Identifying the key sectors for regional energy, water and carbon footprints from production-, consumption- and network-based perspectives

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HIGHLIGHTS

- Key sectors identified from production-, consumption- and network-based views.
- Flows of energy consumption, freshwater withdrawal and CO_2 emissions are mapped.
- The CO_2 transfer path from the energy sector to heavy manufacturing is highlighted.
- Export-oriented products with high resource use but low value-added must decrease.

GRAPHICAL ABSTRACT
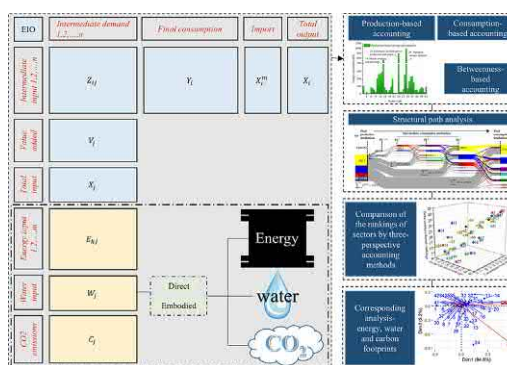
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ABSTRACT

Energy consumption, water use and carbon emission targets are important for promoting sustainable development. This study presents a multi-goal analytical framework based on an environmental input-output analysis, structural path analysis and correspondence analysis to identify the key sectors for energy, water and carbon footprints. Using Guangdong Province as a case study, the energy, water and carbon footprints are modelled from production-based, consumption-based and network (betweenness)-based perspectives. The results show that (1) the construction sector is a key sector for energy use/water use/carbon emissions from the three perspectives. The electricity and heat power production and supply sector emitted the most production-based CO_2 (283.4 Mt), accounting for 52.3% of the total CO_2 emissions. (2) The key sectors in terms of energy, water and carbon differ. The transport, storage and post sector is an important sector for energy consumption, and the agriculture sector and food and tobacco sector are important sectors for freshwater withdrawal. (3) The key sectors differ according to the three perspectives. For example, the energy production sector ranked first in production-based CO_2 emissions (286.2 Mt), but heavy manufacturing ranked first in consumption-based CO_2 emissions (146.3 Mt). This study recommends paying more attention to the abovementioned sectors, specifically concerning the transmission role of light manufacturing in freshwater withdrawal, and reducing energy consumption-intensive but low value-added exports (such as metal smelting and pressing). The findings highlight the need to consider multiple angles and elements to identify the key sectors and help decision makers better understand the relationships and flows among the industries.

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