Water, land and climate nexus of electricity from biomass

Nariê Souza, Thayse Hernandes, Karina M. B. Bruno, Daniele S. Henzler, and Otávio Cavalett
Brazilian Biorenewables National Laboratory (LNBR), Brazilian Center for Research in Energy and Materials (CNPEM), Campinas, Brazil (narie.souza@lnbr.cnpmem.br)

Driven by the expected population growth, the world faces now the challenge of meeting energy demands of about 9 billion people on the next decades and avoid dangerous climate change effects. In this context, Renewable Energy Systems (RES) are a key strategy to decarbonize the power sector and contribute to the climate change mitigation targets. In the Special Report on Climate Change and Land, IPCC calls attention to possible trade-offs, adverse side-effects and implications to sustainable development that the large-scale deployment of bioenergy may cause. A comprehensive understanding of the sustainability profile along the entire life-cycle of electricity production is fundamental if we want to realize the transition to cleaner technologies in the energy sector. In this study we analyze the water, land and climate impacts of electricity production systems in the context of the Sustainable Development Goals (SDGs). We focus our analysis in the electricity production from sugarcane straw in Brazil, since there is a great opportunity for better using this lignocellulosic material for bioenergy applications. We relate appropriate Life Cycle Assessment (LCA) indicators to multiple SDGs, considering attainable and potential sugarcane yields, derived from agroclimatic modeling. When discussing the sustainability of bioenergy production, a broader sustainability analysis, as provided by the SDGs, can help to identify water, land and climate nexus and suggest possible technological solutions for minimizing possible trade-offs among the different impacts. Our analysis demonstrates the nexus implications of electricity production from sugarcane biomass to the context of the SDGs, as well as the spatially explicit environmental implications of electricity production form sugarcane biomass.

Keywords: renewable energy systems, life cycle assessment, climate change mitigation, sustainable development