

Port of Helsinki Ltd
Green Cruise Port -project

Summary of the

**Green Cruise Port Waste Management – Port
Reception Facility: Cost Efficiency and Future
Prospects Report**

11.5.2017

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1. Introduction

The EU directive 2000/59/EC that regulates how most of the Baltic Ports provide their reception facilities (PRF) is going to be renewed. The changing concept of waste, the end-of-waste criteria (Directive 2008/98/EC), is affecting to the renewal of this regulation. On the basis of the end-of-waste criteria specific fractions of waste can be seen as a product with economic profit (today e.g. metal and some plastics) rather than a waste fraction. The end-of-waste criteria and the Circular Economy will most likely open up a market for special waste fractions with economic benefit. The EU Commission gave out a Commission Notice 2016/C 115/05 on the PRF Directive in April 2016 which can be seen as a guideline of how the Directive will be renewed.

Due the changing concept of waste and in the context of renewing directive 2000/59/EC ports need to consider alternative ways of managing the waste streams. The purpose of this report is to study the cost efficiency of the PRF in the Port of Helsinki as it is today and to assess the future possibilities for changes in the PRF both from an economical and environmental point of view.

The Port of Helsinki has contracted Petra Erkkola and Ecobio Ltd to conduct this study that was conducted in summer 2016. The study is part of the EU's Interreg Baltic Sea Region program's Green Cruise Port –project. This is a summary of the project report.

2. Background

2.1 Legislative background

Laws that influence the waste management in the Port of Helsinki are IMO MARPOL Annex V, EU Directive 2000/59/EY, EU Directive 2008/98/EY, Finnish Waste Act (Jätelaki 646/2011) and Act on Environmental Protection in Maritime Transport (Merenkulun ympäristönsuojelulaki 1672/2009). In addition to these laws the Port of Helsinki also follows the “No-special-fee” system recommended by HELCOM RECOMMENDATION 28E/10 (HELCOM 2007). The Baltic Sea region is also designated as a “special area” in MARPOL.

2.2 Waste management in the Port of Helsinki

At the Port of Helsinki vessel waste management is operated through waste management companies contracted by the Port of Helsinki. When a vessel wishes to land waste in the Port of Helsinki, the “vessel-generated waste notification form” must be sent in 24 hours prior to arrival. The Port of Helsinki uses the waste notification format of IMO (MEPC.1/Circ.671/Rev.1).

The Port of Helsinki provides the collection of oily wastes, mixed solid wastes (including international food waste) and recyclables (cardboard, glass and metal) according to the regulation of IMO (MARPOL, Annex V). The waste management companies then collect and transport the wastes from the vessels to waste handling plants (for example Vantaa waste-to-energy Plant) according to the preferred timetable of the vessel. The recyclables (cardboard, glass and metal) are delivered to the containers at the quay by the vessel's personnel and the rest of the waste

fractions are collected straight from the vessel into trucks by the waste management companies.

Port of Helsinki uses the “no-special-fee” system recommended by HELCOM. Therefore the waste management is charged according to the size of the vessel and the household wastes generated in the regular use are not charged separately. Vessels can also leave their grey and black water to port without any additional charge. Since the year 2016 the Port of Helsinki has encouraged passenger vessels to leave their grey and black water to the port’s sewerage system by providing an incentive of 20% discount of the waste fee if sewage is pumped in the port.

Vessels always have to land wastes in the port according to the HELCOM regulations (HELCOM 2007). Vessels can also apply for an exemption from the waste landing from the Finnish Transport Safety Agency (Trafi) if there is no need to discharge any waste in the Port of Helsinki or the vessel has made its own landing and discharging arrangements with a waste management company. Due the great share of regular line shipping, over 80% of the vessel calls the Port of Helsinki had in the year 2016 were those vessels having an exemption from Trafi.

3. Study methods

Port reception cost facility efficiency is studied by conducting a case study in Port of Helsinki. This case study consists of analyses of the cost structures of the waste streams that eight different cruise vessels left at least at one port call in the Port of Helsinki in the summer 2016. The cruise vessels represent different cruise lines and diverse ages and sizes. The study is conducted by analyzing the filled waste notification forms of the chosen vessels and also visiting four cruise vessels with personal discussion with the Environmental Officer on board. The purpose of the case studies is to understand how the vessels process their waste on board - how the vessels separate the various waste fractions - and how the waste fractions are landed to the port reception facilities.

