Analysis of Global Policy and Impact on Automobile Industry under Carbon Neutrality

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ABSTRACT—"Carbon Neutrality" means that enterprises, groups, or individuals calculate the total amount of greenhouse gas emissions produced directly or indirectly within a certain period and offset their Carbon dioxide emissions through afforestation, energy conservation, and emission reduction to achieve zero carbon dioxide emissions. Since 2020, the commitment to Carbon Neutrality has been paid attention to by various industries. Particularly, in the car industry, "Carbon Neutrality" has almost become one of the hottest directions. This paper focuses on policymaking and its impact on the automotive industry in the context of carbon neutrality. It is concluded that Carbon Neutrality is a problem that automobile enterprises must face. Automobile enterprises should set targets and time nodes related to Carbon Neutrality as soon as possible and speed up implementing specific measures. In addition, electric and new energy vehicles are more conducive to carbon emissions and carbon neutral transportation. Its development should also be put on the agenda.

1 INTRODUCTION

On the fifth anniversary of the Paris Agreement, China has announced to the world its national goal of reaching a carbon peak by 2030 and becoming carbon neutral by 2060. This is China's national policy to actively tackle climate change and a national strategy based on scientific demonstration. It clarifies the phase goals of the "energy revolution" and requires us to make more solid and active efforts to transition to low-carbon energy.

Energy transformation is a historical necessity of the continuous progress of human civilization. The discovery and utilization of fossil energy, such as coal, oil, and gas, have greatly improved labor productivity and promoted human civilization from agriculture to industrial civilization, a typical energy life. But for more than 200 years, industrial civilization has also created serious environmental, climate and sustainability problems. The progress of modern non-fossil energy is pushing mankind from industrial civilization to ecological civilization and driving the new-round energy revolution.

However, the characteristics of the three stages of global and Chinese energy structure transformation are different. The first stage of global energy structure transformation is dominated by coal. In 1913, coal accounted for 70% of global primary energy. But after decades of shifting global energy to oil and gas in the second phase, the world is now shifting from gas to non-fossil fuels in the third phase. The first stage of China's energy source structure also focuses on carbon conservation. Still, the second stage will not focus on oil and gas, but on the multi-structure stage, fossil energy and non-fossil energy diversified development, coordination, and complementarity. It will gradually transform to green, low carbon, safe and efficient, and then achieve electrification, intelligence, networking, and low carbon. We will also move to phase three, which non-fossil fuels will dominate.

Since the reform and opening up, the rapid growth of energy in China has supported the rapid development of the economy. The energy efficiency has been significantly improved, and the energy structure has also been improved. However, energy revolution cannot be called, and the extensive growth of heavy industry, low energy efficiency, and high carbon structure have made environmental problems increasingly prominent.

2 LITERATURE REVIEW

Dimitrov examines political dynamics in Paris based on participatory research and highlights process features that help us understand the outcome. Through analysis, the process variables are emphasized, and the role of persuasion, argumentation, and organizational strategy is emphasized. Climate diplomacy has succeeded because the international dialogue in the negotiations has led to a change in perception. Compelling arguments about the economic benefits of climate action have changed the preferences for policy commitments at the national and international levels [1]. Based on a research report, Bruce suggested that Paris's agreement Incentives for participation to increase and maximize...
the possibilities for universal participation are essential, without which meaningful global action on climate change could be stifled. Incentives for continuous implementation and compliance are important design considerations [2]. Chen et al. used a minimum complexity earth simulator and a semi-empirical statistical model to quantify the global mean temperature and sea level rise (SLR) response under a range of emission paths covering different carbon peaks and carbon neutral years for China. The results show that China will require a carbon reduction rate of no less than 6 percent per year and a growth rate of no less than 10 percent per year in its carbon capture capacity to achieve carbon neutrality by 2060. Peak carbon years and peak carbon emission years contribute significantly to climate change mitigation in the short term, while carbon neutral years significantly impact the long term [3].

Matteo Coronese et al. state that there is empirical evidence that climate change increases the frequency and intensity of natural disasters worldwide, causing significant economic losses [4]. Nam et al. estimated the potential synergies between pollution and climate control in China and the United States and summarized the results as the cross elasticity of emissions control. This result suggests that China may have a greater incentive to reduce SO2 and NOx and produce significant local pollution benefits [5]. UNDP expects a myriad of negative impacts on global society stemmed from climate change between 2030 and 2050. It is expected that climate change will cause 250,000 additional deaths a year due to malnutrition, malaria, diarrhea, and heat stress [6]. Jia et al. stated the rapid development of carbon finance in China could become a new path to promote the internationalization of RMB, which has important practical significance for the stable development of China's economy and its role in the international arena [7].

