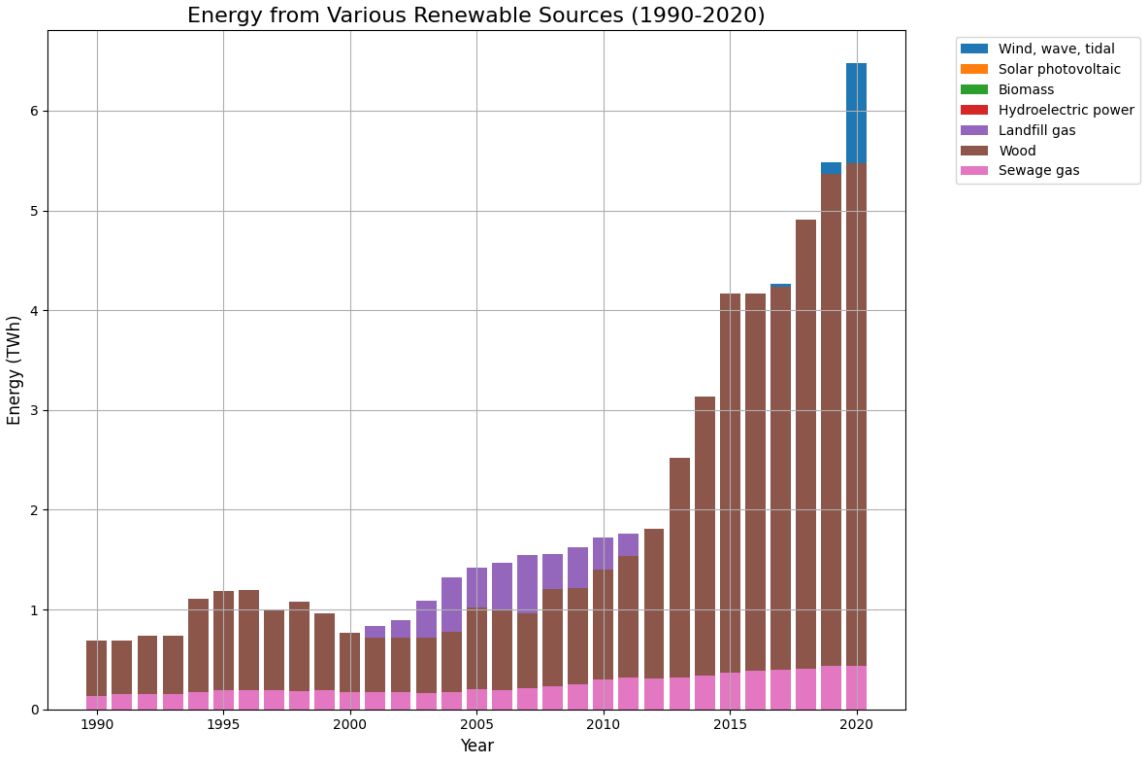


Figure 7: Stacked Bar Chart of Renewable Energy Sources in the UK (1990–2020)

This stacked bar chart illustrates the annual energy production (measured in TWh) from different renewable sources in the UK from 1990 to 2020. Each colored segment within the bars represents the contribution from a specific source of renewable energy.