With this collected background data, an assessment of the cost efficiency and environmental efficiency of the port reception facilities is conducted. A digital platform “evolution®” (eqi-group.com 2016) is used to calculate the cost and environmental efficiency of the current waste handling practices and also to conduct a comparison of the current and potential waste handling practices. The considered waste fractions in these analyses are mixed burnable waste, office paper, cardboard, PET bottles, plastic wraps, glass, metal, food waste and energy fraction. Also the different waste handling costs (waste handling, truck or container rent and disinfection after international catering waste) are taken into consideration but the personnel costs are left out of the calculations. The impact of increased recycling to the total waste management costs were evaluated by analysing the waste structure and costs of one landing from each cruise vessel.

In addition other important observations on the waste management on board and on shore are also collected in order to achieve a good understanding of the current practices that could be improved.

4. Results

4.1 Cost structure of waste management in the Port of Helsinki

The total cost of the waste handling for the Port is created by various factors and also vary greatly between each vessel. The total costs comprise of work, weighing of the waste, possible washing of the waste truck (in the case of international food waste) and the processing of the waste itself. As shown in Figure 1, each of the analysed cruise vessel has a unique cost structure when it comes to waste management.

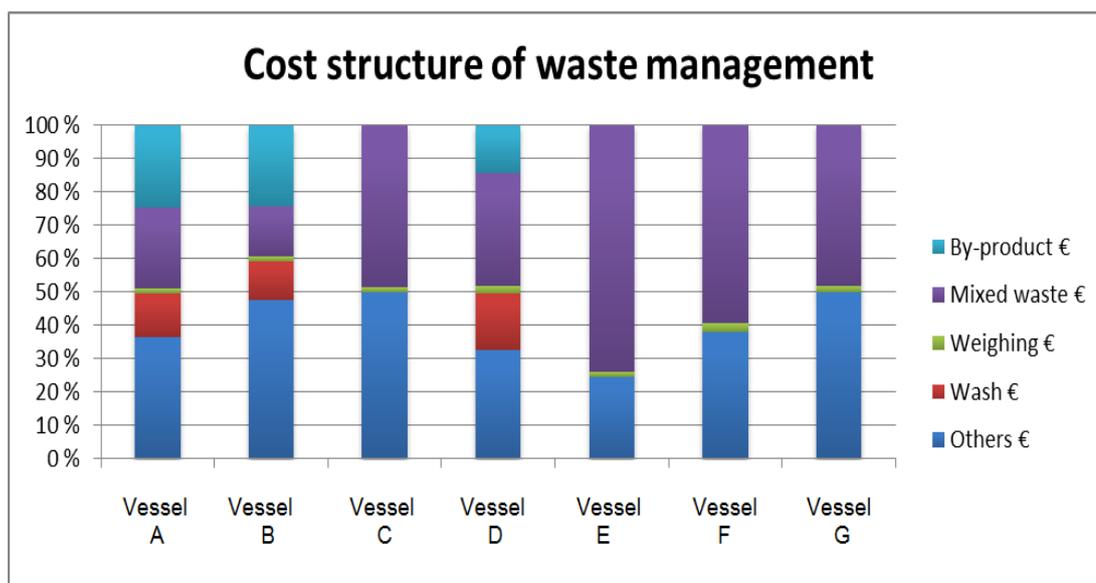


Figure 1. Cost structure of waste management in seven cruise vessels at the Port of Helsinki in the summer 2016

Different waste fractions have different costs to the port and they also have different impacts on the environment. When analysing the costs with the digital “evolution®” platform there can be seen that because mixed burnable waste is the most expensive fraction to handle, recycling and landing sorted waste is more economical for both the Port and the cruise vessels.

The changes in the cost structure that would have the most significant benefits from recycling is shown in the Figure 2 (in which case four landings were analysed): in this case the waste handling costs would be reduced by 45 % if all wastes were recycled. The percentual impacts that increased recycling has on the total costs of single port call of the studied cruise vessels are shown in the Table 1.

