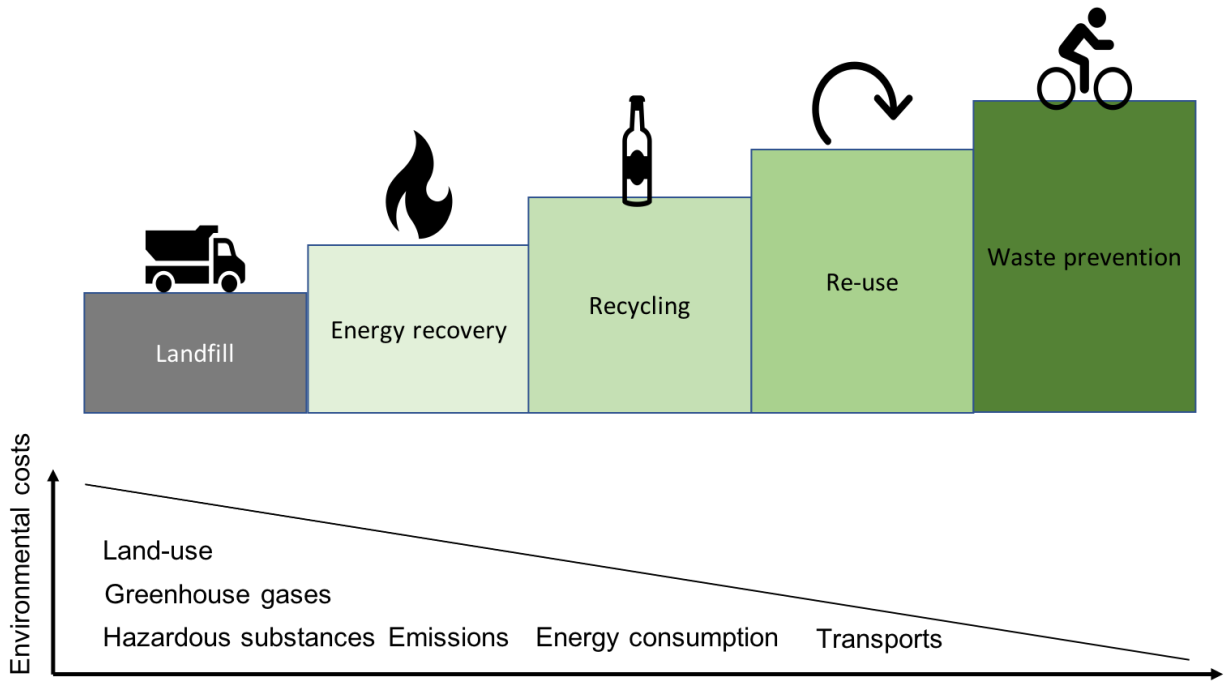
Summary

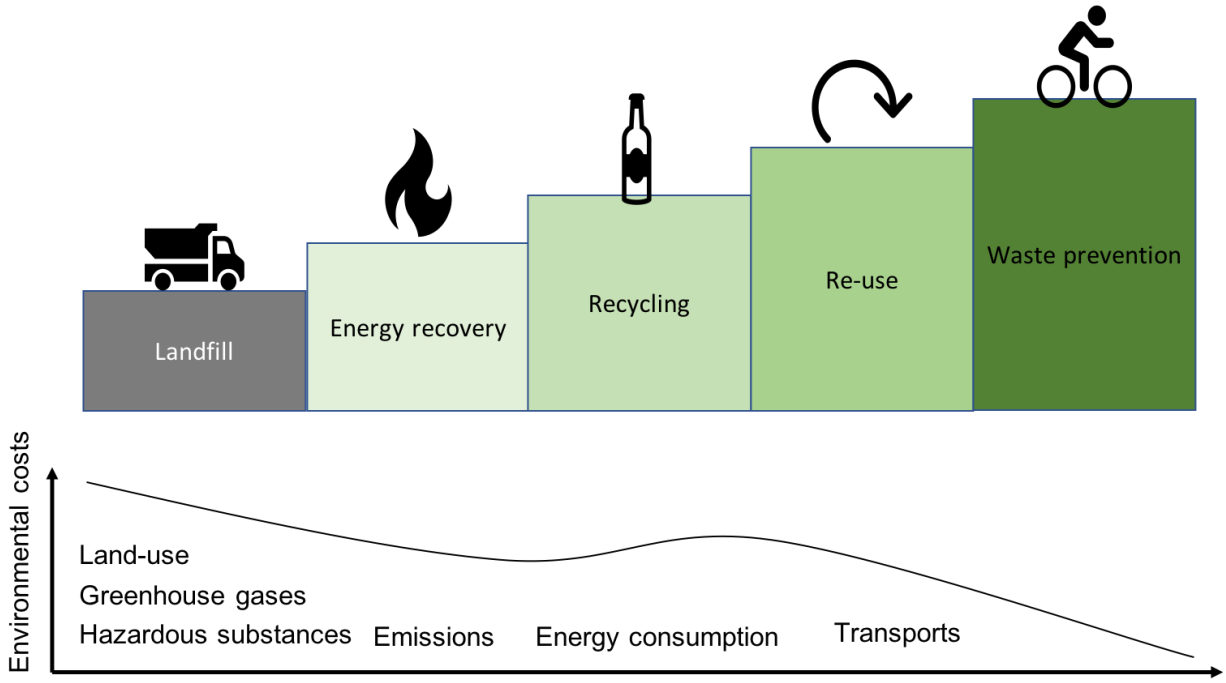
What role can waste incineration with energy recovery play in a sustainable waste treatment system? This is the main issue addressed in this report, which analyses Söderenergi's business operations from a socioeconomic perspective with wide system boundaries. Söderenergi generates electricity and heating at a number of facilities in southern greater Stockholm, with the majority of the production taking place at the Igelsta plant in Södertälje. The production occurs with combustion of forest fuel and waste, both Swedish and imported.

