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Carbon in global waste and wastewater flows - its potential as energy source under alternative future waste management regimes

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Availability of sufficient organic materials for energy generation is key to a successful future decarbonization of the global energy system. Conversion of the carbon content in waste and wastewater into energy offers a potential source of energy that can simultaneously reduce air pollution and greenhouse gas emissions associated with current waste management. Various policy initiatives to reduce the impacts of waste and wastewater on human health and the environment will have implications for the availability of waste and wastewater carbon as a source of energy. In this paper we estimate the carbon content in global waste and wastewater and simulate the associated future carbon flows for a range of different waste and wastewater management regimes. We identify current and future carbon flows for 174 countries/regions, allowing for a wide range of alternative technological solutions for handling and treating municipal and industrial waste and wastewater. We are able to quantify the maximum possible energy that can be generated from global waste and wastewater sectors as well as the potential limitations introduced by possible future waste management policies. We find that considerable amounts of carbon are currently stored in waste materials without being recovered for recycling or made available for energy generation. We also find that different alternative future management pathways have decisive implications for the availability of waste and wastewater carbon as a source of energy.