

Economic analysis of source separation systems for blackwater, greywater and food waste in the H+ urban renewal project, Sweden.

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Abstract

The study covers an economic cost estimation of source separation systems for the H+ urban renewal project in Helsingborg, Sweden. The study showed that source separation, albeit 20-25% more costly than conventional systems, are economically feasible already at a scale of 12 000 inhabitants when compared to a conventional system of 120 000 inhabitants. The increased cost of the source separation systems is caused solely by household installations while the cost of food waste and wastewater management is similar for the two systems.

Keywords

Source separation; economic analysis; blackwater; greywater; food waste

INTRODUCTION

In 2013, the city of Helsingborg, Sweden, decided that source separation systems will be implemented in the urban renewal project H+. The H+ will, when completed, house 10 000 inhabitants and working spaces all designed to reach the high local goals for sustainability set by the municipality of Helsingborg. Source separation systems were selected as a method to help reach these goals, especially in regards to nutrient recovery and increased biogas production. Source separation systems with separation of blackwater, greywater and food waste have been suggested by several authors (Kujawa-Roeleveld & Zeeman, 2006; de Graaf et al. 2010) and similar systems have been shown to have an increased potential for increased biogas production and nutrient recovery (Kjerstadius et al., 2015). However, the economy of such systems is still unclear, given that research on the topic shows conflicting results (Kärrman et al., in press). Thus, this work aimed at mitigating the uncertainty by comparing the economic cost between a source separation system and a conventional system for the management of household wastewater and food waste.

MATERIAL AND METHODS

The study included a green-field cost estimation for collection, transport, treatment and recovery, in a 100 year time perspective using Net Present Value method for economic cost calculation. The systems compared were a city of 120 000 inhabitants with conventional system (Helsingborg today) and a smaller source separation system with 12 000 inhabitants (the H+ area). The rationale being that source separation systems could be implemented gradually when the city infrastructure needs to be renovated. Data collection was based mainly on northern European case studies as well as pilot areas with source separation systems in Germany and the Netherlands.

RESULTS AND DISCUSSION

The results showed that source separation systems are 20-25% more expensive than conventional systems (annual cost of 600 euro capita⁻¹ compared to 490 euro capita⁻¹). However, the main source of the increased cost for source separation systems is for household installations (Figure 1). It was shown that the management cost for wastewater and food waste is the same with source separation systems, albeit shifted from the waste sector to the wastewater sector since food waste is collected

and treated by the wastewater utility. The increased cost for the households is mainly from installation of vacuum toilets and food waste disposers. It should be noted that this cost, when compared to other installation costs for developers, corresponds to a 1.5% increase of the annual rent for a tenant. Thus, when comparing the per capita cost, source separation systems are economically feasible already on a scale of 12 000 inhabitants compared to a conventional system of 120 000 inhabitants.

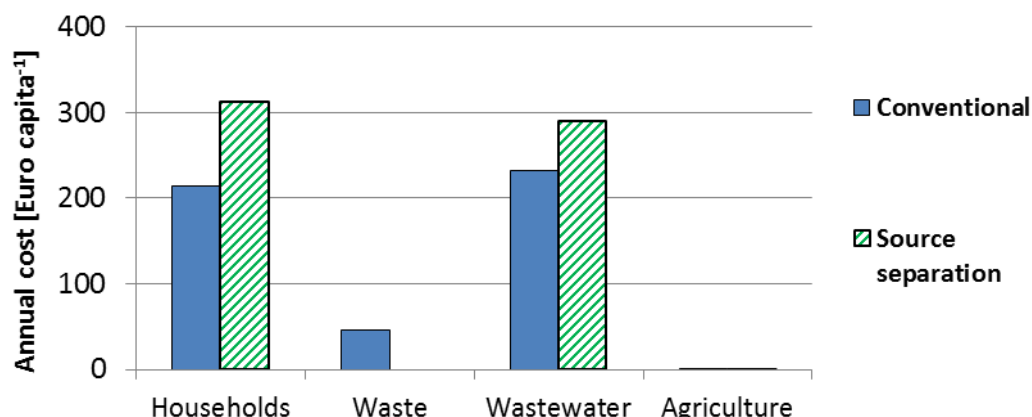


Figure 1. Cost of conventional and source separation systems divided upon infrastructure sectors.

CONCLUSIONS

- The total green-field cost of source separation systems is 20-25% higher than for conventional systems. However, the increased cost is only due to installations in households.
- Source separation systems are economically feasible already on a scale of 12 000 inhabitants compared to a conventional system with 120 000 inhabitants. Thus, a gradual implementation of source separation systems when renovating urban infrastructure is economically possible.

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