

The Protection of Marine Aquatic Life: Green Port (EcoPort) Model inspired by Green Port Concept in Selected Ports from Turkey, Europe and the USA

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ABSTRACT

Ecological Port, also known as Green Port (EcoPort), is an important development strategy protecting marine aquatic life and ecosystem. It provides business information on environmentally best practices and corporate responsibility centred around marine ports and terminals, including shipping, transport and logistics. Green Port concept gives a great opportunity to make transportation clean and efficient. Marine industry should adopt new legislations to create a clean future. It is the key point to implement strict liquid and solid waste policies and to begin to use low sulphur fuel and electric power whenever possible. Green Ports utilize electric powered cranes and they have strict garbage policies and well-educated personnel. Furthermore, the vessels entering Green Ports must have an accredited waste management and bunkering plan. In this study, the implementation of the Green Port concept at some selected Turkish, European and the US Ports was given and a simple Green Port Model was prepared.

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1. Introduction

Water quality may be influenced by a wide range of natural factors (biological, geological, hydrological, meteorological, and topographical). However, an equally important parameter on water quality is the human effect [1]. Marine pollution is a subject of global interest, due to the large number of toxic substances transported from human activities [2-4]. As shipping expanded into a prominent means of transportation and exploration in the 15th century and earlier, the number, size and speed of vessels rose dramatically [5,6]. Ports are the best-known places where man's activities and environmental issues are sometimes in direct interaction. They often have long local traditions, as many principal ports have been centered on local and regional development and are strongly associated with the city profile and image unclear meaning please rephrase. Ports around the world are usually of public ownership due to the nature, size and long-term perspective of the investments needed, although operations are often privatized [7]. This public ownership should be focused on to understand how ports can shape the social and environmental performance of transportation systems, since it allows for the internalization of both social and environmental externalities [8]. Political approaches around the world view ports and port terminals as critical infrastructure assets. Their ongoing success is directly linked to their ability to "go green" by reducing their carbon footprint and by taking into account environmental considerations. Inevitably port planning, design and operation of the future must change to accommodate these concerns.

An Ecological Port, also known as a Green Port (EcoPort), is an environmentally friendly and sustainably developed port, which meets all environmental requirements. Green Port, which allows the voluntary and sustainable environmental sensitivity and the promotion of all company employees and stakeholders, aimed at increasing ownership during the result of integrating the development and operation of port facilities unclear meaning please rephrase. The policies that should be implemented in a Green Port deal with the following: protection of nature, highest possible level of pollution reduction, increased use of renewable energy and the recycling of materials. All these policies are aimed to reduce the negative impact on the environment as well as to protect and improve the ecosystem and marine aquatic environment (natural life policy), to reduce airborne emissions (air policy), to ensure the cleanliness of the harbor and coastal waters (water policy), and of the port base (soil and sediment policy), to collaborate with stakeholders and spread awareness knowledge (education policy), to design and manage applications of the port area, to perform operations (sustainability policy) and to reduce energy consumption by using renewable and environmentally friendly energy (energy policy). The Green Port policy is possible to evaluate these seven titles [9].

As the environmental impact of logistics and transportation has gained recognition, ports have started to develop environmental strategies and to incorporate social responsibility strategies. An essential tool for executing these strategies is the differentiation of port related to their environmental impact. Most “green” port dues relate to vessels, e.g. the Environmental Ship Index (ESI) [8].

2. Green Port Concept

The concept of Green Port is to integrate environmentally friendly methods in port activities, operations and management. Given the logo in Figure 1, Green Port aims to utilize efficiently its resources, to reduce the negative impact on regional environment, to raise the environment management level and improve the quality of the natural surroundings of the port area [9].

The green concept deals with protection of the as well as with its promotion into action. Examples of these enforcing policies are inclusion of trees in the port absorb noise and diminish pollution, and use of renewable energy for the port operations and activities, or enforcement of practices, such as recycling and material reuse [9].



Figure 1. The Logo of Green Port

Most of ports have to fulfil the following goals in order to be characterised as green. These are;

- Waste management, reduce waste from port operations through material reuse, recycling and composting
- Sustainable development, enhance the environmental performance of port buildings while maximizing long-term economic benefits
- Sustainable business practices, give equal weight to environmental, economic and social concerns
- Water, improve water quality
- Energy, conserve energy and maximize energy efficiency to port operations.
- Air, reduce greenhouse gas contributions and other air emissions from port operations [10].

