Interreg
Danube Transnational Programme
ENERGY BARGE

ENERGY BARGE

Building a Green Energy and Logistics Belt

Project Code: DTP1-175-3.2

Deliverable 5.1.3

Slovak shipping and ports JSC - Pre-feasibility pilot study

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I. About the ENERGY BARGE project

The Danube region offers a great potential for green energy in the form of biomass. The main objective of ENERGY BARGE is to exploit this potential in a sustainable way, considering the Renewable Energy Directive 2009/28/EC, thereby increasing energy security and efficiency in the Danube countries. The project brings together key actors along the entire value chain, biomass companies and Danube ports as well as relevant public authorities and policy stakeholders. The project maps value chains and facilitates the market uptake of biomass, supports better connected transport systems for green logistics and provides practical solutions and policy guidelines. The Agency for Renewable Resources (FNR) coordinates the ENERGY BARGE project consortium with fourteen partners from Austria, Bulgaria, Croatia, Germany, Hungary, Slovakia and Romania.

Project coordinator

Agency for Renewable Resources		
Fachagentur Nachwachsende Rohstoffe e.V.	FNR	Germany

Project partners

BioCampus Straubing GmbH	BCG	Germany
Deggendorf Institute of Technology	DIT	Germany
Austrian Waterway Company	VIA	Austria
Port of Vienna	PoVi	Austria
Bioenergy2020+ GmbH	BE2020	Austria
International Centre of Applied Research and Sustainable Technology	ICARST	Slovakia
Slovak Shipping and Ports JSC	SPaP	Slovakia
National Agricultural Research and Innovation Center	NARIC	Hungary
MAHART-Freeport Co. Ltd.	MAHART	Hungary
International Centre for Sustainable Development of Energy, Water and Environment Systems	SDEWES Centre	Croatia
Public Institution Port Authority Vukovar	PoVu	Croatia
Technology Center Sofia Ltd.	TCS	Bulgaria
Romanian Association of Biomass and Biogas	ARBIO	Romania
Federation of owners of forests and grasslands in Romania	Nostra Silva	Romania

II. About this document

This report corresponds to Deliverable 5.1.3 Pre-feasibility pilot studies of ENERGY BARGE. It has been prepared by:

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III. Background

Deliverable "D 5.1.3 Pre-feasibility pilot studies to prepare large-scale investments to transfer ports into biomass hubs" is based on the task as described in the latest approved version of the Application Form (AF) of the project ENERGY BARGE (Project Code: DTP1-175-3.2).

- Activity 5.1. *Pre-feasibility pilot studies to prepare large-scale investments to transfer ports into biomass hubs* (Lead: MAHART)

The port partners of the project elaborated pre-feasibility pilot studies (including investment plans) in order to define development plans and investment needs required to strengthen ports as logistics hubs for the bioenergy sector, where biomass is handled, stored and manipulated in the most appropriate way.

Individual pre-feasibility pilot studies were prepared following a common methodology (D 5.1.2) which helped the port partners to develop their pre-feasibility studies following a unified approach and it will also support the preparation of the synthesis report (D 5.3.2). Each individual pre-feasibility study defined development plans and investment needs - to prepare large scale investments beyond the project duration - of participating Danube ports in bioenergy logistics alongside the Danube River. Studies investigated existing value chains, industrial and logistics capacities and identified technological solutions and related investment projects with a budget, cost-benefit analysis and timeframe. Each of the five studies are interlinked in a way that the investment plans were coordinated to avoid competition and overlap.

Coordinator: MAHART (HU)

Involved Danube ports: BCG (DE), PoVi (AT), SPAP (SK), MAHART (HU), PoVu (HR)

All involved Danube ports prepared their own pre-feasibility pilot study following the D 5.1.2 common methodology and were also responsible for the involvement of policy makers and at least five industry stakeholders to derive industry knowledge and experience.

The key focus of the pre-feasibility study structure was to provide a guideline for the elaboration of feasible and economically sound investments to strengthen ports as logistics hubs for the bioenergy sector alongside the Danube. The study structure was elaborated based on previous experience gained in the preparation of infrastructure development projects funded by the EU and also guides issued by various development organizations including the European Commission (*eg. Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020 (European Commission 2014 - http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf).* Previous ENERGY BARGE activities and deliverables, including experiences gained during the preparation of D 5.1.1 surveys, impressions gathered during the port exchange workshop and results and deliverables of WP4, also contributed to the development of the structure and finally the pre-feasibility studies.

Local biomass markets are at a various development stages in each involved Danube port area. It is also reflected in the subject and results of the pre-feasibility studies:

- Port of Straubing (PP1 – BioCampus Straubing) is an operational logistics hub for biomass handling with a main focus on bioenergy utilization. The focus of its study is to put on a preliminary analysis of options to develop additional storage space for biobased feedstock and products serving the needs of current and future potential customers of services offered in the port by both port management itself and the private logistics companies operating based on the port's infra- and superstructure.
- Port of Vukovar (PP11 – Public Institution Port Authority Vukovar): several analysis on biomass market prices in the wider environment indicated the possibility of inclusion of the port in the production chain, and thus in the value chain via the establishment of a major biomass trade centre primarily for pellets and wood chips provided by the hinterland area of the Port of Vukovar.
- Port of Bratislava (PP7 – Slovak Shipping and Ports JSC): responding to the needs of a growing market and building upon the country's large forest areas on the supply side the subject of the study is to develop the transshipment and storage facility in Port of Bratislava suitable for the handling of wood pellets and wood chips in bulk.
- Port of Budapest (PP9 – MAHART-Freeport Co. Ltd) is located at an ideal site for the implementation of a biomass-based energy production project. The necessary raw materials can be supplied through a waterway-based logistics network. With the planned Galvani Bridge nearby the Freeport a key district heating pipe network will be built very close to the planned place of implementation. For the feed in of green electricity transformers are available on the site as potential connection points. Preliminary calculations show that a profitable biomass-based power plant could be set up in the port.
- Port of Vienna (PP4 – Port of Vienna): is already the largest port and trimodal logistics centre on the Danube in Austria. The study investigates the potentials of log wood/roundwood and waste wood / wood residues in the Danube Region east of Austria up to the coast of the Black Sea in order to disclose relevant insights into price structures and trends to justify business cases and/or logistical value chains. As a conclusion a conveyor belt system is to be installed which will also serve the new generation of the wagon fleets carrying biomass to the port.

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1. Executive Summary

The subject of the pre-feasibility study by Slovak shipping and ports (SPaP) is a transshipment and storage facility in the port of Bratislava, suitable for transshipment of wood pellets and wood chips in bulk. In order to elaborate this project, the company had to set up priorities regarding development. SPaP has a tri-modal position, accessible by barges, wagons and road trucks, cranes with suitable grab, and suitable storage facility. An inspection of the storage facility has shown what needs to be modified on the building – refurbishment of the gates, parts of the roof and ramps. The next step was to find an organisation that was able to provide a concept of technology for the actual transshipment. The company AGM spol. s.r.o. came up with the design of conveyor belts, hoppers, weighing devices and lifts which are suitable for loading of trucks with wood pellets and wood chips in bulk. In connection with the port's crane, this will form a complex way of discharging and loading of trucks and barges. The overall costs for the investment in this project were evaluated with 247,900 €. After an internal financial analysis, SPaP came to the conclusion that this project could be financed from the company's own financial reserves, without need of grants or loans.

Slovakia has got two cargo ports, the port in Bratislava and the port in Komárno. SPaP is the operator of both ports. This means that the company is the only operator in the country with access to water transport and is in control of the situation of transshipment of cargo with regards to inland waterway transport. Usage of wood chips and wood pellets in Slovakia is slowly rising, with heat and power plants all around the country tend to start co-firing wood based biomass fuel, or even switching from co-firing to usage of 100% biomass fuel. Households and bigger commercial subjects tend to invest in boilers firing biomass, too. The main reasons are rising and unpredictable prices of conventional fuels and the fact that biomass usage is sustainable, affordable and available, while gas and coal are imported, affected by the geopolitical situation and the usage of these conventional fuels is considered as less environmentally friendly. So far, producers and users in Slovakia have been using road transport to supply wood based biomass products. The envisaged investment shall enable producers and customers to transport their products to Bratislava in large quantities by barges, then further distribute it by road transport with storage option in the port. Alternatively, they can even export their product to other countries in the Danube region. With the envisaged investment, SPaP aims to fill the gap in the market of biomass within the region of Slovakia and help to spread the usage of biofuels and contribute to green logistics.

