

Factor Analysis of Residential Sector Pollutant Emissions in China

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1. Introduction

Industrial activities and human life are based on energy consumption, and air pollution is mainly caused by this energy consumption. The IPCC points out that the residential sector accounts for about one-third of the world's energy consumption. On the other hand, one of the unique characteristics of the residential sector is the difficulty in applying environmental measures compared to the industrial sector. This study clarifies the factors of CO₂ and NO_x emissions caused by energy consumption in China's residential sector through Logarithmic Mean Divisia Index (LMDI) analysis by considering four factors of the energy structure, energy intensity, economic development status, and population.

2. Method and Data

In this study, energy consumption in the residential sector, mainly CO₂ and NO_x emissions caused by fossil fuel consumption, are analyzed through LMDI analysis, energy structure, energy intensity, economic development, and population. This study analyzes the impact of these four factors on NO_x emissions. Fossil fuel energy consumption in the residential sector uses data from 2000 to 2018 published in the China Energy Statistical Yearbook. In addition, this uses data published by the China Bureau of Statistics for economic and population indicators. The CO₂ emission factor is based on Yuli Shan (2018), and the NO_x emission factor is based on Junfeng Wang (2018).

3. Results

3.1 Changes in the Energy Structure of the residential Sector

The energy structure of the residential sector from 2000 to 2018, coal use as a percentage of total energy sources has decreased by less

Table 1: Energy Structure of the residential Sector

	Coal	Gasoline	Kerosene	Diesel	LPG	Natural Gas
2000	70.3	3.8	1.2	3.0	16.8	4.9
2005	62.9	6.0	0.3	4.6	17.8	8.3
2010	44.9	11.5	0.2	7.2	16.9	19.4
2015	32.7	17.9	0.2	6.8	20.5	21.9
2018	24.7	22.1	0.2	4.1	23.1	25.7

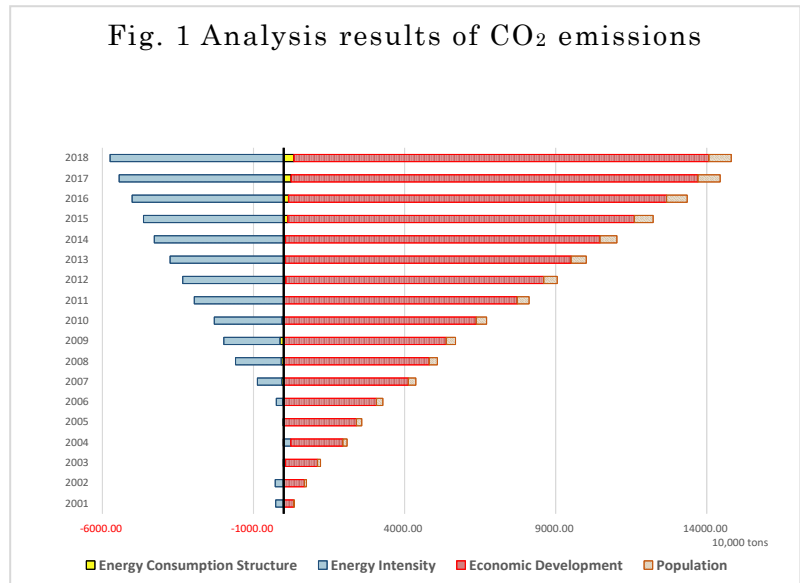
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than half, from 70.3% in 2000 to 24.7% in 2018, while natural gas use has increased significantly from 4.9% to 25.7%, surpassing the share of coal. The share of LPG and gasoline use also increased from 16.8% to 23.1% and from 3.8% to 22.1%, respectively.

3.2 Factor Analysis for CO₂ Emissions

Overall, as shown in Figure 1, the contribution of the increasing factors to CO₂ emissions exceeds that of the factors reducing emissions, indicating that CO₂ emissions from energy consumption in the residential sector will continue to increase. Among the four factors of energy structure, energy intensity, economic development, and population, the increase in economic development is the most powerful factor that increases CO₂ emissions. On the other hand, the increase in energy intensity contributes significantly to the reduction of CO₂ emissions.



The impact of the remaining two indicators, energy structure and population factors, was minor.

3.3 Factor Analysis for NO_x Emissions

As shown in Figure 2, NO_x emissions from the residential sector tend to increase at a faster rate than CO₂, since the contribution of increasing factors to NO_x emissions is much greater than that of emission reducing factors. The increase in economic development and energy structure are the main factors increasing NO_x emissions. On the other hand, the impact of population factor is negligible, while the increase in energy intensity contributes significantly to the reduction of NO_x emissions.

