Developing and evaluating new policy instruments for sustainable waste management

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Abstract: The aim of this paper is to suggest a number of interesting policy instruments that can make the Swedish waste management system more sustainable. Approximately 60 suggestions for policy instruments were gathered through a number of workshops with stakeholders. These were further prioritised in a workshop with stakeholders and by the research team resulting in a list of 15 instruments: information to citizens and companies; tax on raw materials; weight-based waste collection fee; environmentally differentiated waste collection fee; waste minimisation in enterprises; 'Advertising brochures – yes, please!'; recycling certificates; developed collection systems; tax on incineration of waste from fossil fuels; tax on incineration of waste; including waste in green certificates for electricity production; tax on hazardous substances; labelling of goods with hazardous substances; improved control by authorities; differentiated VAT and ban on incineration of recyclable materials. Several policy instruments are needed that can complement each other.

Keywords: incineration; landfilling; recycling; producer responsibility; policy instruments; waste management.

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1 Introduction

Treatment of solid waste is surrounded by a number of rules, regulations and policy instruments. These may be quite different in different countries (Avfall Sverige, 2009), depending on traditions and contexts. The environmental impacts from the waste management systems are also quite different in different countries (Gentil et al., 2009).

Swedish policy instruments affecting the waste management system (Swedish EPA, 2005) include a ban on landfilling of organic materials, a landfill tax, an extended producer responsibility of some product groups including packaging materials and wastes of electrical and electronic equipment, and energy and carbon dioxide taxes on fossil fuels used for heating. These policy instruments have been effective and waste management has changed. Landfilling of solid waste has decreased significantly, incineration with energy recovery (mostly as heat for district heating systems) have increased as well as recycling of materials.

Swedish waste policy is governed by a number of policy documents, including the European Union waste directive, Swedish environmental quality objectives, and policies in other sectors, including energy. In order to fulfil these policies, waste related policy instruments are likely to develop further in the future. For example, the visions in the EC (2011) Roadmap to a resource-efficient Europe requires new policies instruments to be implemented.

The European waste directive requires that the waste hierarchy should be used although exemptions can be made based on life-cycle thinking (EU, 2008). The waste hierarchy states the following priority order:

- prevention
- preparing for re-use
- recycling
- other recovery, e.g., energy recovery
- disposal.

In that context, it can be noted that most currently used policy instruments are moving waste away from landfilling (disposal). There are currently few general policy instruments for supporting waste prevention and increased re-use and recycling, thus supporting the waste hierarchy. To comply with the waste hierarchy there is thus a need for new policy instruments supporting the higher levels of the waste hierarchy. It can also be noted that waste prevention aims not only at reducing the amounts of waste, but also reducing the hazardousness of the waste and the environmental impacts from treatment of the waste suggesting that policy instruments focusing on waste prevention should not only focus on reducing the amount of waste.

The Swedish Environmental Quality Objectives have several goals related to solid waste management. One of these, the national goal of stabilising the amount of waste generated is difficult to reach (Miljömålsrådet, 2008), suggesting that there is a need for new instruments. The threat of climate change will also call for further changes in all sectors, including waste management and the energy systems. The waste management sector has a unique possibility of not only reducing its own contribution to climate change, but it can also, through increased utilisation of waste, contribute to other sectors' reduction of emissions. It has also been shown that an environmentally optimised waste management system can have significantly lower environmental impacts than the current system (Björklund and Finnveden, 2007).

The waste management system is integrated in other parts of society. Policies and policy instruments within these sectors will therefore also influence the waste management system. For example, waste incineration accounts for approximately 25% of the district heating produced in Sweden (Avfall Sverige, 2008). Thus all policies and policy instruments within the energy sector will indirectly also influence the waste management sector. Because the energy sector is influenced by a number of policies affecting for example climate change, energy security and industrial competitiveness, new and existing policy instruments for the energy sector are likely to evolve.

Policy instruments can be divided into several groups (Lindén, 2005; Sterner, 2002):

- economic instruments such as taxes and subsidies
- legislative instruments such as bans
- information
- physical planning such as distance to recycling facilities.

Policy instruments are also studied by different scientific disciplines using different approaches (e.g., Söderholm and Tilton, 2012).