Caineng et al. summarized the main experiences and methods of major countries to achieve carbon neutrality, analyzed the global distribution of carbon dioxide emissions of carbon neutrality, and put forward challenges and countermeasures to deal with global carbon neutrality. Renewable Energy has become the dominant energy market in the third-largest energy transition and will first implement carbon neutrality [8]. An et al. gave an overview of acid-base DEFC technology by describing its working principle, battery performance, system efficiency, ethanol oxidation products, and cost. The recent innovations and prospects of Alkaline DEFCS are highlighted [9]. Teng emphasized the "virtuality, structural diversity and high risk" characteristics of carbon finance related to the virtual economy. The development of carbon finance is both an opportunity and a challenge for China. In the process of carbon finance development, the internationalization of RMB should be promoted. It is an important strategy to achieve the leading role of a low carbon economy in the future [10].

3 POLICY DEVELOPMENT

Across the globe, tackling climate change has also become one of the central banks' core issues. In general, the international policy framework to deal with climate change mainly includes industrial policy, carbon tax, carbon emission trading and other carbon pricing policies, and green finance. In the field of green finance, there are some hot issues in the world, such as the impact of climate change on the financial system, climate information disclosure, the convergence of green finance standards, international cooperation in green finance, and "One Belt And One Road" green investment and financing.

At present, more than 120 countries and regions around the world have proposed carbon neutral targets. Most of them are planned for 2050 in the European Union, the United Kingdom, Canada, Japan, New Zealand, South Africa, etc. US President Joe Biden has made it clear that he will commit to being carbon neutral by 2050. Some countries plan to go carbon neutral even earlier. Uruguay is carbon neutral by 2030, Finland by 2035, Iceland and Austria by 2040, Sweden by 2045, Suriname and Bhutan by 2014 and 2018, respectively, entering the era of negative emissions. China recently announced that it aims to be carbon neutral by 2060.

Most of the countries that have proposed carbon neutral targets are policy statements. In contrast, a few have written carbon neutral targets into law, such as France, the United Kingdom, Sweden, Denmark, New Zealand, Hungary, etc. Some countries and regions, such as the European Union, South Korea, Chile, Fiji, etc., are in the process of carbon-neutral legislation.

Table 1. The commitment time of carbon neutral in major countries

| Country   | Commitment of time | The target date |
|-----------|--------------------|-----------------|
| China     | 2020.9             | 2060            |
| British   | 2019.6             | 2050            |
| Sweden    | 2017               | 2045            |
| Switzerland | 2019.8          | 2050            |
| Spanish   | 2020.5             | 2050            |
| Korea     | 2020.10            | 2050            |
| Germany   | 2019.12            | 2050            |
| Japan     | 2019.6             | 2050            |
| Finland   | 2019.6             | 2035            |

China announced to the United Nations General Assembly on September 22, 2020, that it would strive to be carbon neutral by 2060 and adopt "more forceful policies and measures" to peak emissions by 2030.

Danish: Target date: 2050 Nature of commitment: The law stipulates that in 2018 the Danish government set out a plan to create a “climate-neutral society” by 2050. The plan includes banning the sale of new petrol and diesel cars from 2030 and supporting electric vehicles. Climate change was a major theme in the June 2019 parliamentary elections, and tougher emissions...
targets were enshrined in legislation passed six months later by the victorious "Red Bloc" parties.

Finland: Target date: 2035 Nature of commitment: Ruling party coalition agreement. As part of negotiations to form a government, five political parties agreed in June 2019 to strengthen the country's climate laws. The target is expected to limit industrial logging and phasing out the burning of peat for power generation.

French: Target Date: 2050 Nature of Commitment: The law requires the French National Assembly to vote on June 27, 2019, to encode the net-zero target into law. In its June report, the newly formed High Council on Climate recommended that France quadruple the rate at which it cuts emissions to meet its carbon-neutral target.

Germany: Target date: 2050 Nature of commitment: The law stipulates that Germany's first major climate law will come into force in December 2019, introducing the law saying that Germany will "pursue" greenhouse gas neutrality by 2050.

Japan: The Japanese government approved a climate strategy to study carbon capture, utilization, and storage, as well as the development of hydrogen as a clean fuel source in June 2019, ahead of hosting the G20 leaders' summit. Notably, no plan has yet been put in place to phase out coal, which is still expected to provide a quarter of the country's electricity by 2030.