Table 1. Percentual changes in waste management costs for the Port if recycling was increased

Vessel	Cost reduction if all recyclables sorted	Cost reduction if sorted with energy fraction
A	- 41,7 %	- 42,2 %
B	- 4,7 %	- 11,3%
C	- 15,1 %	- 24,8 %
D	No discharged waste	No discharged waste
E	No discharged waste	No discharged waste
F	- 19,7 %	- 21,1 %
G	- 9,3 %	- 14,0 %
H	- 25,5 %	- 30 %

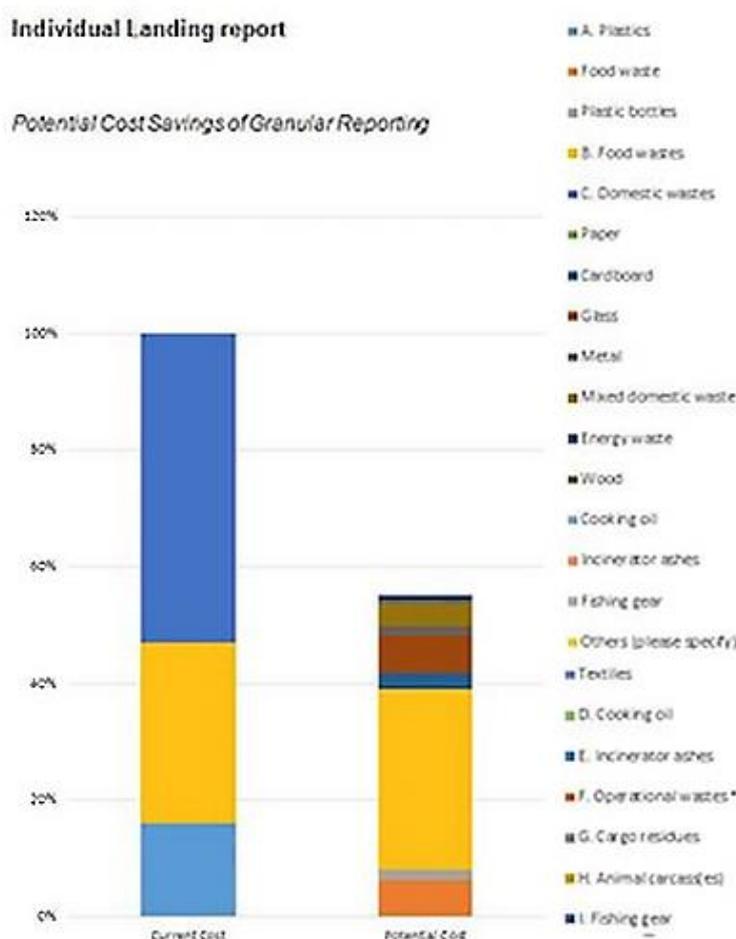


Figure 2. Increased recycling impacts on the cost structure of landed waste

Calculations of how recycling would affect to the costs of the cruise vessel A are shown in the Table 2. In this example the total costs would lower from 4375 euros to 2549 euros (or to 2527 euros if energy fraction is also collected separately).

Table 2. Calculations of the effects of recycling in the cruise vessel A

Fraction	Weights	Original cost	Potential cost
Mixed burnable waste	16 940 kg – 14 819 kg = 2 121 kg	2315,08	256,8 €
	2121 x 0,7 = 1484,7 kg		With energy fraction 30 % 179,7 €
Office paper			
Cardboard (compacted, 200 kg/m ³)	1694 kg (8,5 m ³)		119,8 €
PET bottles	20 m ³ x 125 = 2500 kg		281,8 €
Plastic wrap	5 m ³ x 125kg = 625 kg		70,45 €
Glass (1 m ³ = 1 ton)	5 m ³ = 5000 kg		395 €
Metal (1 m ³ = 1 ton)	5 m ³ = 5000 kg		70,45 €
Food waste	9 540 kg / 21 m ³	1 354,68 €	1 354,68 €
Energy fraction 30 %	2121 x 0,3 = 636,3 kg		56,6 €
Total cost		4375,4 €	2549 €
			With energy fraction 30 % 2528,6 €

4.2 Developing the waste management in the Port of Helsinki

Important details about waste management in the Port of Helsinki were noticed while conducting this study. First of all, the Port of Helsinki is currently serving the vessels according to the vessels preferred timetable. This is a very customer friendly method of working, but it might bring the total costs of the PRF higher. If the port would decide the timing of the waste landing, the waste trucks would not need to be hold waiting at the quay for the vessel's decision to start landing and therefore the transports could be timed more efficiently. Also there would be better opportunities to combine transportations if waste from several vessels could be collected and transported in one vehicle instead of two. Another thing that might bring the costs higher is that there is no limit of how much water the oily waste can contain and higher content of water could mean more trucks and personnel in the transportation process.

