

Climate Change and Sustainable Energy Resources Global Impact



1. **Introduction**

The report analyzes the global impact of climate change and the utilization of sustainable energy resources, focusing on trends related to renewable energy, CO2 emissions, low-carbon electricity distribution, and electricity generation types over time.

1. **Problem Statement**

Climate change is a pressing global issue, and transitioning to sustainable energy resources is crucial to mitigate its effects. Understanding the trends in renewable energy adoption and CO2 emissions can provide insights into the progress toward sustainability.

1. **Questions and Problem at Hand**

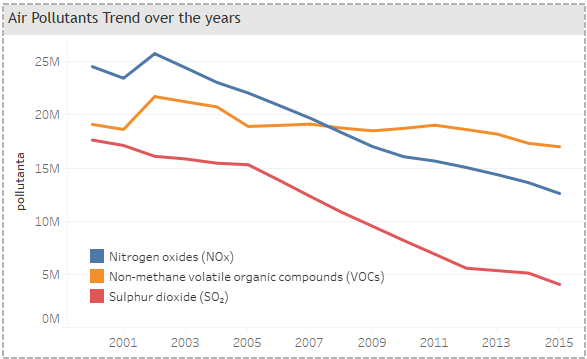
* How have renewable energy generation and CO2 emissions changed over the years?
* What is the global distribution of low-carbon electricity production?
* How has the generation of electricity from different sources evolved from 2000 to 2020?
* What is the transformation of low-carbon electricity production from 2000 to 2020?
* How does renewable electricity generating capacity per capita vary globally?
* What are the disparities in low-carbon electricity production from 2000 to 2020?
* Is there a relationship between GDP growth and low-carbon electricity usage by country?
* How does electricity access compare to GDP per capita globally?

1. **Methodology**

The analysis is based on data related to renewable energy generation, CO2 emissions, low-carbon electricity distribution, electricity generation types, renewable electricity generating capacity per capita, disparities in low-carbon electricity production, the relationship between GDP growth and low-carbon electricity usage by country, and electricity access vs. GDP per capita. The data spans from 2000 to 2020 and includes information from various countries.

1. **Visual Analysis**

The visual analysis for the report on climate change and sustainable energy resources includes eight key insights that provide a comprehensive overview of the global trends in renewable energy, CO2 emissions, low-carbon electricity distribution, and electricity generation types from 2000 to 2020.

1. Renewable Energy and CO2 Emissions Trend by Year: The visualization shows a decreasing trend in air pollutants from 2001 to 2015. Nitrogen oxides (NOx), non-methane volatile organic compounds (VOCs), and sulfur dioxide (SO₂) all exhibit a downward trajectory, indicating effective pollution control measures. Notably, sulfur dioxide shows the steepest decline, highlighting significant reductions in this pollutant over the years 2000 – 2015. 
2. Global Deaths Caused by Air Pollution: This global map visualization illustrates the percentage of deaths attributed to air pollution in 2019. Darker shades of red indicate higher percentages, with some regions experiencing up to 25.63% of deaths due to air pollution. The map reveals that many parts of Africa, South Asia, and Eastern Europe exhibit higher mortality rates from air pollution, highlighting significant public health challenges in these areas.

A screenshot of a map

Description automatically generated

1. Deaths Caused by Air Pollution: The chart displays a gradual decline in the percentage of deaths caused by air pollution from 1993 to 2018. Initially near 10%, the rate decreases consistently over the 25-year period, indicating improvements in air quality or health responses. By 2018, the percentage stabilizes slightly above 5%, suggesting ongoing but reduced health impacts from air pollution.

A graph showing air pollution

Description automatically generated

1. Comparative Analysis of Air Pollutant Emissions in the United States and United Kingdom: The chart compares air pollutant emissions between the United States and the United Kingdom. In the U.S., nitrogen oxides (NOx) are the most emitted pollutant, followed by non-methane volatile organic compounds (VOCs) and sulfur dioxide (SO₂). The UK emits significantly less of each pollutant, with sulfur dioxide being the most prevalent, followed by nitrogen oxides and VOCs. The data illustrates a much higher emission volume in the U.S. across all pollutants.

