Influencing Factors and Scenario Prediction of Carbon Emissions from Energy Consumption in Tianjin: Postprint

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Abstract

Based on the carbon emission estimates for Tianjin from 2000 to 2016, the LMDI model was employed to analyze the influencing factors of carbon emissions in Tianjin. The results indicate that economic scale and energy intensity exert substantial impacts on carbon emissions in Tianjin, with their effects manifesting as promotional and inhibitory, respectively. By categorizing economic variables into three scenarios (high, medium, and low) and emission reduction variables into two scenarios (moderate reduction and strong reduction), six development scenarios were generated through combination, such as high-growth-strong-reduction and medium-growth-strong-reduction. Utilizing the extended STIRPAT model, the changing trends of carbon emissions in Tianjin under these six combined scenarios were projected. The results demonstrate that the medium-growth-strong-reduction scenario optimizes both the carbon emission peak and its timing compared to the other scenarios while ensuring economic development, representing the optimal development model for Tianjin.

Full Text

Factors Affecting Carbon Emissions from Energy Consumption in Tianjin: Analysis and Scenario Prediction

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Abstract

The LMDI model was applied to analyze the factors affecting carbon emission from energy consumption in Tianjin from 2000 to 2016 based on the estimated carbon emission data. The results indicated that the carbon emission in Tianjin was significantly affected by the scale of economy and energy intensity, which played the promotion and inhibition of carbon emission respectively. On which the economic variables were classified into high, medium and low scenarios, and the emission reduction variables were divided into two modes of medium emission reduction and strong emission reduction. By means of the combination, 6 development modes including the high economic growth with strong emission reduction and the medium economic growth with strong emission reduction were obtained. Based on the STIRPAT extended model, the trend of carbon emissions in Tianjin under the 6 combination modes was predicted. The results showed that the mode of medium economic growth with strong emission reduction was the best for maintaining the economic development in Tianjin, and the carbon emission peaks and their occurring years were optimized compared to those of other modes.

Keywords: energy consumption; carbon emission; affecting factor; scenario mode; trend prediction; Tianjin

3. Model and Scenario Design

3.1 Model Construction

The STIRPAT model was used to analyze the driving factors of carbon emissions. The model is expressed as:

$$\ln I = a + b \ln P + c \ln A + d \ln T + f \ln NJ + g \ln CJ + e \quad (8)$$

where:
- I represents carbon emissions (t)
- P represents population (10 persons)
- A represents per capita GDP (10 yuan/person)
- T represents technology level
- NJ represents industrial structure
- CJ represents urbanization level
- e is the error term

References

[5] Presley K, Wessh J, Babette Z. Causal independence between energy consumption and economic growth in Liberia: Evidence from a non-parametric bootstrapped causality test[J]. Energy Policy, 2012, 50: 518-527.

[6] Haberl H, Krausman F, Gingrich S. Ecological Embeddedness of the Economy[J]. Economic and Political Weekly, 2005, 41(47): 4896-4904.

[7] Chang YF, Lewis C, Lin SJ. Comprehensive evaluation of industrial CO emission (1989-2004) in Taiwan by input-output structural decomposition[J]. Energy Policy, 2008, 36(7): 2471-2480.

[8] [Chinese reference - corrupted]

[9] Wei J, Huang K, Yang GS, et al. Driving forces analysis of energy-related carbon dioxide (CO) emissions in Beijing: An input-output structural decomposition analysis[J]. Journal of Cleaner Production, 2017, 163: 58-68.

[10] [Chinese reference - corrupted]

[11] [Chinese reference - corrupted]

[12] Liu Yongwei, Yan Qingwu. On the spatio-temporal distribution regularity of the carbon emissions based on the GIS in China[J]. Journal of Safety and Environment, 2015, 15(3): 199-205.

[13] Tian X, Chang GM, Tanikawa H, et al. Structural decomposition analysis of the carbonization process in Beijing: A regional explanation of rapid increasing carbon dioxide emission in China[J]. Energy Policy, 2013, 53(1): 279-286.

[14] Zhang Wei. Prediction and scenario analysis of industrial carbon emissions in Shaanxi Province based on STIRPAT model[J]. Renewable Energy Resources, 2017, 35(5): 771-777.

[15] Deng Xiaole, Sun Hui. Forecast of the northwest five provinces' carbon emissions based on STIRPAT model[J]. Ecological Economy, 2016, 32(9): 36-41.

[16] Liu Qingchuan, Li Qiang, Zheng Xuxu. The prediction of carbon Factors Affecting Carbon Emission from Energy Consumption in Tianjin based on STIRPAT model[J]. Acta Scientiae Circumstantiae, 2017, 37(4): 1582-1593.

[17] Wang Changjian, Wang Fei, Zhang Hongou. The process of energy-related carbon emissions and influencing mechanism research in Xinjiang[J]. Acta Ecologica Sinica, 2016, 36(8): 2151-2163.

[18] Gu Alun, He Chongkai, Lü Zhiqiang, et al. Industrial structure changes impacts on carbon emissions in China based on LMDI method[J]. Resources Science, 2016, 38(10): 1861-1870.

[19] Liu Yanjun. The Forecast and Analysis of Carbon Emissions' Peak Value in the Beijing-Tianjin-Hebei Region[D]. Beijing: North China Electric Power University, 2017.

[20] Zhang Wei, Shang Li. Impact factors analysis and enlightenment of industrial carbon emission in Shaanxi Province[J]. Ecological Economy, 2017, 33(5): 80-83.

[21] Lin Boqiang, Liu Xiying. China' s carbon dioxide emissions under the urbanization process: Influence factors and abatement policies[J]. Economic Research Journal, 2010, 45(8): 66-78.