

AN ANALYSIS OF THE POSSIBILITIES OF USING LNG TERMINAL IN SWINUJSCIE

The article presents the results of analysis services LNG terminal in Swinoujscie using the Ishikawa Diagram. Presented analysis of the services currently offered by the terminal, indicating and analyzing the possibility of extending the range of services in order to increase competitiveness in the international terminal.

INTRODUCTION

LNG terminal in Swinoujscie is designed to receive and liquefied natural gas regasification. Problems with gas supplies from Eastern neighbors contributed to take action aimed at diversifying the supply of gas.

To this end, measures have been taken to build a LNG terminal in Swinoujscie. It was equipped with unloading arm, a network of pipelines for the transportation of LNG, two tanks for the storage of liquefied natural gas, and regasification, you need to change the form of the liquid to a gas.

The terminal in Swinoujscie is a solution of great importance the country's energy. Its existence gives you the ability to import LNG from anywhere in the world. In addition, the extension of the scope of services provided by the terminal for transshipment and gas exports make it will become a strategic point in the field of energy to other countries using the services of Russia.

The aim of this study is to assess the actual scope of services provided in the context of terminal. The article is an analysis of the potential uses of the LNG terminal in Swinoujscie.

As a basis of analysis the Ishikawa diagram, also known in the literature as a diagram fish, fishbone diagram or fault tree diagram. Under this method, the analysis began by noting the effect of which is to narrow the range of services provided by the LNG terminal in Swinoujscie, then identified and analyzed all the possible causes of the same effect. Applied diagram cause - effect allowed the accurate identification and diagnosis all possible reasons responsible for a narrow range of services that are currently offered by the LNG terminal in Swinoujscie. Furthermore allowed to illustrate the potential and possible to do action implementation aimed at broadening Terminal Services [3]

1. ANALYSIS OF THE RANGE OF SERVICES LNG TERMINAL IN SWINUJSCIE

Analysing the range of services that are currently possible to provide the LNG terminal in Swinoujscie considered the issue "a narrow range of services".

Figure 1 shows the Ishikawa diagram including within its scope the issue in question and the reasons for its occurrence.

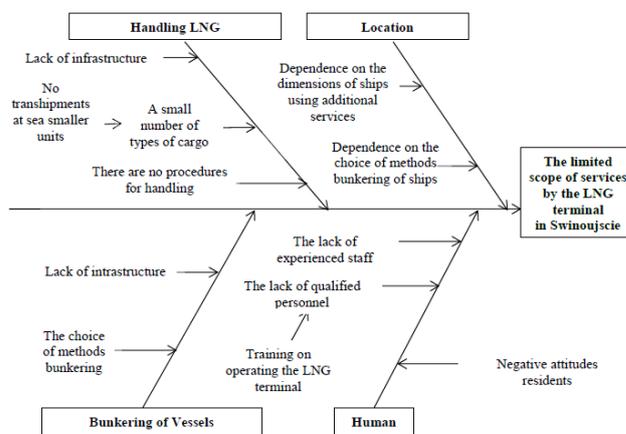


Fig. 1. Diagram cause - effect a narrow range of services provided by the LNG terminal in Swinoujscie [4]

As can be seen from Figure 1, among the important reasons for a narrow range of services offered by the terminal are distinguished:

- Types of handling LNG;
- Location;
- Bunkering ships;
- Human factor.

The above analysis of cause - effect relationship has allowed the accurate display of all problem. Among the causes that generate analyzed the problem, which causes have been observed and studied, deserves special attention - location. The extension of any service connected with the design and selection of the optimal location. In case of extension services bunkering vessel, the location is directly dependent on the choice of the method of bunkering ships. When selecting the location, attention should also be paid to the size of units that will be potential recipients of services. This is important because of the other port operations, which will be simultaneously executed. Without a doubt, the location should be chosen in a way that does not distort the exercise of basic services LNG terminal in Swinoujscie. Wrong locate or not the behavior of an adequate level of safety, can be a limiting factor for the optimal use of the potential capabilities of the terminal.

Another of the reasons affecting analyzed the problem, which is illustrated by Figure 1, are the types of transshipments. Currently, the terminal is adapted to provide services only to the extent transshipment to tank trucks. The range of services noticeable is the lack of transshipments at sea units. This is of course a natural consequence

of the lack of infrastructure for this type of transfer points. Subjecting a thorough analysis, the issue concerning the bunkering of ships LNG fuel terminal in Swinoujscie can be seen that the underlying causes of that service, at the moment, apart from the lack of infrastructure, then chooses the optimal method of bunkering.