South Korea: Target date: 2050 Nature of commitment: Policy announcement South Korea's ruling Democratic Party has returned to power by a landslide in elections due in April 2020. Voters backed his "Green New Deal" to decarbonise the economy by 2050 and end coal financing. The pledge is the first of its kind in East Asia and a big deal for the world's seventh-largest emitter of carbon dioxide. South Korea, which gets about 40% of its electricity from coal, has been a major financier of coal plants overseas.

Spain: The Spanish government submitted a draft climate framework bill to parliament in May 2020, setting up a committee to monitor progress and banning new coal, oil, and gas exploration licenses with immediate effect.

Swedish: Target Date: 2045 Nature of Commitment: Sweden is legally required to set a net zero emission target in 2017, bringing forward its carbon-neutral timetable by five years under the Paris Agreement. At least 85% of the reduction would have to be achieved through domestic policies, with the rest offset by international reductions.

Swiss: On 28 August 2019, the Swiss Federal Council announced its intention to achieve net zero carbon emissions by 2050, deepening the Paris Agreement's goal of reducing emissions by 70-85%. Parliament is revising its climate legislation to include technology development to remove carbon dioxide from the air (one of Switzerland's most advanced pilot projects in this field).

Britain: Target Date: 2050 Nature of Commitment: The UK is legally required to have passed a framework for reducing emissions in 2008, so setting a net zero target is as simple as moving from 80% to 100%.

Parliament passed the amendment on June 27, 2019. Scotland's parliament is working on a bill to achieve net zero emissions by 2045, based on Scotland's strong renewable energy resources and ability to store carbon dioxide in depleted North Sea oil fields.

To achieve carbon neutrality, some countries have developed emission reduction roadmaps based on industrial policies. Considering that 73% of global greenhouse gas emissions come from energy consumption, 38% comes from the energy supply sector, and 35% comes from the energy consumption sector such as construction, transportation, and industry. Some countries have developed industrial policies under the background of carbon neutrality to support the emission reduction target. It includes the following two paths.

3.1 Develop clean energy and reduce coal power supply

According to the International Energy Agency (IEA), from 1990 to 2019, traditional fossil energy (coal, oil, natural gas) accounted for nearly 80% of the global energy supply, while clean energy accounted for only a small proportion. Therefore, countries start from the energy supply side, and promoting the energy supply side's comprehensive decarbonization is the key to achieving the carbon neutral goal. There are mainly two ways:

One is to reduce coal power supplies. 55% of the cumulative carbon emissions come from the power industry from the energy supply side, while 80% of the carbon emissions in the power industry come from coal-fired power generation. To achieve carbon neutrality, countries around the world have taken steps to reduce their reliance on coal. In 2017, for example, The United Kingdom and Canada founded The Powering Past Coal Alliance. Thirty-two countries and 22 regional governments have joined them. Members of The coalition pledged to phase out Coal power in The next five to 12 years. Sweden closed its last coal-fired power plant in April 2020; Denmark has stopped issuing new licences for oil and gas exploration and will stop fossil fuel production by 2050.

Second, we will develop clean energy, develop energy storage technology and improve energy efficiency. Renewable energy has become an important choice for all countries to tackle climate change due to its wide distribution, great potential, and sustainable utilization. For example, Germany has the largest scale of renewable energy development in Europe. In 2019, Germany issued the Climate Action Law and Climate Action Plan 2030, which clearly stated that the proportion of renewable energy generation in the total electricity consumption would increase year by year, and the proportion will reach over 80% by 2050. The U.S. enacted the Recovery and Reinvestment Act in 2009, focusing on encouraging private investment in wind power through tax credits and loan preferences. In 2019, wind power became the first renewable energy in the U.S. In July 2020, the EU released the Hydrogen
Strategy to promote the development of hydrogen technology; Britain, Denmark have proposed the development of hydrogen energy for industry, transportation, electricity, and residential power supply.

### 3.2 Reduce building carbon emissions and build green buildings

Green renovation of buildings has a high upfront cost and long return period on investment, but considerable long-term benefits, which is conducive to the realization of carbon neutrality. According to the European Institute for Building Performance, green renovations and energy-efficient retrofit of buildings can create more jobs, improve productivity and potentially add billions of euros in revenue. Energy-efficient hospital retrofits can also reduce the average length of a patient's stay and save the healthcare industry tens of billions of euros a year.

