European Dredging Summit

07/10/2015, Antwerp

How are regulatory changes affecting dredging projects ?

Paris SANSOGLOU

Secretary General
European Dredging Association

Agenda

- EuDA and the European Business Model
- Dredging is part of the Solution
- Obstacles to building big waterborne infrastructure projects
- Legislative Cases
- Way forward
- Conclusions

Presentation's Objectives

Demonstrate that

- ⇨ Dredging is not a problem
  … it is part of the solution !
- ⇨ Building our Future can and should be done together with Nature !

Provide food for thought with concrete examples.

What is EuDA about ?

EUROPEAN DREDGING ASSOCIATION

"EuDA is the official interface between the European dredging industry and the European Institutions"

- founded in 1993
- represents the European Dredging Companies
- from 16 EU Members States
- world leaders (top 4)
- with a turnover (2014): € 9.2 bn
- +/- 25,000 European direct employment
- >50,000 indirect employment (*supply and service companies*)

20th Anniversary Conference
Key Messages

In 20 years European dredging companies have evolved

- ☞ from "*mud pushers*" to **World Leaders**;
- ☞ from *specialised sub-contractors* to **main contractors**;

European dredgers continue to provide **indispensable services** to the waterborne transport logistic chain.

In 20 years, European dredging companies have continuously innovated, together with their clients, and

- ☞ increased their performance and efficiency;
- ☞ increased their added value for their clients;
- ☞ broaden their portfolio of more diversified services worldwide.

20th Anniversary Conference
Key Messages

In 20 years, European dredging companies have become **stronger**, more **resilient** and more **profitable**.

However, they need **unhindered access** to markets worldwide.

European dredgers build more and more knowledge from a broader and broader range of disciplines and have become experts in the **management of complexity** which implies:

- ✓ solving complex engineering problems but also
- ✓ the management of multidisciplinarity;
- ✓ the management of multiculturality;
- ✓ the building of mutual trust with clients and stakeholders.

European Dredgers'Business Model

European Dredgers'Business Model

From National Dredgers to International Maritime Builders

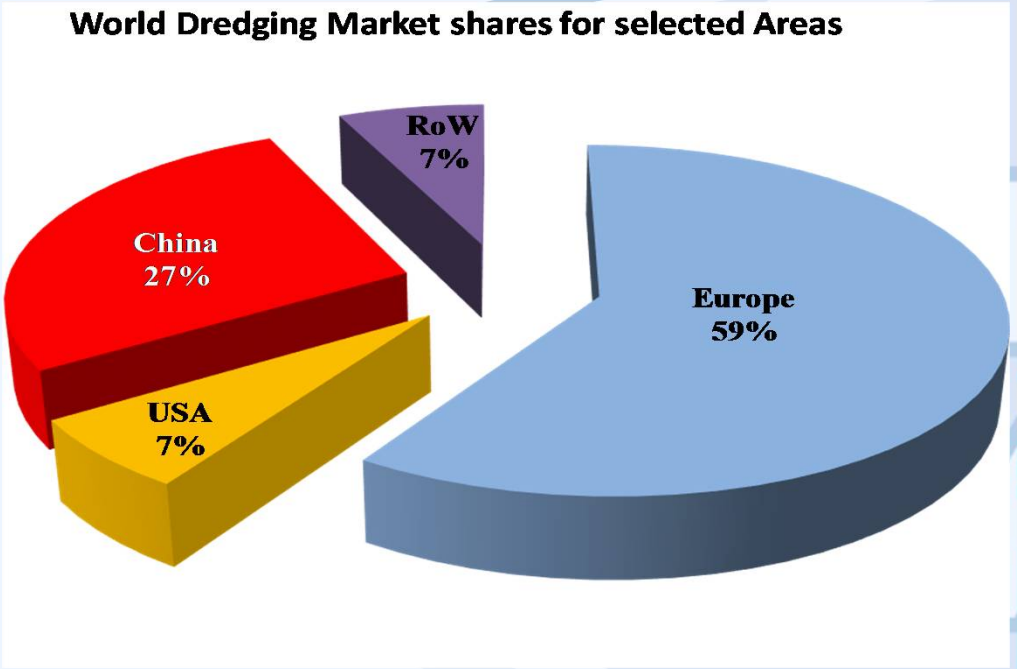
- **DREDGING PLUS**:
  focus on dredgers' technology + focus on other sciences!

Paradox: Focus + No Focus ??