Another, but equally important factor generating the problem of "narrow range of services" is called Human factor.

The study by the human factor interpret both workers as well as people forming the immediate surroundings of the LNG terminal. A well-functioning terminal, is not only the location, infrastructure, machinery or good and comprehensive service. Able prosperous terminal is also his staff, or the human. As is clear from market research carried out for analysis, in the West Pomeranian region there are no specialists in handling LNG terminal.

What's more, from the recognition of tenders universities in Poland, it shows that there is a lack of specialized courses of study or training in this field. Only the Maritime University of Szczecin, in answer - demand offers postgraduate studies in operation LNG terminals. Bearing in mind the human factor to be considered, in addition to specialized human resources, and environment also. Opinion residents of Swinoujscie and the surrounding area is not without significance. Although the negative attitude of the residents does not directly affect the amount or the more the quality of services provided by terminal it is often the power of inhibiting terminal. Only the effectiveness of the management of the terminal and carry accurate information and promotional policies may limit the destructive impact of this factor.

In April 2015 an agreement was signed for the development of the Feasibility Study LNG terminal in Swinoujscie with the company Tractebel Engineering SA. The feasibility study is to be the next step in order to increase the diversification of supply and the competitiveness of Polish LNG terminal on the European market. As part of the feasibility study of the LNG terminal services would be expanded to handling smaller vessels, construction of a third tank and fuel bunkering of LNG ships [8]

2. THE POTENTIAL EXTENSION OF THE FACILITIES OF THE LNG TERMINAL IN SWINOUJSCIE

Broadening the scope of services offered by the LNG terminal in Swinoujscie is a necessary condition in order to compete on the European market. Bearing in mind the specific nature and conditions of the terminal, among the potential directions of its development, can be distinguished:

- The ability mail-order (increasing to 7.5 bcm / year);
- Reloading into smaller vessels;
- Storage of LNG (extension of the offer);
- Bunkering of ships (diversification offers) [2]

When analyzing the possibility of increasing the export capacity terminal to 7.5 bcm / year authors analyzed two parameters, ie:

- Location;
- Construction of the tank.

The location for the construction of additional tank needed to achieve greater capacity, was included in the development plans of the LNG terminal as so field reserve. The planned location is shown in Figure 2.

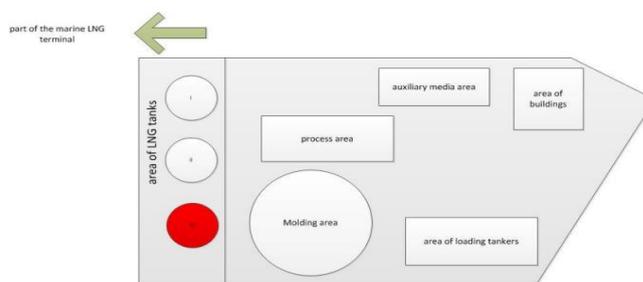


Fig 2. The location of additional LNG tank [1]

Figure 2 is a graphical representation of the location of all points for handling LNG terminal, which so far have been planned. In the onshore part of the terminal, the element marked in red on the number "III" refers to the location of the third tank will eventually destined for LNG. Elements of "I" and "II" refer to two tanks located on the LNG terminal in Swinoujscie with a storage capacity of 2.5 bcm of gas per year each. All tanks are located in the vicinity of the maritime part of the LNG terminal, which greatly shorten the way gas transmission and thus optimize the unloading time.

Increasing the export capacity of the LNG terminal in Swinoujscie, without a doubt, contribute to its development. However, the above solution characterize both advantages and disadvantages. These characteristics are summarized in Table 1.

Tab. 1. The pros and cons of increasing the capacity of shipping LNG terminal in Swinoujscie [4]

Increasing the export capacity of the LNG terminal	
Advantages	Disadvantages
Polish independence on gas supplies from Russia.	The need to build a third tank.
Increase the attractiveness of Polish ports.	The financial outlays .
Ensuring energy security of the country,	Time to adapt terminal.

Among the advantages of the implementation of this solution stand out for Polish independence from Russian gas supplies and provide energy security of the country. This is due to the possibility of import of liquefied natural gas, using sea transport, with many possible directions of offering the sale of these assets. Moreover, among the important advantages can be observed an increase in the attractiveness of Polish ports. Competitive port, providing a wide range of services, with the ability to mail-order may be interested in the major exporters of natural gas, and thus play an importance on the European market.

The disadvantages presented in Table 1 are the factors related to the construction of the tank, ie: cost and time. Build another tank is reflected in the need for financial expenditure including the purchase of materials, the employment or operating costs of machinery used in its construction. In addition, the time required to build a LNG storage tank is prolonged, which makes the investment is able to bring expected only in the long term.