The transshipment facility is planned to be operated by two workers at a time, plus a third person operating the crane if needed. Workers will be trained by the company, which is supplying the transshipment technology. The same company will take care of the maintenance and service of the equipment. For the evaluation of the investment, the price per metric ton for transshipment of wood chips and wood pellets, investments costs, depreciation of technology, human resources, maintenance and expected quantities were taken into consideration. The elaborated cash flow and cost benefit analysis suggest that this project in the port of Bratislava is feasible and will have a positive effect not just only on the company's economic situation, but will also have positive effects on the region due to possible cooperations with other countries of the Danube region.

2. Introduction of the implementing organisation

SPaP belongs to the oldest shipping companies on the Danube and was founded in 1922. 106 vessels of different types, size and performance belong to the company. The company deals not only with inland shipping, but also has a full range of port services in the well-equipped ports of Bratislava and Komárno.

SPaP is a dominant company in the field of transport, transshipment and warehousing of goods, forwarding services, repair works and building of new vessels on the territory of Slovakia. The company offers logistics services, being connected with transportation of all kinds of goods on the river Danube as well as on the whole network of West European waterways between the North Sea and the Black Sea. From river shipping and transshipment, the most common goods are coal, coke, iron ore and steel.

SPaP is directly connected to:

1. Railway transport

2. Road transport (highway junction)

3. Internal pipeline from the SLOVNAFT-refinery

For the purpose of increasing SPaP's business activities and to implement their strategic plans, the company established two subsidiaries that provide additional support within business activities of SPaP. Slovak Shipping and Ports- Lodenica (shipyard) s.r.o. is a wholly owned subsidiary of SPaP a.s., which provides full repair services and rebuilding of motorized cargo and passenger ships, push-pulls and boats to both the company and other business partners. Dalby a.s. provides specialized transshipment of mineral oils on a newly-built transshipment facility in the port of Bratislava in the estuary of the ports pool Pálenisko. It is equipped with an unique technology on the territory of Slovakia, guaranteeing the minimization of the risk of leakage of petroleum substances and maximizing operational safety.

2.1. Organizational structure and activities

SPaP is a company of 230 employees among five departments and its organizational structure consists of the following company authorities:

- General Assembly

- Board of Supervisors

- Board of Directors

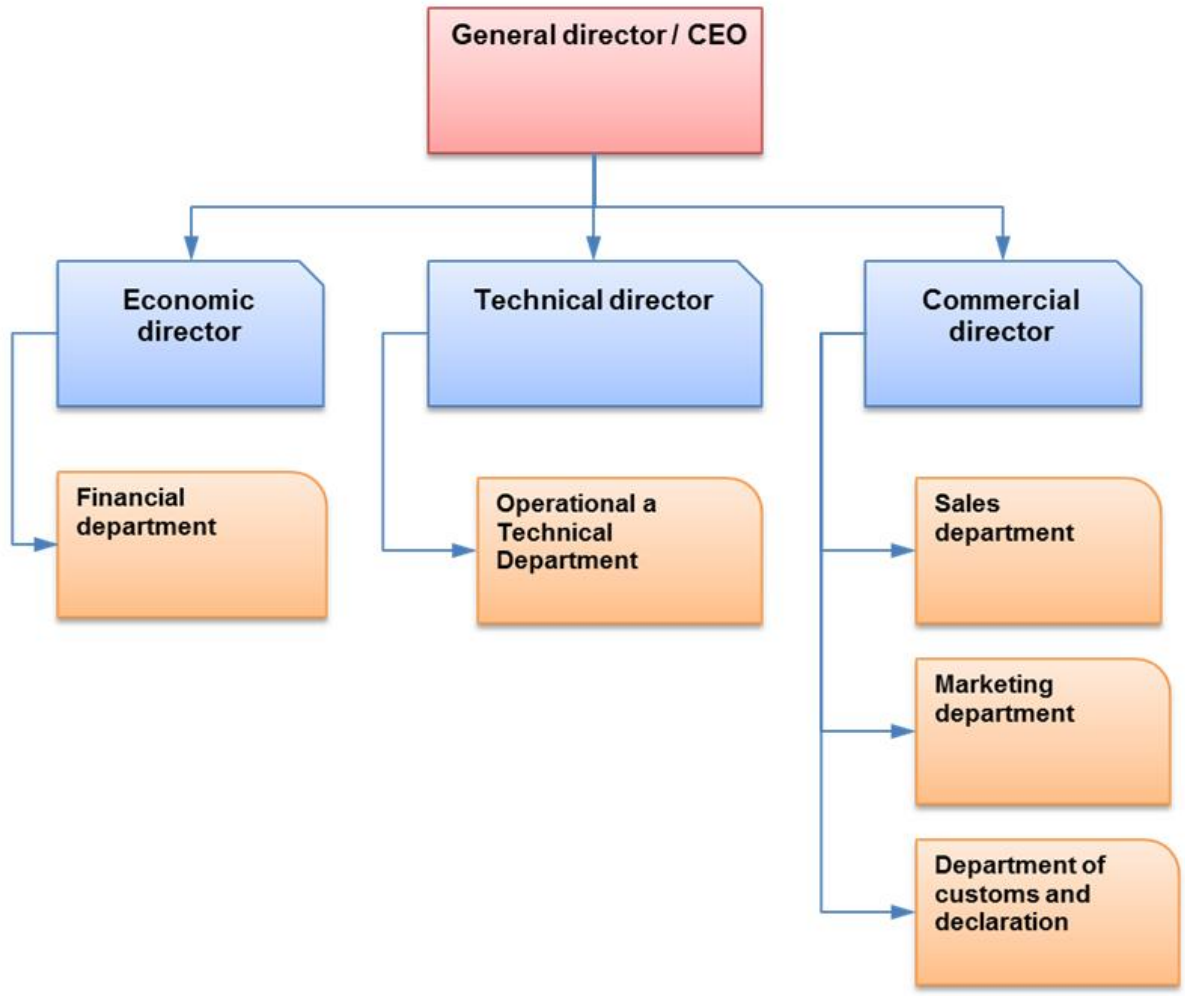

Figure 1: Organigram of Slovak shipping and ports (Source: own editing based on own data).

Daily activities in the port of Bratislava include: Transshipment of ferrous materials: transported material is stored in covered, unheated five-section transshipment hall, with a roofed area of 26,000 m2. Net storage area represents 22,500 m2, with load carrying capacity of 30 tons per m2. Storage capacity of the halls is about 60,000 tons of metallurgical material. There are ten single-beam cranes equipped with magnetic-girder in the halls: three cranes with lifting capacity of 25 tons, two with lifting capacity of 32 tons, and five with lifting capacity of 12.5 tons. The company has a special device for turning of steel coils from vertical to horizontal position and vice-versa and it also has a special device, which allows turning of material lengthwise of its horizontal axis.

Transshipment of bulk goods: the most frequently transported commodities from this category are artificial fertilizers of different kinds, coal, coke, iron ore and ore concentrates. Transshipment of general cargo: the most frequently transported commodities from this category are: steel semi-products, coils, plates up to 25 t/ piece.

Transshipment of liquid cargoes: The terminal of liquid cargoes (PMO) loads and discharges oil products (gasoline, crude oil, light and heavy fuel oils and other heavy oil derivates) directly from the Slovnaft a.s. Bratislava company into ships without in-process storing. Prior to transferring heavy oil derivates from railway tank waggons, a technological pre-heating is necessary. Gasoline and fuel oil have been transferred by SPaP's oil terminal from railway tank waggons to tank vessels. The Port adapted also to new demands for export of liquid chemical products (e.g. liquid artificial fertilizers).

Transshipments of overweight and over dimensional cargoes: on this specialized site, the port offers transshipment in any combination of export or import activities, between waterway, railway or truck transport as well as storing of overweight and over dimensional shipments, up to 560 metric tons. Dimensional limits of the cargo are: diameter (height) of 10 m, and length of 60 m.

The RO-RO facility (RO-RO stands for "roll on, roll off" and refers to the method by which vehicles and machinery are loaded onto RO-RO vessels. Loading and discharging is carried out by driving the vehicles or machinery on the vessel and off the vessel): on the RO-RO facility the port reloads vehicles and goods, loaded on wheeled vehicles (saddle trailers, trailers, roll trailers and fork lifts) using horizontal method (that means by rolling on and rolling off). The facility is equipped by a ramp between the river bank and ship, suitable for units up to 60 tons. The Port is capable to load or unload 400 and more cars per shift by its horizontal technology. Cars and goods are carried by specialized single or more decker RO-RO barges, belonging to the respective shipping companies.

Activities of container terminal: transshipment of containers of ISO 1C - A series, transport, railway-road-river, warehousing / hiring of storing surfaces, gathering of containers, door-to-door service, checking, maintenance, repairs and dry cleaning of containers.