Results:

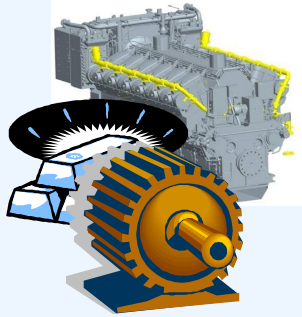
- ☞high added value
- ☞acyclical industry through
  diversification in geography and in activities
- ☞creation of new opportunities

European Dredgers'Business Model
High added value



European Dredgers' Business Model

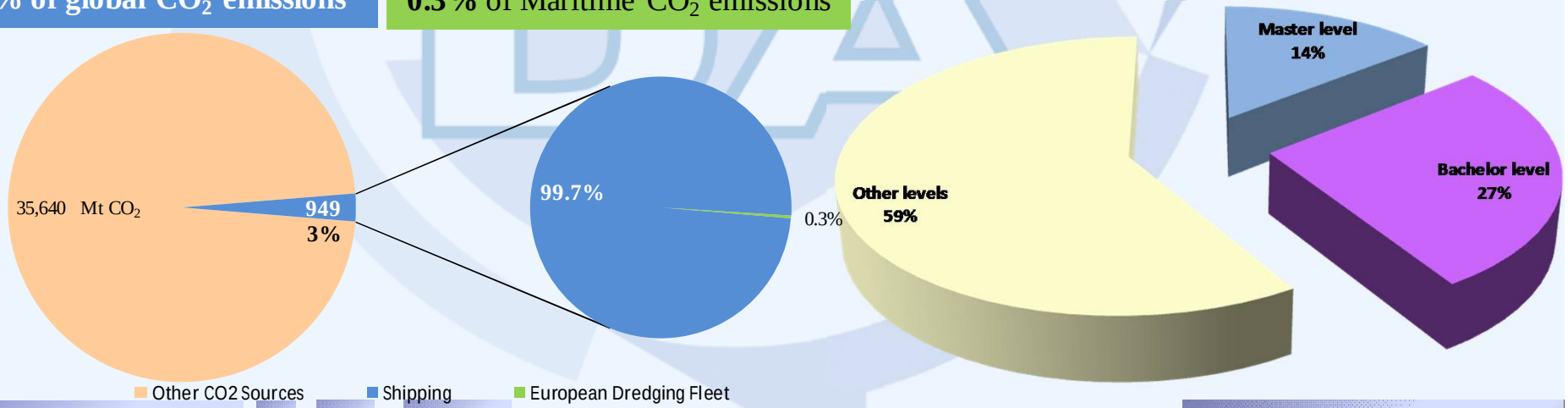
High added value (capital intensive & innovative)



- 2/3 of world's dredging projects (70% outside EU) bringing however 90% return back to Europe
- 7 billion € investments from 2008 to 2012
- 2.5% of total turnover invested in R&D
- largest, most powerful & most technologically advanced Fleet

Maritime Sector (2012): 3% of global CO_2 emissions

European Dredging Fleet: **0.3%** of Maritime CO_2 emissions



European Dredging Association 2015

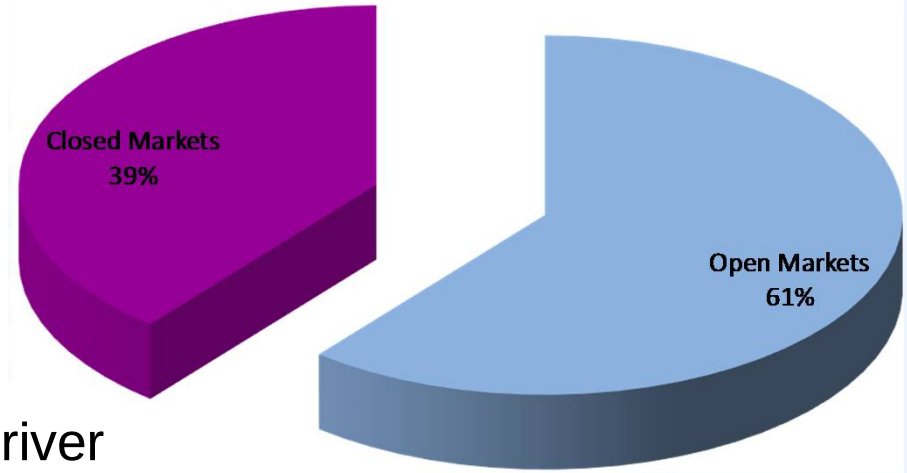
European Dredgers' Business Model

Acyclical industry (diversified international activities)

