

## Drivers and Changing Patterns of Household Carbon Footprints in China (1997-2017)

Topic: Input-Output Analysis: Sustainable Production and Consumption Policies - VII

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**Background:** To encourage economic progress, China's government has been pushing domestic consumption as a substitute for its waning growth in investment and exports. However, China's energy conservation and climate mitigation policies have focused on industries and have largely neglected households. China's households have experienced fairly radical lifestyle changes during the few decades. With rapid income growth, Chinese households "moved up" the consumption ladder. Newly formed middle class has been emulating energy-addicted Western lifestyle with the purchase of cars, bigger homes, and more labor-saving appliances. Although China has also been promoting greener policies for growth, of which green consumerism is a prime component. Given its energy security concerns, global warming pressures and internal environmental concerns, China undoubtedly should be more cautious and alter its energy and climate policy course to include households. This study aims to examine the changing carbon footprint trends of Chinese households, explore related driving forces and identify emission hotspots.

**Method:** This study examines the long-term trends of household CO<sub>2</sub> emission from 1997 to 2017, explores related driving forces of changing household indirect household carbon emission, explore mitigation potential from supply perspective. Environmentally extended input-output analysis, structural decomposition analysis (SDA) and structural path analysis (SPA) were used to assess the changing carbon footprint of Chinese households. Based on multiplicative SDA, we decompose household indirect CO<sub>2</sub> emissions into six partial factors changes in total population, urbanization rate, energy efficiency, interindustry input mix, household consumption preferences, and per capita household consumption level. Doing so yields insights into how progress in industrial technology, household income, urbanization, and lifestyles has affected energy use in the production of goods and services used by households. Structural Path analysis was used to identify emission hotspots and quantify environmental impact transmission in the entire supply chain. Sensitivity analysis was used to determine the system boundary of SPA.

**Findings:** From 1997 to 2017, Chinese households' CO<sub>2</sub> emission use had risen 154% from 1181 million metric tons (MMT) to 2997 MMT. Per capita household carbon footprint rose from 655 kg CO<sub>2</sub> in 1997 to 1280 kg CO<sub>2</sub> in 2017 for rural households and from 1594 kg CO<sub>2</sub> to 2708 kg CO<sub>2</sub> for urban households. The rural-urban gap of household direct carbon footprint narrowed while that of indirect carbon footprint has enlarged. In 2017, household consumption accounted for 30% of China's total CO<sub>2</sub> emission. SDA analysis indicate that household consumption preferences and urbanization have elevated household indirect carbon emission. Fortunately, industrial energy efficiency gains and cleaner energy structure have largely offset household consumption rises. SPA analysis demonstrated that the direct inputs from the sectors of "utilities", "manufacture of non-metallic mineral products" and "Transportation and Storage" generated the most important energy flows, while the service sectors such as "Commercial, Catering, & Hotels", "Education, Health, Sports and Recreation" significantly but indirectly influenced CO<sub>2</sub> emission.