Further activities in the port comprise the bunkering of ships, weighing of wagons, trailers and trucks.

2.2. Description of technical, financial and legal capacity

Legal

Both, the port of Bratislava and the port of Komárno work on a basis of dual legal structure. Land in both ports is in ownership of the company Verejné prístavy a.s. (hereinafter Public Ports). The founder of the Public Ports is the Slovakian state, in which the Ministry of Transport, Construction and Regional Development of Slovakia is acting. The reasons for the company's founding are to optimize the operation of state assets in conditions of the commercial environment and streamlining the use of transport infrastructure in public ports in order to develop the national and international water transport. (Verejné prístavy, n.a.).

SPaP has a long term leasing contract for the port area with Public Ports, while the infrastructure, machinery equipment, barges and buildings are in ownership of SPaP.

Technical

The port of Bratislava is strategically the most important public port in Slovakia on the Danube. At present, it serves as a universal, cargo and passenger port. Its potential is based on its advantageous geographic location at the Rhine-Danube and Baltic-Adriatic Corridor of the Trans-European Transport Network TEN-T.

The port is a territorial complex of water areas, hydro technical facilities, port basins, underground construction and storage areas, located on both banks of the Danube river from rkm (rkm stands for river kilometre) 1,871.450 to rkm 1,862.000. It consists of three port basins on the left bank, where cargo handling is carried out and at the same time serving as a protective part of the port in case of unfavourable navigation conditions (high water, ice, etc.) The port of Bratislava is serviced and territorially connected by transport and technical infrastructure- road network (D1 motorway). It has a good availability to other European capitals and important ports – Vienna and Budapest. Its railway network further enables the transshipment of goods between the different modes of transport (road - water - railway).

Financial

The main income of SPaP is deriving from the following business activities:

Transport of cargo: bulk goods, heavy and oversized goods, piece goods.

Transshipment of cargo: bulk goods, heavy and oversized goods, piece goods, ferrous materials, RO-RO position.

Storage of cargo: agricultural products in the port of Komárno.

Comprehensive container terminal services: transshipment of containers, storage of empty containers, inspection, repair, maintenance and cleaning of containers, comprehensive customs declaration services etc.

Leasing of: vessels, office space, storage facilities.

Other services: bunkering of vessels, weighing of road vehicles and railway wagons.

The capital of SPaP is 65,000,000 EUR (according to the commercial register of Slovakia (Obchodný register, 1997). With regards to the envisaged investment, SPaP would use its own financial reserves. In case the investment is higher than SPaP could cover by its own reserves, SPaP has a bank overdraft account with a limit up to 2,000,000 EUR.

2.3. Previous investments

SPaP has made various investments of different amounts over the past 10 years. In the period of time from 2008 until the end of 2017, the investments were over 20,000,000 €.

Most of the investments were made into the infrastructure in the port of Bratislava, port of Komárno and SPaP´s fleet.

In 2009 and 2010, over 6,000,000 € were invested into the new service pontoon P-65, which is located on rkm 1,866 of the Danube waterway, in close distance of the port of Bratislava. Pontoon P-65 provides services of bunkering of vessels and also selling of drinking water. It serves the whole lot of SPaP´s fleet as well as foreign vessels.

Slovak shipping and ports – Shipyard, Ltd. is a 100% subsidiary of SPaP and provides full range of services associated with building and repairing of vessels. A large investment of over 330,000 € was made in 2009, and more over the years between 2012-2017 with over 800,000 € in total. These investments were made to secure an overall modernization of technical capacities, equipment and infrastructure.

Table 1: Overview of SPaP´s investments over past 10 years (all amounts in euros) (Source: own data).

Investments	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
port of Bratislava: infrastructure, equipment etc.	1,448,000	1,333,000	750,000	305,000	993,000	1,100,000	112,000	134,000	249,000	218,000	6,642,000
port of Komárno: infrastructure, equipment etc.	3,000	23,000	119,000		26,000		189,000				360,000
SPaP´s fleet: repairs, maintenance	1,727,000	233,000	1,470,000	1,288,000	1,419,000	511,000	216,000	134,000	123,000	1,005,000	8,126,000
Pontoon P-65		1,577,000	5,063,000								6,640,000
SPaP-shipyard		330,000			11,000	45,000	31,000	279,000	426,000	89,000	1,211,000
Rest	572,000	85,000	507,000	150,000	122,000	125,000	137,000	36,000	72,000	164,000	1,970,000
Overall	3,750,000	3,581,000	7,909,000	1,743,000	2,571,000	1,781,000	685,000	583,000	870,000	1,476,000	24,949,000

3. Analysis of the current situation

Currently, SPaP is not handling or processing biomass products. The company has certain technical capacities to handle biomass products; however it is not completely equipped to provide comprehensive services. Through this study, SPaP aims to find out what the options are and whether there is a future to handle biomass products in the port of Bratislava.

Biomass trade has been established in the Bratislava region, mainly consisting of supply and demand of wood based biomass, used for heating on many levels, from households to bigger buildings and the whole areas of cities, to power plants that use biomass mixed with coal to generate electricity. Largely grown agricultural products such as corn, rape seed, etc. are being processed in to biomass products such as rape seed oil, bioethanol and biodiesel.

Since prices of conventional fuels have been rising, people get more interested in alternative fuels, such as wood pellets etc., in order to save money and to reduce the emissions according to the Europe 2020 strategy (Reducing GHG emissions by at least 20% compared with 1990 levels;

Increasing the share of renewable energy in final energy consumption to 20%). Moving towards a 20% increase in energy efficiency guides the government and producers to accept biomass products and also makes people more aware of advantages of biomass usage (Eurostat, 2017).

3.1. Supply of bioenergy raw materials

Compared to other renewable sources in Slovakia, biomass, after solar and geothermal energy, is the source with the third most viable potential in the country. Estimates of total usable biomass potential (forest and agricultural) range from 75.6 PJ (or 21 TWh) 6) to 120.3 PJ (or 33.4 TWh). (Biom, 2007).

Local producers and suppliers of wood based biomass in the radius of the port:

Bučina Eko, s.r.o. is a company situated within close proximity to the port of Bratislava. The company offers for private businesses, state administration as well as residents to collect their wooden waste and residues and dispose them in an efficient and environmentally friendly way. Following types of wooden waste are collected: old furniture, timber and lumber, wood industry residues, packaging wood (pallets, boxes etc.), doors and windows, tree trunks and branches. Materials can be brought to the company's complex or are collected by the company's fleet of trucks. The materials are then sorted into groups (forestry waste, biodegradable waste, etc.) for further processing. Using shredders, wooden material is then processed into wood chips and transported for final usage (Bučina Eko, 2015).

Biotrade & trans s.r.o. is a company situated less than 5 km from the port of Bratislava. The company is focused on producing wood chips by processing the following types of wooden materials: waste wood from the wood industry and sawmills, cuttings from forest extraction, fibre, branches, waste wood from cleaning the system of watercourses, the disposal of orchards, ornamental gardens and public green. Materials are processed by shredders into wood chips and can be transported to customers or for further processing (Bio Trade & Trans, 2011).

3.2. Demand for raw materials

Termming a.s. produces and distributes heat and hot water in Bratislava. The company is a part of the Engie group, which is a group that provides comprehensive services in the field of energy, real estate management and technology installation. Termming a.s. runs a heating plant in Bratislava. Two boilers burning wood chips were built there, with a total output of 9 MW and annual usage of wood chips from 15,000-20,000 tons (Trend, n.a.).

Table 2: Key facts about Termming a.s. (Source: Engie, 2018).

Number of heating plants	91
Lenght of distibution	62 km
Annual heat production	199,996 MWh
Total installed power	168,99 MW
Output from biomass	
Heating plant Vrakuňa	9 MW
Heating plant Pezinok	3 MW
Heating plant Malacky	5 MW

Enerbiz s.r.o. is a company with the main focus on the supply of gas, electricity and biomass. Enerbiz's current and potential clients include heating companies, manufacturing companies, manufacturing businesses, urban areas, municipalities, etc. The company is supplying biomass for the segment of medium and large enterprises. Target groups are enterprises that use biomass for the production of electricity, heat, hot water or combined production. Deliveries of energy wood chips are carried out throughout the year with increased emphasis on winter months for the needs of heating companies (EnerBiz, 2013).

Pilexim s.r.o. is an experienced company in the field of trading of secondary raw materials resulting from the processing of wood, including wood pellets and different kinds of wood chips (made of e.g. spruce, pine, fir, beech, oak). The company supplies the following industries:

Energy industry – supply of wood pellets and wood chips made of wood containing bark and tree greenery. It is used for the production of heat and electricity.

