The evolution of China's new energy policy (1995-2021): an analysis based on policy tools

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Abstract. Greenhouse gas emissions lead to global warming, which has been widely concerned by the international community. Further strengthening energy conservation and emission reduction is an urgent need to deal with global climate change. As a responsible big country, China has been formulating strong policies and measures to achieve the goal of energy conservation and emission reduction. Taking the evolution process of China's new energy policy as an example, based on the policy tool theory and using the content analysis method, this paper studies the structural evolution of China's new energy policy from 1995 to 2021. The results show that: (1) With the passage of time, the frequency and intensity of policy combination from the central government to local governments gradually increase; (2) In the use of new energy policy tools, Central government departments and local government departments mainly use mandatory command and control tools, supplemented by economic incentives and social autonomy tools (3) According to the different tasks of energy conservation and emission reduction, the eastern coastal provinces tend to use more applicable and flexible economic incentives, while the central and western provinces tend to use command and control tools. Based on the change trend of China's new energy policy from 1995 to 2021, this study predicts that in the next 10 years, the mandatory tools will be the first policy tools to be used, and the mixed tools and voluntary tools will be appropriately added to promote China's goal of carbon peak and carbon neutralization.

Keywords: new energy policy, policy tools, policy evolution, content analysis method, energy saving and emission reduction

1. Introduction

So far, nearly 200 parties to the United Nations Framework Convention on climate change (UNFCCC) have ratified the Paris Agreement and have begun to implement it in some countries[1]. The long-term
goal of the agreement is to control the rise of the global average temperature within 2 degrees Celsius compared with the pre industrialization period, and strive to limit the rise of the temperature within 1.5 degrees Celsius\(^\text{[2]}\). China's carbon emissions account for about 28% of the global carbon emissions, and it is the largest carbon dioxide emission country in the world. China's carbon dioxide emissions are mainly generated by the consumption of a large number of fossil energy, and the combustion of fossil energy causes serious air pollution in China\(^\text{[3]}\). Air pollution will increase the risk of diseases\(^\text{[4]}\). Therefore, China's energy structure has begun to transform from traditional fossil energy to low-carbon and environment-friendly energy structure. The purpose is to further reduce carbon dioxide emissions and gradually increase the proportion of renewable energy in energy consumption, which plays an important role in alleviating global climate change, improving air quality and improving people's healthy living environment. New energy is an important strategic material in China and plays an irreplaceable role in the rapid development of China's social economy\(^\text{[5]}\). At the same time, the development of China's new energy industry is full of twists and turns. How can new energy continue to play an important role in energy conservation and emission reduction under the constraint of resources and environment? As a major energy consumer, the central government and local governments have implemented a series of policies in the field of new energy.

Public policy plays an unparalleled role in guiding and promoting the process of energy transformation, policy tools supporting new energy technologies are very important for energy transformation\(^\text{[6]}\). At present, China's coal based energy system needs emission reduction technology to reduce carbon dioxide emissions. People's concerns about improving air quality and living environment also reflect a series of social expectations or interests. These fundamental pursuit or interests also promote the transformation of the traditional energy structure with coal as the main energy to the energy structure of sustainable development. In short, in order to promote the transition from the current energy system to a sustainable energy system, government agencies should design an energy policy portfolio suitable for future development, such as policies to support various renewable energy technologies, preferential policies to stimulate the development of new energy enterprises, etc\(^\text{[8]}\).

