

Analysis of the UK's Carbon Neutrality Dilemma and Solutions Exploration——Take Electric Vehicles for an Example

Yuesong Lu*

Inner Mongolia Normal University, Mongolia, China

*Corresponding author: 980524lys@xsy.edu.pl

Abstract. In recent years, countries around the world have been striving to achieve carbon peaking and carbon neutrality. As the first country in the world to achieve carbon neutrality, the UK's road to and results of carbon neutrality are of some reference value and significance, and the overall process of carbon neutrality has been steadily progressing, even reaching its peak carbon target in 1991. However, the issue of carbon neutrality and environmental protection itself has not all had a positive impact. In the UK, it must be noted that despite the many laws and policies introduced in the institutional arrangements for the transition, the achievement of peak carbon in the UK was not entirely institutionally driven, but was to some extent related to the downward trend in the domestic economy, caught in a reactive energy dilemma, while, guided by the mandate of carbon neutrality, the UK followed the rest of the world in starting the process of transforming automotive energy to electric as a source of The task of market operation and security of energy is therefore increasing as vehicle models begin to gain momentum. This paper will analyse the current situation and problems of carbon neutrality in the UK, using residential electric vehicles as an example, and make recommendations from both the business and government sides.

Keywords: United Kingdom Carbon Neutralization Civilian electric vehicles Public Relations Public Affairs

1. Introduction

The 2015 Paris Agreement established a goal of carbon neutrality by the second half of the century, and an increasing number of governments are transposing that into national strategies, establishing a vision for a carbon-free future. UK Climate Change Bill enacted in June 2019, formalising the target of achieving 'net zero' greenhouse gas emissions by 2050, i.e. carbon neutrality. In support of electric vehicles, The UK intends to phase out the sale of new petrol and diesel vehicles, including cars and vans, by 2030, and hybrids by 2035.

The UK's carbon neutral targets provide a clear timeline for a green and low carbon transition, and the development of effective measures will be the focus of future work. Although the global issue of carbon neutrality has only been raised in recent years, the UK has been an early mover in terms of energy efficiency and emissions reduction, In the 1950s, a series of serious air pollution incidents in the UK directly contributed to an energy transition centred on 'coal reduction'. By 2019, the UK's energy transition had achieved some success: the proportion of electricity generated by coal and gas had fallen from nearly 80% to less than half.

2. Background Information

2.1 The UK's energy situation

Although the UK was one of the first countries in the world to take action on the environment, the focus of its energy reforms has not been entirely aligned with carbon neutrality for a long time, in fact, energy reform in the UK since the 1950s has been driven primarily by tackling air pollution rather than climate change, making 'coal retirement' central to this In fact, the UK's energy reforms since the 1950s have been driven more by tackling air pollution than climate change, making 'coal retirement' central to this round of energy reform. In terms of energy consumption in the UK in 2020,

Figure 1 shows that the transition has undoubtedly been successful: in 1950 almost 100% of energy was supplied by coal, by 1990 this had fallen to 30%, and now it is only 1%.

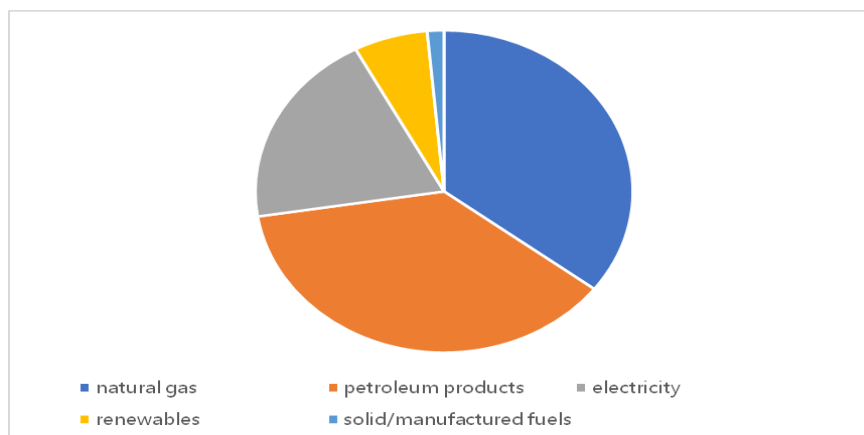


Fig 1. Graphical representation of the consumption of energy types in the UK in 2020[1]

Oil and gas still dominate the UK's energy mix and in the 1970s the UK embarked on a major development of North Sea oil against the backdrop of the Middle East oil embargo. North Sea oil supplies became an important support for the UK's oil and gas self-sufficiency.

