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The adaptability of carbon dual control policy and its impact on high energy consuming industries

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Introduction

- Under the dual control of carbon, the total energy consumption is more relaxed, and the new renewable energy and raw material energy consumption are not included in the total energy consumption.
- High energy-consuming industries account for more than 50 % of the total energy consumption of the whole society, accounting for more than 75 % of the total industrial energy consumption.
- Controlling high emissions industries will help to adjust the industrial structure and increase renewable energy investment.

Methods

The characteristics of EEM-CN dynamic recursive CGE model

- The general equilibrium model represents 33 economic sectors.
- Provide economic development, population, energy demand and supply structure, investment, carbon emissions trajectory.
- Assess the economic impact of restrictions on high-emission industries.

Scenarios

Scenario name		Scenario description
Baseline scenario	BASE	With carbon restrictions and industry-wide sharing, non-fossil energy will develop according to the plan, reaching 25 % by 2030.
Energy consumption control scenario	More stringent carbon-limited energy consumption control throughout the industry (ECDC-SCR)	With carbon constraints and industry-wide sharing (carbon constraints are tight relative to the baseline scenario), non-fossil energy development is the same as BASE.
	Industry-wide strict carbon restrictions and vigorously develop non-fossil energy consumption double control (ECDC-SCRP)	With carbon restrictions and industry-wide sharing (the total amount of carbon restrictions is the same as that of ECDC-SCR), a high proportion of renewable energy installed, and the proportion of non-fossil energy increased to 30 % by 2030.
	High energy-consuming industries undertake carbon-limited energy consumption dual control (ECDC-HSCR)	Carbon restriction (carbon restriction tight carbon restriction is tight relative to the benchmark scenario, but the total amount is the same as ETS-HIS1, and there is no carbon trading ; the non-fossil energy ratio will develop according to the plan, reaching 25 % in 2030.
Carbon control scenario	Double control of carbon emissions in industry-wide carbon trading (DCCE-ETS)	Carbon restrictions and industry-wide sharing (the same total amount as ECDC-SCR) allow industry-wide carbon trading, and non-fossil energy development is the same as BASE.
	Industry-wide carbon trading and vigorous development of non-fossil carbon emission control (DCCE-ETSP)	Carbon restrictions and industry-wide sharing (the same total amount as DCCE-ETS) allow industry-wide carbon trading, a high proportion of renewable energy installed, and the proportion of non-fossil energy increased to 30 % by 2030.
	Dual control of carbon emissions in carbon trading of high energy-consuming industries (DCCE-HETS)	High-energy-consuming industries impose carbon restrictions separately (the total amount of carbon restrictions is the same as ECDC-HSCR), allowing carbon trading in high-energy-consuming industries, and non-fossil energy development is the same as BASE.

Results

1. Under the same total carbon emission limit, the peak time of energy consumption in each scenario is different. Under the planning development of non-fossil energy, the same carbon emission limit and different policies, the energy consumption of ECDC-SCR, DCCE-ETS and ECDC-HSCR scenarios is the same. Under the same policy, different installed capacity and the same carbon limit, energy consumption is different in different scenarios in Fig. 1.
2. Under the same carbon emissions and the same renewable installed capacity, the energy consumption intensity of the carbon emission control scenario decreases slowly. In carbon emissions and the same scenario, the energy consumption intensity of high proportion renewable scenario is lower than that of normal proportion renewable scenario in Fig. 2.
3. The high proportion of renewable opportunities will lead to more losses in GDP, and more will be lost over time. Under the same conditions, carbon emission double control has less loss than energy consumption double control in Fig. 3.

