

*Original Research*

# China's Current Energy Policy: Dependencies and Contradictions

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## Abstract

Global warming and severe air pollution in China have necessitated a transition to a sustainable energy system that eschews coal-dominated energy production. The implementation of energy policies inevitably affects the behavior of enterprises at the micro level, which in turn affects their financial performance. The purpose of the study is to quantify the trends, patterns and contradictions in China's energy policy, identify and predict meaningful indicators for strategic intentions in the context of economic decarbonisation. Correlation and regression analysis, modelling and forecasting of energy consumption and carbon emission indicators by sector were implemented. The study demonstrates the potential positive effect of a strategy to minimise carbon emissions in the commercial and public services sector in the context of energy policy implementation and decarbonisation on China's economic growth. The results have potentially important policy implications for Chinese policymakers and business leaders and are needed to develop further tools to reduce electricity consumption in the government's Provincial Energy Conservation Goal (BEST) program as indicators of its implementation effectiveness in different provinces of China.

**Keywords:** China Five-Year Plans, Climate Policy, Holt Model, National Energy Conservation Goal, Provincial Energy Conservation Goal (BEST)

## Introduction

The current energy policies of most world countries are complex, depending on a number of factors, and often contain contradictions. One of the biggest dependencies of energy policy is fossil fuels, especially petroleum and natural gas, which have been the dominant energy sources for decades. However, these sources are limited and not renewable, and their use contributes to climate change and other environmental problems. As a result, there is a growing demand for renewable energy sources, such as solar, wind, hydro, and geothermal, which are generally cleaner and more sustainable.

Energy policies also depend on the economy. Energy is a critical driver of economic growth and development. Therefore, politicians must balance the need for reliable, affordable energy with the need to reduce greenhouse gas emissions and protect the environment.

In addition to these dependencies and contradictions, political and social factors influence energy policy. Some countries may be interested in maintaining the status quo, while others may be more ready to change. Public opinion and social movements also play an important role in shaping energy policy, as do technological progress and global economic trends.

Looking at the use of electricity a hundred years ago, one can conclude that in a significant number of countries, the energy industry was part of the natural monopoly of the state, and, as a consequence, was fully regulated by governments. The situation changed in the 1980s, when there was a major restructuring and reform in the energy sector. The first reforms were carried out in Great Britain and Latin America. Such reforms were necessary to drastically reduce energy prices through market competition, as well as to provide consumers with better and more reliable services and create additional commercial opportunities for private capital [1]. To overcome monopolization and ensure the sustainability of energy development, the Chinese government launched the first stage of power sector reform in 2002 (the 2002 reform) and the second stage in 2015 (the 2015 reform) [2].

However, the climate issue is now at the center, which determines the widespread attention to the problems of electricity consumption, which is a source of greenhouse gas emissions [3]. Since 2008, China has displaced the U.S. and ranked first among the countries that emit the largest amount of carbon and the largest consumer of electricity. This has caused China to face increased pressure to control and reduce its carbon emissions [4, 5]. The Chinese government has adopted various regulations concerning energy. At the same time, it should be taken into account that enterprises play a key role in the implementation of state management, and this is the core of the relationship between business and state regulation. China's 11<sup>th</sup> Five-Year Plan was marked by strong results in energy conservation.

In addition to this energy policy, the Chinese government set a binding national and provincial energy conservation goal (BEST) in the 11<sup>th</sup> five-year plan to reduce energy consumption. During this period, energy intensity decreased significantly. Chen et al. [6] believe that the national and provincial energy conservation goal that the Chinese government approved in the 11<sup>th</sup> five-year plan was an experimental step, so their study focused on analyzing energy policy in terms of energy intensity and the energy mix of firms. The DID method was used for the analysis, but this method does not illustrate the impact of energy policy on firms' financial performance [7, 8].

Busch and Hoffmann [9] have found that there is a correlation between financial performance and the environmental performance of corporations. Lanoie et al. [10], Min and Wang [11] confirmed the conclusions of previous scientists regarding the positive correlation between carbon dioxide emissions into the atmosphere and financial indicators. These scientists examine these indicators at the micro level, the present study considers the macro level, but also concludes that there is a correlation between the use of electricity and the total production of the country (GDP).