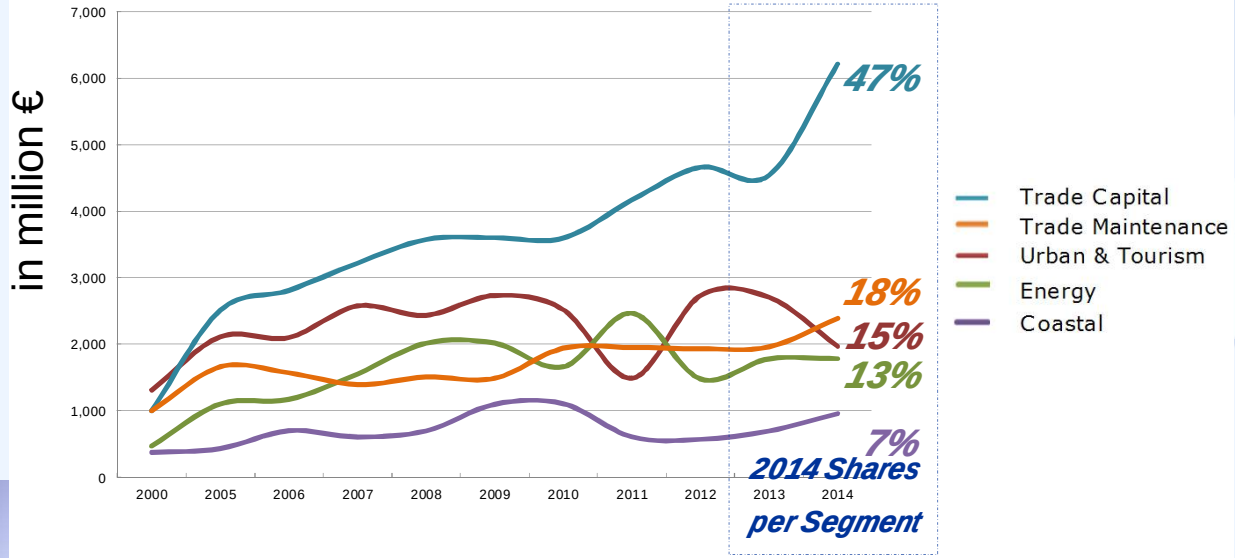
Annual turn-over dredging industry compared with other industries (*in billion €, 2014*)

Royal Dutch Shell	342
Toyota Motor	209
ArcelorMittal	64
A.P. Møller-Mærsk Group	39
World Dredging Industry	16

Turnover (2014) € 15.9 bn



Turnover evolution per driver



2015

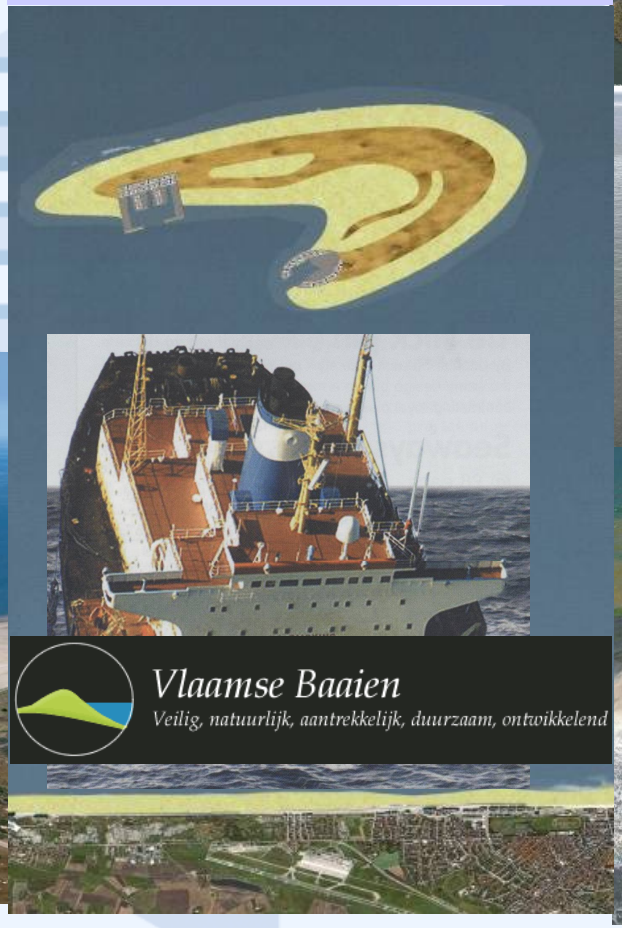
European Dredgers' Business Model
Creation of new opportunities

