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GREEN PORTS – ENVIRONMENTAL CHALLENGES AND ECONOMIC DEMANDS

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Abstract. The article defines the term Green Ports as a part of logistics chain and the transport networks are under sustainable development and process optimization. Port expansion should always be considered in the context of environmental legislation and its implementation in different national laws.

*Keywords: g*reen economy; MARPOL; sustainable development

Introduction

The aim is to find proposals and solutions that can have both environmental and economic maximum impact – result in the port. However, the limitations that have been set for such actions are taken into account, where they could limit the functionality of the port or affect the place and the quality of life of the inhabitants. The most important international practices and challenges for ports are the creation of "green ports and navigation". At the same time, measurable international data emphasize the need for environmental protection and the critical role that shipping and port technology can and does play in it. For this reason, energy data were requested and studied to record the needs that exist and to create a comprehensive report. Then, energy saving measures were evaluated with the cost-benefit logic, as well as the installation of RES in the port for the supply of green energy in it. This evaluation was made after recording and identifying the technologies that can be integrated in the port and followed by an analysis of possible scenarios to find the best one. At the same time, the integration and energy coverage in an electric vehicle station was studied, as their development in the coming years due to the gradual exemption from fossil fuels is expected rapidly. Finally, the results are evaluated and commented on and points worth studying in greater detail and requiring further research were identified. (Holocher et al.) The concept is therefore based on three pillars:

1. Green ports as a prerequisite for green shipping: In the environmental field, the International Convention for the Prevention of Pollution from Ships (MARPOL) of the International Maritime Organization (IMO) of 1973 is relevant. This agreement

will be successively expanded and currently contains six annexes, which deal with different questions of the protection of the marine environment. The MARPOL agreement can only be implemented if the ports have appropriate facilities, in particular for supplying and disposing of the ships.

2. Green ports as ecologically built and operated ports: Port infrastructure and superstructure should be built and operated as ecologically as possible and coordinated with one another in the sense of a life-cycle approach.

3. Green ports as a prerequisite for ecological port hinterland traffic: Most sea traffic is multimodal traffic in which the port is the interface between (port hinterland) land and sea traffic[1)]. In order to give the less environmentally harmful (ecological) transport modes rail, inland waterway and possibly pipeline a chance when choosing the mode of transport for hinterland traffic, the port must firstly be accessible for them, secondly, facilitate the use of these high-volume modes of transport through bundling effects, and thirdly, support ecological traffic management.

Green ports and the maritime transport

The article shows how existing activities of a sustainable port economy can be structured and further developed in order to establish sustainable logistics. The drivers for the further development of Green Ports are, on the one hand, legal requirements, and on the other hand, voluntary measures or measures initiated by the stakeholders (customers, owners, the public). (Biebig 1980)

Figure 1. Port Sustainability Plan

The provision of all types of port services is achieved through the development of many and complex activities, which lead to pollution and degradation of the natural environment, within and outside the port area. Significant sources of pollution as a result of the provision of maritime work can be distinguished: Pollution from ships. Pollution from handling and storage of loads. Pollution from support works. Pollution from the shipbuilding and repair zone.

Taplia is the most common source of environmental pollution in Stalmania. In particular, the usual waste is air and cargo tank waste, oil waste as well as waste for daily use. At the same time, there are some accidents that can occur due to fuel or cargo leaks during the maintenance of a ship. Moreover, it has been proven that the operation of ship engines is burdened by the environment with metals (V, Ni, Pb, Zn) (Arvanitis 2006). Stapliaia are very frequent, especially if they remain for a long time in the port, microorganisms grow on the ridges. As a result, the ship's resistance to water increases, speed decreases and larger amounts of fuel are used. At the same time, rust develops on the steel oxidation vessel. In order to deal with the above problems that arise from the ship's stay in the water, soft colors are used, which, however, due to the chemicals they contain, create environmental pollution in the port. As mentioned above, tire pollution can come from handling and storing loads. In the case of rapid loading, approximately 1% of the load is lost during the loading, transshipment and unloading procedures until the product reaches from the source to the final recipient. In the case of container transport ports, there are quite a few cases where the containers can be found in the sea due to incorrect handling[2)].

