How does Ireland compare with the rest of the EU in terms of renewable primary energy production?

Introduction

As per the European Union Renewable Energy Directive, all European Union member nations must reach a goal to have 32% of their energy usage become renewable by 2030. We decided to examine each EU member nation's renewable energy consumption for the year of 2021 in the categories of solar, wind, hydroelectric and nuclear energy and compare them to that of Ireland's and each other's through a statistical analysis. This report will show the percentage of total primary energy consumption for each source of energy and for each nation. While nuclear energy is not renewable, we decided to include it since it is a low-carbon energy source.

Method:

To investigate each EU member nation's renewable energy consumption, we used an online data archive; ourworldindata.org. Here we were able to find out each EU member nation's share of wind, nuclear, solar, and hydroelectric energy consumption for the year 2021. We collected this data and added it to a spreadsheet where we then created graphs to display and analyse the data. All data found on the website came from the source of https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

Aim:

Our aim was to examine each EU member nations renewable energy consumption and statistically analyse the data to find out if they would hit their goal of 32% renewable energy consumption by 2030.

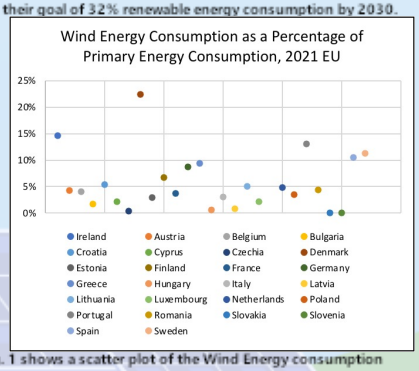

Fig. 1 shows a scatter plot of the Wind Energy consumption percentage across each nation. The consumption varies across each nation quite severely. Note: Malta is absent as no data was available.

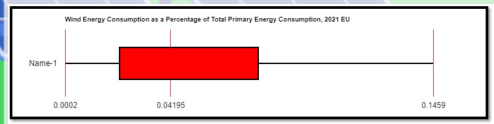

Fig. 2 shows a box plot on the statistics for wind energy consumption. Here you can see the mean and interquartile range of the data and the skewness and outliers of the data.

In terms of wind energy consumption we can clearly see from the data that Denmark leads with 22.49% as an outlier of the data with Slovakia having the least wind energy consumption with >0.01%. Ireland has a consumption percentage of 15% which is second highest of all nations. The mean of the data is 4.938% with the median and interquartile range being 4.1% and 2.11% to 6.68% respectively. This shows that the majority of nations are behind on wind energy consumption. The graph of wind energy consumption is skewed to the right.

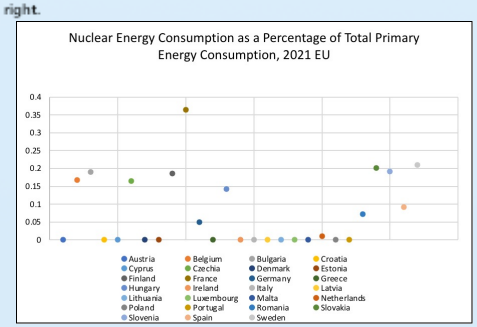

Fig. 3 shows a scatter plot of the Nuclear Energy consumption percentage across each nation. The consumption varies across each nation quite severely. Note: Many nations had no data available yet also had no nuclear power plant in their nation, and so was counted as 0%.

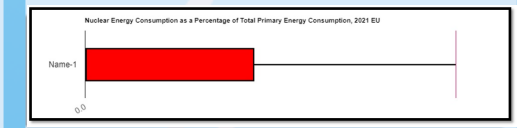

Fig. 4 shows a box plot on the statistics for nuclear energy consumption. Here you can see the mean and interquartile range of the data and the skewness and outliers of the data.

In terms of nuclear energy consumption, we can clearly see from the data that France leads with 36.46% with no outliers of the data with many nations having the least nuclear energy consumption with 0% due to no Nuclear Power plants. Ireland is one of these nations with Austria and Italy. The mean of the data is 7.56222% with the median and interquartile range being 0% and 0% to 3.646% respectively. This shows that the majority of nations are behind on nuclear energy consumption, without any nuclear power plants. The graph of nuclear energy consumption is skewed to the right.

