CONVENTION FOR WASTE MANAGEMENT FOR INLAND NAVIGATION ON THE DANUBE

Report for technical contents of IDSWC in Hungary

Work Package 3: Ship Waste System Development

Activity 3.1: Contents of an international Danube ship waste convention

Output No: 3.8

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1 SCOPE OF DOCUMENT

The scope of this document is to give a basis to the compiled report for the technical contents of International Danube Ship Waste Convention. Based on a common structure, every country has to provide this necessary technical information. This document gives an insight to the major findings of previously elaborated reports in WP 3.2-3.5, selected in accordance with the mentioned goal.

2 SUMMARY

During the project each country had to prepare several national reports with regards to Ship Waste System Development. Most important aspects of this were identified already in the Application form, as follows: waste prevention and pre-treatment, network of Ship Waste Reception Facilities, implementation of Financing Model for a waste collection system and RIS support to waste management.

In this document country-specific information on the above-mentioned topics are collected and compiled to facilitate the final report, as the major output of WP3. The main goal of this report is to provide a comprehensive summary so far in connection with the implementation of the Convention in Hungary, taking all technical, infrastructural and financial aspects into consideration. Most sections of this report feature several references to other activities and outputs of the Projects, where the issues discussed below are elaborated in details.

The report is structured as follows. Section 3 gives an overview about quantitative and other qualitative attributes of the vessel fleet registered in Hungary. Section 4 contains the essence of what we discovered so far in relation to state-of-the-art waste prevention and pre-treatment technologies. Section 5 turns to the infrastructural side of ship waste disposal and treatment, by evaluating the currently available network of such facilities in Hungary. Section 6 outlines future possibilities of infrastructure development and investigates the optimal level of intervention based on the social costs and benefits of investment scenarios. Finally, Section 7 describes what effects the Convention's financial model will have on the Hungarian network and what regulatory and political measures will have to be taken for the sustainable financing of reception facilities.

3 VESSELS DATA

This section gives a basic overview of the vessel fleet registered in Hungary. This information may have particular importance during the financial and geographic planning of the waste reception network, as these vessels will form the demand side of the market.

3.1 Vessel register of Hungary

The national Vessel Registration System is regulated by Act XLII of 2000 on waterway transport and Government Decree No. 198/2000 (XI. 29.) on the registration of vessels and navigation facilities.

3.2 Vessels in different categories

According to the data received from the National Transport Authority there are roughly two hundred cargo vessels registered in Hungary. The following table summarizes the distribution of vessels types, based on engine performance.

The overall fleet of 315 vessels is operated by roughly 12 IWT companies. This number may vary due to often rather complication ownership relations between vessel operators.

Category	Overall propulsion power [kW]	Operating hours per day*	Self-propelled cargo vessels	Pushers	Passenger vessels	Total
I	<250	A1			38	38
		A2	4	10		14
		B				
II	250-500	A1			74	74
		A2		19		19
		B	23			23
III	501-750	A1				
		A2			8	7
		B	31	79		110
IV	751-1250	A1				
		A2			3	3

		B	14	12		26
V	1251-2000	A1				
		A2				
		B				
VI	2001-3000	A1				
		A2				
		B				
VII	>3000	A1				
		A2				
		B				
		Total	**72**	**120**	**123**	**315**

* A1: up to 14 hours per day; A2: up to 18 hours per day; B: Continuous operation

Table 1 | Distribution of vessel types, based on engine performance and configuration

4 WASTE PREVENTION AND PRE-TREATMENT PRACTICES ON HUNGARIAN VESSELS

In this report the specialities of Hungarian inland navigation and some general issues with regards to the onboard waste prevention and pre-treatment are shown. Beside the description of the legal framework, the main findings are the followings:

- there is not only potential for waste prevention, but if generation of the waste can not be avoided, there is also a great potential for pollution prevention;
- from the examination of reported handling practices it is obvious that onboard activities are done, in most cases, in accordance with the technical possibilities and circumstances;
- changing regulations and establishing sufficient subsidy funds in parallel would facilitate waste prevention.

The next sub-chapters describe usual handling practice experienced on-board Hungarian vessels and give on overview on the average waste amounts generated on these vessels. Finally, we list some proposals about prevention and pre-treatment measures.

4.1 Handling practices experienced on-board Hungarian vessels

According to the reports of representatives from IWT companies and to the questionnaires received from Austrian locks, the onboard waste handling practices are quite general. The following paragraphs summarize the main facts learned from a

questionnaire survey performed with the contribution of Hungarian skippers and vessel operators.

4.1.1 Cargo vessels

Concerning solid wastes, separated waste collection exist on most of the vessels included hazardous and non-hazardous wastes. But on board, there are no possibilities for any treatment due to lack of space, equipment and intention of the crew. In most companies, there is no dedicated status for waste handling, or education for the crew, the responsibility is generally assigned to the boatmaster.

Handling of liquid wastes is varying very much, partly due to the possibilities on board, partly due to the attitude of the crew.

On some vessels tanks for waste oil can be found, in this case they are used. Change of main engine lubricants are performed in two ways: it is either discharged directly to the bilge or collected into onboard tuns, barrels or tanks. According to questionnaires:

- in every vessel oily and greasy liquid wastes are collected in bilge;
- 2/3 of vessels has no oil-water separation equipment on board;
- in almost half of the vessels waste oil is collected in bilge...
- ...although more than 2/3 of them have bins for collecting waste oil separately;
- there are separate bins for oily rags in every vessel.

Concerning frequency of disposing oily and greasy ship waste, 60% marked the half year incidence, and 50 % the quarter year incidence. Only one mentioned more often disposal.