New opportunities and possibilities have been created in energy management systems, such as the time slippage of the operation of devices and processes that consume energy and the storage of electricity produced when there is no demand. A modern container handling terminal requires the use of more and more automated technologies and reducing the number of working staff employed. The new generation of hybrid AGVs (Automated guided vehicles) using VDL (VHF digital link) could fully meet today's standards and requirements, with a focus on life cycle cost reduction, improved reliability and less impact on the environment (Grancharova et al. 2013).

Terms and responsibilities The concept of sustainability consists of the three components: ecological, social and economic sustainability. In common parlance, sustainability is often reduced to ecological sustainability and the term “green” is used for this. In the maritime sector, the term “green” has emerged for this, and the terms green ports and green shipping are used accordingly. Based on Biebig (1980), a sea port can be defined as a complex of berths for seagoing vessels, which acts as an interface between sea and hinterland traffic ensures the transshipment of goods and people and has the necessary facilities for the transshipment, storage and

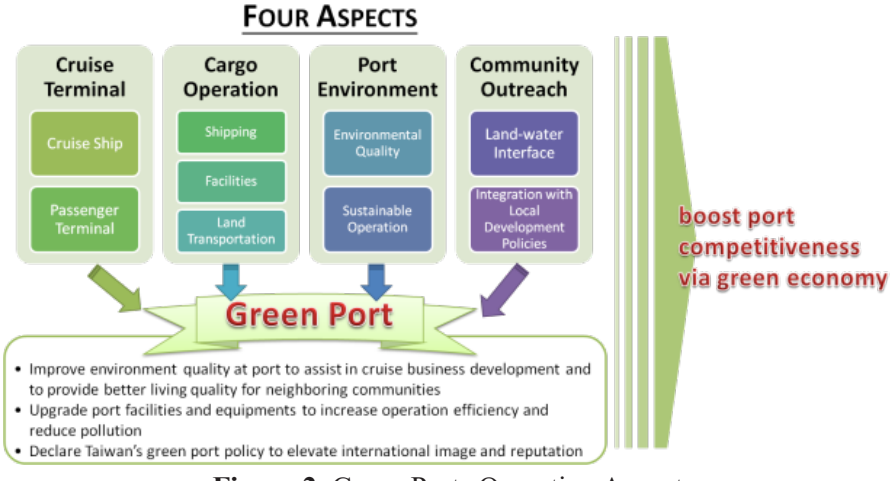

Figure 2. Green Ports Operation Aspects

transport of goods to and from, as well as for traffic and handling of the seagoing ships and inland transport in the port area. Often companies from the port industry have settled in the port area. For the following considerations, it is more appropriate to view the seaport as a separate commercial area on the deep water, which is used in particular for the transshipment of goods and people between seagoing vessels and the land, and in which economic, sovereign and administrative activities of very different companies and authorities are exercised. For successfully operating of ships into and out of ports, it is essential to apply an accurate assessment of the relevant environmental phenomena, which will have influence on and will pose potential risk for safety in the area[2].

When designing and building new port facilities or modernizing existing ones, the following must be taken into account: the protection of the health of the port staff, the environment, the property; the manner of transportation and trans-shipment of dangerous goods; the specific and dangerous facilities in the vicinity; the ability to easily organize actions and evacuate in the event of an accident; the existence of a procedure for action in emergency situations; the provision of facilities for the cleaning and repair of ships or containers.(Holocher et al.)

Distribution networks become active with the presence of RES (Resources for Energy Saving) units and distributed generation units that affect energy flows. Innovative trends in "active" energy demand management are the use of multi-agent systems, which can solve the problem of real-time load management and are implemented with software. Their main element is the agent (mediator), who, with his actions, changes his environment. The distributed, decentralized technology of multi-agent systems is superior to traditional solutions.

