The economic value of imports of combustible waste in systems with high shares of district heating and variable renewable energy

This study analyses the socio-economic value of trade of combustible waste, taking Denmark as an example for importing countries with large district heating networks and already high shares of variable renewable energy. An integrated systems analysis framework allowed to assess under which circumstances import of wastes leads to less expensive waste management and energy, accounting for increasing ambitions for a circular economy and renewable energy. The dynamics of both systems are captured through two optimization models, which are solved simultaneously. OptiFlow optimizes Danish waste management and transport, and Balmorel, the Northern European energy system. Results show that waste import to cover the existing Danish incineration overcapacity during wintertime has definite economic value. Conversely, summertime import can have negative value unless a gate fee is received, with the exception of imports of waste with high calorific content (>16.2GJ/t). In some cases, mothballing of up to 14% of the existing incineration plants is a cost-efficient alternative to decrease the level of over-capacity. In the longer term, results show a socio-economic value of importing waste, being mainly sensitive to assumptions regarding biomass prices and wind power cost, as the technologies would compete with incineration plants. The present methodology can be applied to other countries where waste-to-energy participates in district heating, and where variable renewable electricity and constraints on biomass resources are becoming important. A pan-regional approach regarding waste management planning to maximize the value from combustible waste might be desired, along with a coherent taxation to avoid competition based on tax differences.