TRAINS, PLANES, AND AUTOMOBILES: THE FUTURE ENERGY AND CLIMATE IMPACT OF ALTERNATIVE PERSONAL TRANSPORTATION PATHWAYS IN CHINA

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Overview

A major uncertainty in future energy and greenhouse gas (GHG) emissions projections is the evolution of demand for personal transportation modes in China. This paper explores the implications of two broadly divergent personal transportation scenarios: one favouring personal vehicles over shared transport options, and another emphasizing local public transit, rail and aviation as substitute for vehicle travel. The scenarios are broadly defined based on observed divergent personal transportation patterns in the United States, which is heavily reliant on private vehicles, and Europe, which depends more on purchased transportation options. The analysis compares primary energy use and GHG emissions in China under each pathway, and identifies conditions that would favor the choice of one pathway over another.

Methods

We begin by comparing historical personal transportation mode shares in the United States, European Union, and China. The contribution of public policy, population settlement patterns, geography, and other factors to the evolution of personal transportation and its energy use and GHG emissions footprint in each of the three countries or regions is discussed. This historical analysis will be used to inform the two future scenarios to be applied in China in the modelling analysis. A brief review of literature on forecasting mode shares in China will be included to demonstrate the applicability and limitations of the two scenarios (Meyer *et al.*, 2007; Schafer, 2006).

The MIT Emissions Prediction and Policy Analysis (EPPA) model is then used to evaluate the impact of alternative person transportation choices in China on energy use and GHG emissions through 2050. The EPPA model is a recursive-dynamic general equilibrium model of the world economy developed by the Joint Program on the Science and Policy of Global Change at the Massachusetts Institute of Technology (Paltsev *et al.*, 2005). The EPPA model is built using the Global Trade Analysis Project (GTAP) dataset. For use in EPPA, the GTAP dataset is aggregated into 16 regions and 24 sectors with several advanced technology sectors that are not explicitly represented in the GTAP data. The model allows investigation of how policies interact through their effects on the prices and resulting sectoral allocation of energy resources. This analysis is performed in a version of the EPPA model that includes a detailed representation of the personal transportation sector. Miles-traveled by aviation, rail, and privately-owned vehicles are tracked over time alongside primary energy requirements and resulting GHG emissions. Mode shares are imposed based on the trajectories defined in the two scenarios.

Results

First, the study will use the U.S. and European cases to develop two scenarios for the relative reliance on purchased transport versus household-owned vehicles in China over the next 40 years. Second, this analysis will quantify the impact of the two alternative personal transportation scenarios using the MIT EPPA model, and identify conditions under which each scenario produces favourable outcomes in terms of climate change and energy security. For example, sensitivity of outcomes to the cost and availability of alternative fuel vehicle technologies and a wide range of substitute fuels will be explored.

Conclusions

The conclusions will relate the forecasted energy and GHG emissions impacts of the two alternative personal transportation scenarios to broader climate policy goals in China and worldwide. The role of other considerations, such as congestion, safety, and energy security, and the overall implications for policy will be summarized.

References

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