The main way for the construction industry of all countries to achieve carbon neutrality is to build green buildings. It means that in the life cycle of buildings, resources are saved to the maximum extent, the environment is protected, the quality of space use is improved, and the harmony between man and nature is promoted. To this end, there are two main approaches:

First, we will introduce a green building evaluation system and promote green energy efficiency labeling. The Green Building Evaluation System and Energy Conservation Labelling are important energy conservation guidelines for building designers, manufacturers, and users, which help maximize resource conservation and environmental protection in the whole life cycle. In terms of the evaluation system, the UK has introduced BREEAM, the world's first green building evaluation method. More than 270,000 buildings around the world have completed BREEAM certification. Germany launched the second generation of green building evaluation system DGNB, covering ecological protection and economic value; Singapore has included minimum Green standards in the Building Control Act, introduced the Green Mark evaluation system, and stipulated energy efficiency standards for new buildings, existing buildings, and communities. In terms of green energy efficiency labeling, the United States and Germany have respectively implemented the "Energy Star" and "Building Energy Qualification Certificate" to mark the energy efficiency and consumable grade of buildings and equipment.

The second is to transform old buildings and build new green buildings. More than 80% of the buildings in Europe are more than 20 years old and have high maintenance costs. In 2020, the European Commission launched the "Wave of Innovation" initiative, which proposed that all buildings would achieve near-zero energy consumption by 2030. France has set up a renovation grant to help 7 million high-energy homes meet low-energy building standards; The UK has launched the "Green Bills" program, which encourages people to install emission reduction facilities in old buildings by means of tax rebates and subsidies, and implements "pre-management" for new green buildings, that is, buildings are designed at the beginning with comprehensive consideration of energy-saving elements, and energy consumption analysis reports are submitted according to the standards.

To achieve the goal of carbon neutrality. Every country needs to do overall planning, focus on key industries, steadily advance emission reduction work, and realize the coordination between climate change and economic and social development.

For example, in the energy production industry, we can accelerate the construction of a clean and low-carbon energy system, promote the combination of renewable energy generation and energy storage technology, and realize the deep decarbonization of the power system. In the transportation industry, transportation infrastructure can be improved to realize the substitution of electric vehicles and hydrogen fuel vehicles for fuel vehicles. In the field of construction, energy-saving transformation can be carried out on old buildings, and carbon neutral buildings can be built according to green building standards. In the industrial sector, energy efficiency can be improved, and coal consumption can be controlled. At the same time, we will increase afforestation and support the development of carbon capture technology to offset unavoidable carbon emissions and achieve net zero carbon emissions.

### 4 INFLUENCE ON CAR COMPANIES

The automotive industry, a pillar of the global economy, has taken steps to meet the goals set out in roadmap 2.0 for Energy Efficient and New Energy Vehicle Technologies. To achieve the goal of "carbon neutrality" for the automobile industry, the vehicle enterprises should assume their own responsibilities and drive the upstream and downstream industrial chains to advance together. Achieving the goal of "carbon neutrality" in the automotive industry requires life-cycle reductions. At the production end, the selection of sustainable energy, zero emissions of supply chain and factories, and carbon footprint tracking of upstream and downstream industrial chains are all contents that need to be studied.

It has systematically sorted out the carbon neutrality data of the supply chain of major multinational auto companies. According to relevant data, the carbon emissions from upstream raw material procurement of automobile enterprises account for less than 7% of the whole life cycle of automobiles, which is relatively small. Even so, if an automobile enterprise wants to achieve full life cycle carbon neutrality, it must jointly pay attention to the four areas of carbon neutrality: supply, manufacturing, use, and recycling.

As the most uncontrollable part of the entire life cycle of the automobile industry, it is relatively difficult for automobile enterprises to achieve the carbon neutral goal of the supply chain. For general automobile enterprises, their supply chain system is relatively large,
and there are as many as thousands or even thousands of parts suppliers. Achieve carbon neutrality in the supply chain requires automakers and suppliers to reach a consensus of ideas and requires suppliers to change in capital, technology, and other aspects. Based on this, it can better reflect the determination of a car company to achieve carbon neutrality in the whole life cycle. All production sites will be carbon neutral by 2040; Zf also expects to be carbon neutral by 2040.

After my review, it indicates that only 4 of the 8 multinational automobile enterprises had defined the carbon neutral time of the supply chain. The remaining 4 automobile enterprises did not give the carbon neutral time of the supply chain system but made relevant goals and plans for short-term emission reduction.

