

EGU22-6964, updated on 12 Aug 2022  
<https://doi.org/10.5194/egusphere-egu22-6964>  
EGU General Assembly 2022  
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## Global emission trade market design and local outcomes on the water-energy-land nexus

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The COP26 in Glasgow produced a Paris Agreement rulebook for international cooperation through carbon markets under Article 6. The intent of Article 6 is to enhance mitigation ambition by utilizing efficiency gains from trading and to cooperatively implement nationally determined contributions (NDCs) while avoiding double-counting. Such international emissions trading forms the bedrock to mobilize public and private sector investment flows to meet ambitious climate goals. At the same time, a growing body of research concludes that there are important links between mitigation and other societal objectives, such as those embodied in the UN Sustainable Development Goals (SDGs). Such local and national decisions which consider co-benefits and tradeoffs on some of the SDGs, in turn, are critical in deciding the aggregate success and consequences of global policies. This raises the question of how emissions trading may enable or hinder SDG attainment and how different countries might value their participation in such markets.

Countries view their own climate mitigation efforts through a more comprehensive lens than mere emissions reduction, and the links with societal outcomes would influence their consideration of comparability and participation in emissions trading markets. The success of these markets in enhancing ambition would depend on perceptions of the relationships of mitigation with local and regional societal goals around water, energy & land use. The degree of congruence between these relationships could influence future climate negotiations and market design.

In this paper, using a global integrated assessment model (GCAM: Global Change Analysis Model, ver. 5.4), we demonstrate that spatial and temporal distributions of the influence of Article 6 emissions markets on a subset of the broader SDGs may differ. We use a subset of sustainability metrics related to the energy-water-land nexus issues. Our analysis of these metrics tracks the interconnected nature of human and earth systems under different emission market designs for 10 key geographical regions (USA, EU, China, India, Japan, Brazil, Russia, Australia, Sub-Saharan Africa & Latin America) from 2030 to 2050, under a consistent integrated framework. This allows

us to assess the local implications of emissions market design on energy access, prices & security, water consumption for different applications, food prices and forest area changes. We include the effects of redistribution and international financial transfers. We demonstrate these effects on the energy-water-land nexus for different national and global mitigation scenarios: the recently updated NDCs, a net zero emissions target in 2050 and a scenario which allows countries to reach net zero goals based on equity principles.

Our results imply that global cooperation in markets can be altered if interactions between mitigation and local effects on the energy-water-land triad were accounted for. Furthermore, we demonstrate that the extent to which these distributions differ depends on market design and pricing of nature-based mitigation options.

Our analysis provides a foundation for assessing how global emission market schemes under Article 6 could be better understood in the local developmental contexts of energy, water & land use changes.