The rapid expansion of new energy infrastructure will bring unexpected consequences. For example, hydropower is attracting global attention. China is a leading country in the development of small hydropower projects\(^\text{[9]}\), and hydropower accounts for more than 16% of global power production. The advantage of hydropower generation lies in its low operation and maintenance costs. At the same time, it has low carbon dioxide emissions per unit of power generation, because of its flexibility in operation, high efficiency and profitability even in remote rural areas. However, the construction of hydropower infrastructure such as artificial dams and reservoirs has promoted the change of hydrological characteristics, resulting in adverse effects on the downstream river ecosystem. The government has promulgated a number of policy tools for governance and control. For example, the purpose of environmental impact assessment measures and watershed level management plans is to prevent the adverse impact of hydropower projects on the environment\(^\text{[9]}\). Therefore, we should develop new energy in a sustainable way and take policy measures to deal with the adverse consequences of the development process on the environment\(^\text{[10]}\). The world's energy structure has been transformed into a green and low-carbon energy structure. The world energy structure has begun to change to a green and low-carbon energy structure, which has been transformed into a climate, ecological adaptability and friendly energy structure. The main feature is to ensure energy supply and realize the intelligent transformation of energy services\(^\text{[11]}\).
In order to promote green development and realize the strategy of sustainable development, Chinese government departments and local government departments have promulgated a large number of policies to promote the development of new energy\cite{12,13}. From now on to 2030, carbon emissions will reach the peak, and further to 2060, China will talk about "carbon neutral" of carbon emissions. China will practice the green development strategy and take the road of sustainable development for a long time. The Chinese government is adjusting and optimizing the energy consumption structure and choosing new energy with low energy consumption and low carbon emission as the main energy in the new era. Since the Chinese government implemented the reform and opening-up policy for more than 40 years, the growth in new energy production and consumption has been huge. The central and local government departments have issued a series of environmental policies for energy and new energy production and consumption, and used a variety of policy tools to correct the problems of high energy consumption and environmental pollution.

Although some scholars have made good achievements in the research of new energy policy, the research in this field needs to be further improved. Firstly, most of the previous studies focused on specific new energy policy tools, such as laws and regulations, environment, finance, taxation and government procurement, and rarely conducted comprehensive and systematic research on new energy policy; Second, there may be differences in the new energy policies issued by government agencies, but most studies do not clearly distinguish the policies issued by different government agencies; Third, previous studies mainly adopted qualitative research and lacked quantitative analysis.

Firstly, this paper uses the content analysis method to code and statistically analyze the new energy policy texts implemented by the central government and local government departments since China's implementation of the reform and opening-up policy\cite{14,15}. This paper constructs the analytical framework of China's new energy policy from the perspective of the use of policy tools by the central government and local governments departments, and draws lessons from the classification principles of Hollett and Ramish's policy tools. On this basis, based on the theory of policy tools, this paper studies the policy documents issued by the central government and local governments in the field of new energy, combs the structure of policy portfolio tools in the field of new energy, and excavates the problems existing in China's new energy policy tools; Finally, this paper forecasts the development trend of new energy policy in the next two five-year plans.

The rest of this paper is arranged as follows: Section 2 mainly introduces the data collection and research methods of this paper; The third section combs the historical development trend, policy tool structure and policy combination tool structure of the central and local governments; Section 4 discusses the evolution of China's new energy policy and the existing problems; Section 5 introduces the conclusions of this study and forecasts the trend of new energy policies and policy tools in the next 10 years.

2. Materials and methods

2.1. Data

This paper studies all the policy documents issued by the central government and local government departments in the field of new energy, and traces the evolution of China's environmental policies in the new energy industry from 1995 to 2021. The relevant policy documents in the field of new energy covered the regulatory documents related to the new energy industry issued by China's central government and local governments since the founding of the people's Republic of China. As of May
12, 2021, the central government has issued 329 laws and regulations, all of which are classified into administrative regulations and policy documents, departmental rules and policy documents and industry regulations and policy documents; There are 1778 laws and regulations issued by local government departments, which are classified into four categories: local laws and regulations, local norms, local working documents and administrative permission approval documents.

First, research data collection. Policy text data collection, this article in the "pkulaw" legal database(www.pkulaw.cn), the official websites of the central government departments and the local government departments searched the policy documents of China in the new energy industry. Secondly, preprocess the data, such as the supplement of lost data and the correction of abnormal data; The main task of policy text data processing is to eliminate repetitive and weak correlation text. Finally, we conduct in-depth mining on the new energy industry data and promulgated laws and regulations, analyze the change trend of the number of new energy industry data and policy promulgation over time, and sort out the evolution process of China's new energy industry policy framework and policy promulgation through the analysis and comparison of the documents issued by the central government and local government departments in the new energy industry, This paper analyzes the problems existing in the new energy policy promulgated by the central and local government departments, and the promulgation trend of China's new energy policy in the next 10 years.

2.2. Methods

From the perspective of the use and innovation of policy tools, this paper constructs an analysis framework according to the classification method of policy tools, and introduces statistical analysis technology and content analysis method[16][17] into policy research. Content based analysis is a widely used research method in the field of social science research, which can transform qualitative symbolic content into systematic quantitative data[18]. Carry out background analysis on the policies issued by the government to better understand the connotation of the policies for the policy formulation and implementation departments, so as to ensure the correct direction of these policies [19]. At present, content-based analysis method is applied to the analysis of policies in various fields, covering many industries, such as environmental protection industry[20], transportation industry[21], and mineral resources industry[22].