3. Green Ports in Turkey, Europe and the USA

Environmental concern about port activity is a reality nowadays. The process of making port management “green” affects port authorities around the world in terms of safeguarding their “license to operate” and increasing their economic and environmental competitiveness. In Europe, growing green reflex is mirrored in many green initiatives of individual ports and the coordinated actions of the wider port community [11].

The Port Environmental Review System (PERS) has firmly established its reputation as the only port-sector specific environmental management standards. PERS stems from work carried out by the ports themselves and it is specifically designed to assist port authorities with the functional organization necessary to deliver the goals of sustainable development. While incorporating the main generic requirements of recognized environmental management standards (e.g. ISO 14001) [12]. PERS is adapted to deliver effective port environmental management and its implementation can be independently certified [13].

Turkish Transportation, Communication and Maritime Ministry and Turkish Standard Institution has initiated the ‘Green Port Project’ in December 2014. The idea of this project is to encourage Turkish Ports to be environmentally friendly ports or Green Ports. In order to achieve this accreditation the port must fulfil some responsibilities before to request Green Port Certificate. These are to improve water quality, reduce air pollution, reduce operational pollution, establish renewable energy, manage waste management and improve working conditions. After the port has abided to all the aforementioned rules, Turkish Standard Institution grants a certificate to the port. Until now three ports (Asyaport, Marport and Port Akdeniz) are Green Ports in Turkey. In this manuscript, Marport and Asyaport were selected and assessed.

European Sea Ports Organization (ESPO) established Green Port portal in 1994. The vision of Green Ports has arisen to create a level playing field on port environmental management in Europe through the sharing of knowledge and experience between port professionals. Serving the principle of “ports-helping-ports”, Green Ports brought a network of port professionals from several European ports together to exchange views and practices and to commonly work towards the improvement of the sector’s environmental performance in line with the principles of voluntary self-regulation [14]. In this study, authors assessed Rotterdam and Hamburg Port from Europe.

Most of USA ports have their own Green Port policies or programs. These policies include waste management, sustainable management, air quality, improve water quality, reduce noise pollution. In this paper, Port of San Diego and Port of Long Beach from USA were assessed.

3.1. Asyaport

Asyaport (Photo 1) is located in Barbaros/Tekirdağ on 30 Ha (300.000 sqm) of reclaimed land is being constructed to be exclusively a container terminal. The construction has started in 2010 and started to operation on 1st July 2015 at Barbaros/Tekirdag, Turkey [15].



Photo 1. Asyaport (Tekirdağ, Turkey)

Asyaport which is the first Transshipment Container Terminal (Hub Port) of Turkey having a draft up to 18 m, 2000 m total quay length in the position of a world-scale port. ESPO was reported that Asyaport Liman

(Turkey) took PERS certification after the positive evaluation of their applications by Lloyd's Register Quality Assurance. Asyaport Liman joined the EcoPorts network in 2015 and is the first Turkish port to achieve PERS certification [16].

Asyaport is an environmentally sensitive port designed as a "Green Port". Different technologies are used for reducing Carbon Emissions and for the use of natural resources such as Solar Panels, Liquid Natural Gas powered trucks, Electric-Engined STS and RTG's. Rainwater in Asyaport area, collected and purified through rainwater collectors, is used for irrigation and fire extinguishing. Wastes in Asyaport temporary storage area are separated according to grade and type of hazard. There is a drainage system for the group of hazardous wastes. These wastes are disposed to contract companies in certain periods [15].

3.2. Port of Ambarlı (Marport)

The Port of Ambarlı (Marport) (Photo 2), which is located in İstanbul, Turkey's first private container port, is implementing several projects on long-term projects for environmental and occupational safety issues.

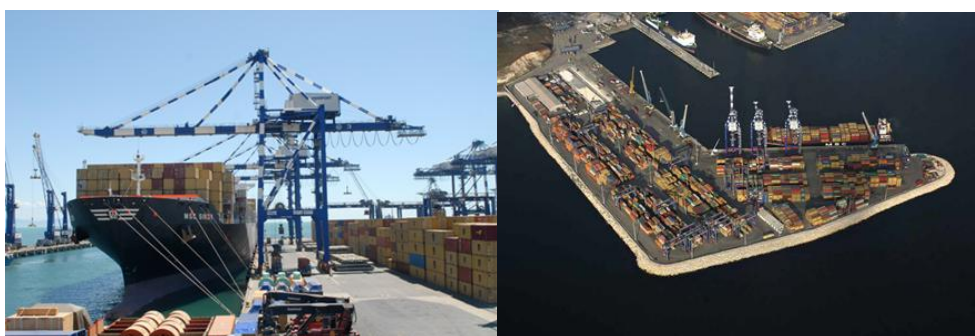


Photo 2. Port of Ambarlı (Marport) (İstanbul, Turkey)

Awareness on the environment can be seen today to have become a priority in the activities of the company. For this purpose, Marport also take social responsibility activities and implement appropriate green projects [17].