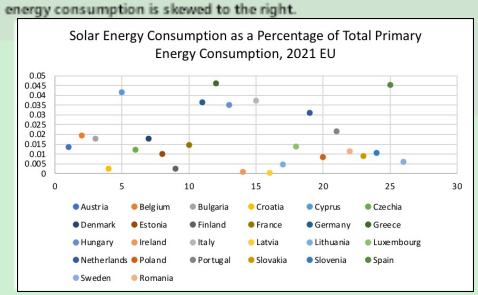

Fig. 5 shows a scatter plot of the Solar Energy consumption percentage across each nation. The consumption varies across each nation quite severely. Note: Malta is absent as no data was available.

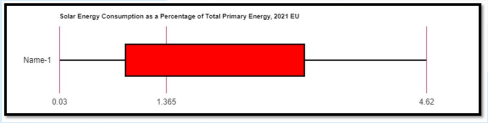

Fig. 6 shows a box plot on the statistics for solar energy consumption. Here you can see the mean and interquartile range of the data and the skewness and outliers of the data.

In terms of solar energy consumption, we can clearly see from the data that Greece leads with 4.62% as an outlier of the data with Latvia having the least solar energy consumption with 0.03%. Ireland has a consumption percentage of 0.10% which is second lowest of all nations. The mean of the data is 1.807692% with the median and interquartile range being 1.365% and 0.84% to 3.1% respectively. This shows that the majority of nations are behind on solar energy consumption. The graph of solar energy consumption potentially symmetrical.

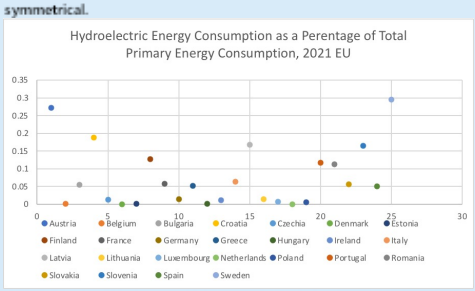

Fig. 7 shows a scatter plot of the Hydroelectric Energy consumption percentage across each nation. The consumption varies across each nation quite severely. Note: Cyprus and Malta are absent as no data was available.

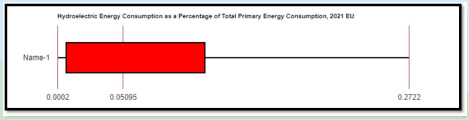

Fig. 8 shows a box plot on the statistics for hydroelectric energy consumption. Here you can see the mean and interquartile range of the data and the skewness and outliers of the data.

In terms of hydroelectric energy consumption, we can clearly see from the data that Sweden leads with 29.47% as an outlier of the data with Denmark and the Netherlands having the least hydroelectric energy consumption with 0.02%. Ireland has a consumption percentage of 1.12% which is 18th of all nations. The mean of the data is 6.47958% with the median and interquartile range being ~5.09% and 0.58% to 11.505% respectively. This shows that the majority of nations are behind on hydroelectric energy consumption. The graph of hydroelectric energy consumption is skewed to the right.

Conclusion:

The sum of the energy included in this poster (wind, solar, and hydro) accounts for 16.22% of the country's total energy consumption. This means that to reach the 2030 goal of 32% of energy consumption being renewable, Ireland will have to almost double its production of renewable energy. The best way to do this may be to drastically increase the number of wind turbines, as they can be installed quickly and cost-effectively. Wind energy is also already Ireland's strongest source of renewable energy, (Fig 1, 2), meaning it only requires expanding existing infrastructure rather than establishing new infrastructure (such as a nuclear power plant).

Relating to other EU countries, Ireland is towards the higher end of the spectrum. 5 other EU countries have already surpassed the 32% target with others in the high 20 percents. Cyprus has the lowest amount of renewable energy consumption (5.66%), while Sweden has the highest (50.92%).

Weaknesses

The original source of this data is BP's "statistical review of world energy". BP, being an oil and gas energy company, may have a degree of bias in their data against renewable energy, perhaps skewing the data in their favour. The lack of a second comprehensive source (and, thus, the inability to cross-reference the data) means that any inaccuracies in the data (whether deliberate or not) may be left unnoticed.

Further research

This project could be furthered by analysing and graphing the data with (for example) box plots.

It could be furthered by looking at data from different years and analysing the trends in growth.

It could by furthered by comparing the different energy sources with the climates of the countries and attempting to find a correlation (e.g., warmer climates use more solar, coastal climates use more wind, etc.).

It could be furthered by comparing the percentage of a country's energy that is renewable with the (for example) GDP of the country and attempting to find a correlation (e.g. richer countries use more nuclear).