During the research period it was noticed that some vessels do not land their solid waste in the Port, even when they do not have an exemption from Trafi (Table 1). That is something that needs to be further acknowledged. On the other hand the incentive of 20% discount of the waste fee if the vessel discharges wastewater indicates that incentives are effective and other (cost) incentives could be implemented also into recycling.

It was also noticed during the study that the vessels might be hesitant to change their internal methods of waste handling just for the case of one port during their voyage. But when developing waste management in ports recognizable is that the Commission Notice on guidelines for the interpretation of Directive 2000/59/EC also gives space for regional waste management plans. For the near future there could be a national waste management plan among the ports of Finland and also a regional plan of the ports in the Baltic Sea. A regional plan for cruise vessels sailing the Baltic Sea with specific guidelines for each port ought to give special strengths to each port and enables the cruise lines to act further environmentally sound.

4.3 Observations made during the study

In the Table 3 there are listed opportunities and challenges on the different waste fractions and their collection both on board and at the Port that was found during the study. Other important observations made during the study are shown in the Table 4.

Table 3. Opportunities and challenges on board and at the Port.

Fraction	Opportunities & challenges on board	Opportunities & challenges at the Port
Mixed burnable waste	+ Fraction easy to sort down to recyclables – Lack of space on board → no space for sorting	+ Fraction easy to sort down → lower waste handling costs – High quantities, collection sorted not efficient currently. If wet high level of fuel needs to be used for incineration
Glass	+ Cruise lines wish to recycle. Crushers on board – Heavy fraction	+ Sorted on the majority of vessels – A number of vessels assumes recycling of glass is not possible in the Port of Helsinki.
Metal	+ Valuable fraction. Compactor on majority of vessels + Various metals already sorted on the vessel	+ Valuable fraction – Vessels will find another place to sell this fraction

PET - bottles	<ul style="list-style-type: none"> + Easy to sort. Compacted/crushed on majority of vessels. – Are vessels willing to sort this fraction? 	<ul style="list-style-type: none"> + Produced on majority of vessels. Easy to sort. Less impact on environmental footprint if recycled. – Low weight & small quantities
Wrapping plastic	<ul style="list-style-type: none"> + Easy to sort. Majority of supplies wrapped in plastic – Gets easily wet/dirty. Small quantities 	<ul style="list-style-type: none"> + Produced on majority of vessels. Easy to sort. Less impact on environmental footprint if recycled – Low weight & small quantities
Cardboard	<ul style="list-style-type: none"> + Easy to sort & produced on majority of vessels – Are vessels willing to sort this fraction? 	<ul style="list-style-type: none"> + Produced on most/all vessels – Already collected, but not efficiently
Paper	<ul style="list-style-type: none"> + Easy to sort – Are vessels willing to sort this fraction? 	<ul style="list-style-type: none"> + Produced on majority of vessels – Is the amount sufficient to allow cost effective collection?
Energy fraction	<ul style="list-style-type: none"> + Domestic waste mostly energy fraction. From cabins mainly energy fraction. – Are vessels willing to sort this fraction? 	<ul style="list-style-type: none"> + More economical for the port than domestic waste (25%). Can be used as a substitute for coal – Can the vessel retain the fraction dry?
International food waste	<ul style="list-style-type: none"> + Sorted on all vessels – Cruise vessels that visits St. Petersburg 	<ul style="list-style-type: none"> + Biogas. Not possible as of now. – Expensive. 2019 new regulation → higher quantities (& higher costs) to the port
Food waste	<ul style="list-style-type: none"> + Produced on all vessels – Difficult to reduce quantities produced on board 	<ul style="list-style-type: none"> + Biogas – Today yet no market for cruise vessel generated food waste
Wood	<ul style="list-style-type: none"> + Produced on all vessels – Some products can be reused on board 	<ul style="list-style-type: none"> + High quantities which could be better sorted → less domestic waste fractions – No constant landings. Vessels might want to hold on to the material

Table 4. Observations made during the project.