The on-board waste water handling shows quite uniformity. Generally the waste water goes directly to the waterway, without any treatment. On some vessels crew uses only that kinds of detergents which are environmentally friendly, and hence, direct discharge of the domestic liquids into the river is allowed. Only one questioned skipper said they have storage tank on board. Therefore, frequency of disposing waste water cannot be recognised, in fact it is done continuously. The unique storage tank equipped vessel reported a more than two weeks frequency.

Collecting separately the domestic waste is quite a common habit on board. 80% of the vessels have got some distinct bins for different types of waste. 50 % of vessels collect glass, plastic packaging and residual waste separately. 40% is the range of separate collection of waste paper, and 30% said, they separate metal packaging and food leftover as well. The domestic waste related disposal frequency, 70 % of the skippers reported for weekly disposal, and 30% for fortnight disposal. In connection with this, all the questioned skippers said that they deposit wastes at ports and locks.

None of the skippers applies onboard burning of waste (it is prohibited according to the national regulations, however, some exceptions are existing).

The handling habit with cargo residues also seems standard. The cargo hold mostly washed outside the port areas (90%), as well the washing water is discharged into the Danube (90%). Only those companies' aims to clean cargo hold, and deposit the washing water inside a port, which has its own port or has their base in a port.

4.1.2 Passenger vessels

In case of passenger vessels the importance of oily and greasy ship waste treatment is limited, because bilge water generation is almost negligible due. Most passenger vessels are designed well-isolated engine-houses. On the other house domestic and communal waste, mainly associated with catering services for passengers, is an increasingly challenging issue for vessel operators. Communal waste storage capacities of river cruisers and other passenger vessels is highly limited, as operators are forced to accommodate as many passenger cabins on board as possible due to economic reasons.

Appropriate port services are crucial to allow passenger vessels to dispose domestic waste frequently. Strong efforts should be done on the Budapest section of the Danube, which is among the top touristic destinations on the river, to establish appropriate domestic waste collection services for the booming cruise industry.

Cruising boats/passenger liners

Unfortunately, separated waste collection of solid wastes does not exist on all types of vessels handled by MAHART Passnave. With regards to the domestic refuse, it was also reported that no onboard treatment is possible due to lack of space. Although compressing of some kind of domestic refuse can reduce the space requirement, it would be only a part-solution since after compression the waste is not selectable and has a higher weight which makes its handling more difficult. The waste is disposed daily at the pontoon to which the vessel is usually moored to appropriate storage bins.

Amount of domestic sewage – especially on well-utilized vessels – is greater, but on most vessels, there is neither a tank for storage nor water-purification equipment, so it is not collected but discharged directly to the river.

Storage of food leftover is not practical due to hygienic reasons and hence it is emptied from the vessels daily. This is the only waste type that is collected separately.

Oily water is collected in the bilge, no onboard treatment is done at MAHART Passnave. In case of those vessels, where oily bilge water is generated, it is sucked out of the bilge of the vessels to appropriate barrels at the home port of the company.

Cabin vessels

With regards to the solid waste collection from the cabin vessels which generate a huge amount of this waste type, it can be said according to the report of MAHART Passnave, that the vessels collect solid wastes separately, but no other onboard treatment is carried out. Considering the general arrangement of an average cabin vessel and the fact that the onboard collection of waste is concentrated to astern of the vessel, the disposal of solid wastes is rather difficult when the vessel is moored to a pontoon. In this case the aft part of the vessel is far from the shore, and as a result, the direct disposal from stern to shore is impossible. If a self-propelled collection vessel is not available, all waste should be disposed through the vessels' main corridor and the pontoon, which is a very inconvenient way. If the cabin vessel can moor to a vertical quay (this is mostly the situation at locations where water level is constant), the disposal is much easier.

Concerning the onboard activities on cabin vessels, it was told by the interviewed skipper, that oily and greasy wastes are generated in a smaller amount, collection and handling of domestic sewage is properly solved, but in case of domestic refuse and food leftovers there are certain points to improve.

The average amount of produced oily water and waste oil on-board are about 1000-1500 litre/season and 600-700 litre/season, respectively. A normal season for cabin vessels operating in Western-European waters lasts for 6-7 month (from April to October) and a normal vessel is equipped with 2x750 kW propulsion power. The vessels are rather new, with special driving units which ensure the small amount of oily water. However, the operation of the "hotel" needs lot of electricity and hence more auxiliary power, that is the reason for the relatively higher numbers for the waste oil, compared to the oily bilge water. The disposal of these wastes is done normally in the CDNI system, 2 times in a season.

The domestic sewage and its sludge are generated in a much greater volume, due to the high number of passengers. The big cabin vessels have about 160-220 passengers and 40-50 persons as crew. Taking an average value into account, this means that 25-30 m^3/day of sewage is generated. This high amount is handled, in most of the cases, by modern cleaning equipments in a separate cleaning room. The cleaning is a three-step procedure after which the sludge remains on board in dedicated tanks and the cleaned water is discharged to the river. The sludge is removed once a year, after the end of the season, by specialist company. The faecal matters are handled separately with special chemical treatment. The treated residuals are discharged to the water as well, since disposal of such wastes are not solved yet. The discharge is usually made to the main stream of the propellers, on waters where the river has a noticeable current speed (not at lock areas).

Handling of the solid domestic wastes has to be differentiated. Food leftovers are collected separately in 60 l plastic barrels. Specific amounts have to be disposed according to regulation existing for the Rhine –region. Booking of the disposal is done similarly to the oil control log. However, the defined volume that is to be disposed is much lower than the generated. Service of collection should be paid as per the collected/disposed amounts. As a result, only the amounts specified by the regulation are disposed. The others are "treated" on-board with macerator pumps and thrown overboard during nights. Considering the previously mentioned passenger number, 1,5-2,5 60 l barrel/day of food leftover is produced on an average cabin vessel.

