Energy Analysis of the United Kingdom

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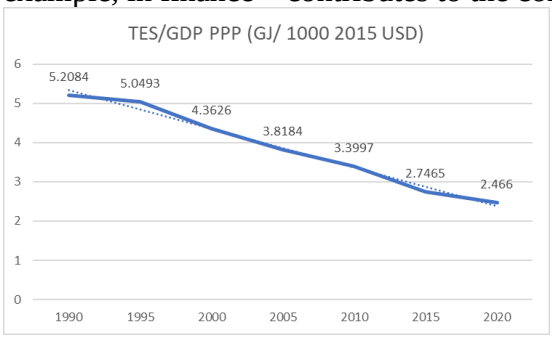
Basic Information

- Population: More than 67.2 Million spread across an area of 242,495 sq. km
- Economics: GDP of 2810.36 Billion USD; anticipated to grow by 3.6% by 2022
  Inflation to peak at 10% by end of 2022 but drop to 4.3% by end of 2023
- Human Development Index:
  Has an HDI of 0.929 with a GNI of 45,225 USD (2017 ppp) and has achieved the 17th Rank

- Per Capita Energy Consumption:
- Progress in achieving Sustainable Development Goals:
  >SDG Index Rank of 11 with an SDG Index Score of 80.55

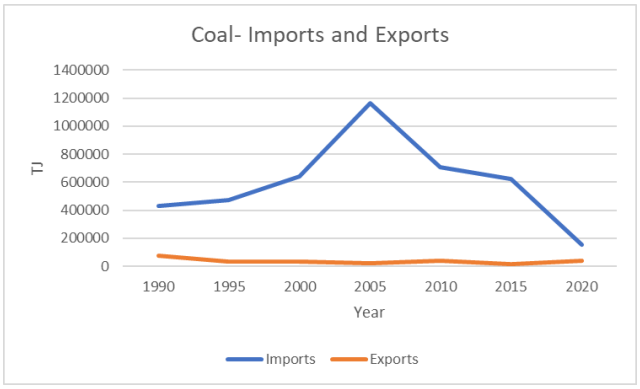
SDG	Progress	Trend
No Poverty	Challenges Remain	Moderately Improving
Zero Hunger	Major Challenges Remain	Stagnating
Good Health and Well Being	Significant Challenges Remain	Moderately Improving
Quality Education	Challenges Remain	Moderately Improving
Gender Equality	Challenges Remain	On Track
Clean Water and Sanitation	Challenges Remain	On Track
Affordable and Clean Energy	Challenges Remain	On Track
Decent Work and Economic Growth	Significant Challenges Remain	Moderately Improving
Industry, Innovation and Infrastructure	Challenges Remain	On Track
Reduced Inequalities	Significant Challenges Remain	Decreasing
Sustainable Cities and Communities	Challenges Remain	Stagnating
Responsible Consumption and Production	Significant Challenges Remain	Moderately Improving
Climate Action	Major Challenges Remain	Moderately Improving
Life Below Water	Significant Challenges Remain	Moderately Improving
Life on Land	Challenges Remain	On Track
Peace, Justice and Strong Institutions	Significant Challenges Remain	Moderately Improving
Partnerships For the Goals	Major Challenges Remain	Moderately Improving

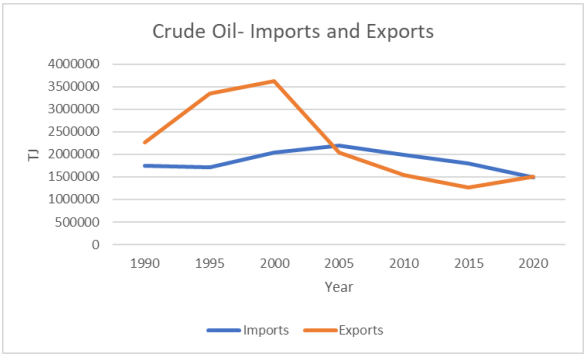
- Energy Intensity:
  It is defined as the ratio between gross inland energy consumption [TFC- Total Final Energy Consumption] and GDP. The economy's structure affects energy intensity. Generally speaking, the service sector uses less energy than the energy-demanding manufacturing sector. Thus, the substantial service sector in the United Kingdom—for example, in finance—contributes to the comparatively low energy intensity.

