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# Green maritime logistics: the quest for win-win solutions

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## Abstract

By green maritime logistics we mean achieving an acceptable environmental performance of the maritime transport logistical supply chain while at the same time respecting traditional economic criteria. In this paper the environmental focus is on maritime emissions. Achieving such goal may involve several trade-offs, and win-win solutions are typically sought. However, finding these solutions may be more difficult than may appear at first glance. The purpose of this paper is to provide a concise overview of the challenges of green maritime logistics and present some examples, both for greenhouse gas (GHG) and non-GHG emissions.

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## 1. Introduction

The traditional analysis of maritime transport logistics problems has been in terms of cost- benefit, economic or other optimisation criteria from the point of view of the logistics provider, carrier, shipper, or other end-user. Such traditional analysis by and large either ignores environmental issues, or considers them of secondary importance. Green maritime logistics tries to bring the environmental dimension into the problem, by analyzing various trade-offs and exploring ‘win-win’ solutions. In doing so, criteria for the benefit of the private end user may give their place to criteria that are more relevant from a societal point of view.

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There can be many definitions of the word ‘green’, and a definition can be critical as regards the subsequent approach and measures to achieve whatever goal is set. For instance, if by green we mean minimising emissions from maritime transport, and we subsequently strive to apply a series of technological measures that would achieve that goal, a conceivable outcome might be that shipping may become unprofitable and various undesirable side-effects may occur, including cargo shifts to other modes, reduction of trade, route shutdown, relocation or even shutdown of production, and possibly others. It is clear that one can always minimise emissions from A to B if trade from A to B is minimised. In the extreme case that trade from A to B ceases to exist because no operator would make a profit engaging in that trade, emissions would drive down to zero. But that’s not a desirable outcome.

So things may be more complex than they appear at first glance, and in fact the goal of greening the maritime logistical supply chain may involve several trade-offs that are at stake, and which have to be analyzed and evaluated if a desirable solution is to be achieved. In the long road towards a sustainable global maritime transport system, a sound knowledge of the balances between economic and environmental objectives, and of the factors that may affect these balances, is a necessary condition.

Based on the above, below is a working definition of the phrase ‘green maritime logistics’:

- *Green maritime logistics is an attempt to attain an acceptable environmental performance in the maritime transport supply chain, while at the same time respecting traditional economic performance criteria.*

Societal criteria are often embedded in the above definition, either on their own right, or as part of the set of economic criteria. It is clear that the weights among the various criteria varies among stakeholders, a private operator assigning more weight to economic criteria, an environmental organisation more weight to environmental criteria, and others perhaps preferring social criteria. Whatever it is, achieving the above is what we call a ‘win-win’ scenario. As we will see however, a win-win outcome may not always be achievable. The word ‘sustainable’ is often used to denote a similar outcome, and *sustainable maritime logistics* is often meant to imply a maritime transport system that combines acceptable economic, environmental and social performances.

We clarify that in the above definition by ‘acceptable environmental performance’ and for the purpose of this paper we mainly mean *acceptable level of emissions*. This is so due to the increased attention anthropogenic emissions have been getting in recent years, both at a global and a regional level. Among them, certainly carbon dioxide (CO<sub>2</sub>) and other greenhouse gas (GHG) emissions have attracted much of the focus from a climate change perspective and the world community has set ambitious goals to mitigate them. Other types of emissions, such as sulphur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>) and others are also important. We make the above clarification because it should be recognised that, other than emissions, there are certainly additional environmental attributes of maritime transport that may create undesirable effects. These include noise, hazardous substances, oil pollution, ballast water, dust, residues, garbage, and others.

The above definition also implies that there exists a well-defined set of criteria to assess the various facets of performance of the logistical system under consideration. These criteria are often called Key Performance Indicators (KPIs). Selecting appropriate and meaningful KPIs is a very important step and one that may be more difficult than it seems at first glance. Difficulties may be due to a variety of reasons, as will be seen later.

With these in mind, the purpose of this paper is to present a brief discourse of the main issues associated with green maritime logistics, and present some examples that are relevant in this area. Due to space limitations, we should clarify that the paper covers only a limited sample of relevant topics, referring to additional publications for more details. The broader perspective of green *transport* logistics, in which shipping is one of the global transport modes, is examined in a recent book by the author (Psaraftis, 2015).

The rest of this paper is organised as follows. Section 2 discusses the main challenges associated with green maritime logistics and Section 3 discusses the difficulties in obtaining win-win solutions. Section 4 refers to logistics-based measures for shipping, with a focus on speed optimisation and the problem of SO<sub>x</sub> reduction, and Section 5 presents the conclusions of the paper.

## **2. Challenges in green maritime logistics**

Green maritime logistics presents some non-trivial challenges. Below we present a non-exhaustive sample.

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