Table 2. Global major multinational car companies supply chain carbon neutral schedule overview

| Company            | Carbon emission target                     | Target date |
|--------------------|--------------------------------------------|-------------|
| VW                 | Achieve overall decarbonization            | 2030        |
| Mercedes-Benz      | Suppliers achieve complete neutralization | 2039        |
| VOLVO              | Suppliers achieve zero carbon emissions    | 2040        |
| Jaguar Land Rover  | Supplier zero emissions                    | 2039        |
| Toyota             | 3% reduction in carbon emissions           | 2021        |
| BMW                | 20% reduction in supply-side carbon emissions compared to 2019 | 2030    |
| Audi               | Carbon emissions are reduced by an average of 1.2 metric tons per vehicle | 2025 |
| Ford               | Reduce carbon emissions by 76%             | 2035        |

At present, Volkswagen, Mercedes Benz, Jaguar Land Rover, and Volvo Cars have set time targets for achieving carbon neutrality in the supply chain, and most of them are in the next 10 to 20 years. At the same time, we can find that the four enterprises that put forward the target of carbon neutrality in the supply chain also achieve carbon neutrality relatively early in the whole life cycle. Mercedes-Benz started a carbon neutral program as early as 2019, directly requiring suppliers to decarbonize the production process of auto parts. Volvo Cars also plans to cut emissions in its supply chain by 25 percent between 2018 and 2025, with suppliers achieving zero emissions by 2040.

Thus it can be seen that these auto companies who put forward the carbon neutral time target of the supply chain earlier have carried out corresponding planning in this field two or three years ago. At the same time, they also reduce carbon emissions in the whole life cycle of automotive products through carbon neutral management of the supply chain to maximize energy saving and emission reduction in a short period.

In addition to the announcement of the carbon neutralization time of the supply chain by four automakers, four automakers have made relevant plans for carbon neutralization of the supply chain. From this perspective, the carbon neutrality of suppliers is indispensable if automobile enterprises want to achieve carbon neutrality in the whole life cycle. According to relevant data, Bosch, the world’s largest component supplier, has announced that it will achieve corporate carbon neutrality through various measures; Continental expects all of its production sites to be carbon neutral by 2040; Zf also expects to be carbon neutral by 2040.

As for the consumer part, electric vehicles are undoubtedly a powerful means to achieve “carbon neutral” cars. According to the Research Report of The Low-carbon Action Plan of China’s Automobile (2020), pure-electric passenger vehicles’ life cycle carbon intensity is 26% lower than that of traditional gasoline vehicles (calculated according to the life cycle of 150,000 km). Pure electric vehicles have obvious advantages over traditional fuel vehicles in terms of carbon emissions.
At present, multinational auto giants also have electric sword models in this tide to find the most appropriate path.

Volkswagen: As one of the world's top four auto manufacturers, Volkswagen is more aggressive in its new energy vehicle scale layout. VW plans to sell 3 million new energy models globally by 2025 under its three major brands -- Audi, Porsche, and Skoda. In addition, Volkswagen will make all its models electric by 2030 at the latest and completely stop selling traditional fuel cars. This series of actions can be said to be radical.

Toyota plans to introduce more than 10 electric models by 2020 and further reduce the number of traditional fuel models in Toyota's fleet to zero by 2025. At that time, Toyota cars in the global market will be equipped with electric vehicles or pure electric models.

Mercedes plans to gradually convert the Smart to an all-electric model and is expected to stop selling a petrol version in China next year. In addition, Mercedes will launch pure electric versions for all its models in The European market in 2020, and by 2020, Mercedes will offer pure electric versions for all its models.

Volvo's first step in this trend was the decision to get rid of diesel engines. And starting with the 2019 S60, Volvo plans all of its new models to be a hybrid, plug-in hybrid, or pure electric. That means gasoline engines will still be available in Volvos but in hybrid form.

Jeep: FCA plans to invest 9 billion euros in new energy over five years to equip its cars with a range of electrification solutions. And Jeep plans to make all its models all-electric by 2021.

It is too early to say whether new energy vehicles can completely replace traditional fuel cars. But the withdrawal of traditional fuel cars has become an inevitable trend. At the same time, the supporting facilities for the construction of new energy vehicles will also become the standard travel equipment in the future.

5 CONCLUSION

This paper summarizes the policies of various countries on carbon neutrality and carbon emission and introduces the developing guidelines of some automobile companies. It provides some policy ideas that the country can use in the next step and the possible direction of the future development of automobile enterprises. For these companies, carbon neutrality in the supply chain is not the main issue at the moment, and it takes longer to prepare and plan for the fundamental construction. Whether new energy vehicles can completely replace traditional fuel cars is not known. But the withdrawal of traditional fuel cars has become an inevitable trend. At the same time, the supporting facilities for the construction of new energy vehicles will also become the standard travel equipment in the future.

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