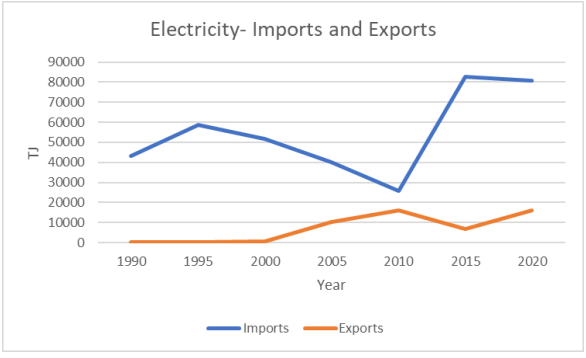


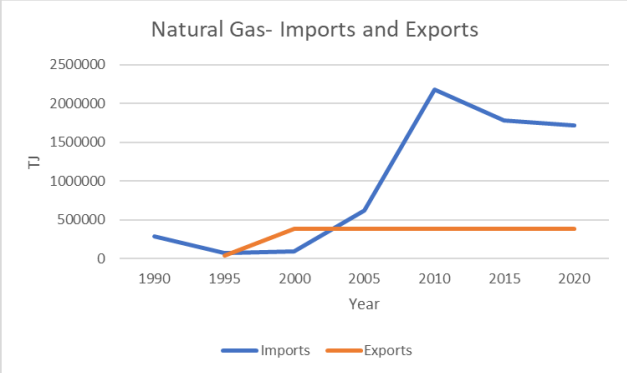
Imports of Energy & Locally Available Resources

Rather than solely relying on their own sources of energy, countries usually try to maintain an intricate balance of imports and exports of energy. The UK, once a net exporter of crude oil, became an overall importer due to varying energy prices. It has a higher wholesale price of electricity and thus attracts trade in its 5-way interconnection with France, Belgium, Ireland and the Netherlands. Seasonally, winters are more energy-demanding as there is a significant requirement for space heating as temperatures drop to single digits on the Celsius scale.









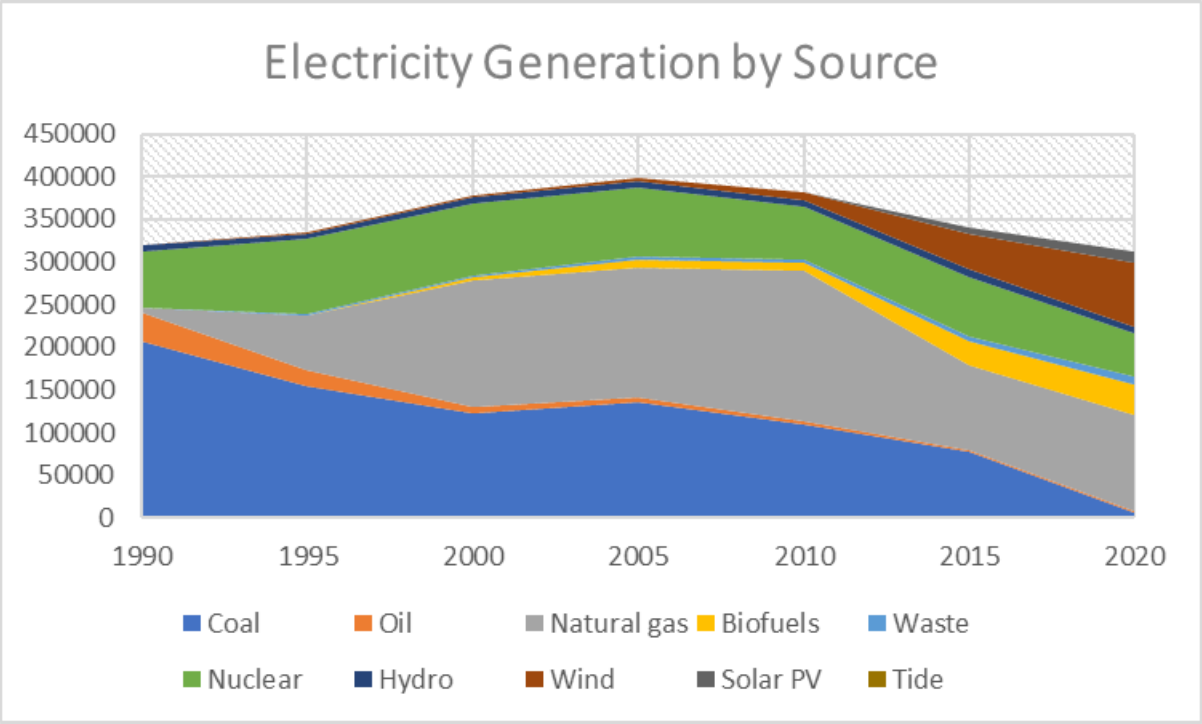
Infrastructure:

- There are six primary oil refineries in the UK that supply bulk of the inland market for petroleum products, with two other refineries specializing in bitumen and other products. They are situated around the coast, and most are connected to pipelines for product distribution. The Corryton refinery's closure in 2012 resulted in production reductions that led to the refinery's gross output in 2017 averaging 59.9 Mt (1.3 mb/d), down from 81.2 Mt (1.6 mb/d) in 2007. About 50 of the major oil terminals are supplied by pipeline (51% of the volume), rail (15%), and sea (34%), which is a combination of domestic production and imports. The domestic oil pipeline network in the United Kingdom spans 4 800 kilometres, each privately owned and run.
- Additionally, pipelines link the UK to platforms that produce oil offshore in the North Sea from domestic and Norwegian fields. The government Pipeline and Storage System's assets make up almost half of the UK's oil pipeline network (GPSS). The six largest refineries and the six major oil ports are all located together in the United Kingdom. The annual import capacity of oil and products through these ports totals 73 million tonnes (Mt/yr.). With a combined 4 Mt/yr. capacity for crude and product imports, two additional specialized refineries also have port facilities. The UK has 36 coastal product distribution terminals and oil ports near refineries. The six largest refineries and the six major oil ports are all located together in the United Kingdom.

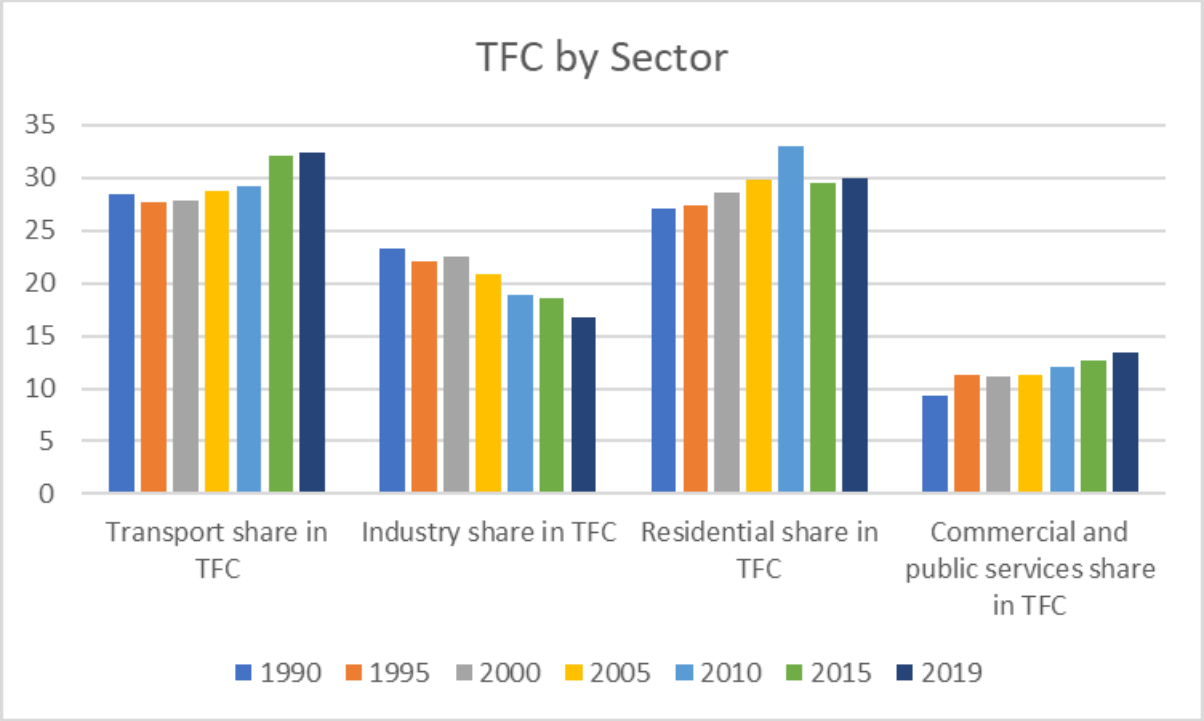
The annual import capacity of oil and products through these ports totals 73 million tonnes (Mt/yr.).