Analyzing expanding the scope of services provided by the LNG terminal drew attention to the handling of liquefied natural gas for transport means, mainly on tankers and smaller vessels.

Table 2 analyzes the pros and cons of the use of this service.

Tab. 2. Advantages and disadvantages of handling LNG , means of transport [4]

Handling LNG on the transport	
Disadvantage	Advantages
Land consumption	The ability to distribute LNG to smaller ports
Cost	The ability to provide services on a national scale
The need for a project	The existing infrastructure of roads
The need for site selection	Mobility
Lack of infrastructure adapted to handling	Acting as HUB

The advantages and disadvantages shown in Table 2, relate to the transshipment of liquefied natural gas for means of transport. The introduction of such services will strengthen the competitive position on the market, as they allow gas distribution by means of road transport and rail, to smaller buyers of LNG. At the moment, the LNG terminal in Swinoujście has two positions for transshipment, LNG to tank trucks with capacity of approx. 95 000 tonnes per year. However, the transshipment on rail tank, requires expansion of terminal infrastructure. It is necessary to choose place for location the rail siding, where it will take place the transshipment. This solution would allow for the distribution of LNG, using the existing network in Poland railway lines. In order to supply the LNG fuel to places which are not accessible by road or rail, it is necessary transshipment on smaller vessels [6]

The LNG terminal in the course of transshipment functions, he will have the character of maritime hub. The disadvantages, resulting from the application of the above solutions are: land consumption, time and cost associated with the creation of the station to transshipments.

Considering the range of provide services the LNG terminal in Swinoujście, should be consider the storage of gas in tanks located throughout the terminal, without the need for prior regasification - storage.

Table 3 shows the advantages and disadvantages of the above solutions.

Tab. 3. LNG storage [4]

LNG storage	
Disadvantage	Advantages
The need a permanent development of the storage area of the LNG tank	The possibility of concluding long-term contracts
Reducing storage space for the country's energy supply sources	Increase market competitiveness
The necessity of constant monitoring of quantitative and qualitative	The possibility of regional cooperation in the Baltic Sea region

Among the significant advantages of storage services for liquefied natural gas in the tanks at the LNG terminal was awarded, among others, the possibility of concluding long-term contracts, which in turn positively affects the stability and maintenance of financial liquidity terminal. In addition, according to market research conducted for this study, at terminals in the Baltic Sea region there is a lack of such services, which would increase the competitiveness of the LNG terminal in Swinoujście.

Implementation of storage services, in addition to advantages, it also has specific disadvantages. Among those of major importance honored: the need to maintain the gas in liquefied form so long how the agreement will be concluded with a potential partner. Moreover,

the specificity of cargo warehousing process makes it necessary qualitative and quantitative control. Accordingly, the terminal will be required to ensure the proper and strict conditions for safe storage of liquefied natural gas.

Among the possibilities for widening the scope of services provided by terminal also analyzed the bunkering of seagoing vessels. summary of the pros and cons of this service has been made with respect to the types of methods bunkering ships , ie:

- bunkering of ships by Ship-to-ship (STS);
- bunkering of ships by Tank truck-to-ship (TTS);
- bunkering of ships by Terminal-to-ship via pipeline (TPS);
- bunkering of ships by Portable Tank Transfer (PTT)[5]

Table 4. shows the advantages and disadvantages of the method of STS .

Tab. 4. Advantages and disadvantages of method STS [4]

Bunkering of ships by STS	
Disadvantage	Advantages
Dependent on vessel traffic	The possibility of bunkering from 1,000-10,000 cubic meters
Dependent on weather conditions	Ability to use maritime vessels and barges
The need to equip the port of fenders and mooring lines equipped for bunkering	The possibility of bunkering in port and at sea
Limited ability for transshipments and storage, limited by the parameters of the vessel	The possibility of bunkering in the port during loading /unloading

Application of bunkering Ship -to -ship is a very flexible solution with many advantages. It allows you to bunkering medium-sized units with a capacity of up to 10,000 cubic meters, both in port during heavy traffic of ships and on the sea. In addition, method STS allows simultaneous carrying out the loading operation or the unloading of the ship. Undoubtedly, a major disadvantage of using this technology are sensitivity on the atmospheric conditions and capital expenditures.

Another bunkering method is the method Tank truck -to -ship with using tankers. Advantages and disadvantages of this method are presented in Table 5.