Other solid domestic wastes, like packaging, papers, plastics, are collected separately in appropriate sacks and disposed at locks, ports or other places where possible. Huge amount is generated, 1,5-2 m^3/day. In some ports located in the heart of a city, disposal is not easy due to the fact that the bins for wastes would be used publicly. This can easily result in that there is not enough place for the wastes from the vessels, and charging can't be executed properly.

Handling of glasses seems to be a great challenge/problem for cabin vessels. Glasses of fresheners are returnable and hence should be kept on board while they are not returned. On the other hand, the bottles of wines and spirits are rarely returnable, so after emptying they become wastes. Both types of bottles and even the broken glasses (approx. 10 pcs./day) raise the question of storage. In general, it can be stated that cabin vessels' storage volumes are under-designed due to economical reasons therefore keeping glasses on-board is a great problem for the crew. This led to the practice that the glasses are broken and the scraps are thrown to the water. Several buckets of scraps per 4-5 days are left the board in this way. (Not only the storage of wastes, but also the storage of provisions are a common problem on board. The vessels are often obliged to pay penalty for reduction of emergency corridors and exits with provisions.)

Most of the Hungarian passenger shipping companies perform ship-borne waste management within the company's facility (it should be mentioned that this is a kind of constraint, as there is no publicly available service at Budapest). The cost of waste collection is not separated from the normal operational costs and hence no information on this could be gained. However, it can be stated that charging for waste collection is done according to the disposed amounts, the payment is done subsequently by the company, and not by the skipper.

4.1.3 List of good practices

- Separated on-board tanks for waste oil. Change of main engine lubricants performed by collecting them in on-board tuns, barrels or tanks.
- Oil-water separation equipment on-board, in case sufficient space is available on the vessel.
- Unique storage tank for waste water, disposal in a more than two weeks frequency.
- Domestic waste collected separately with weekly or fortnight disposal
- Cargo residues washed out within port areas, using dedicated equipment for washing water discharge.

4.2 Average waste amounts generated on board Hungarian vessels

4.2.1 Cargo vessels

Statistics:

The amount of bilge water generated is influenced by the age, construction, equipment and maintenance of the vessels as well as the demanded engine activity, which itself depends on several other factors (upstream or downstream way, cargo load, etc.). For the Danube region, approximations were made in the late 1990s, stating that the average quantity for cargo vessels in the Danube region would be about 4.2 m³/ship/service due to the high age of the fleet. For passenger vessels, floating cranes and other type of working units 2.1 m³/service, for pleasure boats and motor yachts 0.05 m³/ship/service were stated. Based on the assumption that all vessels included in Danube Commissions statistics were in operation, the total amount of generated bilge water in the Danube Region was about 15,000 m³/year (Phare, 2000).

The average amount of waste oils, collected by (mobile) bilge water collection vessels together with bilge water in Germany, ranges between 100 and 125 litres per ship and service. If the whole amount of oil is changed, the amount can be up to 500 litres in twin-engine vessels (Gabriel, 2001).

The amount of other oily and greasy ship wastes collected average between 10 and 20 kg/ship service (Gabriel, 2001).

Other hazardous wastes are produced sporadically, the amounts are rather low: 6.3 kg/service were collected on a collecting vessel in Switzerland; the share of wet batteries was about 4.5 kg/service. However, for cargo vessels, the range of other hazardous wastes can be estimated between 5 and 10 kg/service (Gabriel, 2001).

The annual amount of recyclables produced on cargo vessels can be estimated to be 65 kg/crew member, which is equal to a volume of about 700 litres/year and crew member (Gabriel, 2001).

The amount of residuals produced on cargo vessels is about 130 kg/crew member/year, which equals a volume of 1,200 litres/crew member per year (Gabriel, 2001).

Amounts collected in Budapest and Baja in CO-WANDA Pilot Action:

During the summer, 2013, Pilot tests were carried out in several Danube-riparian countries in the frame of CO-WANDA project. Although the main goal of the pilot was to gather information of an electronic vignette system implemented for the management of waste disposal, data for the disposed wastes were also gained. The average values can be seen in the following table.

	Oil-contaminated filter materials (kg)	Oil-contaminated cleaning rugs (kg)	Used oil (kg)	Lead batteries (kg)	Bilge water (kg)
Budapest (9 vessels)	3 0,3 /vessel	240 26,7/ vessel	280 31 / vessel	0	47000 5222/vessel
Baja (14 vessels)	80,5 5,7 /vessel	76 5,4/ vessel	999 71,4/ vessel	0	32400 2314/ vessel

Table 1 | Collected waste amounts during Pilot action in HU, 2013

However, with regards to the data, the followings should be kept in mind:

- disposal was free of charge
- most of the shipping companies which took part have collected all of their oily and greasy ship wastes using the possibility of free elimination – the collected amounts were more than normal;
- the Pilot was carried out right after the high flood in summer, 2013;
- other shipping companies had get rid of their wastes before the flood – the collected amounts are less than normal averages, as these companies didn't take part in the Pilot.

As a consequence, according to our opinion, the data from the Pilots do not give a realistic picture of the generated and normally disposed amounts of ship-borne wastes.

Interviews, questionnaires:

Unfortunately, from the questionnaires no average values of the different waste types can be gained. During the interviews averages values were asked, but the representatives of the shipping companies described how hard to tell this exactly due to its strong dependence on numerous factors. This may be the reason for the missing answers in the questionnaires, as well.

4.2.2 Passenger vessels

In the case of passenger vessels it is even harder to give good and useful values of generated waste amounts. It is wise to separate cabin vessels and the smaller passenger liners/cruising boats. The vessels in the former group are rather new, while the latter group contains older vessels, some are more than 30 year-old, representing a much older technology.