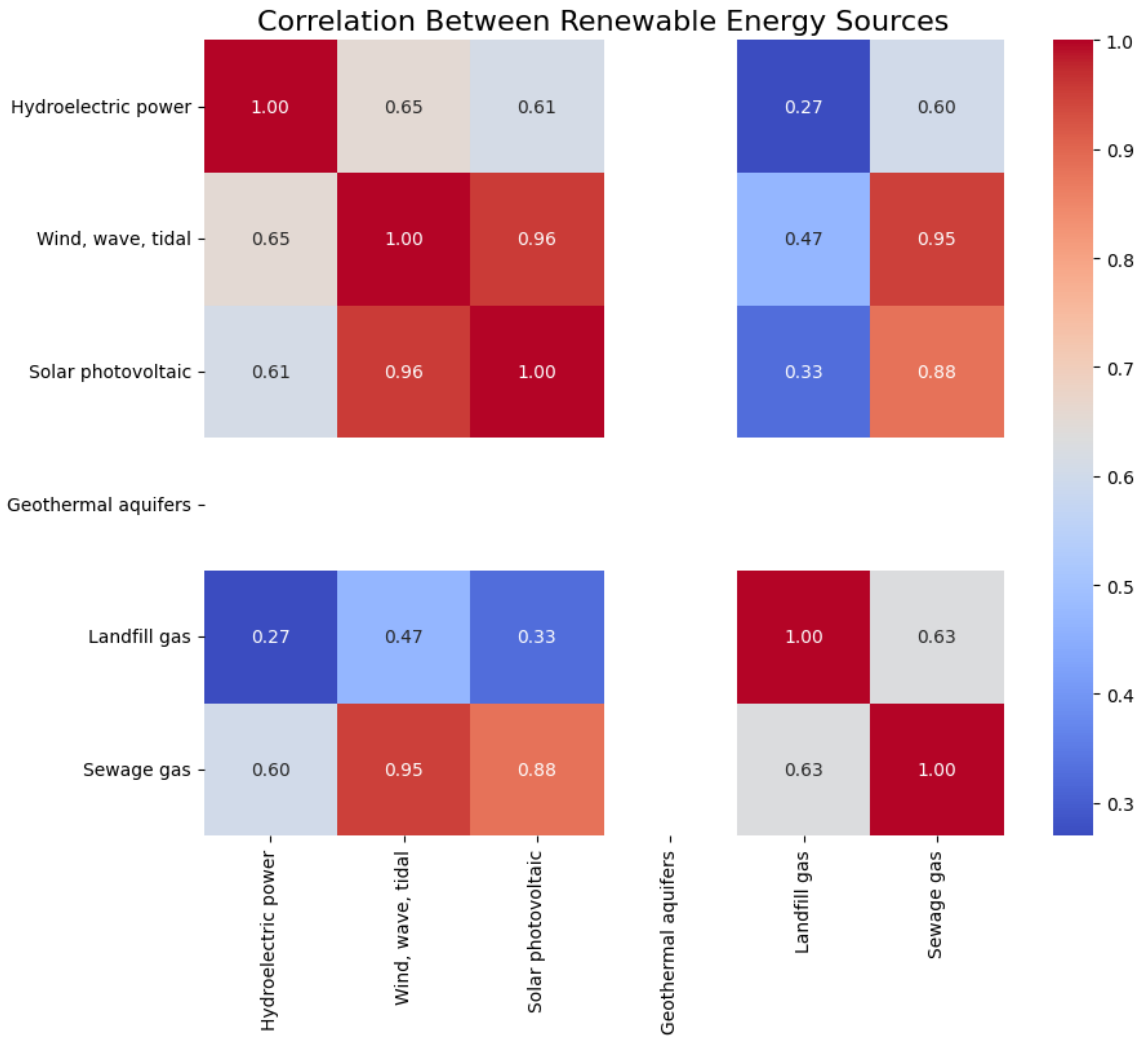


Figure 8: Correlation Matrix of Renewable Energy Sources in the UK (1990–2020)

This heatmap displays the Pearson correlation coefficients between various renewable energy sources over the specified time period. The values range from 0 (indicating no correlation) to 1 (indicating a perfect positive correlation).

## Results and Interpretation

The visualizations indicate that renewable energy in the UK is expanding rapidly, primarily due to solar and wind power. Hydropower remains stable, while emissions from landfill and sewage gas have decreased. Correlation research shows a strong relationship between wind and solar energy, and grouped charts support their dominance over more traditional sources, such as landfill gas.

## Conclusion

The UK's energy plan from 1990 to 2020 demonstrated a strong emphasis on clean energy, with notable increases in the use of solar and wind power. While sewage and landfill gas were gradually phased out, hydroelectric power stayed steady, indicating a move towards more dependable and sustainable sources.

## Summary

The UK’s shift to wind and solar has boosted investments in renewables, increasing clean energy output and changing the energy mix.

## Recommendation

The UK should continue funding and legislating for renewable infrastructure, particularly solar and wind technologies, while also investing in storage solutions and smart grids to maximize the benefits of renewable energy.