Chen et al. [12] and Shi and Xu [13] used DID and DDD methods to assess the impact of the 11<sup>th</sup> five-year plan. The cited studies consider the activities of the government to implement energy policy as a regulatory tool, and the survey data are subjective evaluations of individual respondents, which leads to a distortion of the final result of the survey. The present study, on the other hand, considered the data on investments on environmental protection and pollution prevention, which gives more reliable conclusions.

As for China, the reform of the energy system does not affect the state's GDP growth rate. With such significant growth, the Chinese government has to solve complex problems, which are related to environmental protection and the reduction of emissions of harmful substances in the context of increased energy dependence of production and densely populated megacities [14-18]. China's energy industry, on the other hand, was fully nationalized by the State Energy Corporation, which was a state agency and state-owned company before the 2002 reform. However, this did not allow the organization of a competitive energy market in China.

Taeihagh et al. [19] analyzed the political interplay between tools to reduce pollution from transportation and the United Kingdom's policies that promote the use of active transportation in the country. Among several studies examining the evolution of policy packages, Scordato et al. [20], Wang et al. [21], Guo and Wei [22], Hahn and, Garrett [23], Greenstone et al. [24] analyzed the development of a set of policies for the transition to sustainable development in Sweden. This study shows that new policies are important for the transition to sustainable development. Researchers have stressed the

need to further understand temporal factors and how combinations of policies evolve in the real world [25-27].

Consequently, the main challenge for the Chinese government is to find a balance between the increasing demand for electricity and the implementation of policies to protect the environment by reducing carbon emissions. The purpose of the study is to quantify the trends, patterns and contradictions in China's energy policy, identify and predict meaningful indicators for strategic intentions in the context of economic decarbonisation. According to the formulated purpose, the following tasks were set: to analyze the existing energy policy of China and the dynamics of electricity production and final consumption; to determine what impact the state energy policy has on the country's GDP.

### Experimental

China strives to be CO<sub>2</sub>-neutral, meaning that the state's enterprises reduce their carbon dioxide emissions and their counterparts to zero in the course of their activities. Since China's economy is very dependent on the consumption of traditional primary electricity, which is generated by power plants by burning coal and emitting carbon dioxide into the atmosphere, the present study's methodology consists of identifying the patterns between the measures that China has taken on the road to "carbon neutrality" and the change in GDP, and building a forecast using the Holt-Winters method. The development of green energy, which at the end of 2020 was almost 43%, and its relationship with the rate of GDP growth is also considered.

This study proposes to analyze the impact of the dynamics of growth in electricity production and consumption on the dynamics of changes in GDP. For this purpose, a multiple regression model was built:

$$Y = f(\beta, X) + \varepsilon, \tag{1}$$

$X = X(X_1, X_2, \dots, X_m)$  – vector of independent variables;  
 $X_1$  – electricity generation  
 $X_2$  – electricity consumption  
 $\beta$  – parameter vector;  
 $\varepsilon$  – errors of variation  
 $Y$  – dependent variable (the dynamics of GDP's changes).

The equation of multiple regression has the form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_m X_m + \varepsilon \tag{2}$$

$\beta_0$  – is a constant that determines the value of  $Y$  if all values of vector  $X = X(X_1, X_2, \dots, X_m)$  are 0.

The advantage of using multiple regression in this study is the use of several input variables (energy consumption, carbon emissions, energy production) in the model, which increases the proportion of variance

of the outcome variable (GDP) explained, and thus improves the fit of the model to the data.