The literatures quoted with regard to cargo vessels provide specific data only for the oily bilge water and domestic sewage. It mentions 2.1 m^3/service for bilge water, however it is sure, that for cabin vessels this is not the case. Lot of them equipped with the most trendsetting diesel-electric drive units, and as a result, very little amount of oily bilge water is generated. The value can give an indication for the smaller passenger vessels only.

Waste oil is collected always separately on the new cabin vessels, while this is not true for the smaller boats.

In case of waste water, for cabin vessels the total amount of water can be estimated from 150–230 l/person/day (via donau, 2008; Dorgeloh, Kaiser, Reitz, 2007). On passenger liners/cruising boats the generated amounts are lower; one detected value is that about 35 % of the above mentioned 150 litres/person/day, which equals 2 l/person/hour can be used for the design of on-board purification plants. About 3 % of on-board treated domestic sewage remains as sewage sludge, the remaining 97 % can be discharged back into the waterway as clean water (via donau, 2008).

From the interview made with representative of MAHART Passnave Passenger Shipping Ltd. it was clear that the company does not have available statistics regarding the amounts of different types of wastes. The main reasons were said as follows:

- the big difference in the operational profiles of the vessels they operate in charter or scheduled mode;
- the seasonal operation;
- varying number of passenger/utilisation of the vessels;
- no statistics on number of passengers in charter mode;

- difference in technical solutions – they have vessels with shaft sealing in the engine room and others in which the shaft sealing is in an other compartment without oil generation inside.

4.3 Proposed prevention and pre-treatment measures

Prevention and pre-treatment measures can be divided into two groups of technical and legal measures. According to general waste management principles, one of the most efficient ways of environmentally friendly operation is to provide incentives to prevent the generation of waste. The following sub-sections investigate major elements of prevention on cargo and passenger vessels.

4.3.1 For Cargo vessels

Technical and legal measures as well as some other measures can be identified, which can help to prevent the generation of too much waste onboard. The technical measures are listed below:

- for separate collection and storage, a properly-sized tank for waste oil on every vessel;
- for separate collection and storage, a properly-sized tank for sewage water on every vessel;
- appropriate plumbing for easy discharge from these tanks and from the bilge;
- that kind of system design that ensures the possibility to discharge the used engine oil to the waste oil tank and not to the bilge (e.g. the waste oil outflow of the engine should be connected to the waste oil tank);
- wherever is possible, the compartment of shaft sealing should be separated from the engine room – this can prevent to enter to much water to the always-oily bilge of the engine room, reducing the amount of oily water.
- modernisation of shaft sealing;

The legal measures can be all measures that:

- legally facilitate the above mentioned technical solutions by modifying the existing regulations on inland ship design;
- determine internationally harmonised rules for the onboard waste handling practices;
- ensure strict but clear control and punishing practices;
- precisely entitle the tasks and responsibilities of relevant national authorities for controlling and monitoring onboard activities. Monitoring and control have to be harmonised as well.

Other measures are:

- application for funds reserved to encourage and improve onboard activities/retrofitting of vessels with regard to the waste prevention;
- training and education programmes for crews and stakeholders – to let them know their possibilities in the field of waste prevention.

It is hard to estimate the cost of the technical measures listed above. In case of a new-built vessel or in case of retrofitting originated by other reasons (such as engine replacement), these measures cost almost nothing compared to the whole investment. It is not realistic that a vessel owner will perform such technical modifications unless it is not obligatory or necessary due to a failure.

The cost of the change of relevant regulations is also unpredictable since administrative costs can hardly be allocated for specific activities. The result of legal framework changes surely costs a great amount of money both for the vessel owners (due to necessary technical modifications) and for the national administration (due to increased monitoring and control activities). However, it has to be also taken into account, that without international legal assignment of the tasks, no government allocates financial resources for such activities from the national budget.

Clear benefits of the above detailed measures are the reduction of waste amounts and the increased awareness of environmental protection among skippers.

4.3.2 For Passenger vessels

In case of cruising passenger vessels, mainly the same technical and legal measures that were already mentioned for the cargo vessels can be listed.

The technical measures are mostly in relation to the liquid wastes. One addition can be made: for smaller passenger vessels, the application of water purification equipment may not be justified due to the smaller amount of waste, but further research work can show if it were necessary. However, a storage tank would be favourable in any case.

With regards to the solid wastes (like domestic refuse), the reason for generation of huge amounts of this waste type is the operation itself. Serving passengers with food, drinks and other consumer's goods means that all of the package will be waste at the end. Hence prevention would mean to change the whole system which seems to be impossible at this moment (This is a question for the whole society, too.). Although compressing of the packages can reduce the volume and space requirement of some type of domestic refuse but it does not decrease the weight and the amount of the wastes.

If waste generation could not be prevented, pollution should be prevented as a second step. To change the regulations for ship design and building would be a technical-legal

measure against illegal pollution of solid wastes (glasses). A proposal can be that regulations for the design of inland cabin vessels have to be modified in a way that storage volumes either for provisions or wastes should be calculated according to the number of passengers and trips a vessel done without mooring.

It was said by MAHART PassNave that although ship waste collection from passenger vessels can be managed, at Budapest, there is a great potential in infrastructure development in this field. Taking the special local conditions into account, ship waste collection would be more beneficial from the river-side instead of from the bank-side. This raises the need for a custom made, purpose-built, self-propelled collection vessel, specially operated in line with the passenger vessels' requirements. Other concept is to combine a waste collection vessel with supplying functions to provide cabin vessels with all the provisions (fresh water, fuel, food, drinks, magazines, etc.), which are necessary for vessel operation and the crew itself. However, feasibility of these concepts are not elaborated yet.