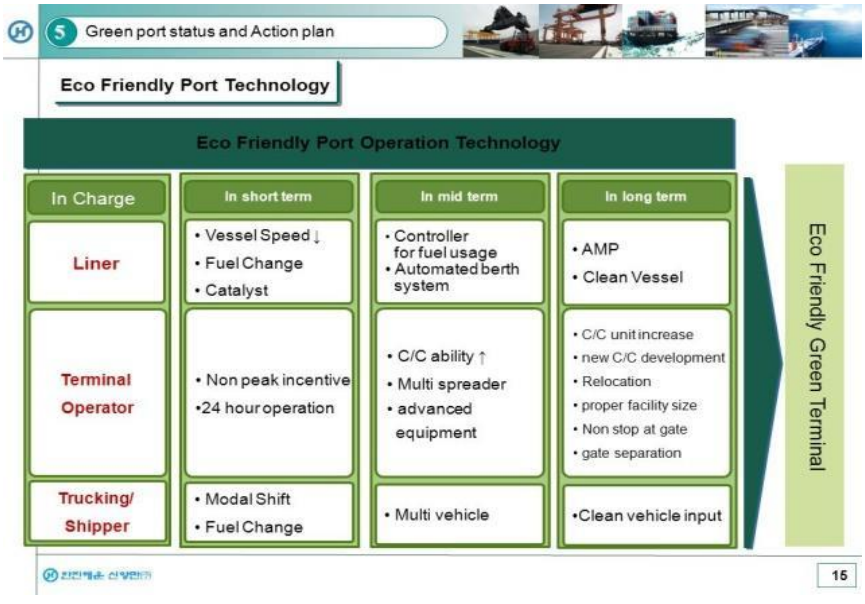

Figure 3. Green Ports Technologies

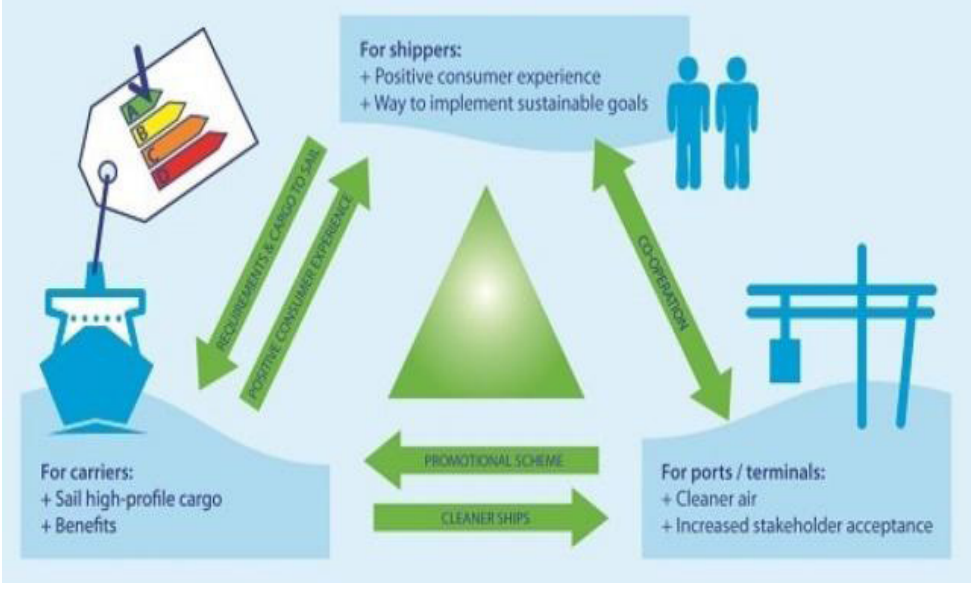

Figure 4. Green port Incocentive Schemes

The research project e-harbor studied the application of innovative energy management technologies in major ports in the North Sea. Related research programs in Europe are Green Efforts, Eficont, Climeport, and Cleanship. In addition, in Europe, the network of European electricity transmission system operators ENTSO-E (European Network of Transmission Systems) plans to develop new and expand existing grids near major ports, envisioning large transit centers to become immediate and large energy hubs. Relevant developments exist at the level of international organizations PIANC – Popular International and National Communications and WPCI – Wireless Personal Communications Inc. in the rest of the world with emphasis on the USA, but also in major international ports such as Los Angeles, Hamburg, Amsterdam, etc. These ports proceed to establish rules far beyond those required by current legislation (beyond legalization) [3].