This study mainly refers to Howlett and Ramesh's classification of policy tools[23], and divides the categories according to the participation of central government and local government in each link of policy. According to the classification results of policy tools, the new energy policy tools adopted by China's central and local governments are divided into three categories: voluntary tools, mandatory tools and mixed tools. In addition, voluntary tools are divided into four strategic tools, mandatory tools are divided into three strategic tools and hybrid tools are divided into four strategic tools, a total of 11 specific strategic tools. Table 1 Types and structure of new energy policy tools.

Table 1. Types and structure of new energy policy instruments

| Types of policy instruments | Policy tools               |
|-----------------------------|---------------------------|
| Voluntary tools             | Publicity and education   |
3. Results

3.1. Analysis of the development process of new energy policy

3.1.1. An analysis of the central government's new energy policy

Figure 1. The number of policies issued by the central government departments each year

According to the statistical results of the number of policies implemented by the central government in the field of new energy every year, it can be concluded that from 1995, the first new energy policy was issued, and from 1995 to 2007, the central government implemented about two policies in the field of new energy every year; Since 2008, the number of policies implemented by the central government in the field of new energy has increased year by year, peaked in 2018, decreased in recent years, and more than 20 policies have been issued every year.
Figure 2. Distribution of effectiveness levels of policies issued by the central government departments

From the statistical analysis of the effectiveness level distribution of policies issued by central government departments, it can be concluded that 85% of the policies issued by central government departments are concentrated in departmental regulations, 14% of the policies issued by central government departments are industrial regulations, and 1% of the policies issued by central government departments are administrative regulations.

Figure 3. Distribution of policies issued by the central government departments

According to the statistical results of policy distribution issued by central government departments in Figure 3, it can be concluded that 82% of the policies issued by central government departments are distributed in various organs of the State Council and 18% in other organs.
According to the statistical results of the distribution of policy categories issued by the central government in Figure 4, it can be concluded that the top policy categories issued by the central government are securities, energy, tax and other fields.

3.1.2. Analysis of new energy policy of local government

As can be seen from Figure 5 statistical chart of the number of policies issued by local governments every year, the number of new energy policies issued before 2007 is very small. Since 2007, the
number of policies in the field of new energy has increased rapidly, and the number of policies issued each year from 2007 to 2020 will remain at about 80; Since 2014, the number of policies issued by local governments has increased greatly, reaching about 200.

![Figure 6](image1.png)

**Figure 6.** Distribution of the effectiveness level of policies issued by local governments

From Figure 6, we can see that 62% of the policies issued by local governments are local work, 30% are local normative documents, and 7% are administrative approval.

![Figure 7](image2.png)

**Figure 7.** Comparison of the number of policies issued by provinces, municipalities directly under the central government and autonomous regions

According to statistics, the number of policies issued by government departments of provinces, municipalities and autonomous regions is shown in Figure 7, it can be concluded that the most issued policies are ranked in Jiangsu, Fujian, Guangdong, Hebei, Jiangxi and Zhejiang. Most provinces and cities are concentrated in the eastern coastal areas and the provinces with high economic development level.
According to the comparative statistical chart of the data of policy categories issued by local governments in Figure 8, it can be seen that the policy categories issued by local governments are mainly distributed in the fields of energy and fiscal policies.

3.2. Analysis on the development process of new energy industry policy tools

By using content analysis and policy tool theory, this paper studies the development trend of policy tools in the field of new energy issued by China's central and local government departments. Referring to previous studies, this paper divides the types of new energy policy tools into three types, and further subdivides the three policy types into 11 policy tools. After the classification criteria have been established, we have made statistics on the frequency of using 11 specific policy tools corresponding to more than 2000 policy texts published by central and local governments.