'Towards a sustainable waste management' is a research programme in Sweden involving nine research institutes (http://www.hallbaravfallshantering.se). The aim of the programme is to suggest and evaluate new policy instruments for a more sustainable waste management. A more sustainable waste management system is a system that contributes to increasing efficiency in the use of natural resources, and to decreasing environmental burdens. Environmental improvements within Sweden should not be offset by unwanted consequences in other countries. To be sustainable, the waste management must also be affordable and widely accepted by the public as well as by key companies and organisations. The aim of this study is to suggest a number of interesting instruments that can be further evaluated in other subprojects. The focus is on the higher levels of the waste hierarchy (prevention, preparing for re-use and recycling). The scope of this study includes all solid waste fractions, all types of policy instruments and a broad inclusion of different groups of stakeholders in Sweden. The scope is therefore much broader than most studies where the focus is on specific waste fractions or types of policy instruments. The paper is based on a more extensive report in Swedish (Bisaillon et al., 2009).

2 Method

Suggestions for policy instruments were gathered through literature studies, three workshops with stakeholders and one conference. A first workshop was organised together with the Swedish EPA's Waste Council with approximately 20 people representing different stakeholders in Sweden. The second workshop was with the researchers and the reference group of the research programme 'Towards a sustainable waste management' with approximately 20 people also representing different stakeholders but with a larger number of researchers. A third workshop was organised together with 'The International Expert Group on Integrated Solid Waste Management and Life Cycle Assessment' with approximately 15 people from different countries in Europe. In these workshops, participants were in a structured brainstorming session asked to give suggestions for policy instruments affecting waste management which would be of interest to study further. Participants were also asked to suggest criteria for evaluating policy instruments. A session on policy instruments was also organised at a Swedish waste management conference. At this session a panel with four stakeholders was asked to suggest interesting policy instruments. Also the participants of the conference, approximately 100 people from industries, government, municipalities and academia, were invited to give suggestions. Further ideas for policy instruments were taken from the work on the Swedish action strategy for non-toxic, resource saving environmental lifecycles (Björklund et al., 2007). Through this process a broad range of different types of stakeholders were given the possibility to participate in the process. After structuring all the suggestions a gross list of approximately 60 suggestions were compiled and all of them were described in a draft report.

For prioritisation, a new workshop with Swedish stakeholders (approximately 25 participants) was organised. The participants got the draft report before the workshop and at the workshop they were 'voting' for the different suggestions. They were given ten positive points and five negative points that they could distribute in any way they wanted over the different policy instruments reflecting their attitude towards the policy instrument. The result from this workshop was one important input to the further prioritisation (see Table 1).

At the workshops, participants were asked to give suggestions for criteria for evaluating policy instruments. A number of criteria were presented. Most of them could however be summarised in three broad categories:

- environmental potential
- acceptance among industries, households and government
- economic consequences.

The project group also added four criteria of relevance for the research programme:

- novelty of proposals
- possibilities for evaluation within other projects of the programme
- balance between different types of policy instruments
- a balanced main focus on the higher levels of the waste hierarchy (prevention, preparing for re-use and recycling).

Based on these criteria and the results of the prioritisation workshop, a list of policy instruments that are of interest to further evaluate (not necessarily implement) was developed. The prioritised policy instruments then need to be further developed and specified so that they can be evaluated in other projects of the research programme.

3 Results

3.1 Prioritisation workshop

Table 1 presents the gross list of policy instruments and the results from the prioritisation workshop.

Table 1 Results from the prioritisation workshop

Policy instruments	*Positive votes*	*Negative votes*
Information and statistics on waste amounts	10	1
Tax on raw materials	7	3
Product charges		7
Weight-based waste collection fee	6	
Environmentally differentiated waste collection fee	10	
Tradeable extraction permits	1	4
Support to waste minimisation in companies	6	
Demands for waste minimisation in companies	1	
Control and influence consumption	6	1
Support and legislation for cooperative solutions	6	
Advertising broschures – Yes please!	4	1
Deposit and refund systems	1	
Banning of use of virgin materials for contruction on landfills	2	1
Rules on waste as a raw material	4	
Certification systems and standard for recycled materials	8	1
Rules on the use of recycled materials for construction	7	1
University education on product design using recyled materials	4	
Economic support for the use of recycled materials	2	
Recycling certificates	4	5
Information to consumers	11	
Information and education directed towards companies	4	
Intervention (inforamtion in combination with practical guidance)	1	
Positive economic instruments for consumers	3	
Developed extended producer responsibility	4	6

Note: No number indicates no votes, neither positive nor negative.