Coastal protection

Safe Place of Refuge

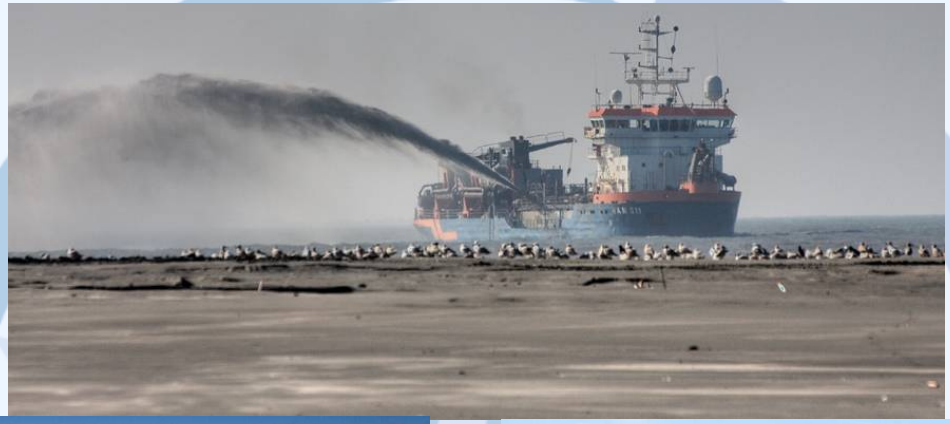
Nature development

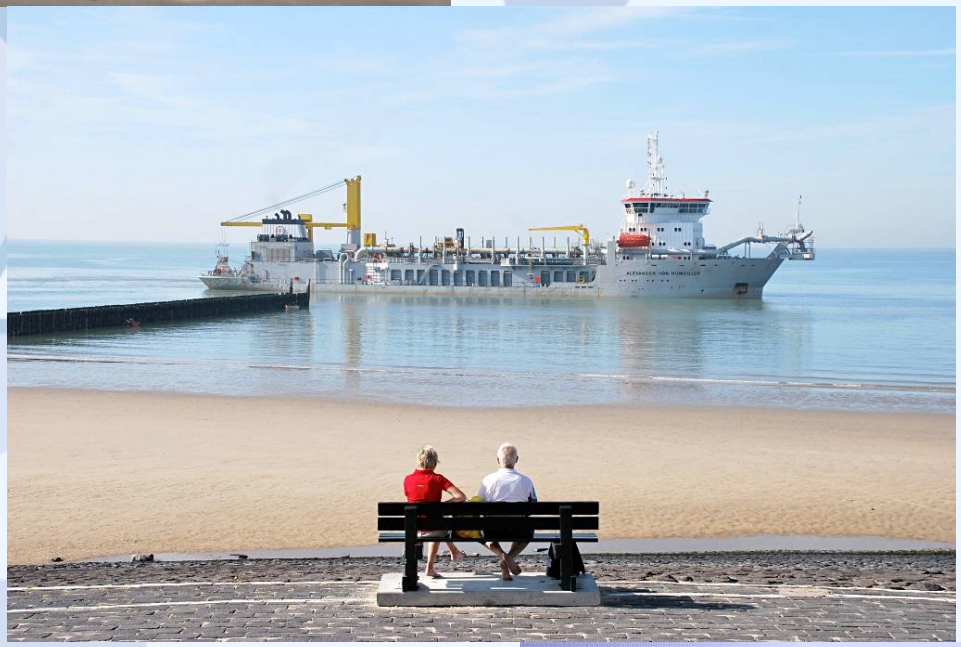
"Multipurpose Island"



European Dredging Association 2015

Dredging is part of the Solution





Dredging is not a problem … it is part of the solution !

Dredging is essential to support waterborne Transport Infrastructures

"Around 80% of the largest population centres in the world are found in coastal areas"
R. Waterman

- Port expansion in densely populated and urbanised areas
  - *"Reclaim land on the sea"*

- Ports' access for bigger ships:
  - *"Access channel deepening"*

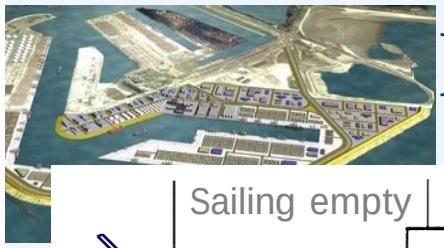
- Guaranteed navigational depth:
  - *"Maintenance dredging"*
- Contaminated sediments on seabed or riverbeds:
  - *"Environmental dredging"*

Dredging is not a problem … it is part of the solution !

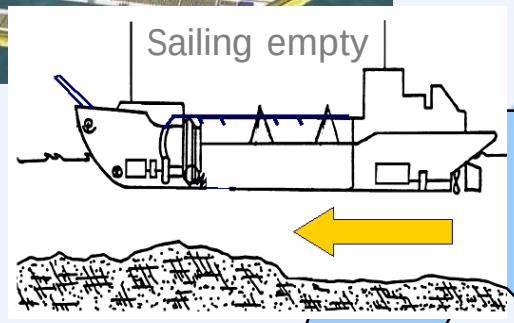
Dredging also facilitates and protects other coastal activities worldwide

