

Abstract

Title: Energy productivity: aligning global agendas

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Overview

Improving energy efficiency has come to the fore in recent years as a way to save money, boost economic growth, increase energy security, and lower greenhouse gas emissions and other pollutants. While much research has focused on harnessing energy efficiency at the national level, less attention has been paid to the risk that energy efficiency improvements in one country may be offset by deteriorating global efficiency overall. We investigate this possible paradox by accounting for the embodied energy in trade and its effect on national energy efficiency. First, we introduce key theoretical debates around energy efficiency's potential before making explicit the differences between energy intensity and energy productivity as measures of national energy efficiency. Next, we fill a research gap by showing the effect of embodied energy in trade on energy intensity, energy productivity and the carbon intensity of major economies worldwide. To our understanding we are the first to show these effects, which are highly relevant in the context of encouraging greater international cooperation on energy efficiency. In conclusion, we argue that accounting for embodied energy shifts the debate around responsibility for energy consumption to an increased focus on managing supply chains which may help encourage greater global cooperation. We also suggest that using energy productivity, rather than the more commonly used metric of energy intensity as a measure of national energy efficiency, could be a way to spark such increased cooperation.

Methods

This paper reviews the theoretical literature around the global potential for energy efficiency as well as recent policy initiatives underway. It then uses descriptive statistics to show key trends across major countries for energy intensity, productivity and carbon intensity, and finally draws on a multi-regional input output analysis to show the effects of accounting for embodied energy in trade on these different methods of measuring energy efficiency at the national level.

Results

Our results show that accounting for the embodied energy in trade has a significant effect on how energy efficiency is measured at the national level. In effect, this leads to increasing the energy intensity (decreasing in the energy productivity) of embodied energy importing countries (mainly advanced economies); and the converse for embodied energy exporting countries (mainly developing economies). We also show that the difference between energy intensity and energy productivity as measures for national energy efficiency is non-trivial, though one is imply the inverse of the other, and argue energy productivity deserves wider application.

Conclusions

Given the goal of the United Nations' Sustainable Energy for All (SE4ALL) initiative to double the rate of improvement in energy efficiency globally by 2030, there is a need to not just look more closely at how energy efficiency is measured at the national level, but also how it best understood at the global level. Our study is the first to show the effects of accounting for embodied energy in trade on such metrics. This offers new insights into how global supply chains influence energy efficiency between countries and highlights pathways for improved cooperation.

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