The two-parameter Holt model, also known as linear exponential smoothing, is a popular smoothing model for predicting trend data. The Holt model consists of three separate equations that work together to produce the final forecast. The basic Holt model consists of a system of equations:

$$\begin{cases} a_t = \alpha y_t + (1 - \alpha)(a_t - 1 + b_t - 1) \\ b_t = \beta(a_t - a_t - 1)(1 - \beta)b_t - 1 \\ t + \frac{k}{y_t} + k = a_t + b_t k \end{cases} \tag{3}$$

$a_t$  – value of the predicted indicator smoothed for the period  $t$ ;

$b_t$  – an estimate of the growth trend, which illustrates a possible fluctuation (increase or decrease) over the period  $t$ ;

$\alpha, \beta$  – smoothing parameters ( $0 \leq \alpha \leq 1; 0 \leq \beta \leq 1$ );

$k$  – the number of periods for which the forecast is made.

The first equation is the basic smoothing equation, which directly corrects the last smoothed value for the trend of the last period. The trend itself is updated over time with the second equation, where the trend is expressed as the difference between the last two smoothed values. Finally, the third equation is used to create the final forecast. The Holt model uses two parameters: one for the overall smoothing and the other for the trend smoothing equation ( $\alpha, \beta$ ). This method is also called double exponential smoothing or exponential smoothing with trend amplification.

In the final stage of the study, a forecast until 2030 is made for the identified most relevant indicators in the context of energy consumption and production policy efficiency and carbon minimisation, using RStudio. This phase also includes time series analysis ( $E_t$ ) and forecast generation based on ARIMA [29]:

$$\Delta^d E_t = c + \sum_{i=1}^p a_i \Delta^d E_{t-i} + \sum_{j=1}^q b_j \varepsilon_{t-j} + \varepsilon_t, \tag{4}$$

where  $c, a_i, b_j$  – model parameters;  $\Delta^d$  – the mathematical operator of the time series difference of order  $d$  (sequential selection of  $d$ -differences of the first order – first from the time series, then from the obtained differences of the first order, etc.);  $\varepsilon_t$  – stationary time series. The model under study is also interpreted as ARIMA ( $p, d, q$ ) – model with  $d$ -unit root. At  $d = 0$ , there are conventional ARIMA ( $p, d, q$ ) models. With the lag operator  $L: Lx_t = x_{t-1}$ , these models can be calculated using the following formulas (5-8):

$$(1 - L)^d E_t = c + (\sum_{i=1}^p a_i L^i)(1 - L)^d E_t + (1 + \sum_{i=1}^q a_i L^i) \varepsilon_t, \tag{5}$$

or abbreviated to:

$$a(L)(1 - L)^d E_t = c + b(L)\varepsilon_t, \tag{6}$$

$$a(L) = 1 - \sum_{i=1}^p a_i L^i, \quad (7)$$

$$b(L) = 1 - \sum_{j=1}^q b_j L^j. \quad (8)$$

The initial data for modelling and forecasting is provided in Table 1 [29-31].

It should be noted that there are some limitations in the current study. First, due to limited cross-sectional data, the relationships of the variables in the present study's theoretical model were correlational rather than causal. Second, the object of the present study included only China. Consequently, further research is needed to collect data from different countries.

## Results and Discussion

It should be noted that China's strict limits on 11<sup>th</sup>, 12<sup>th</sup>, and 13<sup>th</sup> five-year plans based on strict indicators led to Zhejiang province resorting to mass power cuts in order not to exceed the limit policy targets for electricity

consumption. In addition to this energy policy, the Chinese government has set a binding national and provincial target for energy conservation in the 11<sup>th</sup> five-year plan to reduce energy consumption. This plan was outlined in the 11<sup>th</sup> five-year plan, but now, by adopting the 14<sup>th</sup> five-year plan, the PRC government does not set such a strict framework in the process of energy conservation. Fig. 1 presents the dynamics of energy production and consumption in China [28].

The period of China's 11<sup>th</sup> five-year plan for 2006-2010 was the period when the BEST program to reduce regional electricity consumption began; however, electricity production was increasing. Thus, if in 2006 it was 3814564 thousand toe, then in 2019 it was 5998950 thousand toe (up by 47%). As for consumption, from 2006 to 2019, it increased by 25%, which may indicate an increase in China's electricity exports. The Chinese government has significantly increased investment in energy-saving measures. The purpose of these measures was to reduce the contradictions between the demand (final consumption) and supply (production) of energy and to improve the quality of the environment.

