Willingness to pay for environmental performance; the case of decentralised waste treatment systems

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Keywords: decision making, sustainability assessment, life cycle assessment, stated preference analysis
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Analysing the environmental and economic sustainability assessments of decentralised waste treatment systems can be very informative for decision makers. In the case of decentralised treatment, the decision makers, however, are 'regular inhabitants'. Because the perception of these people towards environmental sustainability is unclear, this study not only confronts them with these results, but also performs a quantitative valuation of three different scenarios. To our knowledge, this is one of the first studies that uses such valuation techniques as a way of basic social sustainability assessment in a real case study.

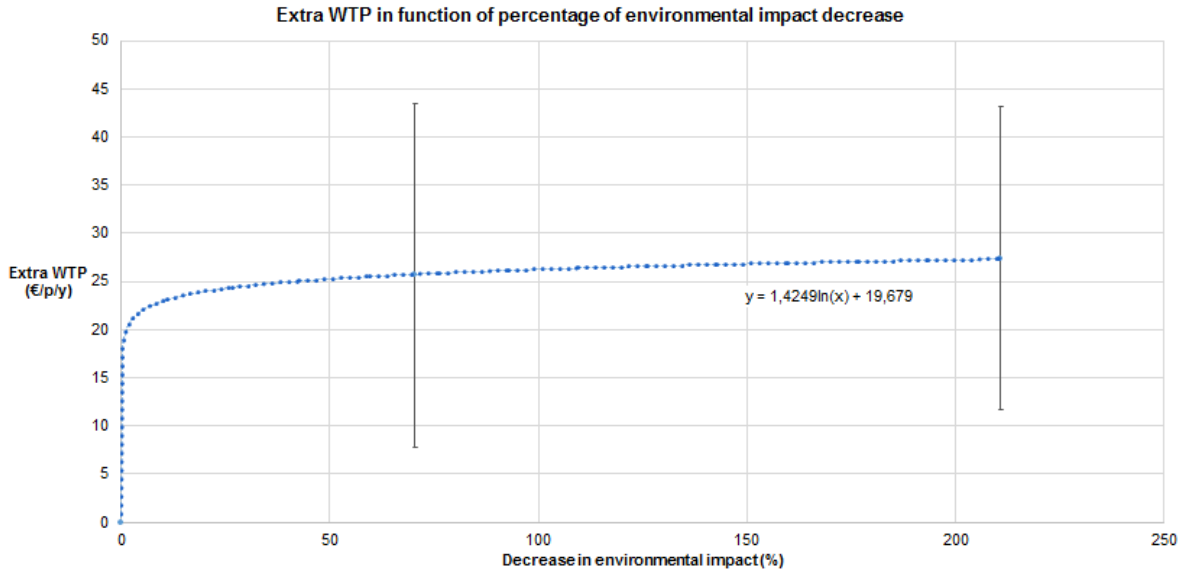
The case study includes three scenarios of waste water treatment systems (WWTS): a centralised WWTS as reference, a constructed wetland WWTS as an example of a decentralised WWTS without direct resource recovery and finally the ZAWENT (Zero AfvalWater met Energie- en NutriëntTerugwinning) WWTS as an example of a decentralised WWTS with direct resource recovery.

To quantify the environmental performance of the three scenarios, a life cycle assessment (LCA) is performed. The results reveal that the decentralised WWTSs perform better than the centralised WWTS, with the ZAWENT WWTS having the lowest environmental impact. The LCA shows that the environmental impact is primarily based on a trade-off between eutrophication caused by a poor treatment of wastewater and toxicity and climate change caused by the products used in the treatment process and the resulting emissions to air. Biogenic methane emissions from the sewer system for the centralised WWTS and the septic tank for the constructed wetland WWTS contribute the most to the overall environmental impact of the respective WWTSs. Resource recovery of energy in the form of heat contributes the most to the overall (avoided) environmental impact of the ZAWENT WWTS.

To quantify the economic performance of the 3 systems, a life cycle costing (LCC) analysis is implemented. These results reveal that the centralised WWTS has a lower total cost than the ZAWENT WWTS when the overhead costs are not considered, but that for a larger population scale the ZAWENT WWTS can possibly become more economically sustainable than the centralised WWTS. The results also show that the constructed wetland WWTS has a very broad range of possible total costs that depends heavily on the scale of the district but that for a population of 1200 people, the constructed wetland WWTS is predicted to be relatively less costly than the other two WWTSs. When looking at the composition of the total costs, capital expenses (CAPEX) dominate for the constructed wetland WWTS while operational expenses (OPEX) dominate for the ZAWENT WWTS. Sewage system costs dominate the total costs of the centralised WWTS when put in relation to the wastewater treatment costs.

To quantify the (social) value of the three systems, a survey is set up based on the stated preference methodology. The results reveal that there is a clear preference among the respondents for WWTSs with a better environmental sustainability and most respondents are willing to be involved in the management of WWTSs, but only if the involvement has potential financial benefits and does not entail physical work. Furthermore, when ranking the parameters of environmental impact, cost, participation/involvement and aesthetics on their influence on decision-making, the majority considers the environmental impact as being the most influential, followed by cost, participation/involvement and lastly aesthetics. Finally, all aspects are linked together by calculating the

mean and median willingness to pay extra for the decentralised WWTSs and by plotting this in relation to an increase in environmental sustainability. These results reveal that for both decentralised WWTSs, the mean willingness to pay extra lies between €20/p/y and €40/p/y, while the projected median lies just above €40/p/y. The plotted results suggest that the willingness to pay extra increases sharply with an increase in environmental sustainability and then levels off to a maximum point between €20/p/y and €40/p/y. From here on, a further increase in environmental sustainability will not increase the willingness to pay extra any further.



Overall the results obtained indicate that a positive link exists between environmental sustainability and the preference of people towards waste treatment. It is clear that such social factors are important to provide support in the evaluation of overall sustainability when comparing scenarios of waste management.