Table 1 Results from the prioritisation workshop (continued)

Policy instruments	*Positive votes*	*Negative votes*
Developed collection systems	7	
Development of the ecodesigndirective	3	
Initiate and support post-collection separation	2	10
Incineration tax – old design		3
Incineration tax – tax on on fossil part of waste)	6	
Incineration tax – mass based	2	
Incineration tax – supporting increased electricity production		
Green electricity certificates	1	
Tradebale emission permits		4
Support for biological treatment		
Tax on biological treatment	1	5
Extended landfill ban		1
Developed landfill tax	1	1
Policy instruments for hazardous chemiclas	2	1
Increased control by authorities	4	1
Differentiated VAT	5	1
Subsidies		1
Waste tax		1
Waste treatment fees	2	2
Bans	1	1
Voluntary agreements	1	
National targets for waste	2	4
Suppprt for benchmarking	6	1
Standardised terminology	6	
Demands on companies to do waste minimisation plans.	3	2
Better bases for waste planning		
Regional waste plans together with industries		1
Environmental labelling	2	
Support for industrial symbiosis		2
Green public procurement	3	
Environmental classification of buildings	2	1

Note: No number indicates no votes, neither positive nor negative.

3.2 Policy instruments for further development

Based on the results of the prioritisation workshop and other considerations as described above, 15 policy instruments were chosen as of interest for further development and evaluation. These are described below.

- *Information to citizens and companies.* Information is a common policy instrument, but may be difficult to design so that the information reaches the targeted group (Borgsted and Andersson, 2010). A number of activities could be included. Here a package is suggested where
  1. municipalities are required to provide information about amounts and treatment of waste
  2. campaigns are initiated for increased recycling
  3. in connection with information campaigns, municipalities are required to provide practical guidance
  4. waste minimisation clubs for enterprises are supported where companies can exchange knowledge and information.
- *Tax on raw materials.* Taxes on raw materials can be designed in a number of different ways (Söderholm, 2004, 2011). Here we suggest two versions:
  1. Tax on oil and other fossil fuels that are used for material production (e.g., plastics) that is the same as the tax on fossil fuels used for heating. There would also be a tax on imported plastics and a refund for exported plastics. The tax on imported plastics would correspond to 5 SEK/kg (1 SEK is approximately 0.1 euro).
  2. Tax on all non-renewable materials that are mined in Sweden or imported to Sweden. A refund is given for materials exported. The tax level to be evaluated is 0.01 SEK/kg.
- *Weight-based waste collection fee for households.* Weight-based collection fees have been introduced in a number of municipalities in different countries and are much discussed (Dahlén and Lagerkvist, 2010; Dresner and Ekins, 2010). The suggestion to be evaluated includes a fixed part (850 SEK/year) and a flexible part (2.12 SEK/kg). Based on earlier studies (Dahlén and Lagerkvist, 2010) it is assumed that this leads to 20% reduced amounts of collected waste. The fate of this reduced amount of collected waste is however unclear. In the evaluations, three possible explanations will be tested:
  1. the whole reduction corresponds to waste prevention
  2. half of the reduced amount is home composted and the other half recycled
  3. the reduced amount is handled illegally (dumping in forest or home burning).
- *Environmentally differentiated waste collection fee for households.* Currently, in some municipalities those who want to participate in a source separation scheme may have to pay a higher waste collection fee. The suggestion to be evaluated includes a lower fee to households that choose to source separate into a number of different fractions including different packaging materials and food waste.
- *Waste minimisation in enterprises.* In this suggestion enterprises are required to report their amounts of solid waste and present plans for reducing the amounts. Technically this can be accomplished through a change in the environmental code or through requirements in the environmental permits.

