

Research Article

An Overview of Approaches towards Sustainable Waste Management in Baltic Sea Region Countries

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Abstract: Municipal waste management is a matter of great relevance and concern to countries in the Baltic Sea region. At present, the region possesses great disparities regarding the ways it handles and processes waste, meaning there are some countries which recover most of the waste they produce, whilst a number of other nations are lagging behind. Such disparity needs to be addressed in order to accommodate a more sustainable solution to waste management issues. This study discusses the extent to which countries in the Baltic Sea Region handle municipal waste management issues and outlines some of the work undertaken as part of the project “RECO Baltic 21 Tech”, partly funded by the Interreg VB (Baltic Sea) Programme. The study outlines the current state of affairs within the field of waste management in the Baltic region and, by means of some examples of good practice, documents a selection of the ongoing initiatives in this field before finally outlining the results of the project. Furthermore, it also describes some of the actions needed in order to foster more sustainable waste management practices in Baltic Sea region countries.

Keywords: Adaptation, Africa, climate change, communities

INTRODUCTION

Treatment of waste and especially its disposal, has the potential to impact upon health and the environment, including emissions to air, surface water and groundwater, depending on how it is managed. The contribution of the waste management sector to climate change has become an increasingly popular topic of discussion (Ackerman, 2000). Waste also represents a loss of natural resources. The effective management of municipal solid waste is therefore a matter of great concern to both industrialised and developing countries.

Research into waste management has witnessed much progress recently, particularly in the Baltic Sea Region (BSR). Researchers have investigated various waste treatment technologies, waste generation, prevention, recycling, as well as various waste management strategies. (Corvellec *et al.*, 2012; Damgaard *et al.*, 2009; Den Boer *et al.*, 2012; Helftewes *et al.*, 2012; Henken-Mellies and Schweizer, 2011; Merrild *et al.*, 2008; Moora *et al.*, 2012; Stenmarck *et al.*, 2011). Life Cycle Assessment has been used to support decision making in old EU member states of the Baltic Sea region for over a

decade. It is now being gradually introduced into the decision-making processes in new member states as well (Bernstad *et al.*, 2011; Birgisdóttir *et al.*, 2007; Björklund and Finnveden, 2007; Manfredi *et al.*, 2009; Moora *et al.*, 2006; Miliūtė and Staniškis, 2010; Damgaard, 2010).

In Europe, where levels of waste disposal have increased considerably in the past 15 years, improved waste management is now perceived as an essential tool in efforts to make the European region more resource efficient. If a country is to generate greater economic returns at a lower cost to the environment, then it must find ways to extract more value from the resources it takes from nature, whilst simultaneously cutting the burden of emissions and waste. One key means of achieving this is by shifting waste management up the waste hierarchy by reducing waste landfilling and instead focusing on waste prevention, reuse, recycling and recovery.

In recent years, important goals have been integrated into European environmental policy, notably the European Commission’s roadmap on a resource efficient Europe (European Commission (EC), 2011)

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and the EU's Waste Framework Directive (European Commission (EC), 2008). Using the waste hierarchy as a guideline, the Waste Framework Directive sets out a range of provisions, including the statutory target to recycle or prepare for reuse 50% of waste from households by 2020. National efforts to promote the waste hierarchy have been underway for much longer, in a large part driven by earlier EU legislation such as the Landfill Directive (European Commission (EC), 1999).

The Baltic Sea region, home to nearly 100 million people, is unique in terms of its environment, central location in the Baltic Sea and its fragile ecosystem. The region is made up of ten countries located in the drainage area of the sea. The area is also highly heterogeneous in terms of economic development levels, infrastructures, institutional set-ups, cultural aspects and the traditions of governance. Nowadays, eight years since the expansion of the EU, the region is facing pressing challenges including the deteriorating state of the Baltic Sea, poor transport links, barriers to trade and concerns about energy supply. There are still significant disparities between environmental footprints of industries, infrastructures and services including waste management systems. A recent screening study also showed the level of disparities across the region in terms of waste management performance (BiPRO, 2012). The east-west division is apparent in Germany, Denmark, Sweden and Finland, with those countries generally scoring two to four times higher in the municipal waste management performance ranks than Poland and the Baltic States (Estonia, Latvia and Lithuania), respectively. In Russia and Belarus, the standards for waste management are even lower.