5 EXISTING SHIP WASTE RECEPTION FACILITIES in Hungary

5.1 General description of WRFs and its services

According to Ministerial (GKM) Decree No. 50/2002. (XII. 28.), Article 28, "*the reception and proper treatment should be assured for ship-borne cargo residuals in commercial ports, and for solid wastes, oily bilge-water and other sewage water in all ports*". In other words, in theory all Hungarian ports are equipped with basic waste reception and treatment infrastructure. However, in the everyday practice waste disposal is almost absent in ports, and these services are not promoted among commercial port activities. There may be various reasons behind this phenomenon: the ease of illegal waste disposal, outdated technical conditions and economically unviable operations are definitely among the most important ones.

As a consequence, only two waste reception facilities remained in daily commercial operation in Hungary: the Green Terminal in the port of Baja, and the newly established Green Island facility in the heart of Budapest. In case of Baja there are serious threats of unsustainable economic conditions – the operator (Baja Public Port Kft.) financed the investment with public subsidies, and the current demand for its services seems to be insufficient to cover operating costs in the long run.

In case of the Green Island infrastructure in Budapest the main threat could be the lack of OGSW capacity: the facility is equipped with a $9m^3$ storage for oily water and the on-board separator needs 5-6 hours to process this amount. As a consequence, the current setting will not be able to accommodate high frequency demand. On the other hand, the

fact that the Green Island is equipped with a high capacity collector vessel, makes the new service much more attractive for skippers than any other waste disposal possibilities in Hungary.

It is important to note that only Baja is equipped with acceptable waste reception facilities among national public ports. Such services are not available in the port of Budapest-Csepel and Győr-Gönyű. Dunaújváros, which attracts the biggest waterway traffic in the country in terms of cargo volumes, is not equipped with state-of-the-art waste disposal facilities either.

Company	Tanker Port Kft	Baja Public Port Kft
Location	Budapest 'Green Island'	Baja 'Green Terminal'
Fee type	Direct payment (Pre-determined or negotiated price based on waste type and quantity.)	Direct payment (Pre-determined or negotiated price based on waste type and quantity.)
Payment method	Bank transfer, advance payment or on-site cash payment	Bank transfer, advance payment or on-site cash payment
Current tariffs of OGSW reception	30.00 EUR/m^3	35.00 EUR/m^3 1 EUR/kg
Tariffs of other services	Hazardous waste: not accepted Domestic sewage: 5.00 EUR/m^3	Hazardous waste: 5 EUR/piece Domestic sewage: 5.00 EUR/m^3 Used oil: 15 EUR/m^3

Table 2 | Waste reception facilities in Hungary and their tariff model

5.2 Wastes collected in last years

As the Green Island facility in Budapest has not been operational until 2014, the only reliable source of data is the Green Terminal of Baja. They have reported that they served 10 to 20 vessels annually (19 in 2011, 9 in 2012 and 15 vessels in 2013). The average amount of occasionally disposed waste was 1750 m^3 in case of waste oil, 2800 m^3 for oily water, 63 m^3 for solid oily and greasy ship waste and 5 kg of other hazardous ship waste.

5.3 Financial data

Financial data collection was also restricted to the Green Terminal waste reception facility. Costs can be divided into fix (output-independent) variable costs, as detailed below.

5.3.1 Fix costs

Employee:	***EUR/year***	*30.840*
Overhead:	***hour***	*3.2*
Permissions and certificates:	***EUR/year***	*1.534*
Maintenance:	***EUR/year***	*4.734*
Other, (please specify):	***EUR/year***	*amortization: 16.667, renting fee: 3.334*

Table 3 | Fix costs of waste reception facility operations in Baja

5.3.2 Variable costs

Oily and greasy ship-borne waste	*Used oil*	*0 EUR/m3*
	Bilge water	*0,4 EUR/m3*
	Other oily and greasy waste	*0,24 EUR/kg*
Other ship-borne waste	*Other hazardous waste(storage battery)*	*0 EUR/kg*
	Domestic sewage	*0,85 EUR/m3*
	Sewage sludge	*-*
	Domestic refuse	*-*

Table 4 | Variable costs of waste reception facility operations in Baja

It can be inferred from the experience summarised in Section 5 that even though sufficient capacity is available on Hungarian stretch of the Danube, the quality of service of these facilities is not high enough to minimise skipper's costs. The regular use of waste collecting vessels would reduce the necessary time of waste disposal, thus making the service more attractive for skippers. The following chapter investigates the trade-off between advantages and disadvantages of stationary facilities and collection vessels. The future infrastructure development concept should be based on balance between operation costs and user benefits.

6 INFRASTRUCTURE DEVELOPMENT CONCEPTS IN HUNGARY

The main goal of Activity 3.3 has been to survey the currently available infrastructure of ship-borne waste deposition in Hungary, analyse possible alternatives for future infrastructure development and compare and rank these alternatives in such a way that is able to outline a strategic plan for the upcoming years. Two separate studies have been elaborated within Activity 3.3; one dealt with waste management needs of the cargo sector

and another investigated the same problem focusing on passenger transport, with special attention to Budapest as a rapidly growing market of waterway tourism.

This section summarises the main findings of these reports, highlighting how the proposed infrastructure development concepts will support the establishment of the standardised international waste reception network along the Danube. Finally, Section 6 gives an overview on the preliminary estimation of investment needs and financial feasibility of the proposal.

6.1 Summary of National Infrastructure Development Concepts

Due to special needs and peculiarities of passenger and cargo vessel's waste disposal, Activity 3.3 has been split into two part. The underlying methodology of scenario evaluation is identical in the two parts. The next two sub-chapters summarize the main results of the analysis of infrastructure development alternatives.