Table 1. Initial data for the key indicators used in the study

Period	Energy consumption by sectors (PJ)			Emissions by sectors (Mt CO <sub>2</sub> )		
	Industry (IND)	Transport (TRN)	Commercial and public services (CAP)	Industry (INDe)	Transport (TRNe)	Commercial and public services (CAPe)
2001	13371	3599	1055	959	254	61
2002	14150	3917	1095	997	276	63
2003	16271	4456	1245	1136	313	71
2004	20715	5266	1530	1498	371	87
2005	25976	5654	1611	1936	397	92
2006	28318	6203	1756	2083	435	99
2007	30842	6698	1925	2274	469	107
2008	32589	7304	1932	2410	507	104
2009	34500	7487	2079	2601	517	110
2010	38687	8253	2301	2844	569	119
2011	40801	9050	2586	3005	622	131
2012	41972	9980	2824	3042	686	141
2013	42752	10804	3015	3068	741	147
2014	43622	11260	3064	3095	770	143
2015	42742	12141	3249	2994	828	150
2016	41736	12455	3376	2846	845	149
2017	41155	12981	3509	2692	878	145
2018	42407	13415	3549	2784	948	133
2019	42888	13546	3671	2786	940	125
2020	43198	13706	3792	2888	896	116

Source: formed by the authors on the basis [29, 30]

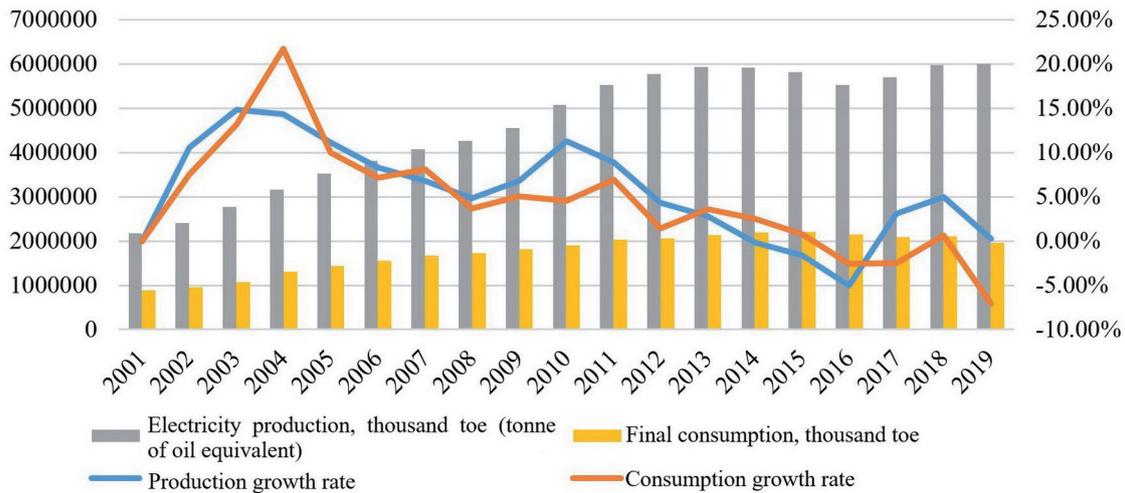


Fig. 1. Dynamics of electricity production and final consumption in China in 2001-2019. Source: developed by the authors based on data from the U.S. Energy Information Administration [28]

Overall, budget investments in energy conservation and environmental emission reduction totaled 223.2 billion yuan. Energy conservation and energy-saving technology projects received the most attention. These issues concern the central state budget, and the provinces have set up funds to improve energy conservation. The main activities of the funds are the implementation of energy-saving projects, the promotion of high-efficiency energy-saving products, and the construction of low-carbon facilities.

A striking example is Tianjin Province, where the fund has been collecting 200 million yuan yearly since 2007 to save electric power as well as reduce atmospheric emissions. These funds aim to develop the environmental component of clean enterprise production and the use of renewable energy sources.

