

Zero Waste Management in Borås

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1 Introduction

Sweden is one of the pioneers in resource recovery and waste management sector for more than 30 years. City of Borås has a great impact on Sweden in sustainable waste management by reducing landfill, recovering fuel from waste and recycling. From 2006, collaboration between University of Borås, Borås Energy and Environment (local municipality) and SP technical research institute of Sweden was started to transfer knowledge and technology on sustainable waste management from Sweden to other countries. In addition, to these three collaborators twenty more state municipalities and private companies collectively initiated an organization to transfer knowledge on waste management called ‘Waste Recovery – International Partnership’. The first project started in collaboration with Indonesia, and it has now rapidly expanded to Southeast Asia (Thailand, Vietnam, Cambodia, and Laos), Nigeria, Brazil, and the USA in a short span, since 2008.

2 Dimension of waste in different countries

Waste is a waste elsewhere, but for Borås it is wealthy resource. Having a population of more than 100 000, a positive economic system was designed back in 1986 to convert wastes into value added products such as biogas, electricity and heat. The waste management system in Borås was started with 3 000 households as a pilot project. From then, within 10 years the complete city was adopted to the waste management system. Some countries in Europe are good at waste management including Sweden, Germany, Austria, Switzerland and Netherlands where less than 1% of waste is ended in landfill. However, eastern European countries such as Romania and Bulgaria end up with more than 99% of waste in landfills. The situation is worse in many developing countries. Ending up the waste in landfills leads to loss of land, loss of useful materials, generation of poisonous gas, climate change etc. Utilizing the waste in a useful and economical way can protect the environment for a better future.

Globally, 2,000,000,000 tons per year municipal solid wastes (MSW) is generated, in addition to agricultural, forestry and industrial wastes. Most of these wastes end as landfills and the most common way to get rid of the problem is to ‘throw-away’. However, throwing away leads to health hazards, safety issues and more over valuable resource in the waste is wasted. The local government has a major responsibility in collection, transportation and processing of waste. Many government companies dump the waste, as it is thought to have no value and no positive economy could be generated from waste. However, back in 1960s and 1970s the waste was increasing beyond the acceptable levels led to the change in the framework directives and policies which formulated waste management hierarchy. According to the waste management hierarchy the wastes should follow, reduce, reuse, recycle and recover before it is dumped in to the landfills.