However, production from North Sea oil and gas fields gradually went into a downward spiral as we entered the 21st century. Under the impact of this, the UK's share of oil and gas imports has continued to climb.

In 2019, the UK passed the Climate Change Act with a clear goal of achieving carbon neutrality by 2050. But soon the energy market shocks caused by the New Crown pandemic and the Russian-Ukrainian war left the UK's energy transition and energy security challenged.

The current energy crisis has arguably hit the whole of Europe hard, and the UK is certainly no exception. Tight supplies and soaring prices are not leaving the UK behind in any of these challenges. The UK is urgently considering the issue of energy security, which is in turn linked to the achievement of carbon neutrality targets.

2.2 Low carbon transition in UK

Secondly, this paper examines the lessons learned from the institutional arrangements for a low carbon transition in the UK over the past 20 years (2000-2020), with a view to finding directions and answers for a carbon neutral future.

An important factor in the UK's green and low-carbon transition during the past 20 years has been adapting to changes in the climate, domestic energy supply and demand, as well as more significant shifts in the global energy landscape. In this process, the UK has pursued different 'carbon governance objectives' through the corresponding institutional arrangements. The green and low-carbon transition in the United Kingdom can be split into four phases.

The first period can be described as the nascent period of the green low carbon transition, when the UK Labour Party won the parliamentary elections under Blair in 1997 and the UK energy policy law changed significantly from that point onwards [2]. Blair's first term in office (1997-2000) continued the path of energy privatization begun by Thatcher and Major's conservative governments. In particular, Around the year 200, market-oriented reforms of the energy market in the retail and wholesale sectors were completed, such as the Utilities Act 2000, which emphasized the government's legal policy obligation to encourage acceptable competition in the energy market.

During Blair's second term (2001-2005), the United Kingdom's legal energy policy started to evolve towards government-led low-carbon development. On the one hand, the Renewable Energy Obligation Act 2002 was passed, introducing the Renewable Energy Obligation regime into energy production, and on the other hand, the 2003 Energy White Paper, Our Energy Future - Creating a

Low Carbon Economy [3]. It was the first energy document to introduce the concept of a low-carbon economy on a global scale, and it is worth emphasising that the document puts climate change ahead of security of energy supply, which represents a priority for the UK's energy law and policy, and formally initiates a shift in the UK's energy law and policy with a low-carbon transition at its core.

The second period was described by Professor Michael Jacobs, a British economist and former special adviser to the Brown government, as "a radical era for climate change and energy policy"[4]. 2007 saw Chancellor of the Exchequer Gordon Brown replace Tony Blair as Prime Minister, with two Acts and a Plan, and a reorganisation of government departments and a redistribution of functions. In 2008, the United Kingdom enacted the Climate Change Act 2008 and the Energy Act 2008, the UK became the first nation in the world to pass climate change legislation with the passage of the Climate Change Act in 2008, and thus having a significant impact on the legal regulation of carbon emissions reduction, while the Energy Act 2008 was mainly to implement the 2007 Energy White Paper, playing more of a supplementary than constructive institutional role [5]. In 2009, the UK government introduced the Low Carbon Transition Plan to ensure that the targets set by the Climate Change Act were met.

In terms of government structure, in 2008, Brown reorganised the UK government by merging the energy portfolio under the Department for Business, Enterprise and Regulatory Reform and the climate change portfolio under the Department for Environment, Food and Rural Affairs to form the new Department of Energy and Climate Change. The Brown Labour government's emphasis on energy and climate change is highlighted by this, and it also suggests that the government would concentrate on energy regulation in relation to climate change. In summary, the Brown government has been more radical in its energy laws and policies, and the dominance of the market is gradually being replaced by government intervention, but unfortunately, despite this, until the 2010 Labour parliamentary election defeat, energy production in the UK remained in a negative position.