6.1.1 Cargo Vessels

The first study elaborated in Activity 3.3 dealt with the currently available infrastucture of cargo vessels and outlined future perspectives for development. There development scenarios have been identified in the study:

- NET-HU-1: waste collection solely based on collection vessels
- NET-HU-2: mixed collection with the parallel use of small collection vessels and stationary port infrastructure
- NET-HU-3: waste collection solely based on a network of port facilities.

Benchmarking of the proposed alternatives has been performed considering multiple evaluation criteria. Fixed investment costs as well as variable maintenance costs have been estimated for individual collection vessels and stationary facilities. These elementary information have been summed up to get an approximate cost structure for the three network designs.

Benefits of the alternatives consists of several elements in the study, such as

- the quality of service in terms of transhipment time and temporal availability,
- geographical coverage,
- dependency on water levels and other weather factors,
- availability for various vessel types,
- capacity utilisation,
- energy efficiency.

The study gives a detailed explanation of the methodology they used to measure the estimated befits for the end users and other agents of the society. Benefit factors are then weighted based on the subjective evaluation of their importance: service quality has become the most important aspect with almost 50% weight, followed by network coverage as the second most influental parameter. According to the benefit analysis' outcome alternative #1 provides the highest utility, while the benefits provided by

the second alternative is just 4% lower than in the first case. Alternative #3 has significantly lower utility (only 64% of NUET-HU-1), mainly due to the absence of flexibility that collection vessels can provide.

However, comparing all costs benefits of the three scenarios, the study concluded that NET-HU-2 has the highest benefit-to-cost ratio. One of the most important reasons explaining this outcome is the high fixed investment cost of collection vessels. The study also investigated an modified version of NET-HU-1, in which case these fixed costs are split between four neighbouring Danubian countries, assuming that these countries will jointly operate collection vessels. Economies of scale of international cooperation result in significant savings for individual countries; this variant outperformed the benefit-to-cost ratio of the second alternative.

6.1.2 Passenger Vessels with special attention to Budapest

In recent years the Hungarian capital has become one of the most frequented tourist destinations of the Danube Region. The city is especially attractive for those who arrive by cruise liners to Budapest, as lots of tourist attractions are located in close proximity to the river itself. As a consequence, the cruise industry is flourishing in Budapest and the growth rate of the sector is expected to remain seady according to forecasts.

Ports for passenger ships with large traffic are integral parts of the Danube bank; a large number of saloon- and hotel boats transports tourists here on a daily basis. Unfortunately, the Budapest port infrastructure suffers serious insufficiencies compared to that of the similar Western European cities. The main - and maybe the most important - insufficiency is the appropriate management of the communal waste produced on liners. Due to the characteristics of the Danube bank in Budapest, the transportation of the waste produced on the ships can only be solved in a difficult and not so civilized manner using traditional devices.

The purpose of the passenger shipping related study in Activity 3.3 has been to investigaet how to ensure the most optimal implementation of collection-handover and disposal processes regarding waste material arising from touristic activity (primarily from pas-senger shipping) in the area of the Danube bank in Budapest, forming the part of the World Herit-age.

Within the study the authors investiged five different infrastructure development alternatives, where the collection method, the location of fixed port infrastructure and the magnitude of activities were variable attributes. They compared these alternatives based on investment costs, maintenance expences and the available financing tools.

Results showed that the optimal and plausible waste collection method seems to be the handover of the material from the water side, loading it onto the coast in a specific, properly designed port.

The collecting (sanitation) ship is an essential tool regarding all of the solutions detailed in the study, on the board of which cargo containers can be transported. The application of a RO-RO type sanitation ship of the appropriate size, may also be a solution, with which the garbage can be directly disposed, measured by an etalon container into a conventional sanitation truck transported by the ship, but in this last case a ramp port is needed, where the truck can roll on and off. The volume calibrated measuring container is needed for the accurate determination of the settlement.

It is important from an economical point of view, that the unloading port should be as close to the passenger ship port as possible, that is to minimize the number of operation hours required for the exchange/emptying.

6.2 Accordance with the proposed international network

The proposed infrasturcture development concepts are in accordance with the international network in the sence that the scenarios have been designed to adapt the technical requirements outlined in the CO-WANDA project. The cargo waste reception study referred to above does not specify concrete locations for stationary facilities, keeping enough room the adjust the Hungarian network design to the pattern to be decided within the framework of the Convention.

Sub-section 6.1.1. showed provided strong evidence about the importance of international cooperation: significant economies of scale can be exploited through the joint operation of vaste collection vessels. Said differently, Hungary's proposed infrastructure development plan builds heavily on finding optimal solutions on international level, instead of treating the Hungarian stretch of the Danube as an isolated market.

6.3 Financial resources

The Danube forms the backbone of the Trans-European Transport Network's Rhine-Danube Corridor, facilitated by the European Commission: "the TEN-T objectives are set at EU level, and initiatives of those who may help achieving them are welcome. With the 26 billion € budget of the Connecting Europe Facility, the Commission may stimulate such action. It hopes that the corridor approach, with "major-project-pipelines" in the centre, will at the same time become a genuine field for promoting a forward-looking transport system, for stimulating ideas and benefiting jointly. With this ambition in mind, the Commission would like to see the nine core network corridors to be forerunners of a full core network, to be completed by 2030." Considering these principles published by the European Commission waste reception facility developments may expect financial support from the Connecting Europe Facility.

Another potential source of financing may be the Operational Programmes of the 2014-2020 financial period. Within the Intelligent Transport Operational Programme Hungary committed itself to support the competitiveness of ecological transport solutions, i.e. inland waterway developments among others.

Finally, market financing, for example in the form of venture capital may also complement national and EU financial resources, as the financial model of the Convention is intended to realise at least self-financing. Profitability cannot be excluded in case of efficiently operated waste reception services.