3.2.1. The policy tools of the central government

This paper makes a statistical analysis of the central new energy policy tools from three types: voluntary tools, mandatory tools and hybrid tools. By analyzing the statistical data of new energy policy tools issued by central government departments (more than 329 policy texts from 1995 to 2021), mandatory policy tools account for the majority of the total policies, followed by hybrid tools and finally voluntary tools. As shown in Table 2, the statistical table of central new energy policy tools.

| Types of policy instruments | Frequency of use | Policy tools | Frequency of use |
|-----------------------------|------------------|--------------|------------------|
|                             |                  |              |                  |

Figure 8. Comparison of policy categories issued by local governments
This paper makes a statistical analysis of local new energy policy tools from three types of new energy policy tools: voluntary tools, mandatory tools and hybrid tools. By analyzing the statistical data of new energy policy tools issued by local government departments (more than 1778 policy texts from 1995 to 2021), mandatory policy tools account for the majority of the total number of policies, followed by hybrid tools and finally voluntary tools. As shown in Table 3, the statistical data of new energy policy tools of local government departments are shown in the table.

| Types of policy instruments | Frequency of use | Policy tools | Frequency of use |
|-----------------------------|-----------------|--------------|-----------------|
| Voluntary tools             | 71              | Publicity and education | 65 |
|                             |                 | Non governmental organizations | 2 |
|                             |                 | Market mechanism | 4 |
|                             |                 | Family and community guidance | 0 |
| Mandatory tools             | 384             | Direct service delivery | 2 |
|                             |                 | Public Enterprises | 49 |
|                             |                 | Financial assistance | 19 |
| Hybrid tools                | 221             | Information and persuasion | 142 |
|                             |                 | Auction of property rights | 1 |
|                             |                 | Taxes and usage fees | 60 |

3.2.2. Policy tools of local government

This paper makes a statistical analysis of local new energy policy tools from three types of new energy policy tools: voluntary tools, mandatory tools and hybrid tools. By analyzing the statistical data of new energy policy tools issued by local government departments (more than 1778 policy texts from 1995 to 2021), mandatory policy tools account for the majority of the total number of policies, followed by hybrid tools and finally voluntary tools. As shown in Table 3, the statistical data of new energy policy tools of local government departments are shown in the table.

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3.3. Problems in China's new energy policy tools

3.3.1. Problems of voluntary policy tools

The market tool system has not yet been established, and China has been promoting the establishment of new energy market. However, due to the imperfection of economic policies such as price policy and financing policy, the new energy field has not formed a complete market; China's state-owned new energy enterprises account for a large proportion of China's state-owned enterprises. Compared with private enterprises, state-owned enterprises can obtain more resources. Therefore, the inherent management system of state-owned enterprises can easily lead to the difficulty in making full use of enterprise capital. At the same time, due to the relatively rigid management mode of state-owned enterprises, it is difficult to introduce a competitive mechanism, it's easier to miss out on competitive opportunities in the energy market.

The tool of voluntary organization is absent. China Electric Power Enterprise Federation is a national joint organization of enterprises and institutions in electric power industry approved by the State Council in 1988. It is also a non-profit social and economic organization. Its basic function is to study the current situation of new energy field and put forward corresponding policy suggestions. It does not play a complementary role to other policy tools.

The effect of family and community tools is not significant, and citizens' awareness and action on the use of new energy are still insufficient. In today's sharing economy, the improvement of citizens' awareness is very important to promote the use of new energy in all aspects, and the role of family and community in this process is very important. Only in families and communities do a lot of publicity, To guide citizens to understand and support the development of new energy can effectively improve the awareness of citizens.

3.3.2. Problems of mandatory policy instruments

The Renewable energy law of the people's Republic of China is the most perfect regulatory policy tool in the field of new energy. Although it has broken the blank of zero, it is only the general framework for the field of new energy, and its specific implementation needs a series of supporting documents such as detailed rules and technical specifications, The corresponding supporting documents are few
and lack of systematicness. In addition, the *Renewable energy law of the people's Republic of China* has not been revised since the second revision in 2009. The reality is constantly changing and making progress, and regulatory policy tools also need to be constantly adjusted and updated. Therefore, the new energy mandatory tools have not formed a system, and have not been continuously improved and revised.

Regulatory tools and direct service delivery tools are lack of enforcement basis, but also lead to insufficient enforcement. The lack of enforcement basis will lead to some wrong behaviors in the process of enforcement, and the enforcement strength will be greatly reduced.

Public enterprise tools lack competitiveness. In recent years, many large and small enterprises have emerged in the field of new energy, and they occupy a certain position in the international market, and some influential large-scale new energy enterprises have formed. However, there is still a big gap between the operation ability of large enterprises and that of International enterprises with excellent operation ability. The problem of management and operation level needs to be improved. At the same time, the technology of China's new energy state-owned enterprises cannot reach the international advanced level, which is difficult to be compared with the United States, the European Union and Japan, which have strong technical strength, restricting the further development of new energy enterprises.