In 2010, Cameron led the Conservative Party to an election victory and formed a coalition cabinet with Liberal Democrat Clegg, and Green and low-carbon legal policy in the UK has started to veer toward stability.

First, in 2013, the UK Parliament passed the Energy Act 2013, which started the process of returning to stability, and its main purpose was to start correcting the deviations of the legal policies of the two Labour governments in the field of green and low-carbon. The Act had two distinctive features: first, in order to safeguard the energy supply when coal-fired power stations were removed from the electrical supply grid, it included provisions for activities to facilitate the construction of nuclear power facilities., strongly shifting the Labour government's hesitancy to build nuclear energy; second, it delayed the achievement of the decarbonization target set in the Climate Change Act 2008.

The 2013 Energy Act is a direct reflection of the Cameron Conservative government's return to stable low-carbon green laws. On the one hand, it no longer one-sidedly emphasizes climate change goals, but pays attention to the coordination of decarbonization goals and energy security to promote, on the other hand, the construction of nuclear power plants from consultation to advance to actual action, but it is worth mentioning that nuclear power plant construction was the choice the Cameron government had to make to ease the national energy crisis [6].

The Conservative Party led by David Cameron won again in the 2015 British general election and was given the power to form a separate cabinet. In the second term (2015-2016), The legal framework for the low-carbon transition was further revised by the Cameron government. In a November 2015 speech, his Cabinet Secretary for Energy and Climate Change, Amber Rudd, emphasized that the Cameron government's upcoming energy policy would put energy security ahead of climate change, which had been the top priority in energy law-making under the Labour Party [7]. Shortly thereafter, the Cameron government turned its promise into reality by directly removing £1 billion of funding support for commercial demonstrations of carbon capture and storage technology (CCS), which caused extreme discontent among climate change supporters within the UK.

Following this, in May 2016, at the urging of the Cameron government, the UK Parliament passed the Energy Act 2016, the two most significant features of which can be summarized as the creation

of a new oil and gas regulator and the phasing out of the Renewable Energy Obligation regime. First, the Oil and Gas Authority is now the official organization in charge of overseeing and regulating oil and gas operations in the United Kingdom thanks to the Energy Act of 2016, which is incorporated as a government company and is granted a number of powers such as offshore oil and gas licensing powers, dispute resolution and sanctions, etc. Its establishment enhances the UK government's regulatory powers in relation to offshore oil and gas, in the meanwhile, the Energy Act 2016 removes or restricts the application of the Renewable Energy Obligation framework for these recently approved inland wind farms while giving local governments the authority to approve additional inland wind farms [8].

The fourth stage can be described as the reorientation of the United Kingdom's low carbon transition. 2016 saw the departure of David Cameron, with Theresa May, the former Home Secretary, and Johnson, the former Foreign Secretary, becoming the new Prime Minister of the UK, and a series of reorientations of the UK's energy policy and legal policy, in line with the Conservative Party's long-standing policy.

Firstly, in July 2016, Theresa May swiftly disbanded the Department of Energy and Climate Change and created a new Department of Business, Energy and Industrial Strategy when she became the UK's new Prime Minister. Although official spokespeople claim the dismantling of the Ministry of Energy and Climate Change will not affect the United Kingdom's commitment to tackling climate change, it is still clear that Theresa May's policy on energy laws around climate change, including renewable energy, will be weakened to varying degrees [9].

It is worth noting that Brexit has given the UK more freedom to reorient its low carbon transition. Prior to Brexit, energy law and policy development after 2009 was directly linked to the EU Renewable Energy Directive 2009, which, although not the only factor in the UK's energy law policy considerations, was an important one, and to some extent even inhibited the UK from exercising greater freedom in its energy law and policy. Brexit, on the other hand, means that the UK can take more account of the characteristics of its own energy development and develop legal policies that promote competition in the energy market for the sake of economic prosperity, at the same time, as far as climate change is concerned, the United Kingdom can reduce its emissions in line with its own political objectives [10-11]. On the other hand, Brexit also creates uncertainty for the UK in areas such as European grid connections and energy investments.