A guiding principle in the transition to a more circular economy is the "waste hierarchy", please see the diagram below. This says that re-use or recycling is preferable to energy recovery. From a socioeconomic perspective, this can be justified by the fact that the environmental costs are greatest at the bottom of the hierarchy, and are reduced at each step taken up the hierarchy.



This report shows that the situation is more complicated in practice, and that the waste hierarchy does not necessarily always lead to the best outcome in all cases; at least not if economic valuations of environmental and health risks are included in the analysis. A similar picture is presented below, with a visualisation of what it can mean for the socioeconomic costs if the material in question is contaminated with hazardous substances. The report describes how waste incineration affects emissions of greenhouse gases and the management of hazardous substances. According to Söderenergi's green house gas disclosure for 2015, the business operations give rise to emissions of approx. 288 thousand tonnes of carbon dioxide equivalents (CO_2e) per year, but at the same time lead to emission reductions of more than a million tonnes. The total socioeconomic effect of this is a benefit worth SEK 907 million per year, valued in accordance with the Swedish Transport Administration's recommendation for climate costs. When it comes to hazardous substances, five hazardous (from a health and environmental perspective) heavy metals have been studied: arsenic, lead, cadmium, chrome and mercury. It is estimated that over 106 tonnes of these heavy metals come into the Igelsta plant's two facilities each year, based on samples of incoming fuel. The

uncertainties are great in terms of the environmental damage of different treatments of heavy metals, but a weighing-up of a number of environmental studies suggests that this quantity of these five heavy metals, without a controlled management procedure, could give rise to environmental and health damage valued at between SEK 189 million and SEK 3.5 billion.



Of the incoming quantities of heavy metals, 24 kg is released out into the air, and 4.5 kg into the water, in other words 0.3 per mille cannot be treated. The probable cost to society of these emissions amounts to SEK 1.7 million per year. According to the Swedish Environmental Protection Agency and the Swedish Chemicals Agency, among others, waste that is contaminated with hazardous substances should not be recycled. Energy recovery is one of few viable alternatives for such waste, and in this report the consequences can be reported with regard to heavy metals. The level of knowledge about socioeconomic consequences of other treatment alternatives is patchy. What this report shows is that the potential costs of emitting heavy metals from the waste flow are very great, and that Söderenergi's operations avoid almost all these costs.

The low socioeconomic cost of energy recovery, and the benefit of separating hazardous substances, is valid even without considering organic contaminants, where combustion may create even more benefit, since such contaminants can be destroyed in the process (as opposed to heavy metals, which are chemical elements). According to this report, the size of the possible socioeconomic gains from separating environmental contaminants could be in the same region as the benefits of reduced greenhouse gas emissions.

In the debate, it may appear that there is a contradiction between material recycling and energy recovery, and that the latter represents an obstacle to the achievement of a more circular economy, where products are re-used and recycled instead of being incinerated. This is an over-simplification of the situation, for several reasons. Landfill is still a common method for waste treatment in Europe and, furthermore, many waste flows are so contaminated that they are not suitable for recycling.

The circular economy is not created solely through the waste management system; it also has to do with readjusting production processes. Materials must be made so free from hazardous substances

that they can be recycled without jeopardising the environment and/or people's health. Heavy metals do not arise in energy recovery facilities - they are introduced onto the market by producers. If these producers were to take responsibility for the environmental and health risks involved, it would impact on production, choice of materials and consumption in a positive manner in terms of sustainability.

As long as there is waste containing hazardous substances; as long as production of electricity and heating generates large emissions of greenhouse gases; and – above all else – as long as European countries continue to use large amounts of waste as landfill, energy recovery has a vital role to play and an environmental service to perform.