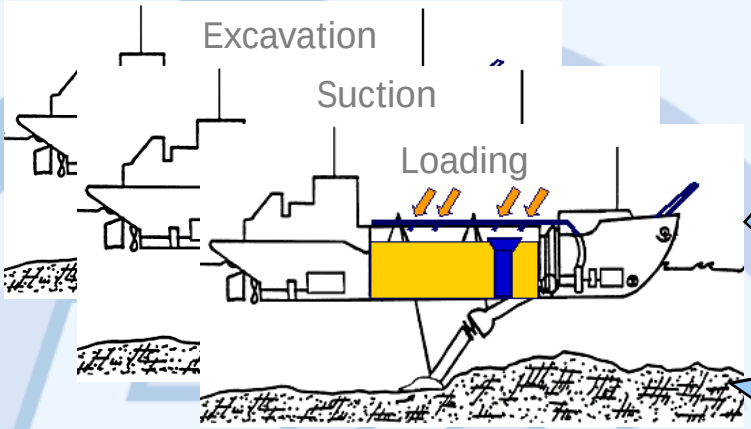
(Coastal) Cities need

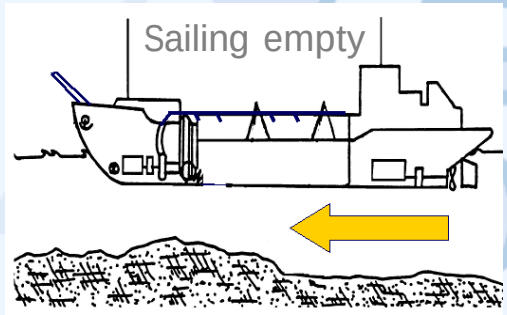
- Energy and resources:
  - *"Offshore Oil & Gas installations"*
  - *"Offshore Wind Farms"*
  - *"Aggregate Mining"*
- Protection from water
  - *"Coastal and flood protection"*
- Recreation
  - *"Leisure infrastructures"*

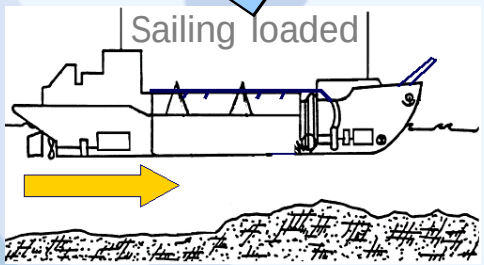


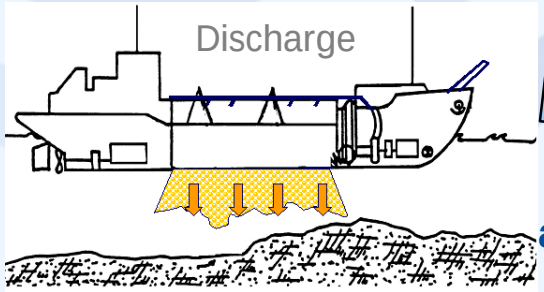
Dredging means transporting











- Sand
- Rock
- Gravel
- Silt

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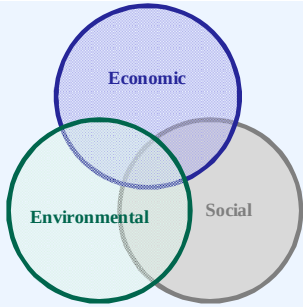
Any Problems ?
Large-scale Dredging Projects



- Development of large-scale projects characterised by
  - Complex environmental legislation (Directives ⇨ National Laws ⇨ Interpretation?).
  - Long-lasting procedures
  - Extensive environmental requirements
  - Uncertainties on project impacts

⇨ **Delays** (leading sometimes to cancellation).

Obstacles to building big waterborne infrastructure

NATURA 2000

CVRIA

Obstacles to building big waterborne infrastructure

Main types of obstacles include:

- ⇨Legislation: multilayered, extensive & complex.

- ⇨Market: Costs Horizons ? Life Cycle vs Project ?

- ⇨Governance: lack of knowledge ? go vs no go ?

Legislative Obstacles

Multilayered Legislative Landscape

⇨International

⇨European

⇨Sea/River Basin

⇨National

⇨Regional

⇨Municipal

Ratification
Transposition

Implementation
Interpretation

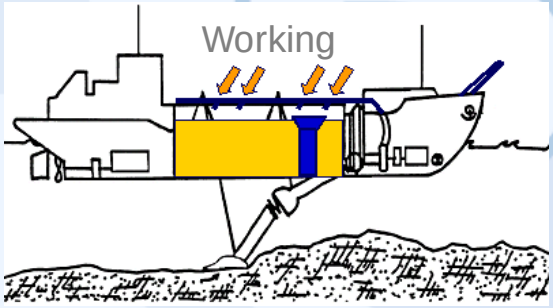
Leading to Inconsistencies

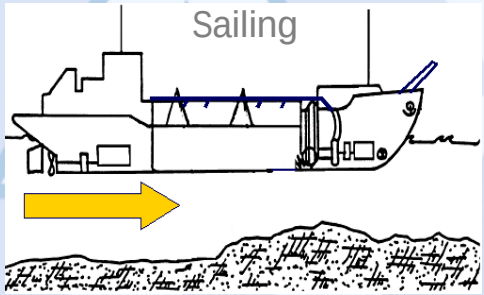
↔ Horizontal

↕ Vertical

Legislative Obstacles
Extensive Legislations

- Legislations cover all aspects of dredging
  - Crew (qualifications, certification)
  - Ship (classification, design, performance)
  - Operations (emissions, environment, market access)





Legislative Obstacles

Complex Environmental Legislation

The dredgers' situation

Market Obstacles
Characteristics

Public authorities are the main driver in infrastructure investments.