By correlating different data on electricity production and final consumption as an indicator of the effectiveness of implementing the “carbon neutrality” policy and the BEST energy conservation program by province, a correlation and regression analysis and calculation of pairwise correlation coefficients and partial correlation coefficients were carried out. As a result of the calculations, a multiple regression equation was obtained:

$$Y = -25.1221 + 4.5E-5X1 - 8.0E-5X2 \quad (9)$$

The resulting equation indicates that the resulting variable Y changes by 4.5E-5 units on average when independent variable X1 (electricity production) changes by one. This means that if fuel production increases by only 1,000 toe, China’s GDP increases by an average of 45 million yuan. As for factor X2, final consumption of electricity, an increase in final consumption by 1 thousand toe leads to a decrease in GDP of 79.65 million yuan, because this variable has a negative value of the constant in the equation. As for the free

term in the equation, which is -25.1221, it shows what Y would be if all variables in this equation were equal to zero. All of the above findings will be significant, provided that the p-value > 0.05, in which case the coefficient can be considered zero, that is, one that does not affect the dependent variable. In addition, one can conclude that the parameters of the regression equation X1 and X2 are significant because the p-value is 0.00042 and 0.0213, respectively. However, this applies only to the independent variables. If one considers the free term of the regression equation, it has no effect on the variables and its p-value is 0.06, which is greater than 0.05. Analyzing the results of t-criterion calculation, the table value of this criterion is 2.1199. The calculated value of the t-criterion for variables X1 and X2 is greater than the tabulated value, which indicates the significance of these two indicators and confirms the conclusions that made by analyzing the p-value indicator.

The R-square coefficient is 0.86, which indicates a high significance of the equation. One can interpret these results in the following way: the growth rate of fuel production has an insignificant (4.52333E-05) positive effect on the growth rate of GDP, while the growth rate of final consumption, that is, an increase in consumption, leads to an insignificant decrease in GDP (7.96512E-05). Pair correlation coefficient is 0.897. This indicator demonstrates a close relationship between GDP growth and the growth rate of energy production, and the correlation coefficient between the growth rate of GDP and the growth rate of energy consumption is 0.98, which also indicates a strong linear relationship.

Electricity production and consumption have a significant impact on China's GDP change, because the correlation between the factors is 0.911 and 0.854. In this case, we can observe a high correlation between GDP and energy consumption across sectors and carbon emissions across all the sectors studied in the same way.

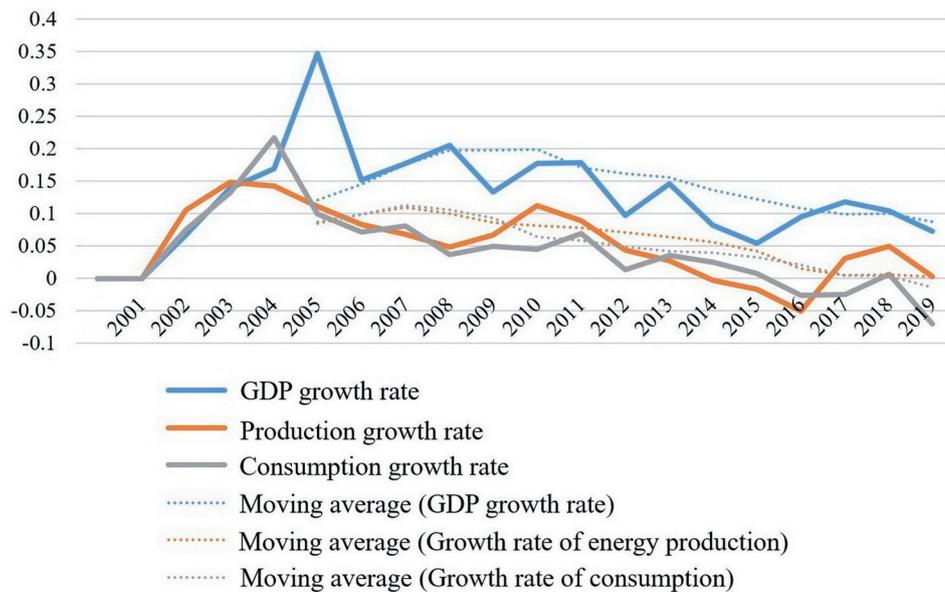


Fig. 2. Dynamics and moving average of the growth rates of GDP, energy production, and final energy consumption  
Source: developed by the authors

Fig. 2 shows the dynamics of GDP growth rate, energy production and final consumption and moving averages.