Observation regarding	Description
PET bottles & plastic wrap	These fractions are easy to sort on board the vessel and majority of vessels produce and separate them daily. Recycling plastic will reduce the environmental footprint of the Port. Easy to recycle. Today incinerated.
International food waste	Expensive fraction due to St. Petersburg not belonging to the EU. There are markets today for food waste being reused as biogas. Food waste needs high amounts of energy when incinerated. Change of MARPOL Annex IV 2019 (the latest 2021) → no sewage discharge into the Baltic Sea – food waste cannot be discharge with the sewage into the sea → higher quantities of food waste to the Port. Costs mainly for the ports. Expensive waste handling costs and stands for a large portion of the total waste management cost due to washing and disinfection of vehicle.
No Special Fee system	Not working as desired. The Port is visited both by vessels leaving exceeding quantities of waste as well by vessels leaving nil.
Waste notification form (MEPC.1/Circ .671/Rev.1)	The current form does not give room for notification of sorted waste fractions. Using a form with more options for recyclables and sorted fractions will result in better waste management and smaller environmental footprint. All the Baltic Sea Area ports ought to have the same format (not the case today).
PortNet	Online portal with updated format in the near future. The Port does not use it on a daily basis. The waste notification form ought to be the same for all the ports using the portal. The Port ought to discuss this matter with Trafi.
Energy waste	Energy waste that needs no extra energy for incineration (than mixed domestic waste) receives higher energy levels. It can be used for example as a substitute for coal in coal fired plants. Reducing cost and environmental footprint.
Wastewater incentive	20 % reduction on the waste fee for vessels leaving wastewaters shows higher amounts of discharged wastewaters to the port. This indicates that other incentives for sorting and recycling could result in higher level of recycling and through that smaller costs and environmental footprints.
Cost structure –	Many factors affecting the cost of the waste management. There can be significant differences based

waste management	on working hours and the international food waste fraction.
Decline in recycling rate	Based on the information from Suez the recycling rates since summer 2014 have significantly declined during 2016. An observation worth investigation.
Cost of landed sludge	Today the fee on landed sludge is not depending on the content of water, and therefore the vessels leave different concentrations of sludge for the same fee. Higher level of water results in higher costs for the Port.

5. Conclusions

The purpose of this study was to analyze the cost efficiency of the PRF in the Port of Helsinki and to assess the future possibilities for changes in the PRF both from an economical and environmental point of view. This analysis was made in the context of the changing concept of waste and of the renewing EU directive 2000/59/EC that will have an effect on how the waste management will be organized in the Port of Helsinki.

The calculations conducted show that it is economically wise to recycle. The Port of Helsinki ought to collect separately at least plastic (PET-bottles and wrap plastic), cardboard, paper, metal, glass and energy waste to achieve a better environmental and economic footprint. Also the benefits of collecting wood separately could be one thing to evaluate further. Energy waste, which consists of dry waste with high energy level when incinerated, is of great value within the Helsinki Area as the Vantaa waste-to-energy Plant extracts energy from household waste. The Port of Helsinki uses the standard MEPC form for the notification for waste landings, but the form does not give room for vessels to inform the Port of different fractions they wish to land. For example energy waste is not stated. It could be evaluated if the usage of a waste notification form, which better fits the provided PRF's, would facilitate recycling processes.

When the cost of waste landing is a set price, only impacted by the size of the vessel, there is little incentive for the vessel to conduct port specific procedures for the collection and separation of the waste on board to suit a specific port. The Port of Helsinki with the current pricing for waste landing and the procedures related to the waste has little possibility to impact the waste, which is landed, if landed at all. It could be further evaluated if some kind of incentive in recycling would work as efficiently as the discount from waste fee if black and grey water is landed in the Port. An incentive could also solve the current problem of landing oily waste with no limit of the water content.

Also, as stated earlier, the Commission Notice on guidelines for the interpretation of Directive 2000/59/EC also gives space for regional waste management plans. If the Directive 2000/59/EC is renewed in a way which makes the waste hierarchy

obligatory also for the PRF it would be recommended to create a waste management region in the Baltic Sea where ports would become specialized in specific waste fractions. Otherwise there might become significant pressure for higher waste fees due to numerous fractions needed to be collected in every port in the vessel's itinerary.

In conclusion, a short summary can be seen on Table 5 of the proposals made by the conductors of this study regarding the development of the waste management in the Port of Helsinki.

Table 5. Summary of the proposals that waste management could be improved

- Increase the amount of recycling – decrease the amount of waste
- Add an incentive to the formation of the waste fee to promote increased recycling of solid waste and decreased water content in the oily waste
- Combine transports of collected waste (especially international food waste)
- Consider the possibility of a waste management area (Baltic Sea for example) to facilitate best environmental and economical practice for the ship generated waste

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