- *'Advertising brochures –Yes, please!'.* Currently people are getting advertising brochures in their mail boxes unless they put a sign saying 'Advertising brochures – No thanks!' The idea with this policy instrument is to change that so instead people will only get brochures if they put up a sign saying 'Advertising brochures – Yes, please!' This can be a part of a waste minimisation strategy (Salhofer et al., 2008)
- *Recycling certificates.* The basic idea of recycling certificates is that the government gives certificates to recyclers and producers who are using recycled materials. The government is also requiring that all producers should have a certain amount or quota of certificates. The producers, who are not themselves using recycled materials, can buy certificates from those who are. In this way a market for certificates are created and cost-efficient solutions for recycling can be sought. In the suggestion to be evaluated, recycling certificates are introduced for plastics. A quota corresponding to 30% recycling is introduced, and those who do not reach that have to pay a fine corresponding to 4 SEK/kg.
- *Developed collection systems.* Source separation is currently limited by practical aspects as well as uncertainties among people (Henriksson et al., 2010). According to this suggestion the collection of recyclables is developed in two ways. The first is a requirement that recyclable materials can be left close to people's homes. The second is that collection is based on the type of material rather than type of product. In the present system, there is an extended producer responsibility for packaging materials, which means that different types of packaging materials are collected. However, other types of products shall not be left in the collection systems for packaging materials, which means that people have no place to leave other types of products that in principle can be recycled. In this suggestion, collection is based on type of material, so that all products of certain type of material can be collected in the same way.
- *Tax on incineration of waste from fossil fuels.* Currently there is an energy tax and a carbon tax on fossil fuels used for heating. If materials, e.g. plastics, that have been produced from fossil fuels are incinerated and used for heating there is however no tax. In this suggestion, the tax would be the same for incineration of all materials made from fossil fuels as for fossil fuels (Finnveden et al., 2007). This would mean a tax of maximum 1.01 SEK/kg of carbon dioxide from fossil fuels. The maximum tax is for heating in own properties, for district heating and for combined heat and power plants the tax is lower (the minimum value is 0.15 SEK/kg carbon dioxide).
- *Tax on incineration of waste.* In this suggestion a weight-based tax on incineration of solid waste is introduced corresponding to 0.4 SEK/kg waste. According to this suggestion incineration of waste from both renewable and non-renewable materials would be introduced.
- *Including waste in green certificates for electricity production.* Currently there is a system of green certificates for electricity production from some renewable sources (Bergek and Jacobsson, 2010). Electricity producers who are using these renewable sources get certificates from the government. All producers are required to have a certain quota of the certificates. The producers who don't get them themselves can buy them from other producers. Currently, electricity production from waste is not included in the system so no certificates are given for electricity production from

waste incineration. Here three different ways of including waste in the green certificate system is suggested:

1. Certificates are given for the fraction of the waste that comes from renewable sources, such as food waste, wood, etc. but not the fraction of the waste that comes from non-renewable sources such as plastics made from fossil fuels.
2. Certificates are given for all waste fractions.
3. Certificates are given for all waste fraction but combined with a waste incineration tax of 0.2 SEK/kg waste.

- *Tax on hazardous substances.* Taxation on the use of hazardous substances can be made in different ways (Söderholm, 2004). Taxes can for example be put on specific substances. The idea is then that the use of these substances will decrease and, eventually the waste may contain less of the hazardous substance and become less hazardous. Taxes can also be placed on all substances fulfilling certain criteria. In the suggestion to be evaluated, a tax on products containing hazardous substances in a concentration of more than 0.1% is introduced. The tax level is 2 SEK/kg of the hazardous substance. Hazardous substances are defined by the criteria for labelling of substances with certain defined risk phrases such as very high acute toxicity, high chronic toxicity, mutagenic, etc.
- *Labelling of products and goods with hazardous substances.* According to this suggestion, products containing more than 0.1% of substances classified as hazardous (with the same criteria as for the tax on hazardous substances) should be labelled as containing hazardous substances.
- *Improved control by authorities.* According to this suggestion, more resources are allocated to control of environmental permits.
- *Differentiated VAT.* Under the heading 'differentiated VAT', a number of different suggestions can be made. Here we make two suggestions for further evaluation:
  1. lower VAT on products containing recycled materials
  2. lower VAT on services (excluding transportation services) and higher on products and transportation services.
- *Ban on incineration of recyclable materials.* Although recycling has increased, there are still recyclable materials that are currently incinerated (Avfall Sverige, 2011). The suggestion to be evaluated is to place a ban on incineration of recyclable materials, except for materials where in a life-cycle perspective, incineration leads to lower environmental impacts. Examples of such materials can be wood waste, yard waste and some types of sludge.