Wood industry - supply of technological wood chips (Pilexim, n.a.).

Intech Slovakia s.r.o. is a company from Bratislava active in the field of energy efficiency. Since its inception, it has been focusing on optimizing energy sources and optimizing energy distribution and consumption, including study design and energy audits. Close attention is paid to use of renewable energy sources. In this area, the company has experience with the use of biogas and biomass combustion. Due to the large consumption of biomass, the biofuels department was created in 2006 to ensure the supply of biomass for energetic purposes. Today, the company has technical equipment for the processing of biomass from harvesting wood in the forest through mechanical processing, transport and landfilling. Thus, it is an interesting partner in terms of biomass handling in the port of Bratislava. Intech Slovakia supplies nine companies in Slovakia, which run heating plants and use wooden biomass (Intech Slovakia, 2014).

3.3. Existing value chains, industrial and logistics capacities for energy biomass

SPaP is not involved and is not part of any kind of existing value chains in the field of biomass.

Several producers and users of biomass are located in the region of Slovakia, for example company Slovenské elektrárne (Slovakian power plants) uses biomass mixed with coal as energy source for the generation of electric energy. In 2017, 10.6% of electric energy was made of coal and biomass as energy sources (Slovenské elektrárne, 2017).

Envien Group is one of the largest and most significant groups of companies in the CEE region active in the production of biofuels, used in blends with conventional diesel and gasoline. Companies of the Envien Group are important players in bioenergy sector in Slovakia.

A number of heating plants in the proximity to the port of Bratislava started co-firing wood based biomass, or switched to biomass only. For example company Termming a.s. (mentioned in chapter 3.2.) operates a heating plant in Bratislava with an annual use of wood chips from 15,000 to 20,000 tons.

Companies are mostly not willing to provide information regarding their own transport activities regarding biomass products; however the companies largely use road transportation for this type of cargo. Heating plants or power plants usually get the supply of raw materials from third companies. The supplying company is often a producer and supplier of wood based biomass with comprehensive equipment to process the wood. In other cases, suppliers act as intermediaries and purchase the products from local sources or import.

The Danube has a specific position in terms of geography within Slovakia. It flows on the southern borderline of Slovakia and covers 172 km (from 1,880.26 rkm to 1,708.20 rkm). In contrast to the high dense network of roads and rails, it does not reach out to all regions of the country and in general, the Danube is not used much in terms of transporting goods within Slovakia because it covers only a small and specific part of the country. The Danube provides an opportunity to import and export large quantities of cargo to and from other countries of the Danube region. Companies handling wood chips and wood pellets located in proximity to the port of Bratislava would be able to import and store their products in the port and distribute them to their operations.

3.4. Currently available infrastructure at the port, technical conditions

Presently available technical background of biomass processing and logistic in the ports:

A high capacity container is used when handling agricultural products and is attached to a crane. It has multiple way of use. Trucks can unload their trailers straight into the container, for trains there is a special position where the container is lowered below the ground level and carriages can be discharged. Container loaded with a product is then moved by a crane above the barge and can drop the product straight into the cargo space of a barge (Figure 2).

Figure 2: Handling agricultural products in port of Bratislava, discharging trucks and trains and loading of a barge with covered cargo area (Source: own database).

Hoppers are used for the handling of bulk materials such as grain, corn or rapeseed (Figure 3). It tapers downward and is able to discharge its contents at the bottom.

Figure 3: Hopper for loose bulk materials in Bratislava port (Source: own database).

Multiple cranes are used in combination with high capacity containers to handle agricultural products (Figure 4). The containers are situated next to water basins and trains can be directed underneath the cranes. Roads for trucks are also accessible so that multiple options to handle products are available.

Figure 4: Cranes ready for loading/discharging of train/barges (Source: own database).

Most of the biomass products require dry and covered space while being transhipped or stored. Humidity or mechanical damage can lower the quality of products. Besides open barges, SPaP owns barges with covered cargo space (Figure 5). They can be used for the transport of goods such as wood chips, wood pellets, fertilizers and agricultural products.

Figure 5: Loading of barge, type DE (Dunaj Europa) with covered cargo area with agricultural products (Source: own database).

4. Development issues

4.1. Analysis of future requirements and demand

In Slovakia, the demand for renewable energy sources and alternative fuels for heat plants, domestic or industrial use is growing. The biomass potential in Slovakia has more than 60% of the total renewable potential of renewable energy sources. Forestry is currently the largest supplier of wood used for energy purposes, along with the wood-processing industry and timber stocks on non-forested land. In recent years, the demand for wood biomass has continued to grow, particularly in the form of wood chips and firewood. The main reasons of this trend are considered

to be an increase of fossil fuel prices, tightening emission limits for coal and favourable purchase prices for electricity produced from renewable energy sources.

New biomass power plants are also built, for example for the production of electricity for deliveries to a public network with complete or partial large-scale heat production, production of heat energy in municipal central heat sources, combined production of electricity and heat with its full use in the industrial and housing-communal spheres (Energie Portal, 2015).

SPaP calculated that the new transshipment facility will be able to handle ca. 20,000 metric tons of wood chips and wood pellets per year in the port of Bratislava. The current demand in the area was difficult to estimate as not every company was willing to release information regarding handled quantities. A heating plant which is operated by Termming a.s. has annual consumption of 15,000 to 20,000 tons of wood chips. There are two more companies located close to the port which are suppliers of wood chips and wood pellets, and one company which supplies wood based biomass for another nine heating plants and supplies biomass technologies as well.

4.2. New technological solutions foreseen

SPaP figured out an efficient way of discharging barges loaded with wood chips in bulk with storage and transshipment options. The company already owns a suitable storage building in the port of Bratislava. This storage is accessible by barges, wagons and road transport vehicles. The main advantage of the building is that it has an opening-closing mechanism in the roof, which was designed to be used in the event when some kind of cargo needs to be moved inside, but it is only accessible or movable by crane. After discussion and check by representatives of the company AGM (supplier of new technological equipment), SPaP came to the conclusion that it is possible to design a new technological solution. A system of conveyor belts, scales, drains, hoppers and other equipment, in combination with the building itself and a port crane would serve for transshipment and storage of wood chips.

The idea is that the product can be discharged from barges by a crane with a grab and directly, through the opening in a roof of the storage, loaded to receiving tray, which would be the first piece of equipment in the whole system. From there, following actions can be carried out:

- the product is transported by belt conveyors and lifts to tanks which will load the vehicle parked below

- the product is transported by belt conveyors and lifts to the storage area for storing

- the stored product is loaded by front loader to the second receiving tray and transported from the storage area back to the tank which will load the vehicle parked below

A full scheme of the production line is described in chapter 5.7 (Figure 14).

4.3. SWOT analyses on biomass logistics

Figure 6: SWOT analysis on biomass logistics (Source: own editing).

5. Project description

The project can be divided in two major parts. The first part is the physical realization of new technological solutions in the port of Bratislava. The plan is to refurbish a storage building in the port, which then will be suitable for storing wood pellets and wood chips in bulk. The new machinery and equipment to secure the stocking, removing and reloading of the cargo will be supplied by an external company. Their production line will add the ability to discharge barges, stock the products, distribute them around the storage, and load the cargo into trucks in the port.

The second part is the marketing strategy that SPaP is intending to follow. SPaP wants to avoid competing with companies producing and selling wood based biomass, because in the region around Bratislava as well as in Slovakia in general, an established market of wood based raw products does already exist. SPaP wants to focus more on the opportunity that it is the only company with access to inland waterway transport. With storage and transshipment capacities, the port could become a hub for wood based biomass, with loaded barges coming from other ports of the Danube region to tranship their cargo into trucks, and supply it further to companies that demand wood chips and wood pellets in bulk.

5.1. Aims of the development

Contribution to green energy and logistic belt

SPaP would like to take this opportunity of entering the biomass industry, and become one of the companies that foster the development of the Danube region in more than one way. By transforming the port of Bratislava into a port that handles biomass, there would be options provided for companies to handle their biomass products in a more efficient way. By switching from road to water transport, a contribution could be made to cut greenhouse gas emissions and help fulfil strategic goals of the Europe 2020 strategy. By providing a new service in the port of Bratislava, the usage of biomass could be increased not only in the area around the port, but in the whole country.

Modernization of the port

SPaP has a positive attitude to establish new technological solutions in the port. Progress and improvement is a key to success in every sphere of business activities. New technology and equipment means new knowledge, new experience and new skills for the company's workers. By investing in new technologies and services, the company could become more competitive and could offer more services to its customers.

Acquiring new customers

By innovation, SPaP is entering a new market and can attract customers it might have not been able to reach with current offers and services. The biomass industry, especially the industry of wood based bio-fuels is continuously developing, and is expected to grow. By development, new

people and companies can be attracted. New sustainable business relationships can be established, including the possibilities for further development or even new investments.