3. Analysis of the current state and causes of the UK electric vehicle market

3.1 The current state of the UK residential electric vehicle market

First of all, as far as the electric vehicle segment is concerned, its development has maintained an overall upward trend over the past few years, albeit with some fluctuations. As shown in Figure 2, since March 2020, there has been a marked increase in the number of registrations of purely electrically powered vehicles and plug-in hybrids.

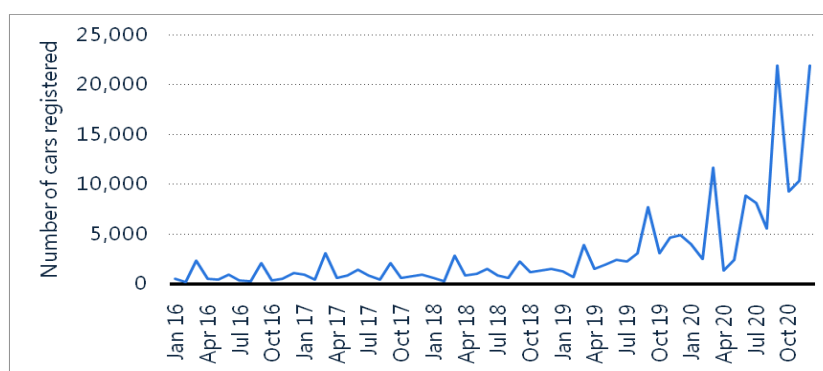


Fig 2. Number of fully electric vehicles registered in the United Kingdom from January 2016 to December 2020, per month[12]

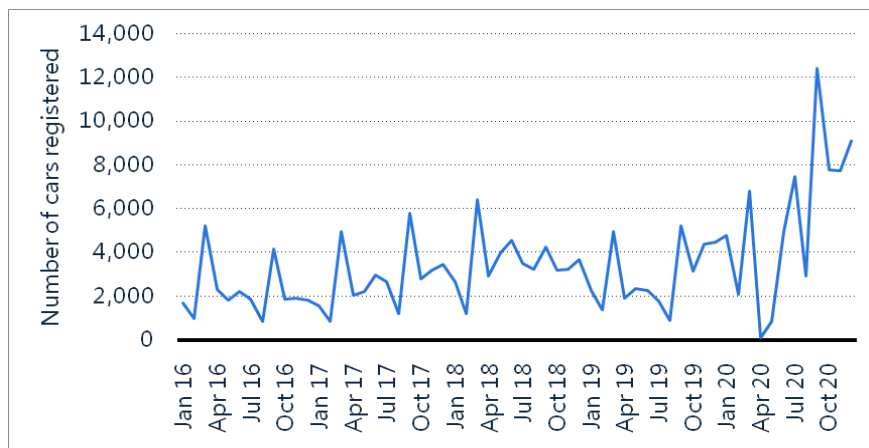


Fig 3. Number of plug-in hybrid electric cars registered in the United Kingdom (UK) from January 2016 to December 2020, by month [13]

However, when viewed in the context of the automotive market, it is clear that the market share of electric vehicles is still relatively small. Figure 3 indicates that internal combustion engine vehicles are still dominant, and indeed the impact of the UK's emissions reduction process on the choice of energy source is more focused on diesel. According to the Figure 4, we can see that between 2018 and 2020 there is a significant decline in the share of diesel vehicles in use, while the share of electric and hybrid vehicles in use has increased, but the share of petrol-powered use remains firmly in place with a significant market share.