7 IMPLEMENTATION OF A FINANCIAL MODEL ON NATIONAL LEVEL

International as well as national policies aim at the application of the Polluter-Pays Principle, meaning that the waste producers have to contribute to the arising costs of processing their wastes. However, direct payment in combination with high disposal prices lead to avoidance reaction of vessels, which then discharge illegally. Therefor a vignette system has been suggested as most feasible solution for the Danube Region and tested comprehsively during the CO-WANDA Pilot Actions in several Danube countries.

The Implementation Manual for Financing Model in Hungary (Activity 3.4) investigated the possibilities for implementation of the proposed financing model for oily and greasy ship waste in Hungary and highlight the most important steps and changes to be set. Therefore it is necessary to investigate the national legal and administrative situation of financing oily and greasy ship waste at first and detect the most important stakeholders involved. This process includes the consultations with national authorities and stakeholders, including the National Transport Authority (NKH) and the Ministry of National Development (NFM) responsible for inland navigation in Hungary.

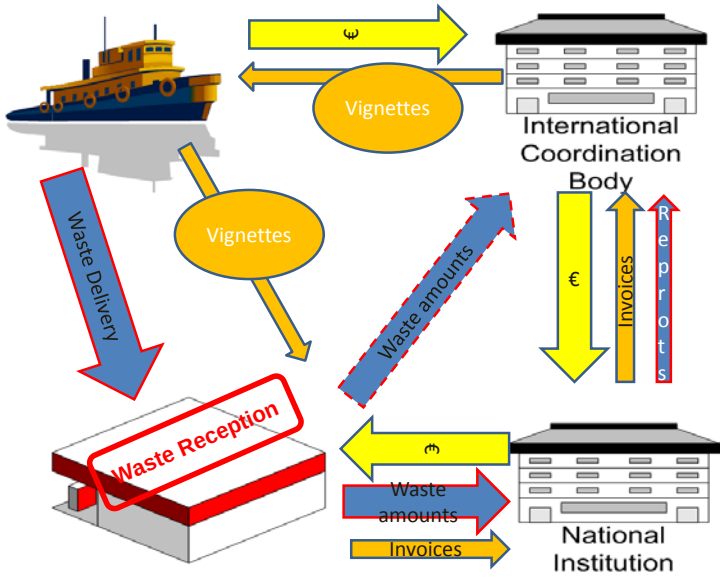

Figure 5 | Graphical concept of the international Financing Model

7.1 Currently applied Financing model for Oily and Greasy Ship Wastes

In general, it has to be emphasized that waste reception services are not financially regulated in Hungary. As a consequence, service providers who fulfill all technical and legal requirements and possess environmental licenses are allowed to operate reception facilities on their own risk, without restrictions on their financial model, tariff system and profitability. Implementation of the Financial Model outlined in the CO-WANDA project strongly depends on whether all current waste reception stations will be integrated into the CO-WANDA network, or competition will be allowed between the newly established CO-WANDA network and independent service providers. Based on the current market structure of waste reception services, we identified the following scenarios:

A. Full market regulation

All existing and newly established waste reception points would be part of the network with CO-WANDA EVS coverage. That is, price regulation would be applied (vignette prices would be centrally determined by the ICCB) on the market of waste reception services, all operators would be obliged to provide services for vessels with valid electronic vignettes and all declared and eligible costs of operators would be recovered through the international clearance mechanism.

B. Competitive market with EVS network and independent operators

Existing and newly established waste reception service providers would have the choice of joining the EVS network in a predetermined process (not elaborated so far), and operate under the Financial Model of CO-WANDA, or providing services on their

own financial risk and applying tailor-made tariff systems. Members of the CO-WANDA network should be chosen by the National Institution in a tendering process, based on the criteria predefined in the Convention and the Network Optimization Model. In this scenario independent operators would compete with the EVS network and they would not be forced with market regulation to apply standardized tariffs.

Most ports in Hungary are partly or fully equipped in technical terms to provide waste reception services. However, only two operators offer dedicated reception services for skippers: Tanker-Port Kft, owner of the 'Green Island' infrastructure in Budapest, and Baja Public Port Kft, operator of the 'Green Terminal' in Baja. Both service providers act on a competitive market, therefore the insight into their business model (e.g. how their prices are determined) is limited. We summarize existing date on their financial model below.

Company	**Tanker Port Kft**	**Baja Public Port Kft**
Location	Budapest 'Green Island'	Baja 'Green Terminal'
Fee type	Direct payment (Pre-determined or negotiated price based on waste type and quantity.)	Direct payment (Pre-determined or negotiated price based on waste type and quantity.)
Payment method	Bank transfer, advance payment or on-site cash payment	Bank transfer, advance payment or on-site cash payment
Current tariffs of OGSW reception	30.00 EUR/m^3	35.00 EUR/m^3 1 EUR/kg
Tariffs of other services	Hazardous waste: not accepted Domestic sewage: 5.00 EUR/m^3	Hazardous waste: 5 EUR/piece Domestic sewage: 5.00 EUR/m^3 Used oil: 15 EUR/m^3

Table 6 | Financing model of existing waste reception facilities

From this table we can infer that both reception points are operated under roughly the same financial model and prices are also rather similar. It has to be mentioned that the Green Island station in Budapest becomes operational during 2014, while the Green Terminal of Baja has been founded in 2011. It is possible that the newcomer's pricing decision reflects a follower market strategy, which results in similar prices.

Note that by the time of finalization of this document hazardous ship waste reception services are not offered by Tanker Port Kft.

7.2 Legal-administrative basis (which laws)

There is no specific regulation regarding the pricing of waste reception services. The following legal acts have been scanned during our investigation: Act CLXXXV. of 2012 on wastes; Ministerial Decree No. 145/2012. (XII. 27.) on the detailed regulations of waste management activities with regards to waste oil; Ministerial (NFM – Ministry of National Development) Decree No. 57/2011. (XI. 22.) on the order of the Waterway Traffic; Law XLII of 2000 on the water transport.