Tab. 5. Advantages and disadvantages of TTS methods [4]

Bunkering of ships by TTS	
Disadvantage	Advantages
High cost of implementation	Bunkering at the wharf or pier
The possibility of bunkering small units of 100-200 cubic meters	Bunkering using cryogenic wire, or re-loading arm
The use of more than 1 tanker truck	The possibility of bunkering other means of transport
Long time of bunkering	Mobility

Analyzing the TTS method, among the significant advantages awarded, include: the possibility of bunkering at the quay or jetty, no need to build additional infrastructure point on the wharf, due to the fact that the process is carried out solely by means of cryogenic cable or transshipment arm. In addition, bunkering using TTS, makes it is mobility and allows bunkering well as other means of transport.

The disadvantage of using this method is primarily time and costs. TTS method allows bunkering small naval units from 100-200 cubic meters, which requires the use of more than one tank truck, thus prolonging time of bunkering because of the need to always switch loading arm and cryogenic cables. Analyzing the relatively high cost of implementation methods TTS recognized that in the case of the LNG terminal in Swinoujście, will be reduced to a minimum because place to station for handling liquefied natural gas to tank trucks have been included in the plans for this terminal.

Another of the methods that were analyzed, is the method TPS, using pipeline hooked into the LNG tank. The advantages and disadvantages of this method illustrated in Table 6.

Tab. 6. Disadvantages and advantages of the method TPS [4]

Bunkering of ships by TPS	
Disadvantage	Advantages
The need to position a cryogenic pipeline network	Bunkering using cryogenic cable
Lack of flexibility	Bunkering on the waterfront
Land consumption	Bunkering large naval units
The location for bunkering station	Fast delivery time
Reducing the implementation of port operations	Alternative for cruise liners

Bunkering by TPS is done directly via pipeline from the reservoir attracted by the LNG terminal. By the need to position the pipeline network that makes this solution becomes expensive. The specificity of the method enforces the need to implement bunkering services in a specific and specially adapted to this place, which unfortunately translates into a lack of flexibility. In addition, the method of TPS reduces implementation of other port activities. However, beyond the substantial drawbacks, as shown in Table 6, the above method also has advantages.

Among the significant advantages distinguished, among others: the possibility of bunkering large units, the relatively short time of bunkering, due to the lack of necessity of substitution of bunkering units.

Another, and also the last of the analyzed methods is the Portable Tank Transfer, a method using a portable tank (container) as a portable fuel storage of LNG. Disadvantages and advantages of the method PPT shown in Table 7.

Tab. 7. Advantages and disadvantages of PTT methods [4]

Bunkering of ships by PTT	
Disadvantage	Advantages
The possibilities bunkering depend on the tank	Ability to move
The need for a storage yard	No dependence on demand

Method PPT, by virtue of specifics, makes it possible to bunkering of ships depending on the capacity of tank. This is a fundamental disadvantage of PTT. This method can be used only for smaller passenger ships and tankers of LNG.

Regardless of defects must be stressed held significant advantages, among them the possibility of moving the container using different means of transport to any distance or lack of dependence on demand.

CONCLUSION

The range of services LNG terminal in Swinoujście is too low terminal to play a strategic importance for the maritime economy. To ensure the growth of competitiveness of Poland as a port on the European market through an investment which is the LNG terminal in Swinoujście is necessary to choose directions of development of the terminal posing among others the possibility of increasing export capacity to 7.5 bcm / year and extend the offer for additional services, ie: reloading to smaller vessels, storage or LNG bunkering of seagoing vessels.

As is clear from the above analysis, among the existing and practicable methods of bunkering, the greatest chances of success have methods TPS and TTS. The increasing importance of the Baltic Sea region, the existing infrastructure for these methods and optimally position the terminal in close proximity to the ferry terminal infer the effectiveness and cost-effectiveness of these methods. The use of such technologies will allow for bunkering both small and large naval units, which will be an adequate response to the needs of the market.

What is important, recommended above alternatives for expanding the scope of services provided by the LNG terminal in Swinoujście are result from the proposals outlined by the Polish LNG company. Also, you should presume that the implementation of the above could in future lead to the possibility of bunkering local passenger ferry "Bielik" and "Karsibór" and liquefied natural gas could be used for bunkering locomotives and other means of transport.

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Analiza możliwości wykorzystania terminalu LNG w Świnoujściu

W artykule przedstawiono wyniki analizy usług terminalu LNG w Świnoujściu przy zastosowaniu Diagramu Ishikawy.

Zaprezentowano analizę stanu usług obecnie oferowanych przez terminal z jednoczesnym wskazaniem i analizą możliwości rozszerzenia wachlarza usług celem podniesienia konkurencyjności terminalu na arenie międzynarodowej.

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