Energy loads can exist both in the processes of a port, such as electric cranes, refrigerators, container vessels, cold rooms, and in the industrial activities involved in the port-city. Also, a very significant electrical load results from the use of cold ironing technology, which eliminates the need for moored ships to use their auxiliary engines, providing them with direct energy from the port's electricity system. At the same time, energy storage technologies can be used in ports, such as the extensive use of electric cars. It also favors the use of other technologies, such as the conversion of port lighting into LED (Lighting Energy Display).

Systematic research efforts seeking a specific method of implementing the idea of the "green" port, in terms of energy management have been implemented in the ports of Koper, Hamburg and Genoa.

In the European Union there is the will to promote and financially support such initiatives in the context of the large-scale pilot application of new technologies in electricity. Isolated substantial energy systems, such as ports or interconnected islands, are the most suitable first applications. Such options are implemented in major commercial ports in the rest of Europe.

Three pillars of the Green Ports concept

Pillar 1: Green Ports as a prerequisite for Green Shipping Maritime shipping spans the world and, to a large extent, takes place outside of territorial waters

Legal regulations relating to shipping are therefore made internationally by the International Maritime Organization (IMO), a sub-organization of the United Nations. Their regulations are primarily aimed at the flag states, i.e. the states under whose flag the ships sail; their compliance is also monitored by the port states, i.e. the states in whose territory the ports of call are located. In the environmental field, the IMO's 1973 International Convention for the Prevention of Pollution from Ships (MARPOL) is relevant. This agreement will be successively expanded and currently contains six annexes (appendices), which deal with different questions of the protection of the marine environment. The MARPOL Agreement can only be implemented if the ports have the appropriate facilities – see the following table 1.

MARPOL Annex VI deals with air pollution from ships. The limit values for certain sailing areas (e.g. North Sea and Baltic Sea) have recently been tightened. The sulfur content of marine fuels is to be reduced to 0.1%. Another important change in the course of the reform of MARPOL Annex VI was the addition of the consideration of pollution by nitrogen oxides (NOx) and fine dust. This will mean that either fuels with a reduced sulfur content or other fuels such as LNG (liquefied gas) or, in the future, hydrogen will have to be made available as bunkers. When using exhaust gas desulphurisation systems as a possible alternative on the ships, it must be possible to collect residues in the port. The ships can be supplied with shore power to reduce exhaust gas and noise pollution while they are in port. Connections and power generation capacities must be provided on the port side. In its three cruise terminals, Hamburg is not only testing the connection to the public power grid, but also a floating liquefied gas power plant at which cruise ships are docked and which provides generation facilities to enable sustainable, ecological shipping (Green Shipping)[4].

Pillar 2: Green Port as an ecologically built and operated port. This core of the Green Port concept is about port infrastructure and superstructure is to be built and operated as ecologically as possible.

Both should be coordinated in the sense of a life-cycle approach. For the approval for the construction of ports, terminals or larger berths in Germany an environmental impact assessment (EIA) is required, which as a rule is part of the plan approval procedure. The EIA determines, describes and evaluates the expected effects of the building on environmental protection, goods and people. The plan approval decision stipulates how environmental damage is to be avoided, reduced or compensated for. This is e.g. laid down in the accompanying landscape conservation plan.