In other words, the business model of authorized waste reception facilities in unregulated in Hungary, operators are setting prices on their own risk.

7.3 Necessary changes to implement a harmonised Financial Model

Main steps of the implementation procedure should lead from the current legal and technical framework of ship waste management to the Financial Model outlined in the project. These steps can be grouped into four clusters: political decisions, legal amendments, technical measures, procedures for financial clearance and horizontal measures.

1) **Political decisions**
   a) Signing the Danube Ship Waste Convention
   b) Allocation of implementation tasks between relevant ministries and government authorities
   c) Decision on market regulation of the ship waste management market
   d) Decision on the adoption of EVS and implementation of the Financial Model in Hungary
2) **Legal amendments**
   a) Ratification of the Danube Ship Waste Convention
   b) Appointment of the CO-WANDA National Institution, definition of its rights and obligations
   c) Amendment of regulation of port operations and waste reception services
   d) Amendment of vessel operations and rules regarding skippers' duties
   e) Establishment of law enforcement procedures and control mechanisms in connection with the EVS
3) **Technical measures**
   a) Implementation of the national network of waste reception points
   b) Interface between the Hungarian RIS system, the EVS and supervisory authorities
4) **New procedures for financial clearance**
   a) Vignette payment channels between the ICCB and Hungarian vessel operators.

b) Vignette control channels between reception facility operators and the National Institution, including reporting and controls on national level.
c) Financial clearance interface between the National Institution and the ICCB.
d) Financial clearance interface between the National Institution and waste reception facility operators.

5) Horizontal measures

a) Communication & awareness raising
b) International coordination

8 NEXT STEPS AND RECOMMENDATIONS IN HUNGARY

The following table gives a detailed picture of these measures by estimating the potential timeframe, stakeholders involved, and expected source of financing for each measures.

Goal of action	Type of Measure	Involved Stakeholders	Timeline	Budget Estimate	Relevance *
1a Signing the Danube Ship Waste Convention	Political decision	Prime Minister's Office, Ministry of Foreign Affairs and Trade, Ministry of National Development	1,5 years	-	3
1b Allocation of implementation tasks between relevant ministries and government authorities	Political decision	Prime Minister's Office		-	3
1c Decision on market regulation of the ship waste management market	Political decision	Ministry of National Development (responsible for transport, Ministry responsible for environment (unknown)		-	3
1d Decision on the adoption of EVS and implementation of the Financial Model in	Political decision	Ministry of National Development		-	1

Hungary					
2a Ratification of the Danube Ship Waste Convention	Legal amendment	Ministry of Justice, Ministry of Foreign Affairs and Trade	2 years	-	2
2b Appointment of the CO-WANDA National Institution, definition of its rights and obligations	Legal amendment	Ministry of National Development		EUR ~ 60-100 thousand	3
2c Amendment of regulation of port operations and waste reception services	Legal amendment	Ministry of National Development		-	2
2d Amendment of vessel operations and rules regarding skippers' duties	Legal amendment	Ministry of National Development		-	2
2e Establishment of law enforcement procedures and control mechanisms in connection with the EVS	Legal amendment	Ministry of Interior, National Transport Authority		EUR ~ 30-100 thousand	1
3a Implementation of the national network of waste reception points	Technical measure	National Institution, Ministry of National Development	1,5 years, possible over-lapping with earlier stages	EUR ~ 0.5-1 million	3
3b Interface between the Hungarian RIS system, the EVS and supervisory authorities	Technical measure	RSOE, National Institution, Ministry of Interior, National Transport Authority		EUR ~ 30-50 thousand	1
4a Vignette payment	Financial clearance	National Institution, Vessel operators,	1 year apart	EUR ~ 10-20	2

channels between the National Institution and vessel operators	procedure	Skippers	from the establishment of the National Institution	thousand	
4b Vignette control channels between reception facility operators and the National Institution	Financial clearance procedure	Natinal Institution, Waste reception facility operators		EUR ~ 5000	1
4c Financial clearance interface between the National Institution and the ICCB	Financial clearance procedure	National Institution, ICCB, Ministry of Foreign Affairs and Trade		-	1
4d Financial clearance interface between the National Institution and waste reception facility operators.	Financial clearance procedure	National Institution, Waste reception facility operators		(involved in 4b budget)	1
5a Communication & awareness raising	Horizontal measure	National Institution, National Transport Authority, Law enforcement bodies, NGO's	Continuously	EUR ~ 100 thousand	1
5b International coordination	Horizontal measure	National Institution, Ministry of Foreign Affairs and Trade	Continuously	-	1

* Relevance in terms of its effect on subsequent measures (increasing on a 1-3 scale)

Table 7 | Financing model of existing waste reception facilities

It is highly recommended during the implementation procedure to actively consult with other member states of the Convention to reach a harmonized legal, technical and financial framework for ship waste management on the Danube.

From a technical point of view it is extremely important and recommendable to cooperate with neighboring countries during the establishment of the waste reception network, as Hungary has sufficient capacity of stationary facilities but in case of collection vessels strong economies could be realized by using shared capacity with other countries.

9 LIST OF ABBREVIATIONS

EPR	Extended Producer Responsibility
EVS	Electronic Webinterface, Electronic Vignette System
FM	Financing Model
ICCB	International Clearance and Coordination Body
NKH	National Transport Authority, Shipping Department
OGSW	Oily and Greasy Ship Waste
OHÜ	National Waste Management Agency Nonprofit Ltd.
OKTF	National Inspectorate for Environment, Nature and Water

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