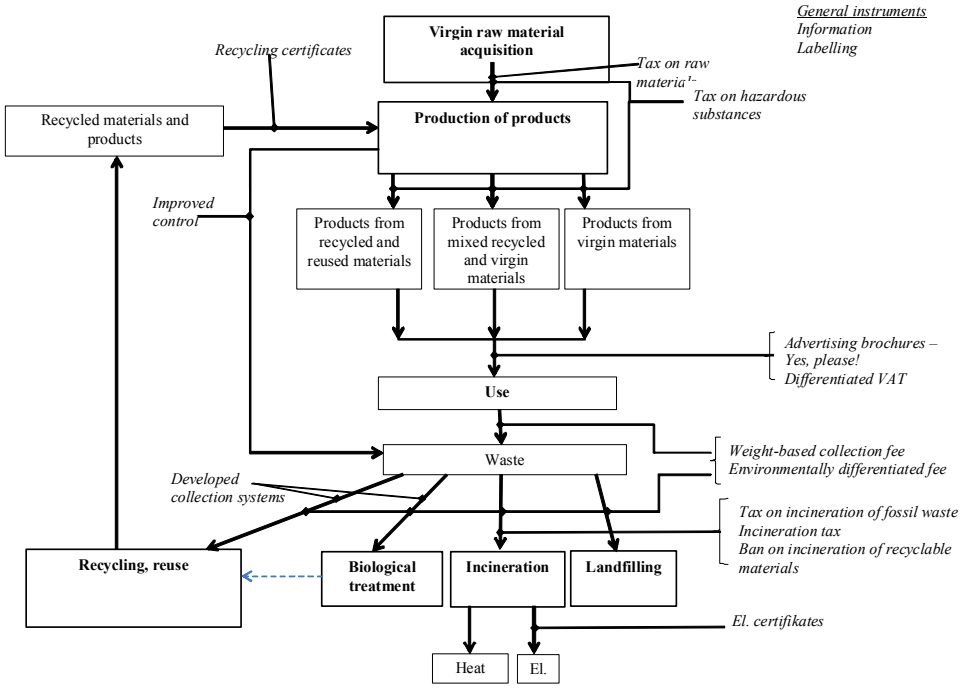
3.3 Policy instruments in the waste management system

A simplified picture of the waste management system is given in Figure 1. It also describes where in the system the policy instruments discussed here are placed in this system.

4 Discussion and conclusions

A number of policy instruments for further developing the waste management system in Sweden towards a more sustainable system have been suggested in a process involving a number of stakeholders. The suggested policy instruments will be further evaluated in several studies within the research programme. It is clear that all policy instruments have advantages and disadvantages for different groups and actors. There is therefore no completely objective process for suggesting and developing policy instruments. But by evaluating policy instruments and studying their potential consequences, a better basis for decisions can be provided.

Figure 1 A simplified picture of the waste management system with the suggested policy instruments (see online version for colours)



Through the process a large number of suggestions for new and developed policy instruments were gathered. It is thus clear that there are possibilities for further development of the waste management towards more sustainable direction. The list of suggested policy instruments can be used as a source book for further discussions also in other countries.

Figure 1 illustrates that there are a number of different flows in the waste management system which policy instruments can try to regulate. This is interesting because this illustrates that different instruments can complement each other and also that several policy instruments are necessary. It is very unlikely that one single instrument can be used to control all flows in a waste management system, instead several instruments are needed.

The results in Table 1 indicate that the stakeholders who participated in the workshop seem to support softer instruments rather than hard policy instruments. For example, information as a policy instrument was preferred over instruments such as product charges, developed extended producer responsibility and recycling certificates. Another example is the rather strong support for the suggestion 'support to waste minimisation in companies' (6 votes) compared to the suggestion 'demand for waste minimisation in companies' (1 vote). The further evaluation may illustrate if softer policy instruments are enough to reach policy goals, or if harder instruments are needed. Still there are probably room for developing new softer policy instruments related to both companies and communities (Philips et al., 2011; Mattsson et al., 2010). It can also be noted that most of the instruments in Table 1, and also most of the prioritised instruments are rather general in character covering many types of waste. Many of the existing policy instruments and also much of the scientific literature on the other hand has a tendency to focus on specific waste types such as packaging (Cela and Kaneko, 2011; Rouw and Worrell, 2011) or WEEE (Monomaivibool and Vassanadumrongdee, 2011; Mayers et al., 2011, Lindhqvist, 2010).

It is interesting to note the strong resistance towards supporting post-collection separation (Table 1). This may be a specific aspect of the Swedish context since many people argued against this on the basis that the society had invested so much effort into supporting source separation and some feared that this would be ruined if post-collection separation became common.

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