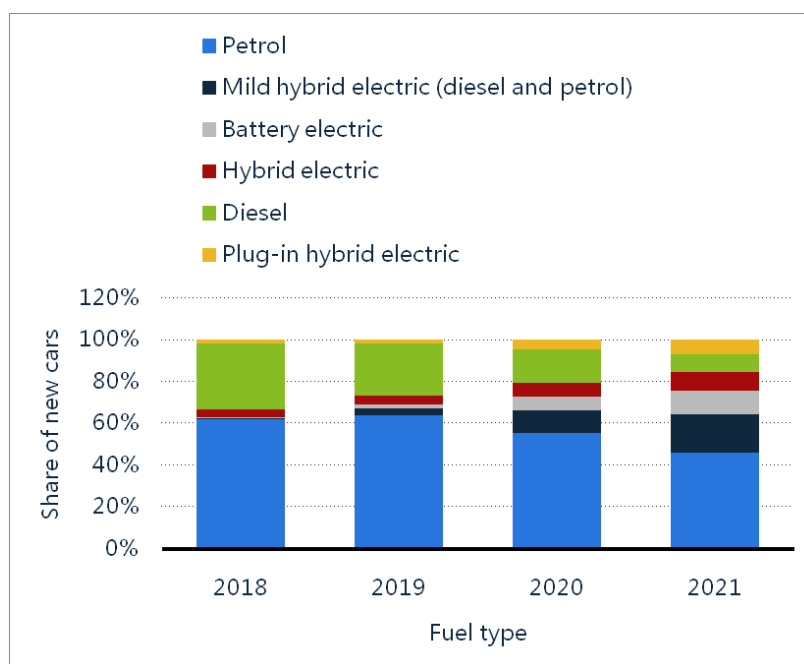


Fig 4. Passenger car registrations in the United Kingdom between 2018 and 2021, by fuel type [14]

3.2 Analysis of the causes of the current situation from the perspective of the electric vehicle market.

The electric vehicle of the 21st century was created in response to carbon neutral policies and concepts, and its low carbon and environmental characteristics coincide with carbon neutrality and net-zero emissions targets. However, from the emergence of the electric vehicle until today, there are many obvious problems, the most prominent of which is the contradiction between the low market share trend of trams and policy requirements. It has to be said that in just seven years the electric

vehicle industry has come a long way, but at the same time, it seems that the development of electric vehicles has encountered a technical bottleneck, on the one hand, the problem of tram range is already a cliché, on the other hand, its mechanical stability, the comfort of the vehicle driving and riding, as well as after-sales and even safety issues are all affecting its development and market image.

3.2.1 The British national car culture scene

On a historical level, Britain was one of the centres of the two industrial revolutions and has a long industrial heritage and automotive history with many world-renowned industrial companies such as Rolls-Royce and Lotus, due to this historical and cultural background, the internal combustion engine (petrol and diesel) has a very deep accumulation of customers in Britain and the British nation has an almost loyal love for the internal combustion engine, and the relatively new electric car of the 21st century was naturally difficult for British citizens to accept for a while.

At the same time, the new coronavirus pneumonia pandemic is a considerable shock to the world economy, and the UK is naturally among them. The average purchasing power of citizens who already own a car and those who will buy one is declining, and the UK government's finances are struggling to make a strong case for electric car companies and buyers in the face of the epidemic.

3.2.2 Technology problems of electric vehicles

When it comes to electric vehicles, the issues that the public is most familiar with and concerned about are their charging time and range. At least so far, in this respect electric vehicles cannot compete with the internal combustion engine, which is an inherent attribute of both the internal combustion engine and the electric motor, and at the same time, the internal combustion engine have been fully developed and technologically accumulated over more than a hundred years of history, with a great variety of types and forms that can meet the needs of different consumers. In contrast, the technical accumulation of electric vehicles is very thin and unable to meet the needs of the population, while many car companies are urged to make risky technical breakthroughs in carbon and target time, which, to a certain extent, will make electric vehicles carry dangerous attributes.

3.3 Solutions

The UK government has made many efforts in the context of reducing carbon emissions, but with the intensification of climate change in recent years and the outbreak of the Russian-Ukrainian war, the UK, still in the throes of an energy transition, is faced with additional problems, and this paper will offer some suggestions on the current issues, both from the government and the EV market sector.

The Russian-Ukrainian war has unsettled the energy situation across Europe, with a corresponding surge in demand for electricity, higher prices for citizens, and the UK's energy management being put to the test, making electricity generation one of the top issues.

Firstly, the UK government should try to make offshore wind power the main source of energy at this stage. The UK has been looking forward to becoming the Saudi Arabia of wind power in recent years and has set itself the target of generating more than half of its renewable energy from wind power by 2030, but currently only a quarter of the UK's renewable energy is produced by wind power. Compared to offshore wind, onshore wind in the UK, although it has more cumulative installed capacity (14GW), is not as resource rich in potential as offshore wind and is more concentrated in Scotland by comparison. In addition to Scotland's long-standing separatist tendencies and weak central government control, Scotland is also a long way from the UK's electricity load centres and the erection of transmission links would be an additional burden on already heavy government expenditure [15]. Offshore wind has a relatively good energy future due to the suitability of the UK's geographic location and the level of government investment.

