

**Port of Los Angeles**  
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# **Environmental Ship Index**

## **Draft Proposal**



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# Content of the presentation

- Introduction
- Environmental Ship Index (ESI) study
- Proposed index
- Organisation and verification
- Next steps
- Goals of the development of the ESI





# Introduction

- **World Ports Climate Conference July 2008, Rotterdam**
- **55 ports endorsed the Climate Declaration as a guide to take action**
- **One of the actions is to develop an ESI for ocean going shipping for air pollutants and greenhouse gasses**
- **An ESI as a base for incentives to stimulate a better environmental performance of sea going shipping**
- **Lead port: Rotterdam**
- **Ports of Antwerp, Bremen, Le Havre and Hamburg joined to make this proposal**





# ISE study

- Requirements for the index
- Existing legislation and developments
- Overview existing indexes for maritime transport
- Examples indexes road and air transport
- Development ESI
- Organisation and verification of the ESI





# Requirements for the index

- **Fit criteria UN / IMO / MEPC**
- **Simple**
- **Transparent and easy to verify / certify**
- **Linked to ship, not fleet**
- **Involve NOx, SOx, PM and CO2**
- **Stepwise development / improvement**
- **Ready to use from 01- 01- 2010**
- **Effect on emissions at sea and at berth**





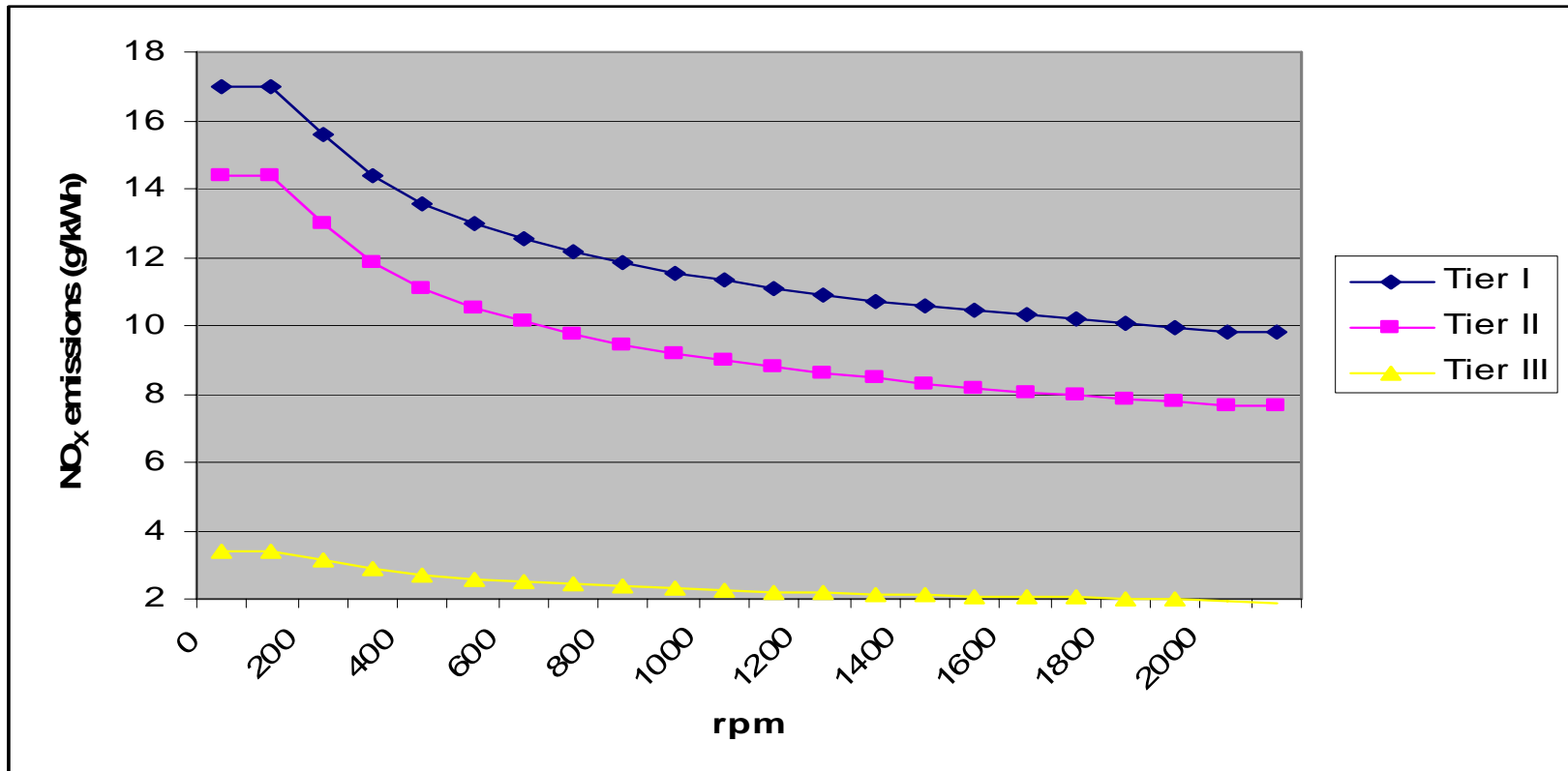
# Legislation and recent developments

- **New standards MEPC / IMO for NO<sub>x</sub> and SO<sub>x</sub> in October 2008**
- **NO<sub>x</sub>: tiered approach, I, II and III: increasing demands for new built ships**
- **New limits for sulphur content in fuel oil, globally, in ECA's and at berth**
- **No emission standards for PM, but PM is strongly linked to SO<sub>x</sub>**
- **Greenhouse gas not yet regulated but IMO developed a CO<sub>2</sub> monitoring index**





# New IMO standards NO<sub>x</sub>





# New IMO / EU sulphur limits

## Globally:

4,5 % until 1 January 2012

3.5 % from 1 January 2012

0.5 % from 1 January 2020

## In ECA's:

1.5 % until 1 March 2010

1.0 % from 1 March 2010

0.1 % from 1 January 2015

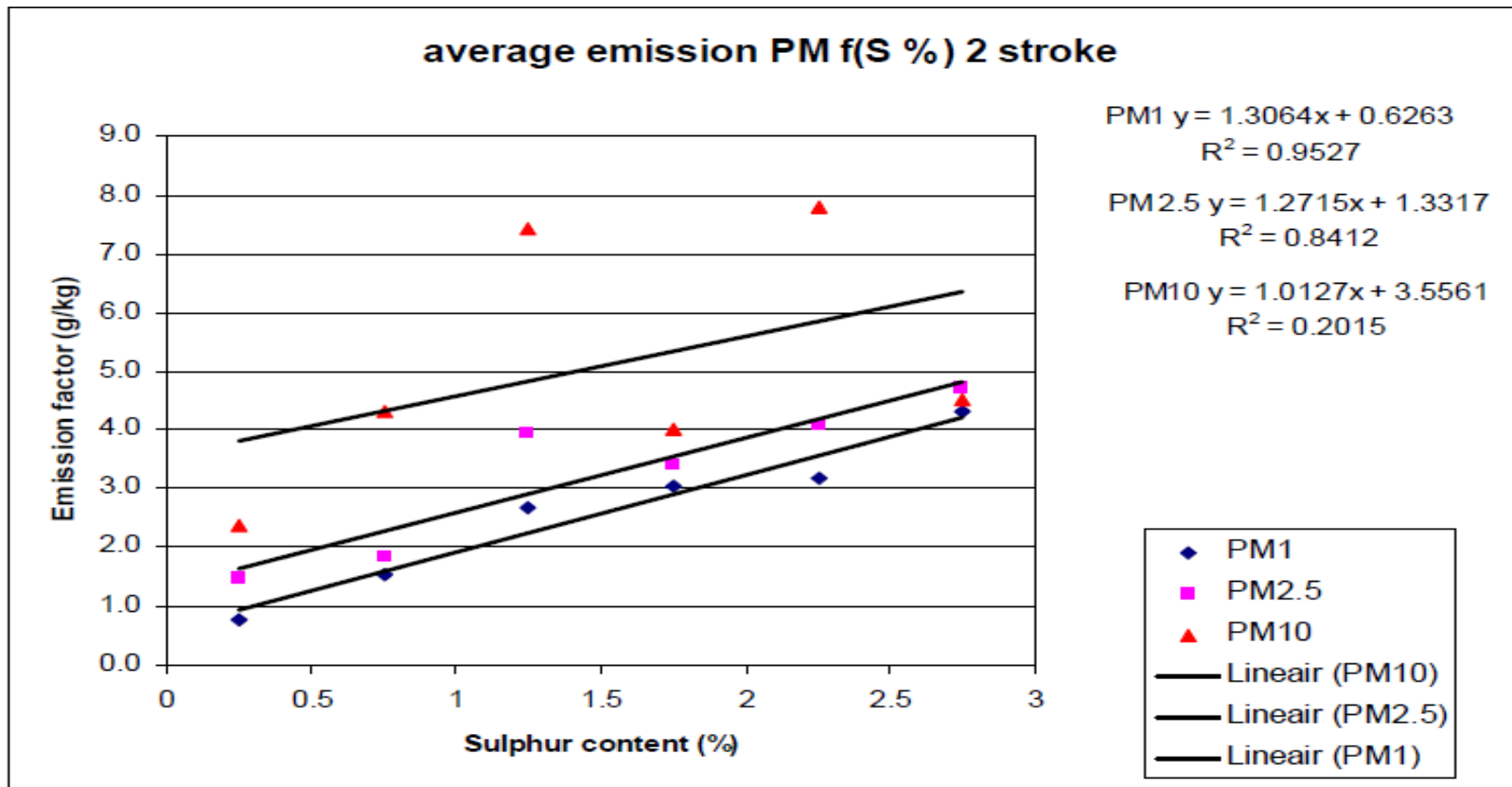
## At berth:

Max 0.1 % in EU from 1 January 2010





# PM strongly linked to SOx





# Existing indexes maritime transport

## *Conclusions and lessons learned*

- 10 indexes reviewed on 7 different criteria ( pollutant, application, control, incentive etc.)
- Indexes in use ( Green Award, Der Blaue Engel) or proposed (Clean Shipping) are complex
- In Sweden indexes for NOx and SOx differ in application by the ports
- Currently no other experience with CO2 index then for monitoring and reporting
- IMO CO2 baseline index is currently being designed

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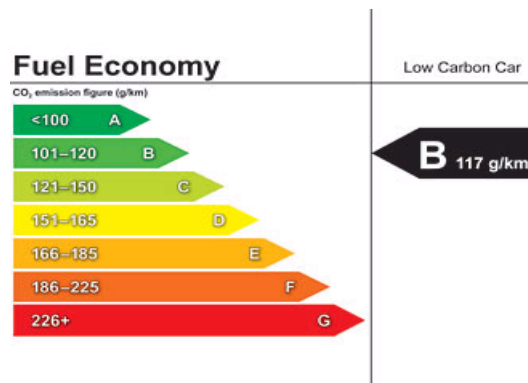






# Examples of indexes road transport

- EU passenger car labelling
- Vehicle registration tax
- Environmental zoning for trucks
- Differentiation of infrastructure charges (Germany, Switzerland)





# Example index air transport

- **ERLIG recommendations**
- **Environmental differentiation landing charges on NOx emissions**
- **Continuous scale in differentiation**





# Existing indexes road and air transport

## *Conclusions*

- All relatively simple and cover only one theme
- Data availability of key importance
- Emission standards and type approval data used as a basis
- CO2 only type approved for passenger cars

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# Development of ESI-NOx

**NOx: respect different engines and situation (open sea or port area)**

$$ESI_{NO_x} = \frac{100}{\sum_{i=1}^n P_i} \times \sum_{i=1}^n \frac{(NO_x \text{ limit\_value}_i - NO_x \text{ rating}_i) \times P_i}{NO_x \text{ limit\_value}_i}$$