The introduction of standard EU laws, instruments and policies have paved the way for a more effective coordination of activities to ensure higher standards of living for the region's citizens, including environmental quality. In spite of good international and interregional contacts and communication, however, effective cooperation and coordination has yet to take full advantage of the new opportunities that EU membership provides to adequately address common challenges, including those related to waste management. In order to achieve the European waste management goals and targets, it is important to facilitate more coherent actions and cooperation within the Baltic Sea region.

In order to help Baltic governments address the increase of waste and associated pollution, new policy ideas and concepts are currently being investigated and developed that may result in longer-term solutions and increased resource efficiency.

FACTS AND DATA ON MUNICIPAL WASTE MANAGEMENT IN BALTIC SEA REGION COUNTRIES

The Baltic Sea region includes ten countries within the drainage area of the Baltic Sea, which have

significant disparities between the levels of municipal waste management. Looking at the main characteristics of municipal waste management sectors, the countries can be clustered into three groups. The region can be schematically seen in Fig. 1.

The first group of countries, i.e., Sweden, Finland, Denmark and Germany, are "old" EU Member States with high Gross Domestic Product (GDP) and established institutional set-ups, have well-developed waste management infrastructures with very little land filling, as well as high rates of separate waste collection and recycling. Compared to other countries in the region, these countries also generate a high volume of municipal waste. Denmark, with 781 kg/person, had the highest amount of waste generated in 2011, followed by Germany, Finland and Sweden with values between 600 and 450 kg/person (Eurostat, 2013). This first group of countries has a good level of organization and fairly adequate financing schemes from mostly national (public or private) sources. Therefore, the highest shares of recovery (material recycling and incineration) of municipal waste in Europe are observed in these countries. Land filling of municipal waste accounted for less than 5% of waste treated in Germany, Denmark and Sweden. Only in Finland was the share of landfilling approximately 40% (Fig. 2).

Another group-Estonia, Latvia, Lithuania and Poland-are new EU members, with GDP rates typically half of the EU average. The amount of municipal waste generated is much less than in the first group of countries. The municipal waste generated was reported as below 450 kg/person in 2011 (Eurostat, 2013). Municipal waste infrastructures and institutions are currently under development. While municipal waste recycling rates are steadily increasing, the majority of waste is still land filled and the quality of waste separation and recycling efficiency remains generally low (Fig. 2). The countries are also experiencing shortcomings in the public financing of waste management, whereas the EU structural funds are still playing a significant role.

The two groups both have to adhere to the EU waste legislation, yet are on opposite ends in several waste management quality rankings. For the time being, the eastern neighbors still have somewhat different targets and implementation schedules (e.g., the EU Landfill Directive 1999/31/EC sets progressive targets for the reduction of the biological fraction of municipal waste going to landfills to 75% of their 1995 baseline levels by 2006, 50% by 2009 and 35% by 2016, with additional allowances for Poland and Baltic States). However, this "two-speed Europe" approach is set to be phased out, implying significant challenges in terms of infrastructure modernization, optimization of institutional and legal set-ups and securing adequate sustainable financing less dependent on EU cohesion funds.

The non-EU countries of Russia and Belarus form another group in the BSR with even less developed



Fig. 1: The Baltic Sea region

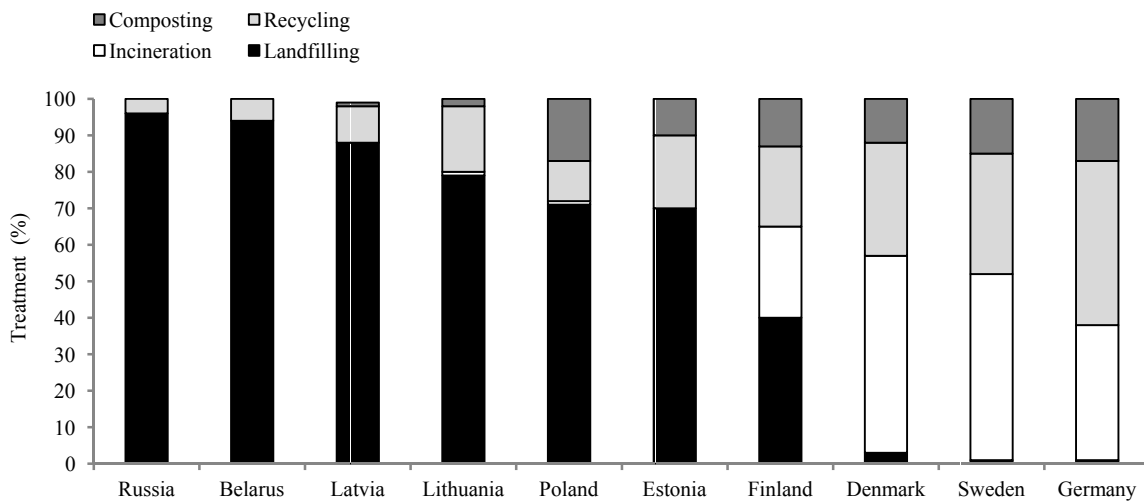


Fig. 2: Municipal waste treatment in BSR countries, 2011 (Eurostat, 2013)