- The infrastructure for supplying natural gas is vast in the United Kingdom. This includes the ability to produce goods offshore, which satisfies roughly half of the demand in the United Kingdom, and a sizable infrastructure for importing goods from Norway and continental Europe, which can import about 100 billion cubic meters per year (bcm/yr.), compared to actual imports of less than 40 bcm/yr. Despite only importing about ten bcm of LNG annually, the UK can import about 49 bcm per year. The United Kingdom has a total gas storage capacity of about 1.4 bcm or about 2% of annual demand. It has a sizable export capacity to continental Europe (20 bcm/yr.) and Ireland (11 bcm/yr.).
- The GB gas system is well connected to its neighbours, including Belgium, the Netherlands, Northern Ireland, and the Republic of Ireland, along with import pipes from Norway. Through the IUK, Belgium and Great Britain have a bidirectional capacity of about 20 bcm/year. The interconnector BBL imports capacity from the Netherlands and sells gas to the Moffatt Interconnector to the Republic of Ireland

Electricity Generation By Source and TFC by Sector



The chart above is the best way to analyse and understand the trends of Electricity generation with time with respect to individual sources. As seen in the chart, the use of coal has declined over the years and coal has gradually been replaced by Natural gas. This is a good sign as this would help reduce overall emissions. As expected, the UK is transitioning towards more wind-based sources, which will end up dominating other sources by 2030.



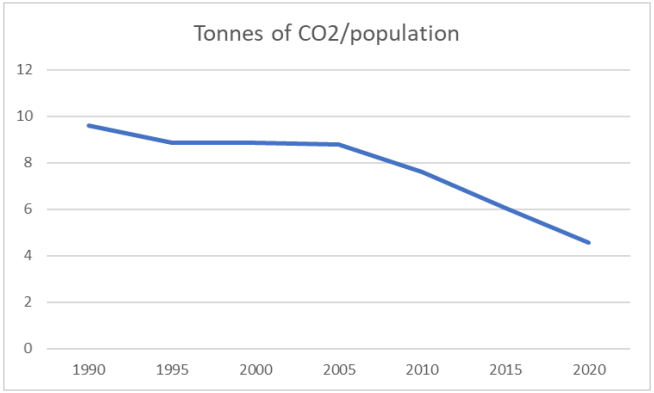
In the time trend for variation of TFC by Sector, it is seen that the industry share has been on a decline, and the commercial and public services share has been on the rise due to the shift in the primary nature of employment in the UK. The ever-growing population and need for transport results in an overall increase in the TFC while maintaining relatively small shifts in the fraction of energy consumed.