A screenshot of a graph

Description automatically generated

1. Rising Trends in Ozone Levels and Associated Mortality from Air Pollution: The chart shows an increase in both the concentration of ozone and deaths by air pollution from 2003 to 2018. Although the ozone concentration has some fluctuations, it generally trends upwards. Correspondingly, deaths attributed to air pollution also rise significantly, indicating a possible correlation between increased ozone levels and mortality due to air pollution over these years.

A graph of green bars

Description automatically generated with medium confidence

1. Air Pollution Global overview: The map visualizes global air pollution concentrations, specifically PM2.5 levels, ranging from 4.2 to 119.8 µg/m³. The green dots indicate regions with lower PM2.5 concentrations, while red dots show areas with higher concentrations. It reveals that parts of Asia and Africa are experiencing significantly higher levels of PM2.5, suggesting these regions face serious air quality issues compared to other parts of the world.

A map of the world with dots and numbers

Description automatically generated

1. Correlation Between Consumption of Prohibited Chemicals and Air Pollution Levels: This scatter plot illustrates the relationship between the consumption of a prohibited chemical and air pollution levels. A clear trend shows that higher consumption of the chemical correlates with increased air pollution. Notably, the most significant pollution levels are observed in instances of consumption exceeding 10K units, highlighting a potentially critical environmental impact.

A graph with red dots

Description automatically generated

1. Financial Impact of Prohibited Chemical Consumption on Expenditures: The scatter plot displays the relationship between the consumption of a prohibited chemical and the associated expenditures. The graph shows a non-linear trend where expenditures significantly increase as consumption reaches beyond 35K units, indicating a disproportionate cost impact at higher consumption levels. Most data points at lower consumption levels maintain relatively minimal expenditures.

A graph with red dots

Description automatically generated

Overall, these insights provide valuable information for policymakers, researchers, and stakeholders to understand the current state of global energy production and consumption and to identify areas where additional efforts are needed to promote sustainable energy practices and mitigate the impacts of climate change.

1. **Key Findings**

* Renewable energy generation has increased, while CO2 emissions have shown fluctuations but with an overall increasing trend.
* There is significant variation in the global distribution of low-carbon electricity production among countries.
* Electricity generation from nuclear and renewables has increased, while that from fossil fuels has decreased over the years.
* Some countries have made substantial progress in increasing low-carbon electricity production, while others lag.
* There are disparities in low-carbon electricity production between 2000 and 2020, with some countries showing significant improvements and others experiencing declines.
* There is a positive correlation between GDP growth and low-carbon electricity usage in some countries.
* Countries with higher electricity access tend to have higher GDP per capita.

1. **Recommendations**

* Encourage the adoption of renewable energy sources through incentives and policies.
* Implement carbon pricing mechanisms to internalize the cost of CO2 emissions.
* Promote international cooperation to share best practices and technologies for sustainable energy.
* Focus on improving electricity access in low-income countries to drive economic growth.

1. **Conclusion**

To conclude my project provides a comprehensive analysis of the shift towards renewable energy and its role in addressing climate change from 2000 to 2020. It clearly explores trends in renewable energy adoption, CO2 emissions, and low-carbon electricity production. The findings form the visualizations indicate that renewable energy generation has consistently increased from 2000 to 2020, highlighting a global move towards sustainable sources. However, CO2 emissions remain a challenge thing to nature, with fluctuations observed over the years. The project also notes significant disparities in the adoption of low-carbon electricity across countries, stressing the requirement of international cooperation to standardize low-carbon practices. Few reports suggest that while some countries have shown remarkable progress, others lag significantly behind, which can prevent global efforts against climate change. Recommendations include incentivizing renewable energy, implementing carbon pricing, and enhancing electricity access in developing regions to boost economic growth and sustainability. Overall, the project underscores the urgent need for coordinated global actions to expedite the transition to sustainable energy systems.

I feel these research question can take the project further.

1) What are the specific barriers and enablers affecting the adoption of renewable energy technologies in countries that lag behind in low-carbon electricity production?

2) How effective are current international policies and cooperation frameworks in promoting uniform adoption of low-carbon energy technologies across different regions?

1. **Reference**

<https://climatedata.imf.org/datasets/4063314923d74187be9596f10d034914/explore>

<https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

<https://ourworldindata.org/co2-emissions>