Public procurement

- ☞ requirements progressively more demanding with regards to the **environment**;
- ☞ need for more long term assessment (**life cycle cost approach**);
- ☞ used in many cases as economic instrument to stimulate the local economy (hence minimum **local content requirements** or even exclusivity with a closed market).

Market Obstacles
Design & Implementation Costs

Eco-dynamic Design

An ecodynamic design of a sand nourishment is characterized by:

- Design serves integral objectives: Guarantee coastal safety, create space for nature development and recreation
- Implementation of a large sand volume (10-20 mln m3 or more)
- Envisaged life span 20 years
- Incidental disturbance of ecosystem
- Use natural processes for distribution of sand. Gradual evolution, ecosystem capable of following morphological changes.

Traditional Design

A traditional design of a sand nourisment is characterized by:

- Primary objective: Shoreline maintenace. Other objectives of secondary importance
- Implementation of a medium sand volume (2-5 mln m3)
- Envisaged life span 5 years
- Frequent disturbance of ecosystem.

- Cheaper in the long term
- Minimise Disturbance/Compensation

- Cheaper in the short term
- Frequent Disturbance
- Compensation can be significant

Governance Obstacles

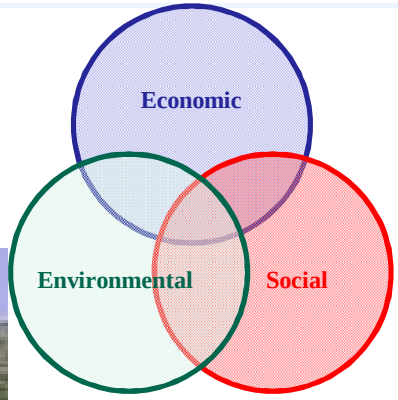
Lack of Knowledge (no decision/action?)

"Monitoring brings more in learning than in control"

"Governance models to support knowledge building!"

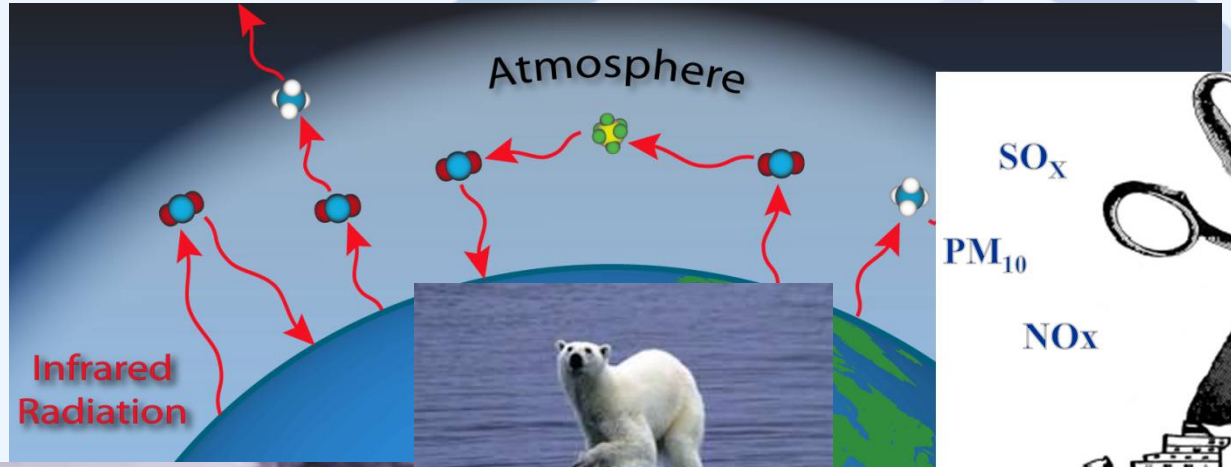
"Newly acquired knowledge to support Governance models !"

