The 2nd International Resource Recovery Conference
Aug 5-9 2017
New York

Estimating and visualizing the value of urban waste recovery – The Resource Value Mapping (REVAMP) Tool

K, Andersson*, D, Ddiba**

* kim.andersson@sei-international.org
** ddiba@kth.se

Abstract:

This paper presents the results from the initial development of the REVAMP (Resource Value Mapping) tool for rapidly estimating the resource recovery potential of urban waste streams. The overall aim is to generate an innovative planning tool, for multi-sectoral stakeholder engagement that can provide arguments for and facilitate implementation of resource recovery at scale, contributing to sustainable development in cities and beyond. The waste flows, currently including sewage sludge, faecal sludge, and organic solid waste, are modelled using different resource recovery options (e.g. biogas, nutrient reuse). The model generates graphs illustrating estimated values of different resource recovery scenarios, expressing potential nutrient and energy recovery, and revenue for selling recovered resources. The promising results from tool testing in Kampala, Uganda, show among other things the high potential of energy recovery from waste that significantly can substitute wood fuel burning.

Keywords: Natural resource management; Planning tool; Resource recovery; Societal values; Urban waste management

Introduction

The global pressure on natural resources is constantly increasing, due to growing demands but also due to external factors such as climate change. New approaches and strategies are required to face these challenges, where improved natural resource management with recovery and reuse shows great potential to contribute with direct and indirect benefits to more sustainable cities (Andersson et al., 2016a).

Unfortunately, most cities are not taking advantage of this. In contrary, inadequate waste management with open dumping or landfilling of organic solid waste along with poorly functioning sanitation are widespread conditions, which pollute water resources and damage ecosystems, and constitute a risk for human health.

Furthermore, this inadequate management lose out on opportunities to derive socio-economic and environmental benefits from the waste streams. Key benefits are among others: safe and cost-effective reuse of valuable nutrients and organic matter in waste streams that could boost food production; renewable energy generation; more efficient use of water resources; and new business opportunities (Andersson et al., 2016b). Many examples of good resource recovery cases are available, but implementation at scale is still uncommon, partly explained by the complex interlinkages and insufficient capacity of cities to collect and process quantitative data about urban metabolic flows (Swilling et al., 2013). There is a strong need to provide evidence and tools to support integrated policy-making and cross-sectoral collaboration.

Our work drives to bridge some of these gaps by developing an efficient tool (Resource Value Mapping - REVAMP) for estimating and visualizing the potential societal value of

urban waste recovery and reuse that can stimulate urban policy-makers, planners, entrepreneurs, among others, towards more integrated natural resource management

Material and Methods

The prototype REVAMP tool under development can model some key organic urban waste streams, including sewage sludge, faecal sludge, and organic solid waste (e.g. food waste). Both the current and the potential waste streams for recovery have been characterized. These waste flows are modelled using different technology options or resource recovery scenarios using MS Excel.

The technologies that have been included so far are: anaerobic digestion producing biogas and bio-solids; solid fuel production; composting; and protein-larvae production using Black Soldier Flies. For each resource recovery option, the key parameters determining the quantities of recoverable resources that could be obtained were taken from the literature. The model generates result graphs depicting the potential values of the different resource recovery scenarios, currently expressing potential nutrient and energy recovery value, and revenue for selling the recovered resource at market prices.

The tool has not yet been used in city planning processes, but has been piloted in Kampala, Uganda, using existing municipal data. Kampala is a city of 1.5 million people where around 90% of households use on-site sanitation systems (mainly pit latrines and septic tanks) while the rest, especially in the Central Business District, are connected to the sewer system (Ddiba, 2016).

Results and Conclusions

The early trialling has shown the potentials of the REVAMP tool to estimate and visualize the benefits of recovery and reuse of urban waste streams and how this approach can help shift towards more sustainable natural resource management.

For Kampala city, the result clearly shows how the different resource recovery options (biogas, solid fuel, protein larvae, and compost generation) can contribute considerably to renewable energy production, nutrient reuse and potential revenues when selling at market prices (Ddiba et al., 2016), as depicted in Figure 1.1 to 1.3.

The modelling result, considering a scenario where 100 % of organic household waste is collected throughout the city, clearly indicates that the energy recovered (in form of solid fuel) could significantly substitute wood-fuel consumption. Apart from accessing an untapped renewable energy source readily available in the city, this option would also help mitigate severe deforestation around Kampala (Ddiba, 2016). The result generated from this tool could therefore be an efficient way to provide initial decision support towards planning for resource-oriented urban waste management systems, without the burden of having to do full-scale feasibility studies.

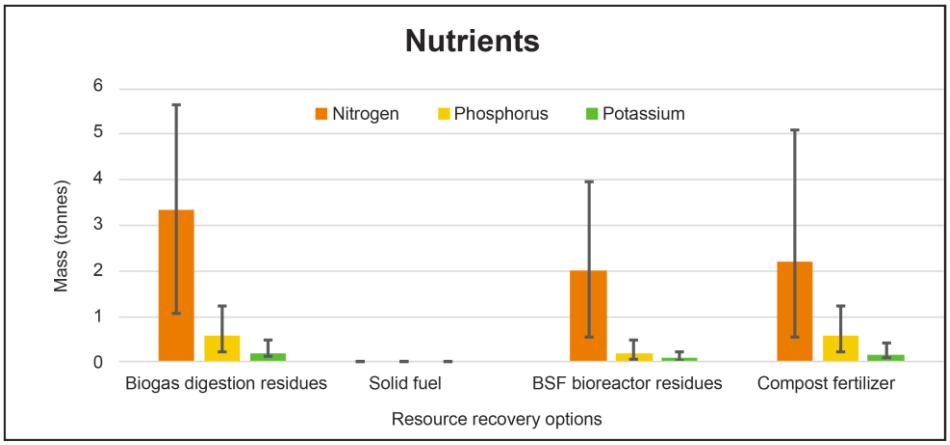

Figure 1.1 An output from REVAMP comparing the nutrient content that could be made available daily for agricultural reuse under different resource recovery options, 100% collection of all organic waste streams in Kampala.