Health, Safety&Environment (HSE) established in port-site is determined by the attendant Environmental Engineers in the Department of Environmental Risks. According to the size and severity of identified risks are planned corrective and preventive activities. In this context, the implementation of the waste management system, the environment and safety for workers to organize trainings, electric cranes and the future with projects aimed at reducing the consumption of natural resources such as the use of alternative lighting systems foster the release of a cleaner environment. In order to intervene in a chemical or fuel leak may be in the terrestrial field Spill Kits and accident response team in order to live in the sea while creating Coastal Emergency Response Plan was prepared. The Marport is also prepared to act in accordance with the International Marpol Convention for the prevention of marine pollution can occur by accident, or may result from the operation of ships by the International Maritime Organization (IMO) [17].

Marport Port Services has been awarded the 'Green Port' certificate as part of a project undertaken by the Turkish Standards Institute and the Directorate General of Merchant Marine, which is under the Ministry of Transport, Maritime Affairs and Communications [18].

3.3. Port of Rotterdam (Port Vision 2030)

Located in the city of Rotterdam, Netherlands, the Port of Rotterdam is the largest port in the Europe (Photo 3). It was the world's busiest port from 1962 to 2002, now overtaken first by Singapore and then Shanghai. In 2011, Rotterdam was the world's eleventh largest container port in terms of twenty-foot equivalent units (TEU) handled (tenth in 2009, ninth in 2008, sixth in 2006). In 2012, Rotterdam was the world's sixth-largest port in terms of annual cargo tonnage [19]. The Rotterdam Port Authority, the port administrator, has evolved from an administrative, reactive landlord port to become a participatory and proactive regional

developer. Where the focus used to be on commercial contracts, the management focus is now on the phenomenon “license to operate and grow”. This is the support from the surrounding community, and the freedom gives support the port to be able to operate and grow.

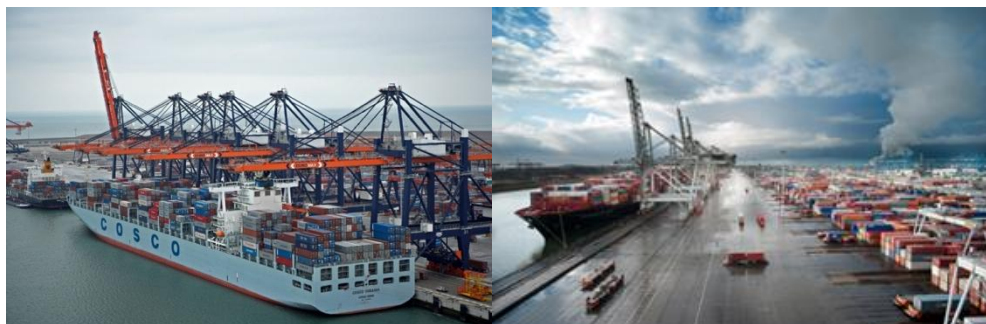


Photo 3. Port of Rotterdam (Rotterdam, Netherlands)

Two main ambitions:

1. The Port of Rotterdam is expected to be Europe’s most important port and industrial complex in 2030. It is a powerful combination of the Global Hub and Europe’s Industrial Cluster, both of which lead the field in terms of efficiency and sustainability.
2. It is hoped to be a link in logistics chains with the lowest ecological footprint per ton-kilometre in the world in 2030.

This governing mechanism, combined with the company’s ambition, being the most efficient and smartest port in this part of Europe, defines the type of client the Port Authority would like to attract. These must be frontrunners companies that lead the way in terms of sustainability. The port administrator gives ships that are more environmentally friendly than the law stipulates a discount on port dues and companies must compete in terms of sustainability, whether involved in land allocation, construction or infrastructure maintenance. In each case, companies go further than the law requires [17].