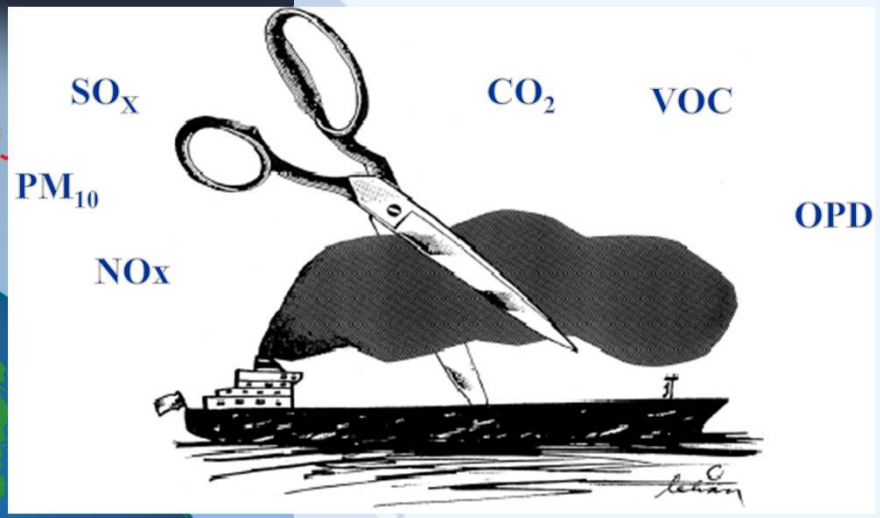
"New knowledge for new projects"

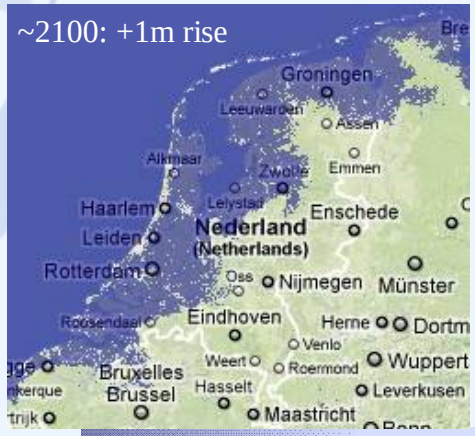


Legislative Examples

Legislation on Air Emissions

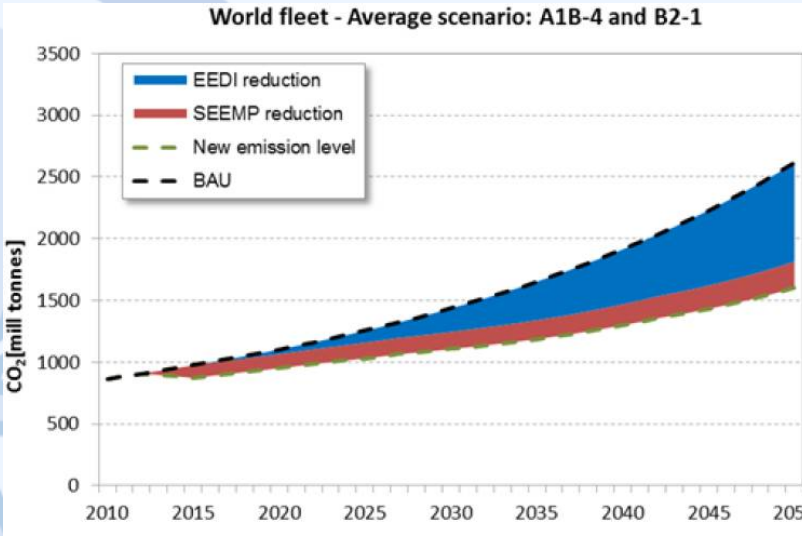






CO_2 legislative background
Developments in IMO

Shipping is a global industry competing in a single global market.



Source: IMO

⇨ therefore preference for global regulator IMO (vs UNFCCC - CBDR; vs EU)

Three categories of measures under development

- ✓ Technical - New Equipment (**EEDI**: Energy Efficiency Design Index)
- ✓ Operational - New Methods (**SEEMP**: Ship Energy Efficiency Management Plan)
- ✓ Market based Measures - Incentives (**MBM**)

- EEDI (not for dredgers) and SEEMP Regulations apply to all **400 GT< ships** from **1st January 2013**.

CO_2 legislative background
Developments in EU

The long term reduction targets set by the EU (DG CLIMA) are:

- **30%** of 1990 by **2030**;
- 50% of 1990 by 2050.

In its White Paper on Transport 2011 the EU (DG MOVE) announced the following objectives:

- **20%** of 2005 by **2020**;
- 40% reduction Carbon emission from Shipping by 2050.

On 29/04/2015, the EU adopted a Regulation on the Monitoring, Reporting and Verification (**MRV**) of CO_2 emissions from maritime transport (EU 2015/757).