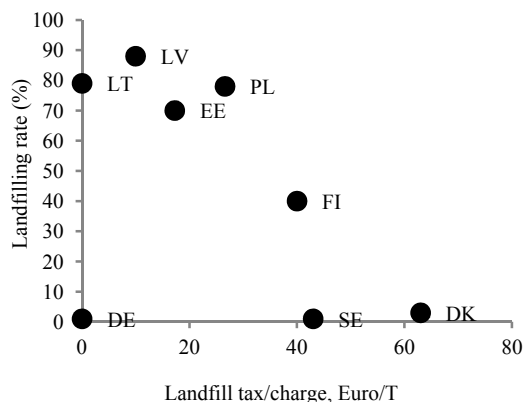


Fig. 3: Landfill taxes and landfilling rates in BSR countries (CEWEP, 2012)

waste management sectors and weak institutional and administrative set-ups in terms of effectiveness. Most of the municipal waste is land filled and only very few land filling sites are comparable to those acceptable by EU standards (Fig. 2). Separate collection and recycling levels are gradually increasing, but they are still very low. The situation with financing is even more critical, as they are not eligible for the majority of EU financing. The state plays a dominant role in setting municipal budgets and regulating tariffs for local public services (incl. waste management). Whilst the municipalities are weak, they are still legally responsible for organizing waste management similar to the other countries in the BSR. The involvement of the private sector is emerging but is very marginal and not yet transparent.

The development of municipal waste management in BSR countries reflects the initiatives taken by individual countries. In addition to historical and cultural backgrounds, there is evidence of a clear correlation between the cost of land filling and the share of municipal waste land filled/recycled in BSR countries. Countries with high landfill gate fees or landfill tax (Sweden, Denmark and Finland) also have the lowest land filling rate (Fig. 3). Based on the experiences of different countries, it is clear that landfill taxes and regulatory restrictions (e.g., a ban of land filling untreated waste in Germany) play an important role in promoting the waste hierarchy.

To summarize, the lowest amount of land filling is seen in Germany, Sweden and Denmark, whereas this practice remains fairly widespread in Finland. Bearing in mind the connections between land filling and emissions of greenhouse gases, further reductions are expected in the future which places additional pressure on countries to act.

DESCRIBING THE RECO BALTIC 21 TECH PROJECT

Even though the concept of waste management and prevention has been broadly accepted and widely

implemented, it is clear that the ever-growing volume of waste, waste diversity and associated risks are heightening the need for governments to pursue waste prevention and recovery more intensively and as an essential component of strategy for a sustainable future. In spite of this, efforts in this field have been hampered by numerous factors, one of which is the limited access from less developed countries to approaches, methods and technologies available elsewhere.

In order to address this need, the RECO Baltic 21 Tech (RB21Tech) has been created. RB21Tech is a waste management project co-financed by the Interreg IVB Programme (Baltic Sea). RB21Tech is acknowledged as both a EUBSR flagship and a CBSS Lighthouse project (i.e., a project officially registered by the Council of Baltic Sea States due to its far-reaching regional impact and interest).

The need for the project is based on the fact that waste management is a matter of great concern to Baltic Sea region countries, where significant national disparities can be seen. Insufficient transnational actions in the field of waste management hamper the development of Baltic Sea Region (BSR) and pose both environmental and economic challenges. Recently, the EU set new and extensive directives for waste generation to stabilize from 2012 onwards and decline from 2020. A waste hierarchy is fixed as a guiding tool, serving as the greatest potential reduction in environmental impacts from waste generation and management.

Even though Baltic Sea region countries are under the same EU legislation, the immaturity of the waste management system varies dramatically and one purpose of RB21Tech is to even out these gaps and to help all countries to climb in the waste hierarchy (i.e., improve waste management).