### 3.3.3. Problems of mixed policy instruments

The use of information tools is not comprehensive, especially in today's society, there is still a waste of resources. Fundamentally speaking, the cognition of protecting resources and environment is not enough, especially in the field of new energy. Improving the education level and strengthening the information policy tools are the problems to be solved. In daily life, there are always people and things who do not understand the current environmental situation, which also means that we do not have enough publicity on environmental protection topics and new energy advantages. We should strengthen the publicity on the use of new energy, so that more citizens can understand new energy, buy new energy vehicles and practice green travel.

The content of tax tools is not perfect, and tax incentives are attractive to many enterprises. A single financial subsidy tool is very unfavorable to promote the establishment of China's new energy market. Only by changing the way and content of financial subsidy tools, establishing a diversified financial subsidy tool, and increasing the intensity and amount of subsidies, can the policy effect be more significant. For the development of enterprises, the government's tax tool is an important tool to guide the progress of new energy industry. The establishment of guiding tax tools by government departments, guiding traditional enterprises to enter the field of new energy and promoting the development and progress of enterprises in the field of new energy are very important to the rapid development of new energy in China.

The role of financing tools is weak. For the development of enterprises, capital is very important, so a variety of financing methods are needed. The degree of financing is an important indicator to measure the healthy development of enterprises. At the same time, the development of new energy enterprises is the same. How to greatly improve the financing channels of enterprises in the field of new energy has become an urgent problem to be solved. Nowadays, the development of new energy is still in the primary stage, and has not formed a large scale. Compared with other advantageous enterprises, the ability of financing in the capital market is relatively low. Therefore, the ability of active financing is
very weak, and the financing ability of new energy enterprises can only be improved through the support of national policies. Although China has adopted a series of financing tools, their role is limited and the effect is very little. The progress of enterprises in China's new energy field has not reached the expected level. Therefore, it is urgent to use financing tools to improve the financing ability of enterprises.

China has implemented the fiscal subsidy policy earlier in the renewable energy field, but the subsidy means are single, lack of strength, the amount of subsidy is small, and the source of funds is unstable, which leads to the policy effect is not significant. The most popular subsidies in the world include investor subsidies, producer subsidies and consumer subsidies, while the rare one in China is consumer subsidies, which is a policy tool with great effect for stimulating terminal consumption to expand the market of renewable energy products. A single financial subsidy tool is very unfavorable for promoting the establishment of China's new energy market. Only by changing the way and content of financial subsidy tools, establishing diversified financial subsidy tools, and increasing the intensity and amount of subsidies, can the policy effect be more significant.

4. Discussion

This paper analyzes the evolution of the new energy policy portfolio in the past 27 years by using the data of the new energy policy promulgated by the Chinese government based on time series, which is helpful for the international community to further understand the work of the Chinese government in the design of the new energy policy portfolio and the promulgation of the new energy policy, and support China's unremitting efforts in promoting sustainable energy development.

In the future, China's demand for new energy, the development of energy field and the change of energy structure will affect the choice of policy tools used by the Chinese government. In addition, the preference of government departments in the choice of policy types and the types of new energy will also affect the final use of policy tools. Generally, policies in the field of new energy also follow the self-strengthening mechanism of "path dependence", which can usually explain the persistence of the system[24]. The policy tools issued by the government in the field of new energy and the types of policy tools used will continue to be used in the future on the basis of the existing policy tool structure. Based on the theoretical framework of "path dependence" in the next 10 years, China's new energy policy tools predict many factors affecting the evolution trend of new energy policy tools.

The type of mandatory policy will continue to be the main policy tool adopted by the Chinese government for future new energy issues. Mandatory policies can give full play to the power of the government, the cost of investment is relatively low, and achieve better policy objectives. Command and control tools show rapid response speed to reflect government orientation and economic interests. At the same time, it may affect the production profit of the enterprise. From the perspective of central government departments and local governments, the implementation goal of command and control tools is relatively high, and the government is more inclined to choose command and control tools. In practical application, we will further strengthen the supervision and inspection of industry access standards, industry regulations, administrative license approval and other links[25]. When renewable energy companies exceed pollution emission standards, penalties for violations of laws and regulations will gradually increase[26].