Economic growth

An important aim of the investment is of course economic and financial growth. For further development, SPaP must secure financial stability. With new products and services and proper management of the facility, SPaP could increase the company's income in the long term and be able to make more investments and ensure the economic stability and growth.

5.2. Definition of development needs

The object of development in this case is a storage and transshipment facility, according to findings from previous chapters. The ideal way for storing wood chips and wood pellets in bulk is supposed to be a clean and dry covered storage. It is possible to meet these requirements partly by the company's existing storage. With some additional work, the building will be suitable for storing such products. The storage shall have fire doors and has to undergo a fire protection revision. Dimension-wise, the storage has an area of 3,070 m2 and a payload of 5 mt/m2. It has sufficient space to handle the estimated quantity of 20,000 mts per year. Regarding the technology used in the storage, it is designed for the transport of bulk loose products so it meets the purpose of the project, which comprises the transshipment and storage of wood chips or wood pellets.

5.3. Definition of planned products/services

The service which is planned to be offered to customers is the possibility to tranship and store their products in the port Bratislava. Following options of discharging, storage and loading of products can be offered:

- discharging of barges with the product going straight to trucks

- discharging of barges with the products staying in storage capacities

- loading of trucks from storage capacities, without need of usage of crane or presence of a barge

- loading of barges from storage capacities

5.4. Target group/stakeholders

The main target group are companies that use large quantities of wood chips and pellets, which are mostly power plants and heat plants. A number of heat plants within Slovakia have already switched from fossil fuels to biomass and this number keeps growing. There are also schools and premises of companies that are heated by biomass fuel instead of conventional fuels.

Intech Slovakia- supplier of biomass for energy purposes, biomass equipment supplier (boilers etc.), energy and heat distributor.

Termming a.s.- produces and distributes heat and hot water in Bratislava. The company operates heating plant in Bratislava annual usage of wood chips from 15,000 to 20,000 tons.

Enerbiz s.r.o. is a company with main focus on supply of gas, electricity and biomass. Target group are enterprises that use biomass for the production of electricity, heat, hot water or combined production. Deliveries of energy wood chips are carried out throughout the year with increased emphasis on winter months for the needs of heating companies.

Pilexim s.r.o. is an experienced company in the field of trading of secondary raw materials resulting from the processing of wood, including wood pellets and technological wood chips. The company supply wood chips into energy and wood industry.

Heat station in Martin- has been using wood chips combined with coal since 2010 and is intending to work on wood chips only in the future.

Slovenské elektrárne (Slovak power plants)- in 2015, the company generated 19,444 GWh of electricity, out of which 0.12% was generated from wood based biomass. The company is intending to increase this share (Energie Portal, 2015).

Mondi SCP,a.s. Ružomberok- the biggest manufacturer of paper in Slovakia and a member of Mondi Group which has over 100 manufactures of paper around the world.

5.5. Location, site

The subject of SPaP's pre-feasibility study is a storage capacity with options for transshipment of wood based biomass products, specifically wood chips and wood pellets. The building itself already exists and is located in the port of Bratislava. The storage is accessible by river barges, rail cars/wagons and road transportation/trucks and trailers. The storage capacity has been previously offered, and taken to long term lease, but in recent year it has been unused and after taking in consideration its accessibility and position, it was used for the elaboration of SPaP's pre-feasibility study. Being located in the port of Bratislava it has a connection to the road network (D1 motorway) and the railway network, so it is possible to carry out the transshipment of goods between the different modes of transport (road - water - railway).

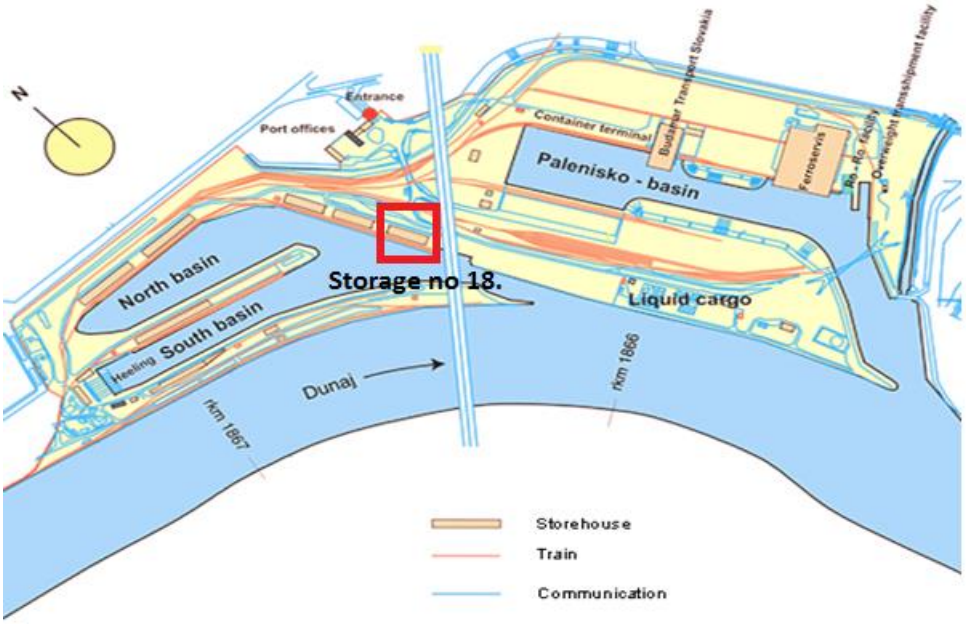

Figure 7: Location of storage no.18 (highlighted red) in port of Bratislava (Source: own editing).

5.6. Technical parameters/capacities

Table 3: Overview of parameters of the storage building (Source: own editing).

Name of the building	Storage no.18
Cadastral area	Bratislava-Nivy
Parcel number	3867/6
General dimenssions	Length: 120 m Width: 25.6 m
Storage area	3,070 m2
Payload of storage area	5 mt/m2

Technical description: It is an existing building that was originally built as storage. For the purpose of the project, it requires a renovation of gates, parts of the roof and ramps. It is a single-storey brick made, ground floor building, unheated, divided into four separate self-storage spaces, located between the northern basin of the port of Bratislava and the main highway. The construction of the warehouse allows storage up to 4 m, with a particular storage height depending on the type of goods, the packaging and the weight. It has a concrete floor, steel windows are firmly integrated. Parts of warehouse No. 18 are offices located directly in the warehouse, which are heated by electric storage tanks. At the side of the building, the opposite warehouse No. 17 has a ground floor building, serving as a social facilities and offices. From the two sides of the warehouse, there are handling ramps with the possibility of accessing by wagons and trucks. From the side of the basin there is a newly built gate with dimensions of 3.4 x 3.0 m and a gate with dimensions 3.5 x 4.0 m from the other side. Inside of the storage, the walls are

painted with anti-mould paint and the storage can be ventilated if needed. The storage has an opening in its roof which allows transshipment of goods from the top of the building.

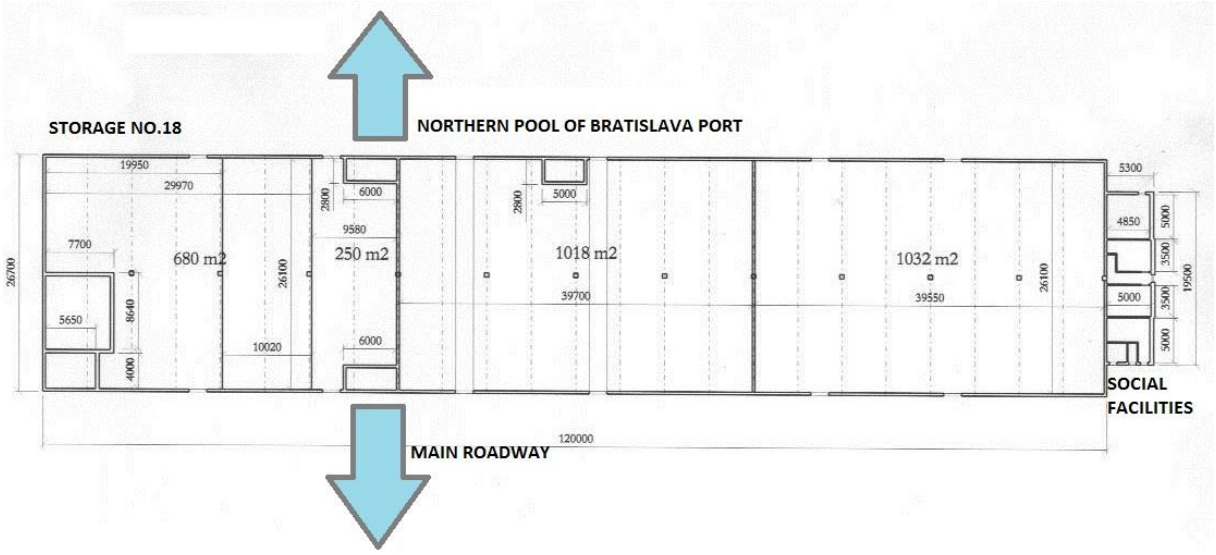

Figure 8: Technical drawing of storage no.18 and its position towards northern pool of port, where quay for barges, rails and crane is situated (Source: own editing).