In the graph, the moving average of the growth rate of energy production and the growth rate of final energy consumption are almost the same for the periods 2005 to 2009 and 2015 to 2018. As for the GDP growth rate, there is a downward trend for GDP as well. Such dependence and similar development trends indicate that China's economy is energy dependent, and the increase in the rate of production inevitably increases the demand for energy and the construction of new energy carriers. At the same time, the Chinese government adheres to a policy of energy conservation and strives to minimize carbon dioxide emissions into the atmosphere. The study proves that these policies are leading to a deterioration of China's macroeconomic performance, which means that the government needs to develop additional measures that will stabilize the economic situation. The authors suggest that these measures should be represented by serious structural changes in key approaches to the functioning of energy-intensive industrial sectors.

Since the 13<sup>th</sup> five-year period observed ended in 2020, one should make a forecast to determine whether the downward trend in the analyzed indicators will continue. The Holt model is used for forecasting. For the data the system of equations looks like:

$$3a + 0.21b = 0.021a + 0.0241b = 0.0279$$

The assessment results are shown in Table 2.

Based on the calculations, the forecast value was -0.103, which also indicates the continuation of the downward trend in China's GDP. The negative impact

of energy policy on the macroeconomic indicators of the state can be reduced or even fully mitigated by active energy conservation activities and benefits.

In this case, the state goes to the trouble of continuing the policy of strict restrictions on the use of electricity, despite the negative consequences that affect the growth and development of the national economy. Enterprises are forced to comply with this policy and pay additional funds for over-regulated energy use, as well as for emissions into the atmosphere. Enterprises must be fully aware that as they strive to develop, they must adapt to the needs of the times and pay attention to energy conservation.

To identify the most significant factors in the context of energy consumption against the backdrop of China's strategic policy implementation, modelling was carried out. This took into account both energy consumption and carbon emission factors by sector, which represent the majority of companies and production in the country's decarbonisation pathway. The resulting modelling is shown in Table 3.

Based on the exclusion of the least significant variables under study, models were generated sequentially. The last model demonstrates that the most significant among the studied factors is the volume of emissions of commercial and public organisations, the volume of energy consumption by them, as well as by transport.

Reducing carbon emissions from commercial and public organisations can have a significant impact on the country's GDP and the attainment of its decarbonisation targets. But it is important to note that transport also requires special attention, because there is a fairly strong correlation between energy consumption in this sector and GDP. A large proportion of companies operating in

Table 2. Holt model evaluation results

Period	$y_t$	Data smoothing, $a_t$	Trend smoothing, $b_t$	Forecast, $y_t^*$
2001	0	0.0987	0.248	0.0987
2002	0.105939346	0.275	0.227	0.347
2003	0.148445652	0.396	0.195	0.502
2004	0.143041227	0.456	0.155	0.591
2005	0.111402319	0.461	0.11	0.611
2006	0.083520426	0.425	0.0659	0.571
2007	0.068053649	0.364	0.0278	0.491
2008	0.048431345	0.289	-0.00305	0.392
2009	0.067634232	0.22	-0.0227	0.286
2010	0.112675408	0.172	-0.0303	0.198
2011	0.089196045	0.126	-0.035	0.142
2012	0.0435057	0.0767	-0.0393	0.091
2013	0.027763945	0.0345	-0.0402	0.0374
2014	-0.001902862	-0.00453	-0.0398	-0.00565
2015	-0.016393889	-0.036	-0.0373	-0.0444
2016	-0.050383916	-0.0664	-0.0353	-0.0733
2017	0.03100637	-0.0619	-0.0233	-0.102
2018	0.049980447	-0.0446	-0.0112	-0.0852
2019	0.002830148	-0.0382	-0.00588	-0.0558
2020		-0.0309	-0.00191	-0.0441
2021				-0.103

different sectors use logistics and transport, which to a certain extent allows the results to be linked.