At the same time, nuclear technology should be more on the radar of the UK government's energy buildup. 1956 saw the launch of Calder Hall by Elizabeth II herself, the world's first nuclear power station to operate on a commercial scale, but that's where the UK's achievements in nuclear power stations stop, with five of the UK's six currently due to be decommissioned within 10 years and only one new build project, in 2022. The UK government has proposed a target of tripling the installed

nuclear power capacity to 24GW by 2050 and increasing the proportion of nuclear power in electricity generation from 15% to 25%, which means more investment in nuclear power funds and R&D in nuclear power technology, etc. It should also enrich the resources for siting nuclear power plants to lay the foundation for a larger scale development of nuclear power.

With the current energy situation not meeting energy demand, relying on other forms of energy to make the transition, as Germany has done, and waiting for a breakthrough in energy technology is also a viable option for the UK.

Geothermal energy is the longest available resource of renewable energy and many countries have incorporated it into their national energy systems and are focusing on it as a key energy source, with corresponding monitoring and evaluation and research continuing unabated. In the UK, despite the lack of active volcanic areas, the government has included geothermal in its national development plans and hopes to master this form of energy and increase its use in UK households from the current 2% to 18% by 2050 [16]. Accordingly, the UK government should now focus on continuously exploring the energy storage potential of underground space, conduct in-depth investigation and research on the geological engineering feasibility of energy injection, exchange and application involved in the storage of heat and cold in depleted oil and gas reservoirs, oil and gas in salt caverns and energy storage in underground aquifers, evaluate and preferentially select more underground spaces with energy storage conditions, improve energy security capacity and promote the comprehensive development and use of abandoned underground space.

Another initiative to reduce carbon is carbon sequestration. The British Geological Survey is recognised as the pre-eminent carbon sequestration research organisation in Europe and has established a dedicated research organisation and team. The geological survey and dynamic monitoring of carbon capture and storage will be included in the work of geological survey, and corresponding investment in human, material and financial resources will be made. With the geological survey bureau as the main body, the geological research model for carbon sequestration underground reservoirs and other related research should be carried out jointly with scientific research institutions of universities, and relevant survey standards, indicators and specifications should be established as soon as possible, so as to investigate and evaluate the geological conditions and potential of carbon capture and sequestration on a nationwide scale, and select a number of early test areas, comprehensive reserve areas and potential areas suitable for carbon capture and sequestration.

The two biggest difficulties facing new energy vehicles in the UK at the moment are the inherent limitations of energy itself, including consumer will and energy security, and the technical bottlenecks, such as range.

As depicted in the Industrial Decarbonisation Strategy published in 2021, the future development of decarbonisation technologies in the UK cannot be separated from innovations in fuel switching technologies, including low carbon electricity, hydrogen and biomass energy types, especially hydrogen energy, which is more environmentally friendly than electricity as far as the carbon cycle is concerned, and at the same time has properties more similar to traditional energy sources in the automotive industry sector as well as in consumer concepts, and the new energy vehicle industry could follow in the footsteps of government plans to play a proper role in hydrogen energy. However, pure hydrogen power is not currently feasible, as there is no good and widespread means of replenishing this energy source for the population. It is for this reason that accelerating research into battery technology energy is the priority of the moment, the use of hydrogen and other energy sources should only be used as a matter of emergency and transition.

4. Summary

The UK government's energy policy over the last 20 years still has some relevance today, but the problems that existed at various stages should also be taken seriously. The accumulation of the UK government's energy policy and legal path has now caused a depletion of the market dividend and a sharp reduction in competition, which is clearly anachronistic in the current energy market situation.

We should understand that the choice between market and government is a historically shaped process and a dynamic logic in multiple contexts. The UK government should take a holistic view of the country's historical characteristics and geographic advantages, build on its strengths and avoid its weaknesses, and play its rightful role in the energy market.