Climbing the hierarchy presents an indisputable challenge for these countries as the local authorities, which are responsible for coordinating and implementing municipal waste management plans, often lack experience, capacity and funds to initiate a process of:

- Evaluating more than one alternative
- Carrying out adequate procurement
- Finding an instrument which catalyses and multiplies the process

A poor execution of the process results in both long-term dependencies on single solutions and an imbalanced overcapacity on a regional and national level.

RB21Tech responds to these great challenges by strengthening local and regional capacity to climb the waste hierarchy to meet the EU directives. The overall objective of the project is to improve local and regional capacity to apply the process of implementing waste

management that supports the implementation of the EU Waste Management Directive, helping countries in the Baltic Sea region to address their problems with waste management and disposal.

RB21Tech is an offshoot of a WM initiative that started as a bilateral cooperation between the cities of Stockholm and St Petersburg in 1998. Along the way, an initial RECO project, also co-financed by ERDF funds, was carried out between 2004 and 2007. Due to the long history of collaboration and clearly defined goals and objectives, the current project relies on a solid and devoted partnership. This history of collaboration between a large number of countries with different systems, administrative procedures, cultures, languages and WM advancement will be a central trait when spreading the RB21Tech method to regions beyond the BSR. RB21Tech strongly believes that lessons learnt over the years will provide the ability to avoid foreseeable and decelerating obstacles, be that administrative, legislative, cultural or technological.

PROJECT ACTIVITIES AND RESULTS

The activities targeted to achieve the project results were numerous and diverse. The project created the two following important outputs:

- Baltic Sea Region Waste Management Strategy (joint strategy) -aiming to influence the decision-makers on an EU, national and local level
- Investment concept-aiming to assist the local and national government in making the required sustainable investments into waste management projects

The aim of the joint strategy for municipal waste management in the Baltic Sea region is to help harmonize the regional approach towards waste management and by doing so, facilitate climbing in the waste hierarchy in all countries within the BSR, thus reducing its heterogeneity in waste management approaches. It is to be developed by exploiting the historic experiences and best practices of all countries across the BSR.

The vision is that the BSR should be a leading European region in waste management, meaning waste prevention has to be a top priority in governmental strategies and that waste management in the region is clearly geared towards the top solutions of the waste hierarchy. In addition, the perception that waste is a strategic economic resource has to have a firm rooting in the mentality of the population. The value of recycling of waste material should be prioritized above all other means of waste recycling and the waste that is recycled should retain the high quality of original material. Waste management should be carried out in a sustainable manner with minimal impact on human

health and ecosystems, whilst decisions need to be made with long-term goals in mind.

A joint strategy would also ensure that EU funding is used in a way that gives the best possible, cost-effective, long-term environmental benefit, whilst investments should also be optimized to suit local needs. The strategy targets decision-makers dealing with municipal waste management at a national and EU level. It contains a description of the situation and identifies the obstacles found to be causing the difficulties regions have in climbing the waste hierarchy. The strategy also gives suggestions for actions to be taken at various levels to improve the situation. Our hope is that the strategy will provide an input to other strategies developed for the region, as well as serve as a guideline for decisions taken regarding future investments in the region's waste management system.

Other important activities within the project were:

- Conducting pilot projects on waste management
- Further development of LCA-software WAMPS
- Preparing an overview of waste management in the Baltic Sea Region
- Cooperation with Mediterranean (MEDA) regions
- Organizing the Waste Management Council
- Development of a database on waste management issues
- Development of internet training on waste management issues
- Activities related to procurement issues in the field of waste management

Conducting pilot projects together with the development of the above described joint strategy and investment concept formed the core of the project. In total, 18 pilot projects related to biodegradable waste management, recycling of secondary raw materials and biogas from landfills have been carried out. Feasibility studies, environmental impact assessments, business plans and a number of other activities, depending on the type and needs of the particular pilot project, have also been prepared. The aim was to unlock investments of €20 m into waste management and treatment facilities. Furthermore, developing concrete waste management or treatment pilot projects enabled the identification of the main challenges which municipal and private project developers face. The lessons and experience gained from conducting pilot projects were necessary to develop the joint strategy and investment concept-the two key outputs of the project.

When developing waste management plans and deciding on waste treatment infrastructure, it is important to consider the entire life cycle. WAMPS (Waste Management Planning System) is specialist software which calculates the environmental impact and factors in the economical aspect from the chosen waste

management system. Development and further improvement of this web-based software took place during the project. The environmental impact was analyzed with the help of WAMPS in some of the pilot projects.