In order to determine the effects of the energy policies implemented and China's strategic intentions, predictions were made for the most important factors identified during the period under study (Table 4).

By 2030, energy consumption in the commercial and public services sector is expected to be 33% higher than in 2020. Carbon emissions from this sector will fall by 76.3% on average, but it is worth noting the wide range of possible deviations. The forecast increase in energy consumption by commercial and public services is expected to increase carbon emissions by 57%, but with an effective strategy to minimise this, a full decarbonisation of the sector is possible. The relationship between these factors and GDP identified in the previous stage of the study indicates the potential positive effect on China's economic growth of a strategy to minimise carbon emissions for this sector, in the context of energy policy and decarbonisation.

Energy policies aim to reduce the use of electricity in the initial production and consumption of energy by businesses. State energy consumption controls may also require disclosure of energy use and emissions,

which increases compliance costs and potentially increases a facility's capital turnover. This has led to an increase in leverage, which directly weakens the financial performance of companies. At the macro level, companies should develop and adopt new strategies that are more adapted to dynamic management and instantaneous changes in reducing energy consumption and sustainable growth and development of company financial results. Thus, the results show that energy policy has increased the financial burden on energy-intensive industries, thereby confirming the assumption put forward that the state's desire to reduce energy consumption has a negative impact on economic growth.

Various scholars have examined and researched China's energy policy. Existing studies have emphasized different aspects of China's energy policy development, and more so China's role in the international arena in climate conservation negotiations and China's leadership on this issue [32-34]. Of great importance is energy and the carbon emissions associated with it, the transition to green energy [35-37].

The present study results resonate with the research of Lanoie et al. [10]. They found that stringent

Table 3. Modelling results for China's GDP in terms of energy consumption and carbon emissions by sector.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
(Intercept)	47.74 ***	47.74 ***	47.74 ***	47.74 ***	47.74 ***	47.74 ***
	(0.33)	(0.31)	(0.34)	(0.33)	(0.39)	(0.40)
IND	-1.15					
	(16.00)					
TRN	33.33 *	33.28 *	23.34	24.56 **	17.74 *	20.98 **
	(15.11)	(14.46)	(14.83)	(6.63)	(7.21)	(7.03)
CAP	16.59	16.43	13.86	13.44	23.29 **	19.03 *
	(8.91)	(8.27)	(8.96)	(7.46)	(7.62)	(7.20)
INDe	6.06	5.14				
	(13.15)	(2.68)				
TRNe	-8.13	-8.31	0.85			
	(10.31)	(9.59)	(9.14)			
CAPe	-11.23 ***	-11.20 ***	-9.65 ***	-9.59 ***	-10.01 ***	-10.96 ***
	(1.45)	(1.34)	(1.17)	(0.92)	(1.07)	(0.85)
EP	3.34	3.35	7.42 *	7.56 *		
	(3.86)	(3.70)	(3.33)	(2.87)		
FC	-9.59 *	-9.51 **	-6.82 *	-6.97 **	-2.02	
	(3.27)	(2.94)	(2.84)	(2.24)	(1.44)	
N	20	20	20	20	20	20
R2	0.98	0.94	0.93	0.92	0.92	0.92

Note: All continuous predictors are mean-centered and scaled by 1 standard deviation. \*\*\* p<0.001; \*\* p<0.01; \* p<0.05. Source: formed by the authors

Table 4. Forecasts of energy consumption by transport, commercial and public organisations and their carbon emissions to 2030

