***Research on the Coordinated Development of Economy, ENERGY and Environment in the Yangtze River Economic Belt based on "three Lines and one Order"***

[PengXinjie, China University of Geosciences( Wuhan), 18310788318, 5404598@qq.com]

[Chengjinhua, China University of Geosciences( Wuhan), 13971128538, chengjinhua100@126.com]

## Overview

## "Three lines and one order" refers to the red line of ecological protection, the bottom line of environmental quality, the upper line of resources utilization and the list of eco-environmental access, and is a kind of energy and environmental control policy implemented by the Chinese government. At present, "three lines and one order" is still in the argumentation stage, and the relevant restrictive indicators have not been fully established. Speeding up the construction of the "three lines and one order" system of the Yangtze River economic belt, strengthening the management and control of energy and environment is still the focus at the present stage.

This study constructs the dynamic model of the economy-energy-environment system of the Yangtze River economic belt under the influence of management and control policies to analyze the internal relationship between systems and the external impact of energy and environmental control. Moreover, This study calculates and compares the coordinated development level of the Yangtze River economic belt under the different intensity of energy and environmental control by the coupling coordination degree model.

## Methods

## The system of coordinated development of economy, energy and environment in the Yangtze River Economic Belt under the influence of management and control policies is a complex giant system. There is not only interaction and influence among the subsystems, but also the external shock from the policy, so this paper intends to adopt the system dynamics model to simulate the evolution of the main indicators in the economy-energy-environment system of the Yangtze River economic belt under different control policy scenarios. In this study, the parameters of the model are mainly determined by the methods of arithmetic average, table function, econometrics model calculation and referring to the existing literature. What is more, This study sets up four kinds of policy scenarios: the upper limit of energy utilization, the bottom line of environmental pollution, the negative list of environment and the red line of ecological protection. Meanwhile, in order to compare the impact of energy and environmental control on the economy-environment-energy complex system under different constraints. Weak, medium and strong policy scenarios are set under each category of policy scenarios. The starting year of the policy is set as 2017, and the target assessment year is set as 2030.

## The policy impact research based on system dynamics can only output the predicted value of a single variable, so it is difficult to evaluate the comprehensive indicators of multi-variables and can not directly measure the degree of coordination among the subsystems. Therefore, in order to select the policy scale of "three lines and one single" management and control which is most suitable for the coordinated development of the Yangtze River economic belt, this paper introduces the coupling theory to measure the coordination degree of economy-energy-environment of the Yangtze River economic belt under different intensity of management and control.

## Results

## The results of system dynamics show that the growth rate of GDP from low to high is: pollution bottom line constraint, energy upper limit constraint, ecological red line constraint, benchmark scenario, negative list control. The energy consumption from low to high is: energy upper limit constraint, pollution bottom line constraint, ecological red line constraint, benchmark scenario, negative list control. The pollution emissions from low to high are as follows: pollution bottom line constraint, negative inventory control, energy upper limit constraint, ecological red line constraint, benchmark scenario.

## The calculation result of coupling coordination degree shows that in the benchmark scenario, the coupling coordination degree of economy-energy-environment in the Yangtze River economic belt increases at first and then decreases, reaches a peak of 0.6523 in 2024 and 0.5661 in 2030, which is lower than that in 2017. Under the weak intensity control scenario, the coupling coordination degree decreased to 0.5719 in 2018, and will reach a peak of 0.7341 in 2028. Under the medium intensity control scenario, the coupling coordination degree continued to increase after falling to the lowest value in 2018, and its value reached 0.775 in 2030, which was higher than that of the other three scenarios. Under the high-intensity control scenario, the coupling coordination value rose rapidly to 0.65 in 2018, and then increases slowly to 0.7291 in 2030.

## Conclusions

## First, the contradiction between economy, energy and environment in the Yangtze River economic belt still exists. Without the control of energys and environment, the increase of energy consumption and environmental pollution caused by the expansion of economic scale will make the region face the risk of overloading of resources carrying capacity and decline of environmental quality.

## Sencond，"three lines and one order" plays a positive role in achieving their respective goals. it can reach the target value of 2030 through structural adjustment, environmental protection and energy saving investment and ecological red line supplement, and there are complementary effects except for the negative list. Therefore, it is of great significance to speed up the construction of "three lines and one single" management and control system and implement comprehensive management and control of energy and environment.

## Third，"three lines and one order" can effectively improve the level of coordinated development of economy, energy and environment in the Yangtze River economic belt, and the moderate intensity of constraint plays the most significant role in promoting the coordinated development of the Yangtze River economic belt. Too high or too low constraint intensity will damage the long-term growth power of the coordinated development of the Yangtze River economic belt, so choosing the constraint intensity with appropriate scale is the key to the implementation of regional energy and environmental control.