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Uncovering regional energy and environmental benefits of urban waste utilization: A physical input-output analysis for a city case

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13  
14 **Abstract:**

15 A variety of urban wastes pertain to biomass bringing promising prospect for the transition of  
16 fossil to renewable energy sources. Increasing amount and irrational disposal of them are leading  
17 to health and environmental hazards. It is imperative to implement waste utilization for energy  
18 recovery for promoting urban energy security and environmental improvement. Considering the  
19 deficiency in the analysis of the regional energy and environmental benefits created by the  
20 utilization of multiple urban wastes from a holistic perspective, this study elaborates four kinds of  
21 waste-to-energy (WtE) applications, including combustible waste incineration, food waste biogas,  
22 organic wastewater biogas and livestock manure biogas for their industrial development. A  
23 physical input-output (I-O) model combined with the baseline method of Clean Development  
24 Mechanism methodology is developed to evaluate the overall regional energy and environmental  
25 benefits of waste utilization for energy recovery. In the city of the case study, power generation  
26 from energy recovery could amount to  $1.6 \times 10^9$  kWh, of which the largest is from waste  
27 incineration accounting for 50.4% by 2025. Total mitigation potentials for the accumulative  
28 greenhouse gases, sulfur dioxide and nitrogen oxide emissions are  $85.6 \times 10^9$  t (carbon dioxide  
29 equivalent),  $1.6 \times 10^3$  t and  $2.9 \times 10^3$  t, respectively during 2016-2025. The amount of wastes  
30 available for energy recovery, energy efficiency and environmental impacts of WtE technologies  
31 and regional I-O framework are major factors affecting the energy and environmental benefits.  
32 The methods and results presented are expected to provide local government with references for

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