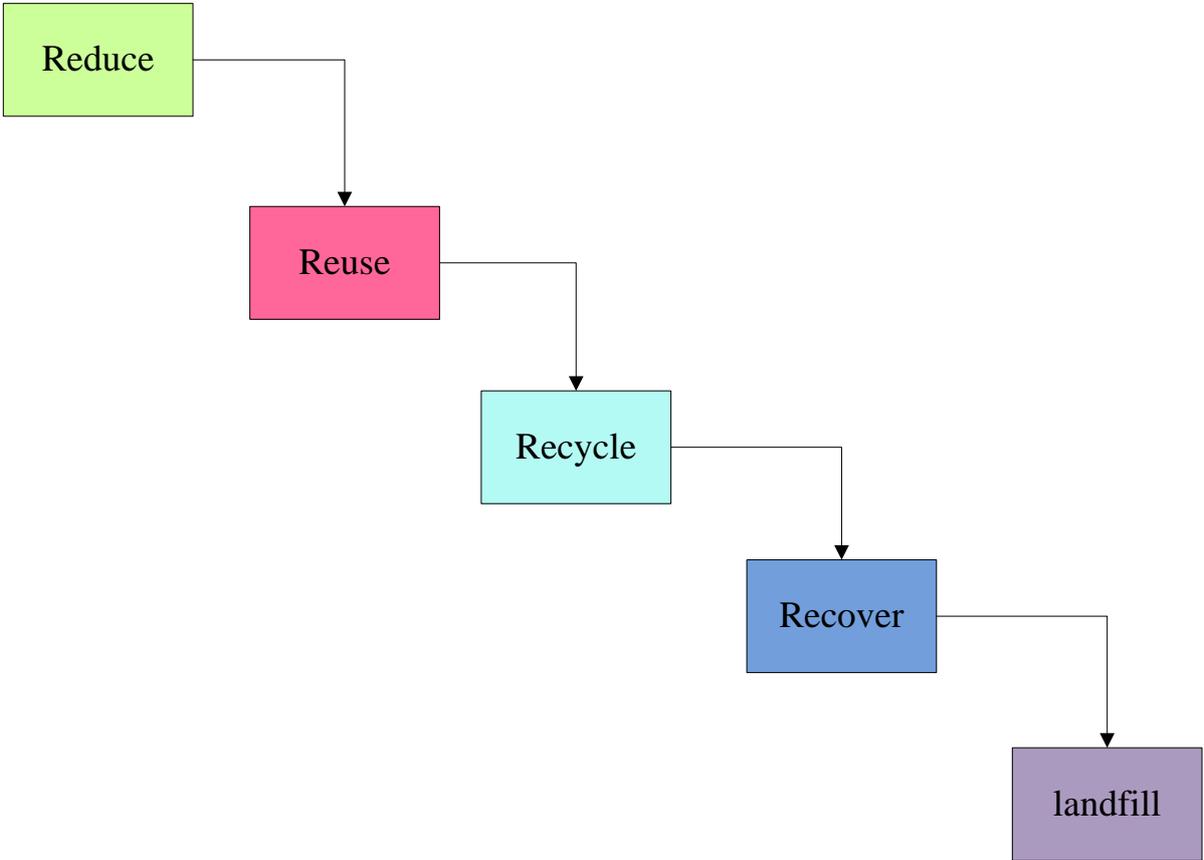


Figure 1. Waste management hierarchy.

Sweden’s view on sustainable waste management was supported by policy makers, public, industries, governments, universities and research institutes. By incorporating garbage collection fees, easy access to recycling stations, and awareness campaigns, the recycling rates in Sweden has increased significantly in the recent years. Some laws also have been

formulated with respect to this regard including a ban on landfilling combustible waste since 2002 and organic wastes since 2005. Before 2004 itself 96% of all glass packaging, 95% of metal, 86% of corrugated cardboard and 80% of electronic waste was recycled in Sweden. Wastes which could not recycle are recovered through biological and thermal treatment to obtain biogas, heat, and electricity.

3 Borås Model

Back in 1996, more than 40% of wastes were landfilled in Sweden. But then with implementation of innovative and integrated new technologies for waste separation, fractionation, biological treatment, thermal treatment for waste to electricity and heat reduced the landfill. Today in Borås, the household waste is sorted in 30 different fractions, which is either recycled or converted to electricity, fuel or heat. Almost zero percent is landfilled today, which is an enormous achievement. A key factor behind this sorting is the cooperation of the citizens. Children are taught at school about waste sorting and management. Further, regular sports and social activities are conducted to create awareness among adults in the city. The success behind boras waste management system has several crucial factors such as citizens, policy and decision makers, research and development, and children. Policies are formulated in such a way the citizens pay less tax when the sorting rate goes higher and vice versa, which intern adds additional responsibility to each citizen to sort better. At the University of Borås, wider research is performed to utilize the wastes into innovative value products.

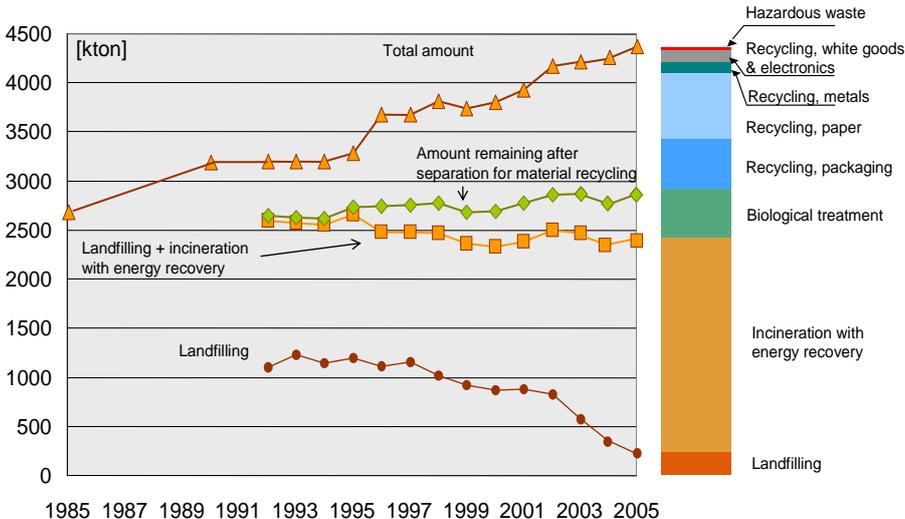


Figure 2. Household waste collection and treatment in boras since 1985.