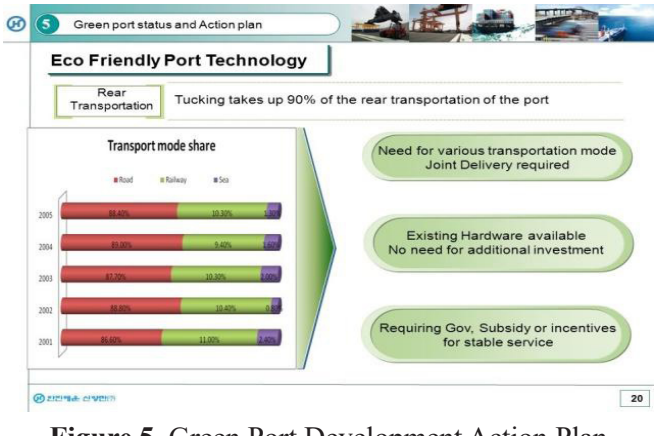

Figure 5. Green Port Development Action Plan

The participation of the (affected) public and environmental associations ensures that ecological concerns are adequately taken into account in port construction and operation. The – 1190-sided – planning approval decision for the Jade Weser Port stipulates, for example, how the project executing agency must ensure compliance with the MARPOL regulations in the construction and operating phase of the port facility plants, large-scale plant manufacturers (e.g. of crane or wind energy plants), refineries, fertilizer manufacturers, etc. In the case of building and operating permits, ecological concerns are taken into account according to the current legal status. In the case of a Green Port, in addition to compliance with the relevant regulations, further voluntary ecological measures should be carried out. In practice, there is no uniform opinion – or even regulation – regarding which measures are to be classified as ecological[5]. Therefore there is a multitude of the most diverse ecological activities, which are reported on in sustainability reports or life cycle assessments.

Pillar 3: Green ports as a prerequisite for ecological port hinterland transport.

Most sea transports are multimodal transports in which the port is the interface between (port hinterland) land and sea transport. In order to give the less environmentally harmful (ecological) modes of transport rail, inland waterway and possibly pipeline a chance when choosing the mode of transport in the hinterland, the port must firstly be accessible for them, secondly, their use through bundling effects must facilitate high-volume modes of transport and, thirdly, support ecological traffic management (Grancharova & Grancharov 2013).

Conclusions

1. Concerns about global climate change are growing as its effects become apparent. The increase in population, combined with the increase in consumer goods and the improvement of living standards has led to a sharp increase in energy consumption. At the moment, as a natural consequence, oil production and the demand for electricity has multiplied in the last ten years.

2. Combined with the limited use of renewable energy sources, they have led to an increase in emissions, thus degrading the environment and gradually destroying household systems. In all manufacturing sectors, the method by which they continue to operate in the context of sustainable development is examined. Thus, in the lexicon of the international community, new terms have been added, such as green house, hybrid means of transport, etc.

3. The response to shipping in this new "green harbors" is needed. The "green port" promotes sustainable development, taking actions that positively affect economic well-being, environmental quality and social responsibility.

4. Actions in this direction are related to the protection of the community from environmentally harmful port works, the promotion of ports or environmental protection guidelines, the promotion of sustainability and environmental protection,

5. It should be emphasized that a green port does not explicitly promote environmental policies without taking into account the economic performance of these policies.

NOTES

1. "Πράσινα" λιμάνια και βιώσιμη ανάπτυξη Ο Μανόλης Ντουντουνάκης M.Sc. ηλεκτρολόγος μηχανικός ΕΜΠ, υποψήφιος διδάκτορας Πολυτεχνείου Κρήτης
2. Swiftly Green, Greening port operations – Best practice guide.
3. Bremen May 20153HHLA, Geschäftsbericht 2015, Hamburg 2016, S. 1614BLG,
4. ΠΡΑΣΙΝΑΛΙΜΑΝΙΑ: ΗΠΕΡΙΠΤΩΣΗΤΗΣΕΛΛΑΔΑΣΥ ψηλάντη Ευαγγελία Διπλωματική Εργασίαπουυποβλήθηκεστο Τμήμα Ναυτιλιακών Σπουδώντου Πανεπιστημίου Πειραιώςωςμέ ροςτωναπαιτήσ εωνγιατηναπόκτησητου Μεταπτυχιακού Διπλώματος Ειδίκευσηςστη Ναυτιλία Πειραιάς Νοέμβριος
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