Possibilities of using of lifting equipment:

Portal crane **ZZ – 40 019** – GANZ 16/32 t: portal, boom, can serve a parts of the warehouse by specified piece shipments and designated bulk substrates.

Portal crane **ZZ – 40 020** – GANZ 5/6 t: portal, boom, can serve the entire warehouse by specified piece shipments and designated bulk substrates.

5.7. Technology and equipment

SPaP has requested a price indication from the company AGM spol. s.r.o., which is an expert company in the field of delivery, installation and fitting of production lines, conveyor belts, supporting equipment and comprehensive services regarding maintenance and training of employees.

AGM provided a price offer for delivery and installation of complete system of machinery and equipment for the transshipment and storage of bulk materials, which is suitable for wood chips and wood pellets. The whole system was dimensioned for SPaP's storage No.18 mentioned in chapter 5.6. The system consists of the following machinery and equipment:

1. Receiving tray V-30 m^3, 1 piece

2. Adjustable drain- RO, 1 piece

3. Belt conveyor PD 650 L- 8.0 mm, 1 piece

4. Bucket elevator, 1 piece

5. Compensatory bin V 0.75 m^3, 1 piece

6. Drain, electrically operated, 1 piece

7. Weight tray V-1 m^3, 1 piece

8. Weighing equipment Q-500 kg, 1 piece

9. Drain, electrically operated no.2, 1 piece

10. Compensatory bin V 0.75 m^3 no.2, 1 piece

11. Adjustable drain- RO no.2, 1 piece

12. Bucket elevator no.2, 1 piece

13. Double-way valve, electrically operated, 1 piece

14. Belt conveyor PD 650 L- 36.0 mm, 1 piece

15. Gathering device, 1 piece + shifting device 1 piece

16. Belt conveyor PD 650 L- 36.0 mm no.2, 1 piece

17. Gathering device no.2, 1 piece + shifting device 1 piece

18. Belt conveyor PD 650 L- 24 bm, 1 piece

19. Rake conveyor PHD 650 L- 12.0 mm, 1 piece

20. Chain conveyor DOR 80 L- 20.0 m, 1 piece

21. Underpass expedition tank V 30 m^3, 1 piece

22. Drain RO, 1 piece

23. Receiving hopper V-1.5 m^3, 1 piece

24. Adjustable drain- RO no.3, 1 piece

25. Belt conveyor PD 650 L- 3.0 m, 1 piece

26. Gradient pipeline + armature/ fixtures, 20 linear metres

27. Steel frames

28. Additional equipment: engine and light installation

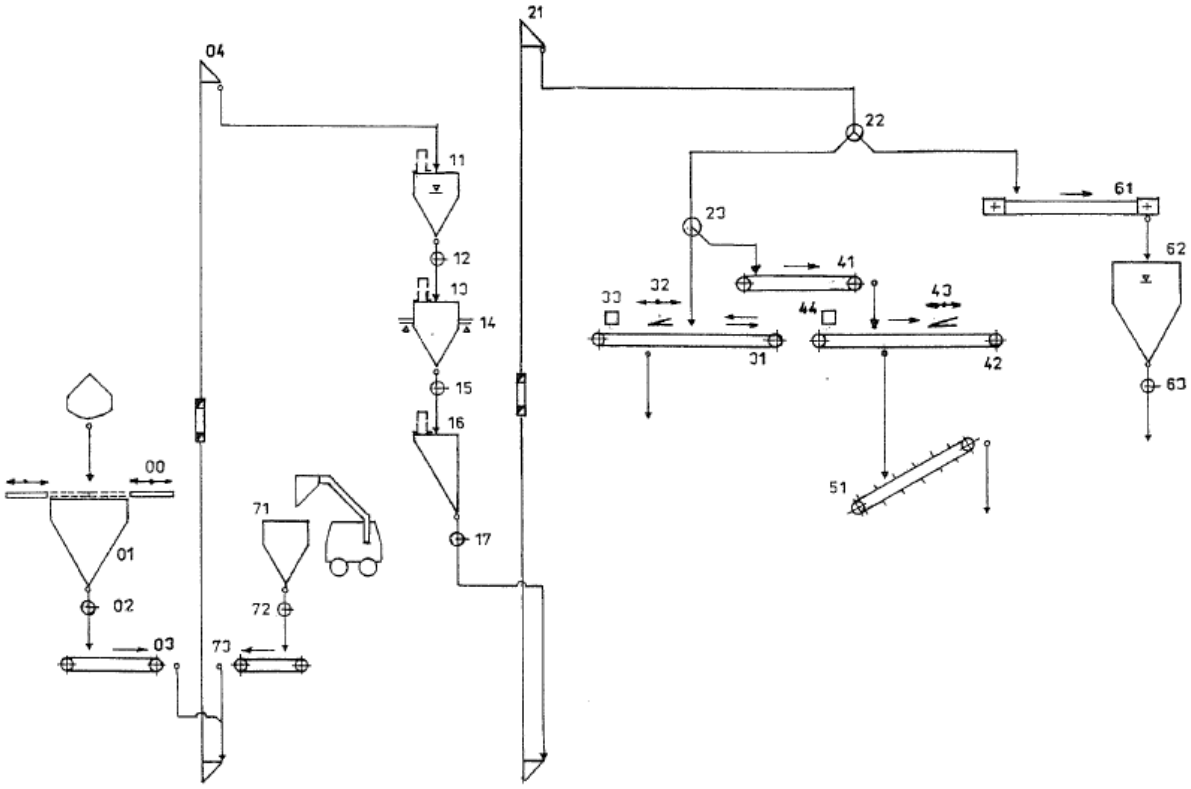

Figure 9: Scheme of production line with description (Source: project documentation).

00: opening in the roof, 01: receiving tray, 02: adjustable drain, 03: belt conveyor, 04: bucket elevator, 11: compensatory bin, 12: electrically operated drain, 13: weight tray, 14: weighing equipment/device, 15: electrically operated drain, 16: compensatory bin, 17: adjustable drain, 21: bucket elevator, 22: electrically operated double-way valve, 23: electrically operated double-way valve, 31: belt conveyor, 32: gathering device, 33: shifting device, 41: belt conveyor, 42: belt conveyor, 43: gathering device, 44: shifting device, 51: rake conveyor, 61:chain conveyor, 62: underpass expedition tank, 63: drain, 71: receiving hopper, 72: adjustable drain, 73: belt conveyor, + front loader

5.8. Design and permissions

It is obligatory to obtain the authorization from the regional public health authority for putting business premises into operation. The business premises must obtain a decision before it is used for a business under which the regional public health authority approves it for business. This obligation follows from act no. 355/2007 Coll. on the protection, promotion and development of public health. It is necessary to request the regional public health authority to consent to the opening of premises for the production hall, store, office, or warehouse.

Handling and storing of wood chips and wood pellets do not require any specific permission. SPaP plans to undertake a revision of fire extinguishers, pressure tests, revision of hose devices (hydrant) in regard to the storage capacity.

5.9. Partners to be involved

AGM, spol. s.r.o.- supplier of technological solutions for the storage. AGM will play an important role as SPaP's partner, considering that after delivering, fitting and installing the equipment, the company will provide training of SPaP's workers. The company also provides the service and maintenance of the equipment. Regular checks of the technology are needed while handling wood based biomass, which constitutes a flammable material. Therefore, a long term partnership with this company is foreseen.

5.10. Recommended implementation schedule

Once SPaP would submit an order of the technical equipment, it would take six to eight weeks for the supplier to manufacture and prepare the equipment, machinery and additional components. This time would be utilized for a modification and renovation of parts of the building, specifically its gates, ramps and a part of the roof. Following this process, the delivery of the machinery and equipment could be started, along with the installation. Once the installation is done, the supplier would finish the remaining works, like e.g. paintworks and light installations. Meanwhile, the fire revisions would be commenced. This process would take five to six weeks. Two weeks would be necessary for the supplier to start a trial operation, fixing possible bugs and training of SPaP's employees. Before the operation could be started, a timeframe of 13 to 16 weeks would be needed in order to prepare the building, machinery and employees.

