



## **Industrial emission competition network of China and its implication on industry planning**

Qier An, Debin Qu, Ming Zhu, and Hujun Zhang

Research Institute of Petroleum Exploration and Development, China (anqier@petrochina.com.cn)

China is facing increasing threaten of environmental problems. In recent years, the role of environmental impact is becoming more and more important in industrial planning and policy making. The industrial pollution, the main sources of each waste, the relationship between industries in waste pollution are factors that could be considered in industrial planning.

Based on two mode network method, this paper analyses the interaction between Chinese industry system and environment system. Since there are many industries and many kinds of wastes, network methods has advantage in analyzing all these subjects and relationships among them. As for different kinds of subjects, in this paper as industries and wastes, two mode network is a useful tool to detect the relationships among these two systems because it allows two kinds of nodes in one network. It helps to recognize the industries with similar emission, and the industrial emission group structure of China. This results shed light on development preference and location decisions for industries.

Based on China Environmental Statistic Yearbook, 40 industries are considered. Emission are categorized into five kinds: industrial waste water discharged, industrial waste gas emission, industrial soot dust emission, common industrial solid wastes produced, and hazardous wastes produced.

Firstly, 2-mode network that shows the relationship of 40 industries and 5 kinds of waste are build. Number of connections in this network are analyzed to find out the emission concentration of each emission. According to the result, Hazard waste, Waste gas and Common solid waste can be easily tracked because 6-8 industries contributes 90% of total waste. Further, the 2-mode network is changed into a correspondingly 1-mode industrial network to identity the emission relationship among industries. In this network, industries are nodes and emission competition relationships are edges. The weight of edge from  $i$  to  $j$  is the number of waste that industry  $i$  and industry  $j$  both dispose. The degree, weighted degree of industries are analyzed, and correspondence method is used to draw an industrial emission map about industries and wastes.

According to the industrial emission figure obtained by correspondence method, the close industries in the picture dispose quite similar emission. These industries should not located closely because of similar emission could impact local environment. Furthermore, 4 groups are found in 40 industries. The group structure provides detail information for location decision. Industries in the same group should be scattered if possible. Manufacture of Raw Chemical Materials and Chemical Products, Manufacture of Non-metallic Mineral Products have high degrees, indicate they dispose same emission with many industries. In other words, they are under intense emission competition in China.