In addition, financial subsidies and tax instruments will be strengthened. Due to the implementation of a dedicated environmental management fund system and environmental tax, the environmental costs
of the new energy industry will be internalized continuously\cite{27}. The Chinese government will use more financial subsidy policy tools and tax policy tools to promote the production of enterprises to expand to the field of new energy, such as the application of new technologies and the production and application of new materials\cite{28}.

In addition, new energy policy tools should focus on guiding the improvement of pollutant emission trading mechanism of renewable energy in the future. At present, in order to achieve the goal of energy conservation and emission reduction, the Chinese government has established a carbon dioxide emission trading system. With the continuous improvement of carbon dioxide emission trading system and the maturity of pollutant trading market, the pollutant emission trading mechanism of renewable energy will be widely promoted and used in the near future\cite{29}\cite{30}.

The role of information and persuasion tools in the field of new energy is not as good as other types of tools. Therefore, this type of tool can be used for publicity in the cultivation of awareness of energy conservation and emission reduction, so that more people can understand and understand the benefits of new energy and increase the publicity role of information tools.

Finally, social autonomy policy tools, which will have outstanding performance in guiding and supervising the promotion and application of new energy. Secondly, in order to protect its ecological rights and health interests, the voluntary participation of social citizens will be improved, and residents will participate in the new energy supervision. There will be differences in the choice of new energy policy tools between provinces and cities, which will continue to be maintained. The new energy market in economically developed provinces and cities will be more mature than that in economically underdeveloped provinces. Therefore, in these provinces, more and more people adopt economic incentives and social autonomy policy tools that can provide more independent choices for the new energy industry to develop and adopt new technologies.

5. Conclusions

In the next 10 years, mandatory tools will become the preferred tool type for central government departments and local government departments to choose to use policy tools. The proportion of financial subsidy policy tools and tax policy tools will also gradually increase. In addition, with the adjustment of energy structure and the increase of energy conservation and emission reduction tasks, mandatory and direct tools are more effective than other types of policy tools to deal with environmental problems. However, the frequent use of this policy tool is bound to restrict the enthusiasm and independent innovation ability of enterprises. Therefore, the frequency of financial subsidies, taxes and property rights trading tools will continue to increase, which will further stimulate the vitality of the new energy industry and accelerate the high-quality and rapid development of the new energy industry. So far, voluntary and social monitoring tools are rarely used. However, as citizens' voluntary participation increases, the frequency of adoption of these policy tools will also be greatly increased. The implementation effect of information persuasion tools in the field of new energy is not obvious, however, this type of policy tool can play an important role in publicizing the promotion and use of new energy. According to the different tasks of energy conservation and emission reduction, the eastern coastal provinces tend to implement more applicable and flexible policy tools of economic incentives, while the central and western provinces tend to use command and control tools to achieve sustainable development and achieve the goals of carbon peak and carbon neutralization in advance.
Acknowledgements

We would like to thank Ming Xu, Pezhman Ghadimi and Felix Carl Schultz for helpful discussions and comments. This work was supported by the National Natural Science Foundation of China (Grant No. 72033005).

Reference:

[1] Chen-ke, Cheng, Hua, Liao, Zhong-ju. Towards Sustainable Growth in the Textile Industry: A Case Study of Environmental Policy in China. Polish Journal of Environmental Studies. 2018;27(5):2325-36.

[2] Li L, Taeihagh A. An in-depth analysis of the evolution of the policy mix for the sustainable energy transition in China from 1981 to 2020. Applied Energy. 2020;263.

[3] Limin C, Ming Liang X. The impact of industry cluster and environmental policies on residents' health risk evaluation using big data. Work. 2021(1):1-10.

[4] Tilt B. China's air pollution crisis: Science and policy perspectives. Environmental Science & Policy. 2019;92:275-80.

[5] Qiuyun D. Discussion on Strategic Transformation Situation and Motivation for Enterprises in a Low-carbon Economy. Science and Technology Management Research. 2013;33(24):113-7.

[6] Boqiang L, Yufang C. Impacts of policies on innovation in wind power technologies in China. Applied Energy. 2019;247(AUG.1):682-91.

[7] Polzin F, Egli F, Steffen B, Schmidt TS. How do policies mobilize private finance for renewable energy?—A systematic review with an investor perspective. Applied Energy. 2019;236(FEB.15):1249-68.