Table 4: Recommended implementation schedule (Source: own editing).

Implementation schedule	
Timeframe	**Activity**
6-8 weeks	Confirming order of technical equipment from AGM, manufacture
	Supply of machinery
	Refurbishing and modification works in storage: roof, gates, ramps
5-6 weeks	Delivery of equipment, starting of installation
	Fire revisions, finishing of details, cleaning
2 weeks	Starting of trial operation, training of employees
Total time needed: 13-16 weeks	Starting of operation
	Discharging first barges
	Stocking up the storage

5.11. Investment costs, financing

SPaP would be financing this investment by its own financial reserves. After calculating the final estimated costs of this investment, it was decided that no grant or financial loan would be required.

A major part of costs is the new machinery and equipment for the transshipment system for storage capacities. SPaP received a price indication from the company AGM, spol s.r.o., which is a company providing delivery, fitting, and maintenance of production lines.

Table 5: Costs recap of price indication for delivery and installation of new equipment (Source: own editing).

Costs Recap	
Supply	158,450.00 €
Engines and lights installation	27,370.00 €
Montage/Installaton	23,200.00 €
Surface treatment-paintwork	1,660.00 €
Delivery costs + lifting equipment	7,220.00 €
Total	217,900.00 €
tax not included	

The price offer covers supply and installation of the whole lot of machinery, equipment and steel frames (Table 6), engine and lights installation, surface treatment (paintwork) of all equipment, freight costs, lifting equipment and training of SPaP's employees during the trial operation after the installation is finished.

Table 6: Full list of supplied machinery and equipment with prices for supply and installation per item (Source: price calculation from company AGM; own editing).

no.	Short description	Unit of measure	Quantity	Supply	Installation
1	Receiving tray V-30 m^3	piece	1	11,800.00 €	2,900.00 €
2	Adjustable drain-RO	piece	1	1,590.00 €	120.00 €
3	Belt conveyor PD 650 L- 8.0 m	piece	1	5,900.00 €	960.00 €
4	Bucket elevator	piece	1	10,620.00 €	1,020.41 €
5	Compensatory bin V 0.75 m^3	piece	1	430.00 €	310.00 €
6	Drain, electrically operated	piece	1	790.00 €	120.00 €
7	Weight tray V-1 m^3	piece	1	1,600.00 €	140.00 €
8	Weighing equipment Q-500 kg	piece	1	10,390.00 €	1,720.00 €
9	Drain, electrically operated	piece	1	790.00 €	120.00 €
10	Compensatory bin V 0.75 m^3	piece	1	1,600.00 €	140.00 €
11	Adjustable drain-RO	piece	1	590.00 €	120.00 €
12	Bucket elevator	piece	1	10,620.00 €	1,260.00 €
13	Double-way valve, el.operated	piece	1	790.00 €	120.00 €
14	Belt conveyor PD 650 L- 36.0 m	piece	1	12,750.00 €	1,990.00 €
15	Gatrhering+shifting device	piece	1	2,400.00 €	500.00 €
16	Belt conveyor PD 650 L- 36.0 m	piece	1	12,750.00 €	1,990.00 €
17	Gatrhering+shifting device	piece	1	2,400.00 €	500.00 €
18	Belt conveyor PD 650 L- 24 bm	piece	1	10,120.00 €	1,190.00 €
19	Rake conveyor PHD 650 L-12.0 mm	piece	1	13,450.00 €	650.00 €
20	Chain conveyor DOR 80 L-20.0 m	piece	1	9,200.00 €	1,510.00 €
21	Underpass expedition tank V 30 m^3	piece	1	19,200.00 €	4,100.00 €
22	Drain RO	piece	1	590.00 €	120.00 €
23	Receiving hopper V-1.5 m^3	piece	1	1,410.00 €	390.00 €
24	Drain RO	piece	1	590.00 €	120.00 €
25	Belt conveyor PD 650 L- 3.0 m	piece	1	2,900.00 €	710.00 €
26	Gradient pipeline + fixtures	bm	20	1,290.00 €	350.00 €
27	Steel frames			11,890.00 €	4,200.00 €
	Total			158,450.00 €	27,370.41 €

SPaP estimated another investment of 30,000 € for refurbishing of parts of the storage (roof, gates, and ramps) and together with equipment, the total costs for the project are estimated for 247,900 €.

6. Operation

6.1. Project Management Organisation, human resources

Considering the fact that the supplying partner, the company AGM, will provide training of employees after installation of the system, SPaP came to conclusion that the storage with its equipment will be operated in following regime:

Two shorter shifts per day (three hours each shift), or two longer shifts (six hours each shift) every other week day, depends on current needs: morning- afternoon shift + afternoon-evening shift. Each shift will consist of two persons, one person to be operating the control room, which will be responsible for transhipped quantities, speed, stopping and starting of the machinery and responsibilities associated with the operation of the equipment. One person will be supervising the area of the actual storage and physical condition of the machinery and an operation of front loader if needed. This person will be also responsible for communication with heads of discharging barges, coming and departing trucks and a paperwork regarding the transshipment operation. This calculation does not include a person operating the crane, because the use of the crane will not be needed at all times (for example while loading trucks from the storage) and crane operators are always available during these shifts, and are given different tasks if they are not needed in the crane.

Transshipment and storage will be under supervision of SPaP's department of cargo transshipment, which consist of skilled workers with all necessary certificates and trainings. It is not expected to hire new workers as SPaP has enough human resources and in unpredicted busy times, the company can always rely on trained workers form the port of Komárno. Workers from the port of Komárno, which is 100 km away from Bratislava, have always been coming to the port of Bratislava to help out if it was necessary.

6.2. Operation and maintenance costs

Human resources

4 persons in 2 shifts (2 x 2)

Costs for 1 person (1,200 € Brutto / month, total costs for company 1,622.4 € / month)

1 person / month	1,622.4 €
1 person / year	19,468.8 €
4 persons / year	77,875.2 €

The percentage of time dedicated to the new business amounts to 20% per year. Thus, the total costs for four persons would amount to 15,575 € per year.

Electricity

Costs of 1 crane during unloading procedure approx. 11.71 € / hour

Costs of the technology approx. 8.00 € / hour

Estimated costs of crane per year (400 hours) 4,684 €

Estimated costs of technology per year (600 hours) 4,800 €

Maintenance

Estimated service fee for maintenance per year (first 5 years) 1,000 € / year

Total costs for operation and maintenance per year: 26,059 €

6.3. Pricing

While setting the rates for transshipment of wood chips and wood pellets, SPaP had to take into consideration the rates for transshipment of other types of cargo, such as agricultural products, iron ore, metallurgical materials and others, and the fact that this is a new type of business for the company. It means an opportunity to establish partnerships with new partners and ports, and also to attract new customers and contribute to green logistics. The rate for transshipment was therefore set for 5.50 € per metric ton. This price does include the storage fees.

6.4. Preliminary cash flow estimates

Table 7: Estimated total earnings per year (Source: own editing).

Pricing	**5.50 € / mt**
Estimated number of barges per year	**40**
Estimated total volume per year	**20,000 mt**
Total income per year	**110,000 €**

Table 8: Estimated cash flow statement for 10 years (Source: own editing).

CASH FLOW STATEMENT (in EUR)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL 1-10 years
Income from revenues	(+)	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	**1,100,000**
Electricity consumtion expenses	(-)	-9,484	-9,484	-9,484	-9,484	-9,484	-9,484	-9,484	-9,484	-9,484	-9,484	**-94,840**
Personnel expenses	(-)	-15,575	-15,575	-15,575	-15,575	-15,575	-15,575	-15,575	-15,575	-15,575	-15,575	**-155,750**
Reppairs & maintanance expenses	(-)	-2,479	-2,479	-2,479	-2,479	-2,479	-4,958	-4,958	-4,958	-4,958	-4,958	**-37,185**
Maintanence	(-)	-1,000	-1,000	-1,000	-1,000	-1,000	0	0	0	0	0	**-5,000**
Investments paid	(-)	-247,900	0	0	0	0	0	0	0	0	0	**-247,900**
Total Cash flow netto		**-166,438**	**81,462**	**81,462**	**81,462**	**81,462**	**79,983**	**79,983**	**79,983**	**79,983**	**79,983**	**559,325**

6.5. Cost-benefit analysis

Table 9: Cost –benefit analysis for 10 years (Source: own editing).