The waste management situation in all countries of the Baltic Sea region was reviewed in order to acquire background information for all further activities. In addition, a similar overview has been conducted for the MEDA region in order to identify opportunities for cooperation and to facilitate exchange between the two regions. The project appealed to the MEDA region by initiating a RECO-MEDA project.

The initiative to bring together authorities responsible for waste management in the BSR and to provide them with opportunities to discuss, exchange good and bad experiences and to highlight the most urgent and relevant issues associated with the RB21Tech project. This initiative is called Baltic Waste Management Council (BWMC). BWMC was able to meet a few times during the project conferences, as well as during the purposefully organized meetings. BWMC was consulted when developing the BSR Joint Waste Management Strategy, as they are one of the key target groups of the strategy. Aside from BWMC meetings, a number of other events have been organized on international (conferences and seminars in Tallinn, Riga, Vilnius, Minsk, Stockholm, Hamburg, Copenhagen, Barcelona, etc.) and national (in all participating countries) levels, which attracted the attention of various waste management-related stakeholders and contributed to the mitigation of regional differences by way of an exchange of knowledge.

A number of study visits, primarily as part of project conferences, took place during the project. Anaerobic digester for the treatment of food waste was visited in Hamburg (Germany), a plastic recycling company near Vilnius (Lithuania) and a new mechanical biological treatment plant near Tallinn (Estonia), etc.

The development of a database on waste management companies, technology suppliers, experts and study visits in the Baltic Sea region is another activity directed towards the exchange of knowledge and stimulating easier cooperation among the countries and various stakeholders.

Capacity building is also important when procuring waste management activities. It is not unusual that those having to procure various waste management facilities or operations lack the experience and or skills to best carry out their task. Thus, a seminar was organized and recommendations were prepared to enhance the capacity of BSR regions and municipalities in order to produce high-quality and efficient procurement for waste management investments. In addition, training programmes on technical issues such

as biogas, composting etc., a program and materials for the Internet, as well as training on managerial issues were also developed.

Moreover, the project has provided a context for a better understanding of the historical development of waste management facilities across the Baltic, with reference to cultural, policy, planning and financial factors.

LESSONS LEARNT

A number of lessons have been learnt from the experiences gathered as part of the project RB21Tech over the past 3 years.

Firstly, countries around the BSR typically have a large number of small municipalities that often lack competence, experience, technical, financial, infrastructural or the human resources to exercise their waste management responsibilities at a desired degree or quality level. This could be compensated for by cross-municipal cooperation and by pooling resources together.

Secondly, climbing up the WM hierarchy requires the creation of adequate conditions for improved hierarchy solutions to become more competitive with the cheapest WM approaches. Today, hierarchy solutions, such as recycling and composting, for example, often cannot compete with the cheaper options available, such as land filling. The scope for policy makers to intervene by providing the conditions for all market players to have an economic interest in the recycling of material value over other means of waste valorization. Several well-tested policy tools exist to facilitate the climbing up the waste management hierarchy, which primarily implies diverting waste away from land filling, promoting material recycling and waste prevention. Unfortunately, some BSR countries still lack effective interventions, such as bans, restriction and land filling taxes.

In addition, in the BSR countries where waste recycling rates are low, one of the most important underlying problems is source separation due to uninvolved and unmotivated households. Public participation in WM schemes is paramount for climbing up the waste management hierarchy. Involving the public requires time, money, efforts and concerted long-term planning. Unfortunately, awareness-raising activities are often de-prioritized in favor of technical solutions and infrastructural investments. Efforts in involving the public also often fail to address other important elements, such as adequate incentives and convenient infrastructure for waste sorting.

Sweden, Denmark, Finland and Germany are expanding separate collection systems from households and investing heavily in biological treatment methods. In some countries bio-gas production is developing particularly rapidly. Here, the main stimuli are national

strategies and municipal policies for climate change, energy security and transport. On the other hand, in Poland, the Baltic States, Russia and Belarus at least 80-90% of bio-waste still ends up in landfills. Once in the landfills, bio-waste is one of the major sources of greenhouse gases, such as methane, which is more than twenty times more potent than carbon dioxide. Alternative treatment methods such as composting and anaerobic digestion are gradually emerging, but they are still on rather marginal level.

There is significant potential to aid sustainable waste management in regulations based on Extended Producer Responsibility (EPR). Although most of the countries in the BSR have implemented EPR-based waste legislation, the implementation of EPR programmes differs across the region.