In Borås, each household is given a booklet by the municipality which contains how to handle different wastes. Approximately, 130 different materials are listed in the booklet, so that the citizens could look what to be done with that waste. For example, white glass bottles are sorted separately and colored bottles are distinguished separately. Recycling containers are placed in walking distances from each household all around the city to collect pure fractions of each material, which are sent to industries for further processing. The municipality also provides white and black bags for every household for free. All combustible waste must go in black bags, while other waste goes in white bags for incineration. The black bags and other organic flows are sent to biological treatment for the production of biogas. Around 3,000,000 m³ biogas is produced every year which is enough to run the buses in the city, garbage collecting trucks and some CNG vehicles. The white bags and other industrial waste are sent to two 20 MW combustion plants where 960 MWh heat and electricity is produced every day. The complete block diagram of household waste flow is shown in Figure 3.

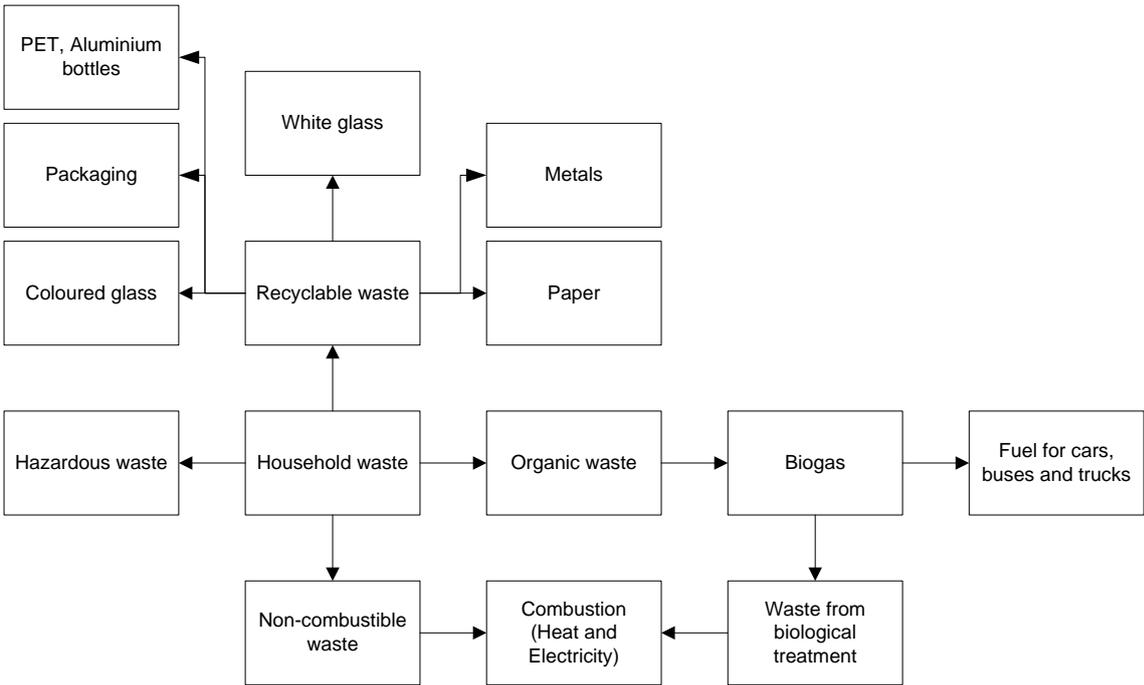


Figure 3. Block flow diagram of household waste flow in Borås.