COST -BENEFIT ANALYSIS (in EUR)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL 1-10 years
Revenues from services	(+)	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	**1,100,000**
Electricity consumtion (crane 400 hours)	(-)	4,684	4,684	4,684	4,684	4,684	4,684	4,684	4,684	4,684	4,684	**46,840**
Electricity consumtion (technology 600 hours in+out)	(-)	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	**48,000**
Reppairs & maintanance	(-)	2,479	2,479	2,479	2,479	2,479	4,958	4,958	4,958	4,958	4,958	**37,185**
Personnel costs	(-)	15,575	15,575	15,575	15,575	15,575	15,575	15,575	15,575	15,575	15,575	**155,750**
Depreciation technology (12)	(-)	18,158	18,158	18,158	18,158	18,158	18,158	18,158	18,158	18,158	18,158	**181,583**
Depreciation warehouse investment (20)	(-)	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	**15,000**
Service fee (first 5 years)	(-)	1,000	1,000	1,000	1,000	1,000						**5,000**
Profit (+) or Loss (-) on accounting period		**61,804**	**61,804**	**61,804**	**61,804**	**61,804**	**60,325**	**60,325**	**60,325**	**60,325**	**60,325**	**610,641**

6.6. Market analysis and marketing concept

Energy use of biomass in Slovakia currently lags significantly behind potential energy, economic and environmental options. Biomass has a great perspective in the production of heat for heating especially in the central heating systems in the form of wood pellets, wood chips and in private households in the form of firewood, pellets and briquettes.

On the Slovakian market, there are at least 30 to 40 companies that focus on a production and sale of wood based biomass products for purposes of heat production. At least six to ten companies producing and selling wood based biofuels are located in the region of the port of Bratislava. Logistics of these companies are mainly based on road transportation. During the analysis it was discovered that rail transportation is not used for transport of wood chips and wood pellets. SPaP's advantage compared to the current market in Slovakia is that it is a dominant market actor in the field of inland water transportation and is the operator in both Slovakian cargo ports in terms of providing transshipment of cargo. That gives the company a monopoly position in terms of transshipment of potential wood based biomass on a tri-modal way. SPaP aims to attract companies that supply large quantities of wood chips and wood pellets and are currently using road transport, like Termming a.s. (runs heating plants in Bratislava), EnerBiz s.r.o. (supplier of electricity, gas, and wood based biomass for energy purposes), Pilexim s.r.o. (supplier of wood chips and wood pellets), Intech Slovakia (energy supply, wood based biomass supplier etc.). The offer for these companies is the option to transport their cargo on barges to Bratislava, tranship the cargo to trucks and trailers and distribute it further by road transport. Customers are offered an attractive transshipment rate and a free storage. Therefore, after bringing wood chips and pellets to the port of Bratislava in large quantities, they can be stored inside the port, and removed step by step by trucks while customers will not be charged extra fees for storage.

6.7. Partners to be involved

For the operation of the project, cooperation with the port of Komárno is envisaged. With skilled workers and transshipment technology for loose bulk materials, this port will be able to help not just by supplying skilled workers in peak times, but also with handling of wood based biomass products. In case there would be more orders for loading of trucks and discharging barges, some barges could be sent to the port of Komárno where direct transshipment from barges to trucks can be carried out.

Budamar Logistics is a company which has been engaged in international forwarding and logistics services. They are experts in the field of rail and road transport and associated services and are an important partner in terms of forwarding transhipped cargo from barges to trucks or wagons.

AGM, spol. s.r.o.- the supplier of technological solutions for the project. AGM also provides the service and maintenance of the equipment and SPaP plans to use this service.

Inspekta Slovakia- an independent international organization for the inspection of services and goods of all kinds. Provides following services associated to the project operation: sampling and

analysis, versatile quality assessment, visual assessment, weight control and taring, loading and unloading controls, verifying complaints.

6.8. Co-operation possibilities with other ports

As mentioned in chapter 6.7., the port of Komárno will play an important role in the project operation. Also being operated by SPaP, it offers very flexible options of co-operation. It can provide following services: discharging of barges by crane with suitable grab, transshipment from barge to an open storage area, trucks or wagons, transshipment from barge to a barge, transshipment from trucks or wagons to a barge.

Additional ports with possible synergies are located at the lower Danube such as the port in Panchevo, where wood chips for local manufacture are handled, the port of Rotterdam, which is a major European hub for biomass handling and sets a great example in terms of transshipment technology and distribution of wood pellets in Europe. Germany and Austria are large scale users of wood pellets and wood chips for commercial and residential heating and ports in Germany and Austria are therefore interesting ports for cooperation as well.

7. Risks and barriers

7.1. Risks and barriers during the implementation

Supply of raw materials- Romania is one of the biggest European exporters of wood based raw materials and wood pellets. It is also a country from the Danube region with several ports and interesting partners in terms of supply of wood based raw materials. Import of raw materials can be unstable due to multiple factors such as national regulations, Danube navigability etc.

Customers- are located within the region of Bratislava, in some cases even customers from further regions might be attracted.

Contractor failure- a contractor, in this case the company AGM, could fail to deliver contracted machinery and services.

Overly optimistic schedule- setting up schedule of implementation which turns being too tight.

Inaccurate cost estimates- contractors and partners find difficulties in the process of implementation, are not able to keep contracted prices, additional costs.

Failure in training- training of employees does not meet the desired effects- inability to start the operation, delays and possible extra costs, dissatisfaction of stakeholders.

Finding of bugs, defects and inaccuracy in design- delays of launch of the operation, delays of transshipments, possible extra costs, and dissatisfaction of stakeholders.

7.2. Risks and barriers during operation

Prices of biomass cargo- prices of wood based biomass would rise and customers would switch to conventional fuels or decrease a demand for wood chips and wood pellets.

Customers switch to another port- other ports near Bratislava (Wien, Budapest) start offering better conditions for handling of wood based biomass and customers/partners switch to these ports.

Different trading routes- partners and customers are not convinced by the performance of the business (etc. transit times, storage capacities) and switch back to road transportation.

Machinery breakdown- breakdown of technical equipment, in this case covered by maintenance services of supplier, but it could still cause delays and extra costs.

Technology failure or outage- technology turns out not being able to keep up with expected volumes and load- can possibly cause failure of the project.

Lack of cargo- due to geopolitical, economic or other reasons, overly optimistic estimated quantities.

Inaccurate costs estimates- inaccurate estimated depreciation of technology, costs of human resources or maintenance causing false financial expectations.

Disruption due to weather conditions- heavy rain, heavy and strong winds, abnormal water levels- could cause stoppage of operations, delays in schedules, extra costs.

Partners fail to keep up with contracts- inability to provide contracted quantities, loss of income.

Failure on side of employees- failure to follow the methodology, work instructions, possible technology breakdown, failure to follow work ethic, workplace injuries.

Lack of demand for service- for geopolitical or economic reasons, changes of prices of fuels, a technology innovation that changes the industry.

8. Recommendations

The aim of this pre-feasibility study was to explore whether it is feasible for the company Slovak shipping and ports (SPaP) to enter the biomass industry, specifically the business of storage and transshipment of wood chips and wood pellets in bulk. SPaP is in an advantageous position within Slovakia, being the only port operator in the country, operating both ports, the ports of Bratislava and Komárno. That makes the company the only one in the country being able to operate in a tri-modal way (water, rail, road). Inland waterway transport gives companies an opportunity to transport bigger volumes in one shipment, usually for competitive prices and with less emissions and pollution than by road or rail transport. By providing a transshipment position for wood based biomass in the port of Bratislava, SPaP could fill the gap in the regional but also the national

market. In order to be successful in the new business and to make it sustainable, a number of recommendations were elaborated.

It is essential to monitor the biomass market in the Danube region and even beyond. The offer of wood based biomass products can be unstable due to weather conditions or changes in law and legislation of countries involved. Even though in this project the customers are expected to secure their own supply (SPaP is supposed to be just an operator of transshipment position and storage), SPaP needs to be able to secure additional supply of products from different regions if needed. Prices of wood chips and wood pellets can vary depending on a season of the year, weather conditions, the geo-political situation and other factors. The company needs to monitor prices and overall development of the marketing order to stay competitive and be able to adapt to changing circumstances.

Regarding the customers and partners, SPaP should put efforts to increase its network and to attract new business partners. To support this requirement it might have a positive impact if the company would get involved in more projects and activities which help spreading information about green logistic and biomass usage. By supporting an expansion of biomass handling, trading and using, SPaP can attract more partners to get involved in the company´s new business activities.

In terms of the technical side of the envisaged investment, it is necessary to maintain the new technology devices. This can be achieved by regular technical checks and a proper maintenance. For this purpose, SPaP will cooperate with the supplier of the new equipment, the company AGM. AGM will also be involved in regular training sessions of SPaP's employees in order to keep them qualified and informed about market changes and new trends in technology.

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