

# CHALMERS

## **Systems Aspects of Increased Swedish Waste Incineration**

Jenny Sahlin

Akademisk avhandling som för avläggande av  
teknologie doktorsexamen vid Chalmers tekniska högskola  
försvaras vid offentlig disputation måndagen den 26 mars 2007,  
kl. 10.00 i sal HA3, Hörsalsvägen 4, Chalmers, Göteborg.

Avhandlingen försvaras på engelska.  
Fakultetsopponent är professor Thomas H. Christensen,  
Danmarks Tekniska Universitet, Lyngby.

Institutionen för Energi och Miljö  
Avdeleningen för Energiteknik  
CHALMERS TEKNISKA HÖGSKOLA  
41296 Göteborg  
Tel. 031-772 10 00



Systems Aspects of Increased Swedish Waste Incineration  
JENNY SAHLIN  
Division of Energy Technology  
Department of Energy and Environment  
Chalmers University of Technology

### **Abstract**

Recent bans on landfilling of combustible and organic waste in Sweden have resulted in an increase in alternative waste treatment, especially waste incineration with energy recovery.

This thesis elucidates how the current increase in Swedish waste incineration affects and is affected by the two systems to which it belongs: the waste management and the energy systems. The work as a whole aims to contribute to the understanding of the future role of waste incineration as a waste treatment and energy recovery alternative. To investigate this, nine research questions are formulated.

The methods used include utilisation of the energy systems models MARKAL-Nordic and HEATSPOT, various literature surveys, a questionnaire and the development of a spreadsheet model in order to estimate the net marginal cost of waste treatment methods that are alternatives to waste incineration.

A general conclusion is that the role of incineration as the dominant waste treatment alternative for Swedish municipal solid waste (MSW) is likely to continue with the policy measures currently in force. From an energy systems perspective, this work suggests that the increase in waste incineration may have a large local effect in some district heating systems, where it affects alternative fuels and technologies. On a national scale, however, waste incineration covers only a small part of the demand of the energy system.

It is clear that the effects of the increase in waste incineration vary with the local conditions of the district heating system where the waste incineration plants will operate, and that the methods applied vary in ability to detect the local differences. Biomass is the alternative fuel mainly affected by increased waste incineration on a national scale, but the environmental implications depend on the fate of the biomass saved through expanded waste incineration. This work also suggests that the type of fuel replaced when waste incineration increases can be one of the key factors in the environmental comparison of waste treatment methods.

This thesis expects the recently introduced tax on the average fossil content of the household waste for incineration, to have an effect mainly on the biological waste fractions, and even this effect is likely to be small, according to the proposed results of this work. The tax is not likely to contribute significantly to the goal of material recycling of plastic packaging waste, or to significantly affect the current driving forces for import of waste for incineration in Sweden. Information is expected to be a key factor in transferring the governing force of the tax to the households as well as improving the households' attitudes towards material recycling.

**Keywords:** waste management, waste incineration, recycling, biological treatment, district heating, landfilling ban, incineration tax, MSW, waste import, value of households' time.