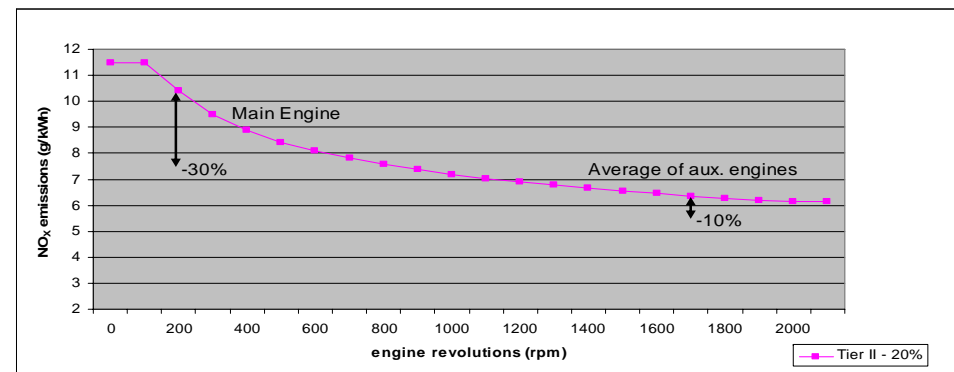
**ESI NOx = index value NOx (1 – 100)**

**Pi = power engine i**

**NOx rating i = certified emissions engine i**

**NOx limit value i = max. allowable NOx emissions engine i (Tier II – 20%)**

**n = number of engines**





# Development of ESI-SOx

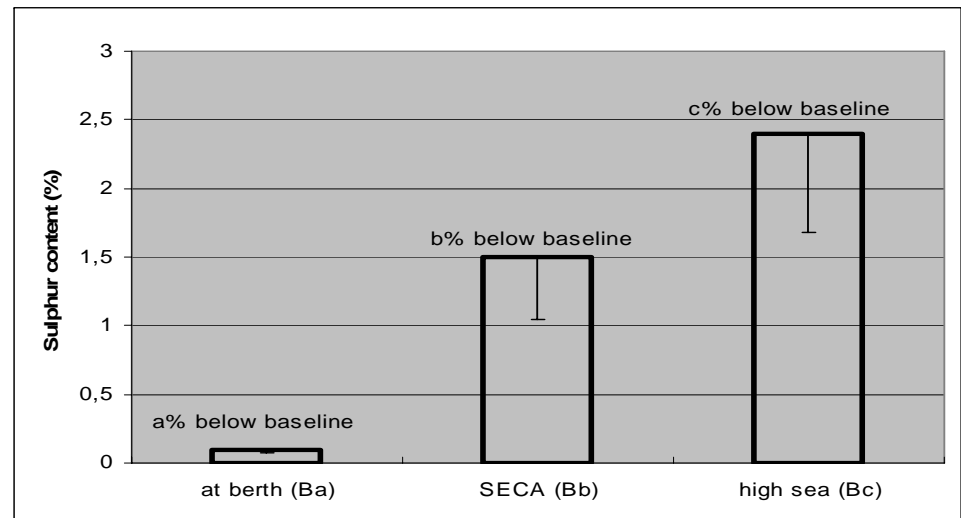
SOx: respect different fuels used at different places

$$ESI \text{ - } SOx = \frac{W_A * a\% + W_B * b\% + W_C * c\%}{W_A + W_B + W_C} * 100$$

**a%,b%,c% = relative improvements of in zones used fuel compared to baseline**

**WA, WB, WC = factors to weigh emission different in different zones**

**Weighing can be equal (W=1) or on fuel bunkered per zone per year or weighing on fuel bunkered x baseline sulphur content (calculates relative amount reduced)**





# Weighing between NO<sub>x</sub> and SO<sub>x</sub>

Based on damage costs €/kg and emission level:

Damage costs according to CAFE: refers to Clean Air For Europe:

	€/kg
SO <sub>x</sub>	5.6
NO <sub>x</sub>	4.4

Note: the damage costs of SO<sub>2</sub> also include the contribution to secondary PM.

Per unit of output (kWh) NO<sub>x</sub> emission is roughly 2 x SO<sub>x</sub> emission