3.4. Hamburg Port

Sustainability plays an important role in the port of Hamburg as the proximity of the port areas to the city and the sensitivity of the Elbe river ecosystem require particular attention to sustainability issues in the development of the port. An interesting development in the port–city relationship in Hamburg is the Hafencity project. The port of Hamburg (Photo 4) and the city of Hamburg have been investing in renewable energy since the early 1990s, when Hamburg pioneered the development of wind energy (Acciaro *et al.*, 2014). Hamburg Port Authority (HPA) is the organization mandated by the Free and Hanseatic City of Hamburg to manage the port. The city of Hamburg is the sole shareholder of the HPA and as such it ensures that environmental goals are an integral part of HPA strategy [21].



Photo 4. Hamburg Port (Hamburg, Germany)

Since 2005 the HPA has been providing future-oriented port management services offering one face to the customer. As an institution under public law, the HPA is in charge of paving the way for the efficient, resource-friendly and sustainable implementation of infrastructure projects in the port. The HPA is the contact

point for all kinds of questions concerning the waterside and the landside infrastructure, the navigational safety of vessel traffic, port railway facilities, port property management and the economic conditions within the port area [22].

3.5. Port of San Diego

Port of San Diego (Photo 5) is a self-supporting public-benefit corporation that was established in 1962 by an act of the California State Legislature. It is located on San Diego Bay in southwestern San Diego, California. In 2009, The U.S. Bureau of Transportation Statistics ranked the Port of San Diego as one of America's top 30 U.S. containership ports bringing in nearly 3,300,000 metric tons (3,200,000 long tons; 3,600,000 short tons) of cargo per year [23].



Photo 5. Port of San Diego (California, USA)

Port of San Diego adopted Green Port Policy at 2007. It was developed to achieve long-term environmental, societal, and economic benefits through resource conservation, waste reduction, and pollution prevention. Goals of Green Port Policy are waste management, sustainable business practices, sustainable development, water, energy and air [10].

3.6. Port of Long Beach

The Port of Long Beach (Photo 6), also known as Long Beach's Harbor Department, is the second-busiest container port in the United States, after the Port of Los Angeles, which it adjoins. Acting as a major gateway for US-Asian trade, the port occupies 3,200 acres (13 km²) of land with 25 miles (40 km) of waterfront in the city of Long Beach, California [24].



Photo 6. Port of Long Beach (California, USA)

The Port of Long Beach established a reduced speed zone (RSZ) in 2006, which rewarded vessel operators for slowing vessels within 20 nautical miles (nm) of the port; the zone was extended to 40 nm in 2010. This program cut CO₂ pollution from ships by an estimated 26,700 tons in 2007. The Port also adopted an Alternative Maritime Power (AMP) technology approach to cutting emissions by using a mobile power supply system involving zero emissions from vessels while they are at the pier [25].

The Port of Long Beach is committed to improving the environment, as demonstrated by its 20-year record of environmental protection programs. The Green Port Policy is an aggressive, comprehensive and coordinated

approach to reduce the negative impacts of Port operations. The Green Port Policy, which the Board adopted in January 2005, serves as a guide for decision making and established a framework for environmentally friendly Port operations. The policy's five guiding principles are:

- Protect the community from harmful environmental impacts of Port operations.
- Distinguish the Port as a leader in environmental stewardship and compliance.
- Promote sustainability.
- Employ best available technology to avoid or reduce environmental impacts.
- Engage and educate the community [26].

4. Green Port (EcoPort) Model

In this study, a simple Green Port (EcoPort) Model (Figure 2). In this model, six criteria were selected. These are air quality, wildlife, water quality, waste management, community relation and sustainability.

