The critical role of international cooperation in advancing innovation for energy transition and improved resource productivity.

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The metabolism of our economies is sustained by material flows that have vital roles in our health, well-being, and development, as evidenced by the growing use of natural resources, including energy. The concern over the sustainable use of resources has led to various studies and governmental initiatives, including some of the Sustainable Development Goals and the 2019 European Green Deal.

A major international challenge to promote global sustainability is decoupling economic growth from resource use, and different regions show different trends. For example, in industrializing nations, resource intensity increases due to infrastructure build-up or the shift of production to less efficient economies, but this does not solve global problems, as all the value chains must be incentivized to improve and decouple.

Economy-wide material flow accounting has helped provide general indicators, like domestic extraction; however, they do not provide detailed information on the characterization of the dynamics of the socioeconomic metabolism of each country. In this work, the goal is to identify and better understand the factors that may lead economies with different levels of economic development, measured as GDP/cap, to have significantly different resource productivities and development pathways. This work analyses four countries' socio-economic metabolism (SEM) with two levels of resource use and economic development. It was found that the economic structure and the resource productivity of the different economic sectors have a critical role in the GDP/cap of the country. The analysis of the SEM in this work has shown, with a significant level of detail, how the differences in the SEM of these countries may explain the different development pathways these countries are taking, but also that they are looking at international cooperation. It is critical to evaluate resource productivity along the entire value chain of products and services, and in this context, China and Brazil are key providers of natural resources. It will thus be very relevant to map resource productivity of different resources in different economic sectors, both for China and Brazil, to benchmark them in an international context as a strategy advance in fulfilling innovation gaps and quantifying its impact on economic development and environmental effects, this is to say in sustainable development.