In terms of the electric vehicle business, because of the UK's history, the consumer preferences created by culture and the stage reached by the accumulation of technology, and the current energy shortage faced by the UK and the world, the development of electric vehicles is still stuck in a period of pain and, more importantly, the car companies have no say in the choice of energy source. Therefore, the only thing EV companies can do is to comply with the policy direction, strengthen marketing and technology accumulation, with a view to turning around product marketing and contribute to the energy transition of the UK and the world.

Energy policy and law and electric vehicles and even new energy vehicles are only part of a national energy strategy, and car companies, consumers and governments all have a role to play within this larger framework. A real and stable combination of theory and practice in the context of the actual situation is an important safeguard for the current energy policy and landscape in the UK and the world.

Reference

- [1] UK Department for Business, Energy and Industrial Strategy, and GOV.UK. "Forecast Final Energy Consumption in The United Kingdom (UK) from 2020 to 2040, by Energy Type (in 1,000 Metric Tons of Oil Equivalent)." Statista, Statista Inc., 7 Dec 2021, <https://www.statista.com/statistics/495010/final-energy-consumption-uk/>
- [2] ROBISON C. From nationalization to state control: the return of centralised Energy Planning [M]. London: Institute of Economic Affairs, 2013
- [3] UK DTI. Energy white paper: our energy future-creating a low carbon economy[R]. London: TSO, 2003
- [4] CARTER N, JACOBS M. Explaining radical policy change: the case of climate change and energy policy under the British labour government 2006-10[J]. Public Administration, 2004, 92(1).
- [5] TOWNSHEND T, FANKHAUSER S, AYBAR R, et al. ed. Climate legislation study: a review of climate change legislation in 33 countries[R]. London: Globe International, 2013.
- [6] HEFFRON R J H. The application of contrast explanation to energy policy research: UK nuclear policy 2002-2012[J]. Energy Policy, 2013[55]
- [7] RUDD A. Amber Rudd's speech on a new direction for UK energy policy [EB/OL]. (2015-11-18) [2021-7-31] <http://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy>.
- [8] VASS U. A review of the new UK energy bill: very fancy footwork[J]. LSU Journal of Energy Law & Resources, 2015(4).
- [9] JOHNSTON I. Climate change department closed by Theresa May in "plain stupid" and "deeply worrying" move [EB/OL]. (2016-7-14)[2021-7-30] <http://www.independent.co.uk/environment/climate-change-department-killed-off-by-theresa-may-in-plain-stupid-and-deeply-worrying-move-a7137166.html>.
- [10] GAMBOA J. The green deal goes sour for the clean energy sector in Great Britain[J]. Journal of Global Justice & Public Policy, 2016(2).
- [11] HEPBURN C, TEYTELBOYM A. Climate change policy after Brexit[J]. Oxford Review of Economic Policy, 2017, 33(S1).
- [12] SMMT. (January 6, 2021). Number of all-electric cars registered in the United Kingdom (UK) from January 2016 to December 2020, by month [Graph]. In Statista. Retrieved September 11, 2022, from <https://www.statista.com/statistics/310696/pure-electric-plug-in-cars-registered-in-the-united-kingdom/>
- [13] SMMT. (January 6, 2021). Number of plug-in hybrid electric cars registered in the United Kingdom (UK) from January 2016 to December 2020, by month [Graph]. In Statista. Retrieved September 11, 2022, from <https://www.statista.com/statistics/310709/non-pure-electric-plug-in-cars-registered-in-the-united-kingdom/>

- [14] SMMT. (January 6, 2022). Passenger car registrations in the United Kingdom between 2018 and 2021, by fuel type [Graph]. In Statista. Retrieved September 11, 2022, from <https://www.statista.com/statistics/299031/fuel-types-of-new-cars-registered-in-the-united-kingdom/>
- [15] Energy New Media 2022 Carbon Neutral Nations: With no way back, the UK's transition to offshore wind and nuclear power <https://mp.weixin.qq.com/s/-uKfETs3IW3wu4Rvs4E0yg>
- [16] International Institute of Green Finance, Central University of Finance and Economics, China 2021 IIGF Perspectives: Carbon Neutral Pathways in the UK Industrial Sector <https://mp.weixin.qq.com/s/37uDVPqXM GnNm7aCiEt41w>