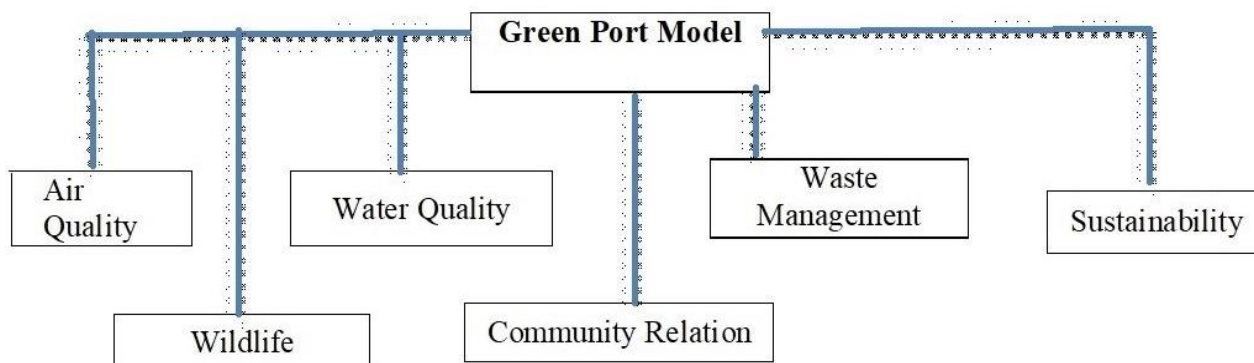


Figure 2. Green Port (Ecoport) Model prepared in this study

4.1. Air Quality

This criteria's main aim is to reduce air pollution and improve air quality in the port area. Ships in the port and some cargo handling equipments are produce NO_x , PM and CO_x . Ships in Port can use shore electricity which is Alternater Maritime Power. Port of Long Beach used this system.

4.2. Wildlife

The ports should monitor wildlife by tracking several indicators of habitat quality, including the abundance of birds and the number of fish species found in the harbor during periodic biological surveys. If the ecosystem is damaged, the ports must plan restoration programs that will contribute to the rehabilitation of the area and protect the ecosystem [11]. There are 172 commercial ports in the Turkey. More than 20 new ports added this mount last ten years. Most of ports have plan for expanding. These ports must prepare Environmental Impact Assesment (EIA) but this is not enough for ecosystem. All ports must periodic biological surveys after all construction completed.

4.3. Water Quality

Marine pollution is major pollution in the port area. Major sea pollutants are ship wastes and leakages, in case of accidents or bad services of ships, and infrastructure inside the periphery of the port. Also, routine activities, such as ship discharge (ballast, sewage, and spillage) contribute significantly to water pollution [11].

The water quality can be measured via a set of parameters: transparency, pH, temperature, salinity, turbidity, suspended solid (SS), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), sulfide (S_2), nitrogen (N), mercury (Hg), lead (Pb), zinc (Zn), phosphorous (P), cadmium (Cd), cyanide (CN), hydrocarbons (H/C), density and types of phytoplankton and zooplankton are some of the more usual parameters that are measured to study the quality of the water [14].

4.4. Community Relation

When the port construct or expand, it must complete EIA in Turkey. EIA is required to contact local community. But port must improve local community relation for sustainable development. Other issue is public relation, port also continue public relation using public broadcasting such as TV channels and newspapers. It is very important for inform public to protect environmental.

4.5. Waste Management

As the strategy of waste-management, it is very important to ensure that waste materials are recycled and reused in different industry in order to protect the ecological environment and there are so many initiatives related to this subject [27]. Waste management is reducing waste from port operations through material reuse, recycling and composting and also improve ship's waste reception facility. Ship's waste reception facility can accept oily and solidwastes and also ballast and sediment from ship. If port is using electric power for cargo handling equipment, it is cause less waste from port operation.

4.6. Sustainability

Sustainability is a new concept with various perspectives in communities [28]. The sustainable practices are aiming to reduce pollution, by all means and in all fields. One applicable sustainable practice is recycling [11]. Recycling of wastes is beneficial environmentally and economically [29]. Each port can recycle everything, from plastic (bottles) and paper (newspapers, magazines) to tyres and computers [11].

5. Discussion and Conclusions

The trade of goods in the world causes serious environmental damages. To avoid this detrimental effect, The Green Port projects may play an important role to strengthen the environmental economic options [30]. In this study, authors prepared a simple Green Port (EcoPort) Model considering Green Port concept in selected ports from Turkey, Europe and the USA.

The Ministry of Transport, Maritime Affairs and Communications, and the Directorate General of Merchant Marine in Turkey have initiated the Green Port Project in 2012. In this Project, "Green Port" award was given to the port facilities which comply with the standards that have been stipulated by Turkish Administration. The application for the awarding is based on volunteer scheme. Whenever any port claims that it is fully compliant with the standards, a survey is being carried out and if successful the port is awarded with a certificate. A pivotal part of the Green Port project is the inclusion of well educated personnel fully aware of environmental matters. Other parameters that constitute a Green Port (such as improving air and water quality, waste management, promoting sustainability, protecting wildlife, conserving energy, reducing greenhouse gas contributions and other air emissions, community relation, national safety of vessel traffic, economic conditions, etc.) in not only Turkish but also European and US examples are also presented in this paper. In conclusion, authors may claim that Green Ports are beneficial both for business and for marine aquatic environment protection.

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