Another interesting way of recycling is the PANT system. According to this system, all PET and aluminum bottles are recycled in super markets by a collection machine. Every time a

PET or aluminum bottle is bought by the user, an additional fee of 2 SEK is charged, which is returned when the PET or aluminum bottles is sent to the collection machine. More than 90% recycling of PET and aluminum bottles is reached in Sweden. This system is very attractive and innovative as managing the waste is easier, efficient and economic. Fraction of waste recycled, sent for biological and thermal treatment is shown in Figure 4.

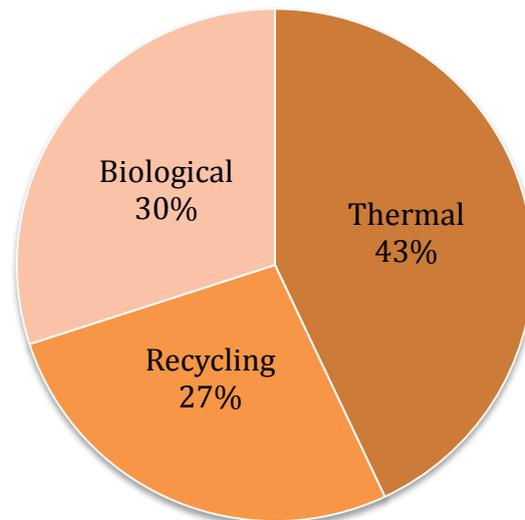


Figure 4. Fraction of waste utilized in different forms in Borås

4 Transferring the knowledge

Borås is now a zero waste city and its time to think beyond Borås and Sweden. With this thought, transferring knowledge organization was founded namely *Waste Recovery – International Partnership* (WR). In this organization, the politicians, citizens, industries and the universities are brought under one roof a Public, Private Partnership is created. The politicians discuss with the partner country to have better policies, while industry implement the technology developed by the university. WR includes Borås Energy and Environment AB, University of Borås, SP Technical Research Institute of Sweden and about 20 different companies involved in waste management. The international collaboration started in 2006 and now it is in connection with Southeast Asia, Africa, Latin America, North America and Europe. WR is a non-commercial organization with an objective to see a better environment for the planet.

The collaboration could be at different levels for different countries, but the starting point of collaboration for any country would be the collaboration between the universities. University plays a major role as education is a powerful tool to initiate a change. University of Borås and its collaborating country university will exchange faculty, researchers, and students at Msc and PhD level to develop an appropriate technology for the collaborating country. The industries and other members in the group will help in their part to achieve the goal. A research at PhD level called “Sandwich-PhD” where a student spend half time in the home country and half time at University of Borås specially working on the research aspects related to home country. The network also offer a specially designed course in Sustainable Waste Management in Borås for one week which is to be followed up by one week in collaborative country. During the second week the local situation is analyzed to support strategic decisions for local development.

The first collaboration was made with biggest the Indonesian university namely Gadjah Mada University and Yogyakarta municipality to convert market waste into biogas for producing electricity. The Gemah Ripah fruit market produces 4-10 tons of rotten fruit waste, which was dumped before. Now, the wastes are sent to biogas digester to produce 500 kWh electricity per day. Before the biogas digester was installed, around 14 truck of waste was landfilled every week and after the installation the number reduced to one.



Figure 5. Waste Recovery- International partnership collaborative model

University of Borås is invited to conduct workshops in various universities all around the world, which is starting point for international networks and relationships for collaboration. Contacts created are shared with collaborating partners for possible collaborations. In parallel, the governments are connected through embassies for making a smooth and faster collaboration. When a collaborative initiative is taken, a mutual exchange of visits between Borås and the partner cities is to be started. The meetings are financed by the collaborating parties or international organizations or by different authorities in Sweden. After this initial step decisions about the future collaborations are to be taken. WR in Borås expects the collaborative part to create a similar Public, Private Partnership. A good start point is to start student exchange and to organize the introduction course for mayors and other important people from the local society.

5 Conclusion

Borås is open to transfer knowledge and technology on waste management in a context of open innovation. Borås is open to share its knowledge developed during the past 30 years. With the Public, Private Partnerships created in Borås in collaboration with a Public, Private Partnership in another country a strong productive international platform is created. The long term vision has to be a planet without waste.