The Waste-Carbon Economic and Climate Action Tool (WECAT): A New Model for Determining the Waste-Carbon Energy Resource Potential

Kurt Solander (ksolander@lanl.gov), Paolo Patelli, Chonggang Xu, and Babetta L. Marrone
(Los Alamos National Laboratory, Los Alamos, NM, USA)

Background/Objectives. Climate change represents a major threat to global peace and security, and threatens life on our planet. To take action, the US has pledged a 100% clean energy economy, and net zero greenhouse gas (GHG) emissions by 2050. Innovations in traditional renewables like solar and wind, and advancements in the implementation of bio-derived products will all be required to achieve this goal. However, regional heterogeneities in resource availability—compounded by uncertainties about the future under climate change—play an important role in the successful implementation of these emerging technologies. To address this challenge, we have developed a geospatial modeling tool designed to help meet local-to-regional climate resilience and GHG mitigation objectives. The new model, known as the Waste-carbon Economic and Climate Action Tool (WECAT), is designed to determine the potential for developing waste carbon resources into energy through optimization of GHG emission and monetary cost reduction, while comparing these values to those of existing resources. Our main objectives with the initial phase of model development were to quantify 1) the availability of waste carbon energy resources at the Continental US (CONUS)-scale, 2) the change in waste-carbon energy resource utilization with respect to a baseline and 3) how this change impacted both GHG reduction and energy expenditures.

Approach/Activities. The model was built by integrating multiple data layers including both geospatial data such as baseline energy resource use, energy resource availability/feedstocks, GHG emissions, transportation networks, and demographics, as well as auxiliary information on energy conversion technology and associated costs, production and tax credits. Such data and information are used in the optimization routine to generate predictions of energy resource potential achievable at two spatial scales—the county-level across the CONUS and for a local organization or community by building in features to enable a user to adjust model parameters or constraints that are tailored to specific needs according to that entity (e.g., specify minimum renewable energy quotas or energy resource cost ceilings).

Results/Lessons Learned. We provide an overview of the model by describing its various components and possible user applications. We also will show results from applications at both the local and CONUS scales, to demonstrate how the model can be used for energy resource planning tailored to specific user needs as well as at a coarser scale to aid with GHG emission reduction goals at the national level. Finally, we close with discussing possible areas for future model development to improve predictions, integrate climatic shifts in resource availability and expand to the global scale.