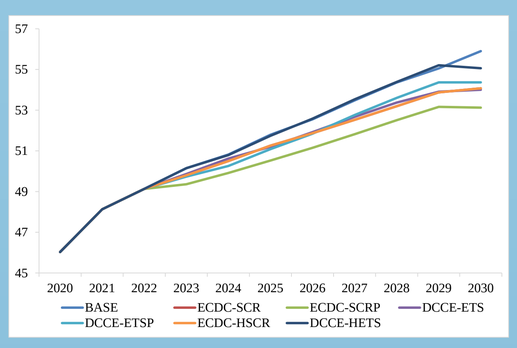


Fig.1 Energy consumption in each scenario

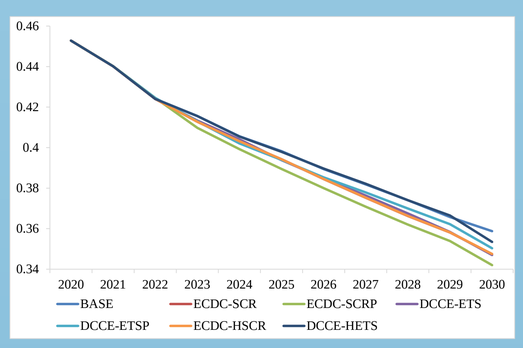


Fig.2 Energy consumption intensity under different scenarios

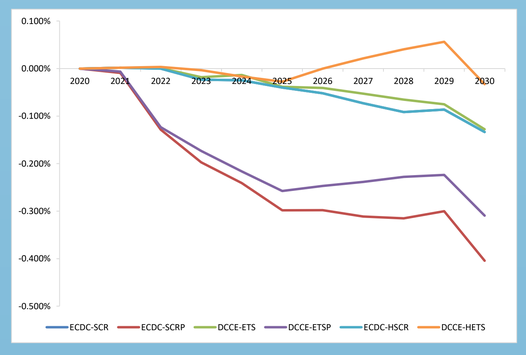


Fig.3 Loss rate of GDP change

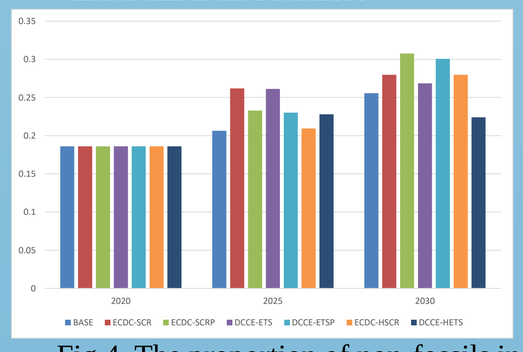
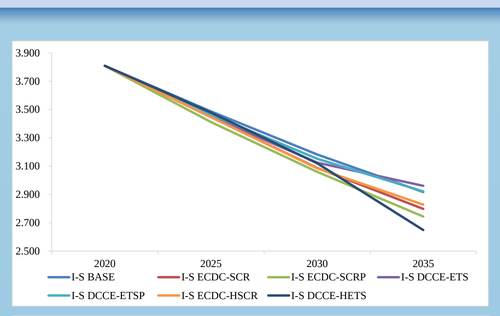


Fig.4 The proportion of non-fossils in each scenario



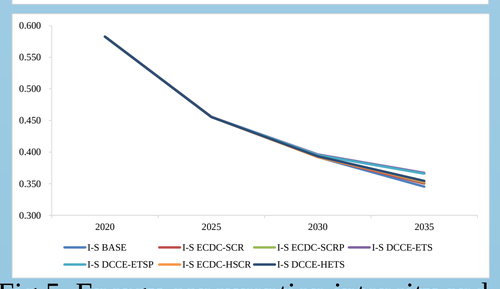
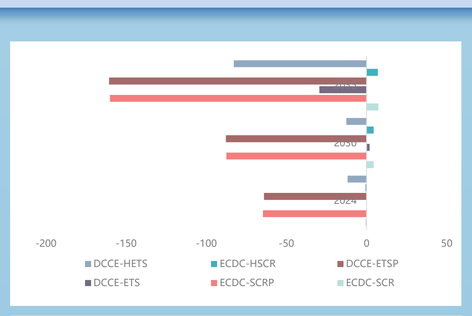


Fig.5 Energy consumption intensity and carbon intensity of iron and steel industry



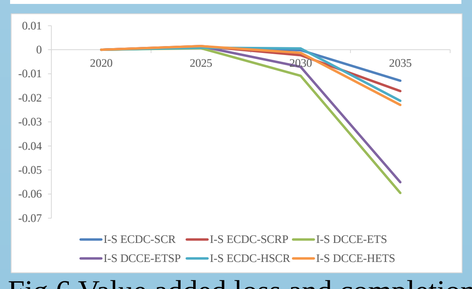


Fig.6 Value added loss and completion of the steel industry

4. The results obtained by using different control scenarios under the same installed capacity show that the change caused by the external carbon policy has less impact on the whole non-chemical proportion, and the change of installed growth rate has a greater impact on the energy structure in Fig.4.
5. Energy consumption intensity : The ferrous metal industry has the fastest decline in DCCE-HETS, and the carbon emission control scenario generally declines faster than the energy consumption control scenario. Under the same policy, the high proportion of non-fossil energy declines more.
6. Carbon intensity : the energy consumption control scenario declines faster than the carbon emission control scenario. On the high energy-consuming sectors alone impose more decline than the whole society. The proportion of non-fossil energy has no obvious impact on the industry in Fig.5.
7. Value added loss : the value added loss of carbon emission double control scenario is the most, followed by that of high energy consumption sector alone, and the loss of energy consumption double control is the least. Under the same policy, the high proportion of non-fossil energy scenario loses more.
8. Employment : In addition to a small amount of employment growth by imposing carbon restrictions on high-energy-consuming industries alone, other control scenarios will lead to a decrease in employment in Fig.6.

Conclusion

1. The transformation from energy consumption dual control to carbon emission dual control is conducive to the rational utilization of resources. Under the same carbon emission, the energy consumption of carbon emission dual control is lower, which is more conducive to energy transformation.
2. The vigorous development of non-fossil energy is conducive to the implementation of the carbon dual control policy. The energy consumption of high energy-consuming sectors is greatly affected by renewable installed capacity, and the energy consumption intensity and carbon intensity of high energy-consuming sectors decrease more.
3. Speed up energy substitution in high energy-consuming industries and increase investment appropriately. The carbon dual control can not only keep the total energy consumption rising slowly but also the energy consumption and carbon intensity decreasing faster.