Features and Evolution of International Fossil Fuel Trade Network Based on Value of Emergy

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ABSTRACT

Fossil fuel is crucial to the development of modern society. The major types of fossil fuel are coal, crude oil and natural gas. The uneven distribution of the production and consumption of fossil fuel makes the fossil fuel flows between countries by international trade. This study aims to quantitatively analyse the features and evolution of the international trade of fossil fuel by complex network and emergy. We transform the trade quantity of coal, crude oil and natural gas into emergy by transformity and the sum of the three emergies is the emergy of fossil fuel. The complex network models of the integrated fossil fuel trade as well as the trade of coal, crude oil and natural gas are built up based on the value of emergy. We analyse the trade relationships, trade quantity, trade density, and hierarchy structure of the networks.

We find that the number of trade relationships and the trade quantities follow the power law distribution; countries with many export relationships tend to have many import relationships; the centralization of trade quantity is becoming more intense for fossil fuel, crude oil and coal, but less intense for natural gas; the pattern of top relationships is diversified; the trade density of fossil fuel is increasing; and countries with more than 20 trade relationships tend to have a hierarchy structure. Our findings implicate that as the hierarchy structure is becoming more ordered, the statuses of the countries are clearer, and thus it is easier for policy makers to identify the roles of their own countries or the roles of other countries. Coal is the “cheapest” fuel measuring by “energy cost” and is the most widely traded type of fossil fuel. When two countries exchange fossil fuel and money in the international trade, they should look further into the energy cost of them and reconsider the effectiveness of the trade. Our study can also reveal the trade strategy of the countries.

Citation