In western BSR countries, the industry is self-organized in setting the material fees of EPR products and administering EPR programmes. In principle, the funds generated are adequate to cover basic WM costs. The way the material fees are set may result in improved product design optimized for the post-consumer stage and material choices contributing to waste minimization. EPR programmes are sufficiently transparent and authorities have little role in their administration other than controlling the implementation of producer obligations.

In eastern BSR countries, EPR schemes lack transparency and are poorly controlled and enforced. This leads to a black market of EPR waste certificates. In addition, the collection of waste packaging is focused mainly on retailers and industrial users, since collecting consumer packaging is more costly. Until recently, legislation created options for the industry to pay centrally administered fees (e.g., packaging waste tariffs in Lithuania prior to January 2013), which were unnecessarily complex and created several administrative inefficiencies. The infrequent revision of material fees, poor enforcement and the numerous opportunities for free riding created large discrepancies in EPR revenues and actual WM costs.

Ideally, waste management should be financially self-sufficient, without requiring cross subsidizing from municipal or national budgets. Unfortunately, this is not often the case in most BSR countries. The rates of WM fees vary greatly across BSR with a 5-10 factor difference in what the households pay for WM services across the region. Although waste management fees require less than 1-2% of the household income in all countries, households of Eastern BSR remain highly price-sensitive to WM tariffs. The fees are generally too low for adequate investments into WM systems without governmental support or European Cohesion funds. This makes the municipalities increasingly dependent on European support schemes, which in turn require co-financing.

The financial capacity of municipalities to borrow from commercial banks is often limited (especially

small municipalities or those that have already invested in large infrastructures). This limits the size of investments making it difficult to build large-scale facilities and benefit from the economies of scale.

Another problem is that the available EU financing is used without proper planning and coordination, which can result in overcapacity of WM facilities. There is often too much focus on organizing the investment process itself (getting access to funding), whilst relatively little attention is paid to operational costs and the long-term perspective on future trends of waste generation levels, waste composition, recycling targets and other upcoming EU legislation promoting improved hierarchy solutions.

Many municipalities lack a sufficient analytical basis for decision-making which sometimes leads to environmentally and economically suboptimal decisions in long-term investments. Short-term perspective in municipal planning and a poor understanding of tomorrow's realities limits waste management possibilities in the future. Currently, many municipal WM plans are made on an ad hoc basis, in order to address the most urgent problems. Investments guided by short-term visions could be effective in addressing today's problem but fail to secure further improvement opportunities for the future. Investments into certain WM options may imply long-term financial and infrastructural commitment, eventually leading into deadlock situations.

CONCLUSION AND RECOMMENDATIONS

The introduction of common waste management rules, instruments and policies have paved the way for a more effective coordination of activities to deliver higher standards of living for the citizens of the Baltic Sea region countries, including overall environmental quality. However, in spite of good international and interregional contacts and communication, effective cooperation and coordination has yet to take full advantage of the new opportunities that EU membership provides to adequately address the common challenges related to waste management.

The EU is setting new goals and targets for waste recycling and waste prevention, including the goal of declining waste generation levels from 2020. Since the disparities in waste management standards within BSR are significant, achieving these targets requires cooperation and more coherent governmental actions within the Baltic Sea region.

Based on the results and findings of the RB21Tech project, the main recommendations for the strategic priorities of the municipal waste management strategy of the Baltic Sea region countries are:

- Maintain a waste management hierarchy as a key principle with lifecycle perspective.

- Create conditions for more competitive high-level hierarchy solutions by combining strict regulations with economic incentives and informational instruments.
- Apply known and well-tested informative, administrative and economic policy instruments to facilitate waste diversion away from landfills.
- More strategic focus on high-quality recycling; prioritize waste separation at the source by waste generators, focus on consistent and long-term improvement of separated waste quality (especially biodegradable waste).
- Facilitate cross-municipal cooperation and optimize the engagement of the private sector in competitive waste management by means of tendering and public-private partnerships.
- Pay greater attention to public participation; engage and motivate households to source separately; introduce mandatory sorting, combined with higher convenience and tangible economic stimuli.
- Improve the involvement of the industry (producers) by optimizing and strengthening extended producer responsibility systems.
- Improve the financing of waste management schemes through local and national mechanisms; improve the absorption capacity for EU funding with the long-term goal to reduce its significance.

Finally, information on best practices from across the EU should be collected, amassed and disseminated, making best practice systematically and proactively available to others. This will be instrumental in convincing people that fighting waste management is possible and effective.

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