[8] Seto KC, Davis SJ, Mitchell R, Stokes EC, Unruh G, Rge-Vorsatz D. Carbon Lock-In: Types, Causes, and Policy Implications. Social Science Electronic Publishing. 2016;41:425-52.

[9] Couto TB, Olden JD. Global proliferation of small hydropower plants – science and policy. Frontiers in Ecology & the Environment. 2018;16(12):91-100.

[10] Kuriqi A, Pinheiro AN, Sordo-Ward A, Garrote L. Flow regime aspects in determining environmental flows and maximising energy production at run-of-river hydropower plants. Applied Energy. 2019;256:113980-.

[11] Bo Z, Xudong S, Ying L, Suping P. Development Trends and Strategic Countermeasures of China's Emerging Energy Technology Industry Toward 2035. Chinese Journal of Engineering Science. 2020;22(2):38.

[12] Jian W, Xu H, Ke H, Zhouquanc C, Xin L. An exploration on corporate-community relationship in mining sector in China – Lessons from Yunnan Phosphate Chemical Group Co., Ltd. Resources Policy. 2017;52:54-64.

[13] Xiaohong L, Tong Z, Ching-Ter C, James FC. China's Renewable Energy Strategy and Industrial Adjustment Policy. Renewable Energy. 2021;170(6).

[14] Zhijun Y, Xu G, Ruoxue W. Tool Preference and Path Optimization of Environmental Governance Policies——Based on the Content Analysis of 43 Policy Texts. Journal of Northeastern University. 2017;19(03):276-83.
[15] Shu W. Transformation of Chinese Government Functions from the Approach of Policy Typology——An Empirical Study on Higher Education Policy. Chinese Public Administration. 2016(07):115-21.

[16] Zhongju L. The evolution of wind energy policies in China (1995–2014): An analysis based on policy instruments. Renewable & Sustainable Energy Reviews. 2016;56:464-72.

[17] Huatao P, Yang L. A comprehensive analysis of cleaner production policies in China. Journal of Cleaner Production. 2016;135(nov.1):1138-49.

[18] Yang L, Feiyan L, Jianfang Z, Jianbo G. Insights into the nature of food safety issues in Beijing through content analysis of an Internet database of food safety incidents in China. Food Control. 2015;51:206-11.

[19] Tixier JP, Hallowell MR, Rajagopalan B, owman DB. Automated content analysis for construction safety: A natural language processing system to extract precursors and outcomes from unstructured injury reports. Automation in Construction. 2016;62(Febr.):45-56.

[20] Huiming Z, Qunwei W, R. MS. Waste cooking oil as an energy resource: Review of Chinese policies. Renewable & Sustainable Energy Reviews. 2012;16(7):5225-31.

[21] Inhaber H. Shortfall in on-road fuel economy: Implications for public policy. Energy Policy. 1982;10(4):356-9.

[22] Chai S, Zhicong Z, Jianping G. Evolution of environmental policy for China's rare earths: Comparing central and local government policies. Resources Policy. 2020;68.

[23] Howlett M, Ramesh M. Studying Public Policy: Policy Cycles and Policy Subsystems. American Political Science Association. 2009;91(2):548-80.

[24] Moncada JA, Lukszo Z, Junginger M, Faaij A, Weijnen M. A conceptual framework for the analysis of the effect of institutions on biofuel supply chains. Applied Energy. 2017;185:895-915.

[25] Aiping H, Jianping G, Yalin L. Vertical vs. horizontal integration: Game analysis for the rare earth industrial integration in China. Resources Policy. 2016;50:149-59.

[26] Powell-Turner J, Antill PD. Will future resource demand cause significant and unpredictable dislocations for the UK Ministry of Defence? Resources Policy. 2015;45:217-26.

[27] Jianping G, Yalin L. Resource tax on rare earths in China: Policy evolution and market responses. Resources Policy. 2018;59(C):291-7.

[28] Zhongju L. Environmental policy instruments, environmental innovation and the reputation of enterprises. Journal of Cleaner Production. 2018;171(pt.2):1111-7.

[29] Qingqing W, Xu H. A review of China's carbon trading market. Renewable and Sustainable Energy Reviews. 2018;91(aug.):613-9.

[30] Zhonghua W, Yao H. Research on China's Carbon Emissions Trading Market Price Distort Based on Shadow Price Model. Ecological Economy. 2019;35(05):13-20.