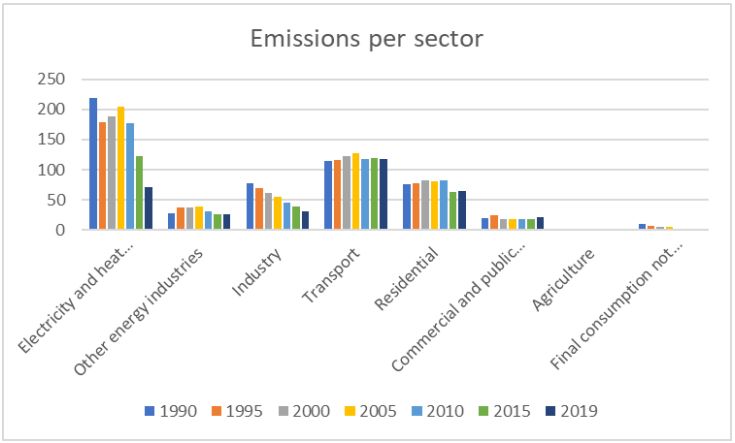
CO2 and GHG emissions from the country

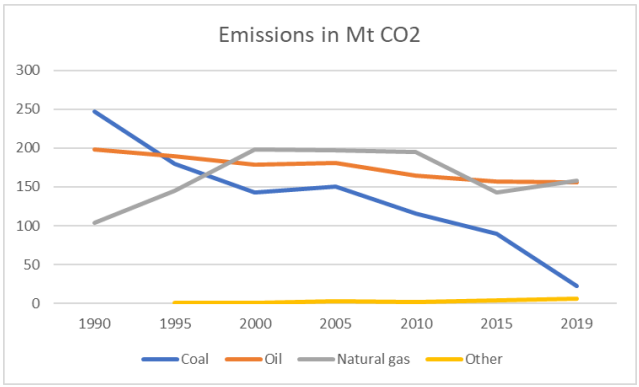
In 2017, oil and natural gas were the two largest sources of energy-related CO2 emissions, at 45% and 44%, respectively. Coal emissions reduced significantly, and in 2017 accounted for a record low of 10% of total CO2 emissions. Natural gas and coal-related CO2 emissions stem from electricity generation. Emissions from oil originate mainly in the transport sector. As the share of fossil fuels in the total primary energy supply (TPES) has decreased over the past decade, the emissions from all fossil fuels have also been reduced. From 2007 to 2017,

emissions from coal declined by 76%, those from natural gas by 17%, and those from oil by 10%. The overall CO2 emissions per capita have been declining.

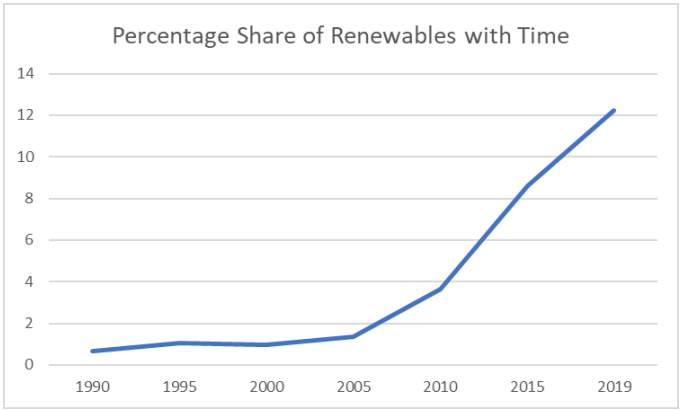
In its first commitment period of the Kyoto Protocol, the UK met its target along with fellow EU members to reduce GHG emissions by 8%. The UK is working in its second commitment period ; set out under the Doha amendment.