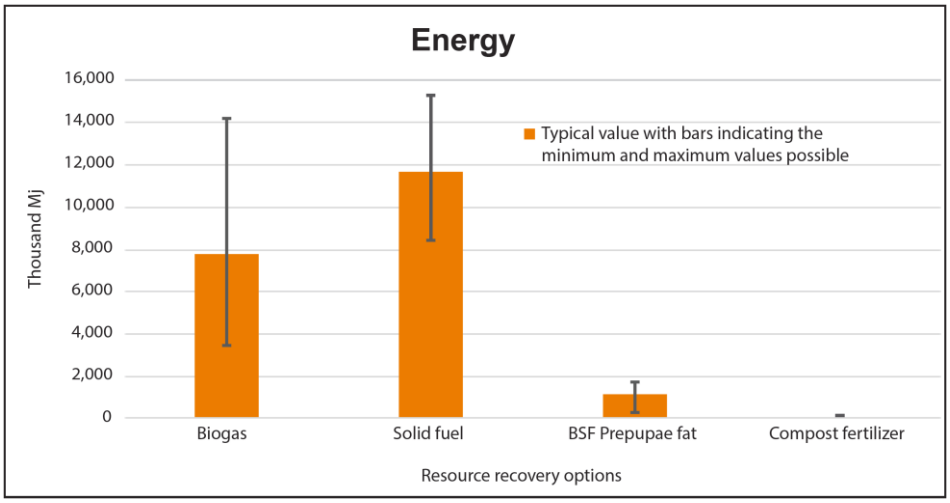

Figure 1.2 An output from REVAMP comparing the energy content that could be recovered daily under different resource recovery options, 100% collection of all organic waste streams in Kampala

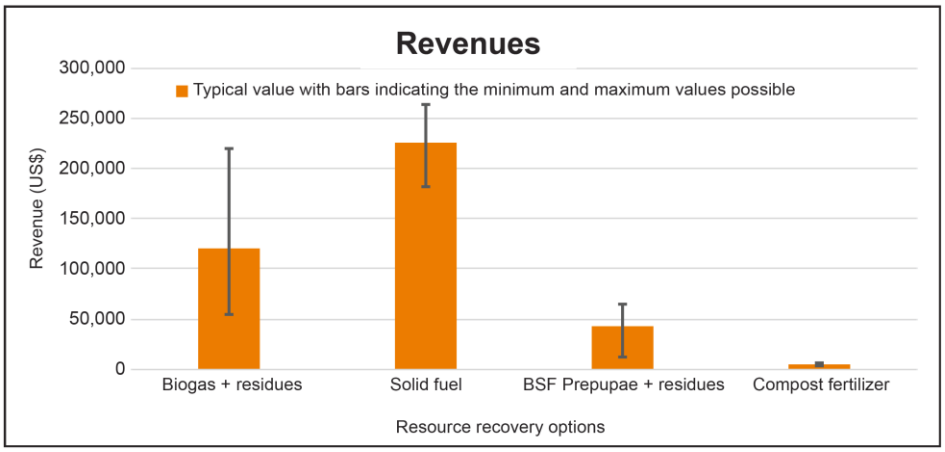

Figure 1.3 An output from REVAMP comparing the potential revenues from different resource recovery options, 100% collection of all organic waste streams in Kampala

There are additional economic and other benefits such as additional food production, job creation and environmental protection, besides the improvements in public health as a result of cleaner neighborhoods without indiscriminate disposal of excreta and organic solid waste. The planned future development of the REVAMP tool will be exploring more of these added societal values from resource recovery, while also integrating more waste streams and resource recovery options and technologies.

References

Andersson, K., Dickin, S., Rosemarin, A. (2016a). Towards "Sustainable" Sanitation: Challenges and Opportunities in Urban Areas. *Sustainability* **8**(12):1289.

Andersson, K., Rosemarin, A., Lamizana, B., Kvarnström, E., McConville, J., Seidu, R., Dickin, S. and Trimmer, C. (2016b). Sanitation, Wastewater Management and Sustainability: from Waste Disposal to Resource Recovery. UNEP and SEI.

Ddiba, D. (2016). Estimating the Potential for Resource Recovery from Productive Sanitation in Urban Areas; KTH Royal Institute of Technology: Stockholm, Sweden

Ddiba, D.; Andersson, K.; Rosemarin, A. (2016). Resource Value Mapping (REVAMP): A Tool for Evaluating the Resource Recovery Potential of Urban Waste Streams; SEI: Stockholm, Sweden

Swilling M., Robinson B., Marvin S. and Hodson M., Hajer, M. (2013). City-Level Decoupling: Urban resource flows and the governance of infrastructure transitions. A Report of the Working Group on Cities of the International Resource Panel.UNEP.