Period	TRN (PJ)	Lo 95 TRN (Pj)	Hi 95 TRN (Pj)	CAP (PJ)	Lo 95 CAP (PJ)	Hi 95 CAP (PJ)	CAPe (Mt CO <sub>2</sub> )	Lo 95 CAPe (Mt CO <sub>2</sub> )	Hi 95 CAPe (Mt CO <sub>2</sub> )
2021	14237.95	13747.74	14728.16	3936.06	3780.28	4091.84	107.52	94.81	120.23
2022	14769.91	14076.65	15463.17	4080.12	3859.82	4300.42	99.04	75.42	122.67
2023	15301.86	14452.79	16150.93	4224.18	3954.37	4493.99	90.56	54.60	126.53
2024	15833.82	14853.40	16814.24	4368.24	4056.69	4679.79	82.09	32.37	131.80
2025	16365.77	15269.63	17461.91	4512.30	4163.97	4860.62	73.61	8.83	138.38
2026	16897.73	15696.96	18098.49	4656.36	4274.79	5037.93	65.13	-	146.18
2027	17429.68	16132.70	18726.65	4800.42	4388.27	5212.56	56.65	-	155.13
2028	17961.63	16575.11	19348.16	4944.48	4503.88	5385.08	48.17	-	165.15
2029	18493.59	17022.96	19964.22	5088.54	4621.21	5555.86	39.69	-	176.19
2030	19025.54	17475.36	20575.72	5232.60	4739.99	5725.20	31.21	-	188.20

Source: formed by the authors

environmental regulations have a direct negative impact on company operations and financial performance [38]. The Chinese government has focused on technology

development as a means to counteract this undesirable trend and has adopted a «green growth» approach to respond to the challenges of climate change [39].

The limitation of this study stems from events that occur in the international arena as a result of military conflicts and pandemics. These events can have a significant impact on changing indicators in recent years (2021-2022), which this study does not take into account. As a consequence there are also inevitable transformations in the global energy market, which might also introduce additional risks and incentives for China to minimise them. All of these factors could affect the bias of the results of this study. To counterbalance this limitation, an additional recalculation may be made in the long run, taking into account updated data. Another important limitation is the fact that GDP may be affected by a number of other factors that are not related to the energy sector. It is therefore important to emphasise that this study points out the interrelationships between the factors under study, rather than their interdependencies.

### Conclusions

It was found that as a result of implementing the BEST policy, which began during the 11<sup>th</sup> five-year plan phase, the dynamics of energy production and final energy consumption began to decline. It was found that with an increase in fuel production by only 1 thousand toe, China's GDP increases by an average of 45 million yuan, and an increase in final consumption by 1 thousand toe leads to a reduction in GDP by 79.65 million yuan. The analysis of the correlation coefficients shows that the model factors are statistically significant and have a close relationship, indicating a direct linear relationship of China's GDP decline due to the introduction of government measures to transition to "carbon neutrality".

The research contribution of this study proves that one of China's key policy objectives remains to maintain GDP growth at a sufficiently high level by shifting from high-speed to high-quality growth by increasing domestic consumption and restraining the growth of carbon emissions, with a particular focus on the commercial and public services sector. This sector is poised for a qualitative transition in the coming years which will have an impact on the country's GDP. Although energy consumption by commercial and public services is projected to increase by 2030, decarbonisation of this sector is possible with an effective minimisation strategy. The study demonstrates the potential positive effect of a carbon minimisation strategy in this sector in the context of energy policy implementation and decarbonisation on China's economic growth.

To level out the negative effect of reduced energy consumption, a more unique approach is needed to account for the different factors of each specific industry in energy consumption. Factors such as location, size, and ownership should be considered when assigning energy conservation targets. The provincial

energy reduction targets should take into account the characteristics that are specific to a particular industry. These features should be taken into account when developing energy policy, especially in the aspect of providing tax incentives, the possibility of subsidizing firms that are willing to implement a policy of energy conservation. Thus, enterprises with environmentally friendly production process will be supported by the state.

The study of China's current energy policy has a high practical value for developing strategies and recommendations for reducing greenhouse gas emissions and managing climate change. Also, the correlation between climate policy and economic policy should be considered in the future to analyze the degree of competitiveness of Chinese products and the Chinese economy in the global market for goods and services.

### Conflict of Interest

The authors declare no conflict of interest.

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