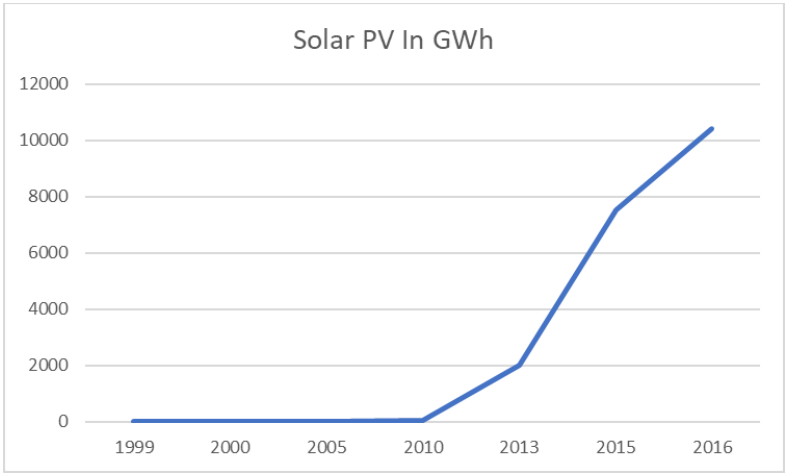


Progress in Renewable Energy

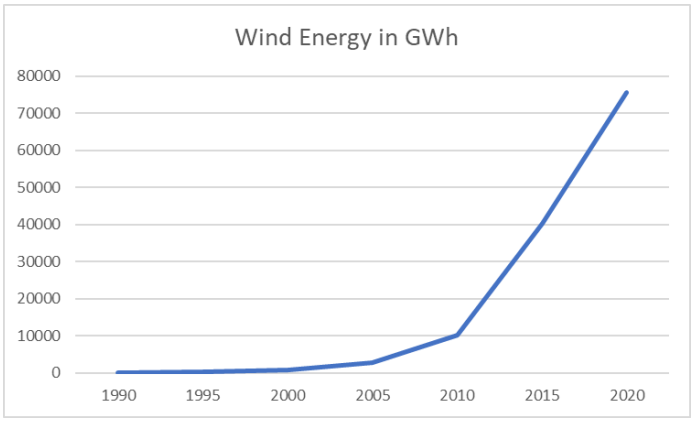


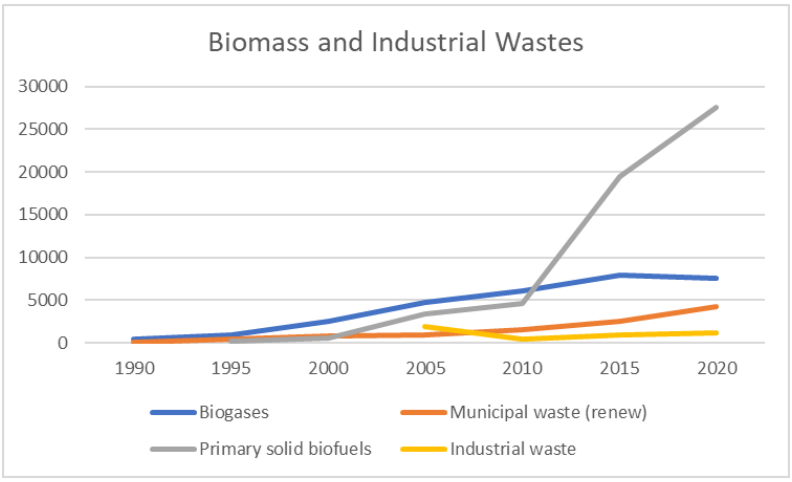
Over the past decade, the UK has seen a tremendous growth in the production of renewable energy. From 2% in 2007 to 10% in 2017, renewable energy's percentage of the total primary energy supply (TPES) and its contribution to the production of electricity have both increased significantly.

Solar Energy has seen a rapid rise in the past decade, with production jumping from 40GWh in 20210 to roughly 13000GWh in 2020, and the trend is expected to stay on the rise.



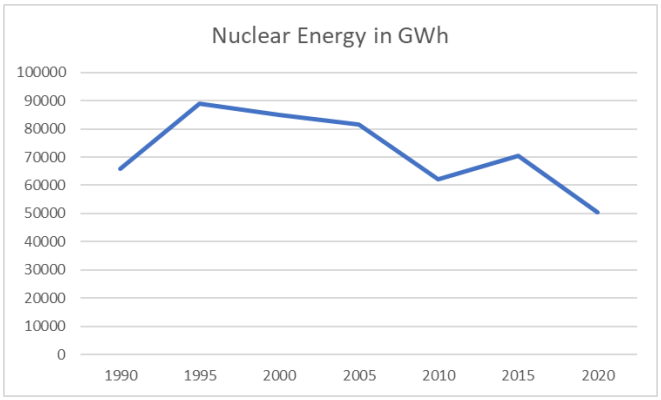
Wind Energy continues to thrive in the UK and continues to remain the largest contributor amongst renewables. It surpassed coal in 2016 and nuclear in 2018 and is only behind Natural Gas.





Nuclear

Nuclear energy is a potent net-carbon-zero source, and I feel the UK has done a mixed job regarding this. The UK has been a leader in nuclear energy generation and usage with 15 nuclear reactors. However, I believe that when it comes to nuclear energy, a country's policies overpower the actual plant. The recently concluded Brexit was constantly draining the legislative bodies of the UK, and the issues of new power plants and waste disposal of the existing power plants have been dragged along much longer than needed. After powering the country for 46 years, the Hinkley B power plant was shut down on 1st August 2022; other plants are expected to follow in subsequent years.



Policies

The Climate Change Act (CCA) of 2008 established a long-term legal framework to mitigate emissions. After the IPCC's report on Global Warming in June 2019, the CCA was amended to set the UK on a path to achieve net-zero by 2050

The Energy act 2013 paved the pathway for four mechanisms for a low-carbon generation:

1. Emissions performance standard
2. Carbon price floor
3. Capacity market
4. Contracts for difference

Among the current policies implemented, the most notable one is the Clean Growth Strategy adopted in 2017. Its salient features are:

- To accelerate the shift to low-carbon transport by working towards an extensive nationwide charging network to facilitate the transition to EVs.
- To improve energy efficiency in business and industry.
- To improve the energy efficiency of residential clusters.
- To foster the roll-out of low-carbon heating.
- To deliver clean, smart, and flexible power by phasing out Carbon with nuclear energy.
- To address climate change and promote the creation of a Green Finance Taskforce.

Concluding Remarks

I believe that the UK has made significant progress over the years and will continue to do so as long as the policies and reforms passed are implemented well enough. The UK has a vital role in the global transition towards net-zero as it sets an example for effective minimisation of Coal.

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