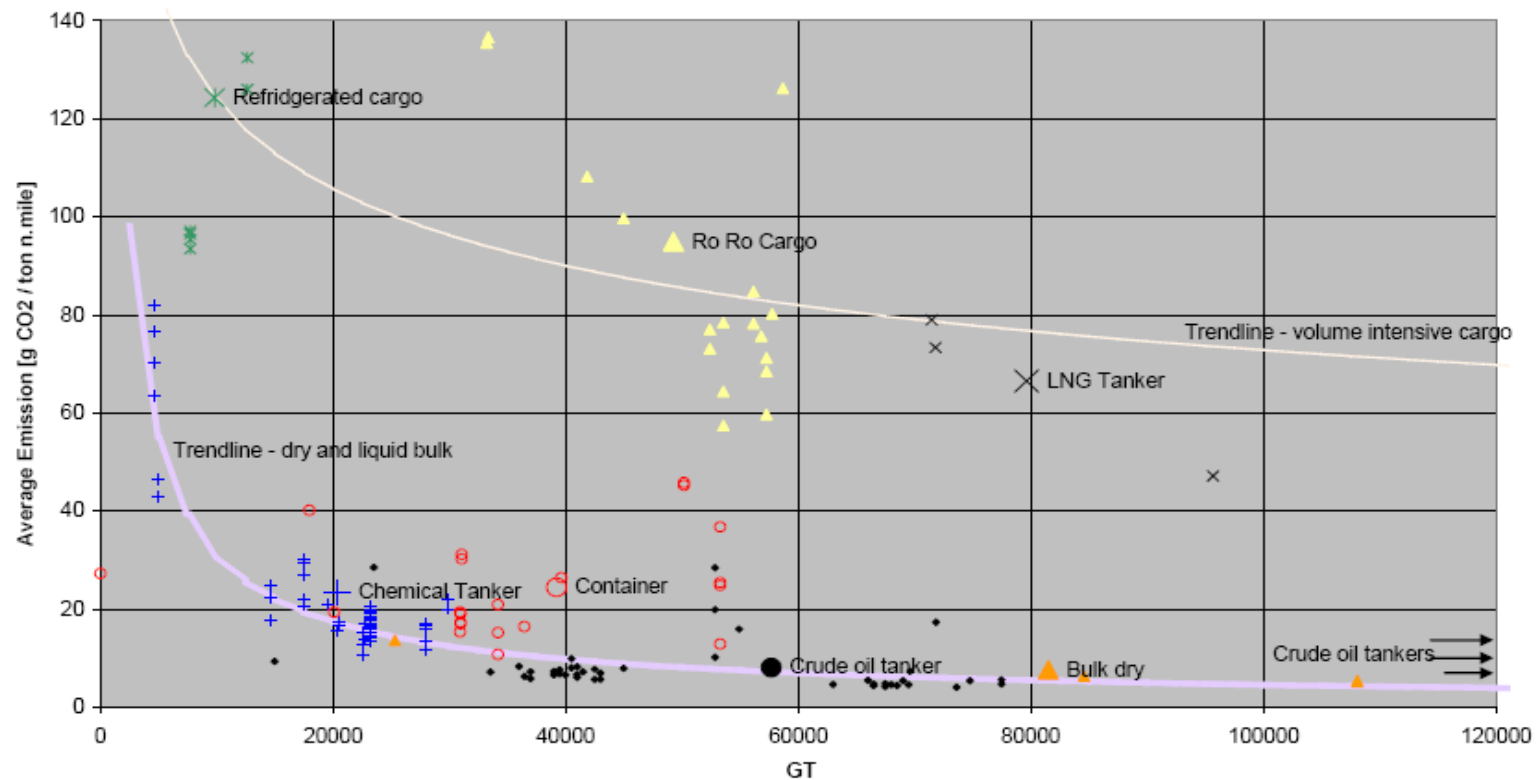
Proposal weighing NO<sub>x</sub> versus SO<sub>x</sub> is 2:1





# CO2 index (1)

No baseline reference available





## CO2 index (2)

Reward the reporting of the energy efficiency performance with an additional score of 10 points, compared to NOx max 200 and SOx max 100

Data to be reported:

- Fuel consumption (measure for emitted mass of CO2)
- Ship type / GT
- Shipped cargo and distance
- IMO / CO2 index:

$$IMO_{INDEX} = \frac{Emitted \text{ _ mass _ } CO_2}{Transport \text{ _ work}}$$

$$Transport \text{ _ work} = \sum c \text{ arg o _ mass } * dis \text{ tan ce}$$





# Overall ESI formula

$$ESI = \frac{1}{3.1} ( 2 * ESI_{NO_x} + ESI_{SO_x} + RR_{CO_2} )$$

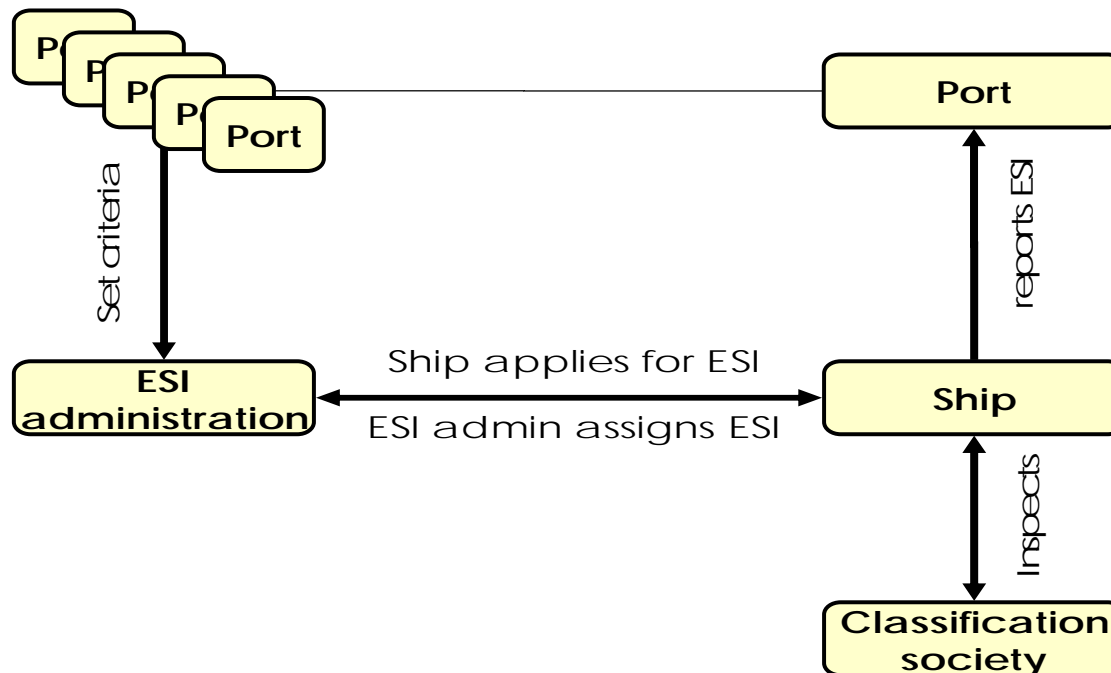
## Features:

- Integrated approach NO<sub>x</sub>, SO<sub>x</sub> (includes secondary PM) and CO<sub>2</sub>
- Balanced for emissions at sea (high sea and ECA) and berth
- Engine certification data (EIAPP-certificate) and allowed and used fuel sulphur contents as baselines for individual ships
- Range 0 (meets current average performance and no CO<sub>2</sub> registration) to 100 (no NO<sub>x</sub> and SO<sub>x</sub> emissions and adequate CO<sub>2</sub> reporting)
- Continuous scale





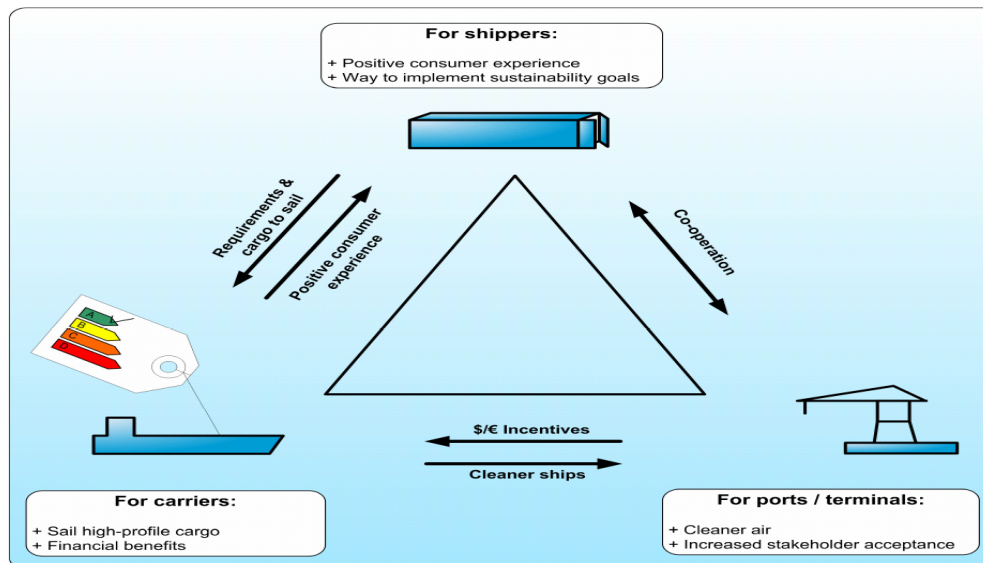
# ESI organisation and verification





# Next steps

- **Establish the baselines**  
(average NO<sub>x</sub> rating of current engines as function of engine power and average fuel sulphur content used in high seas and ECA's and determine the weighing)
- **Test the formula on a number of ships**
- **Further specify the ESI administration (e.g. ISO certified) and get the approval on the ESI organisation**
- **All in close corporation with the relevant Stakeholders (see below)**





# Goals of the development of the ESI

- **Reliable index that on a worldwide scale is widely used to stimulate better environmental performance of sea going shipping**
- **Ports, shippers and carriers that as a result together indirectly and directly effectively invest in cleaner engines and cleaner fuels**
- **Cleaner air and further awareness of the need for CO2 management**
- **A further development of ESI especially with a baseline CO2 index**
- **Leading not only to cleaner but also to more energy efficient and climate friendly shipping**