CO_2 emissions
MRV Regulation

The basic principles behind the Monitoring, Reporting & Verification Regulation are:

1. WHAT *should be monitored* ?
   fuel consumption;
2. WHO *should report* ?
   the **ship** (reporting entity vs ship-owner/operator/charterer, cargo-owner);
3. HOW *should it be implemented* ?
   keep it simple and use existing information and data (IMO requirements) collected on a yearly basis;

CO_2 emissions
European Commission CO_2 Policy

European Commission Objectives:

1. Implement MRV and establish **CO_2 emissions from maritime transport**;
2. Establish (agreed) **global energy efficiency standard**;
3. Consider introduction of a **'regional' MBM**.

CO_2 Emissions
EuDA Strategy

International Association of Dredging Companies

EUROPEAN DREDGING ASSOCIATION

50-008-2

IMO AND REGULATION OF GHG EMISSIONS, THE POSITION OF THE DREDGING INDUSTRY.

The Dredging Industry is prepared to contribute its share to the current and future efforts to reduce the emission of greenhouse gases (GHG), in particular CO_2. CO_2 emissions of the world seagoing dredging fleet have been estimated at 6.3 Mton for 2008, this represents about 0.6% of the total emissions of global shipping.

The Dredging Industry supports the introduction of fair, effective and equitable market-based instruments (MBI) that should be applied on a global basis. The particulars of the dredging operations and dredging equipment however need special consideration in development of any regulation to reduce GHG emissions by the Dredging Sector.

The discussion in IMO has concentrated primarily on development of measures that will enforce that new ships will comply with minimum energy efficiency requirements. IMO is in the process of developing a standard methodology to rate the energy efficiency of ships: the Energy Efficiency Design Index (EEDI). Each dredging project has a different scope and is carried out under specific conditions and technical requirements. This has resulted in a worldwide fleet of dredging vessels with very diverse specifications. The combination of variable project conditions and very diverse equipment specifications make it impossible to transpose efficiency indices for regular shipping to dredging operations. During MEPC 58 it was acknowledged that dredgers at this stage are to be excluded from development of the index and related baselines.

The dredging industry is looking for support from national representatives in IMO to share the opinion that the development of a generic energy efficiency index under IMO regulation will not result in a practical and effective tool to reduce GHG emissions by dredgers due to the specifics of dredging operations. Any proposal to include the dredging vessels in the scope of the EEDI at a later stage should be refused.

In order to contribute to developing effective measures for dredging vessels, the Dredging Industry will take the initiative to develop in the course of 2010 up to 2011:

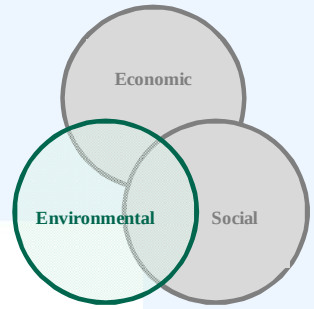
1. A set of fact based emission figures for different types of dredging operations under normalized conditions.
2. A transparent calculation method to estimate the energy performance of specific types of dredging vessels considering variable project specifications.
3. A benchmark for future emission reduction.

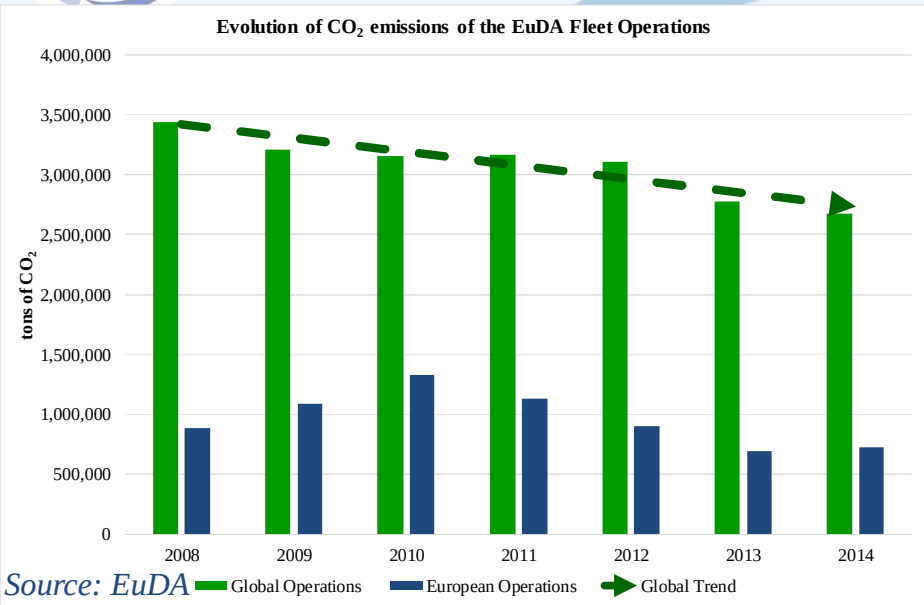
Jac. G. (Koos) van Oord
IADC President

Marc Stordiau
EuDA Chairman

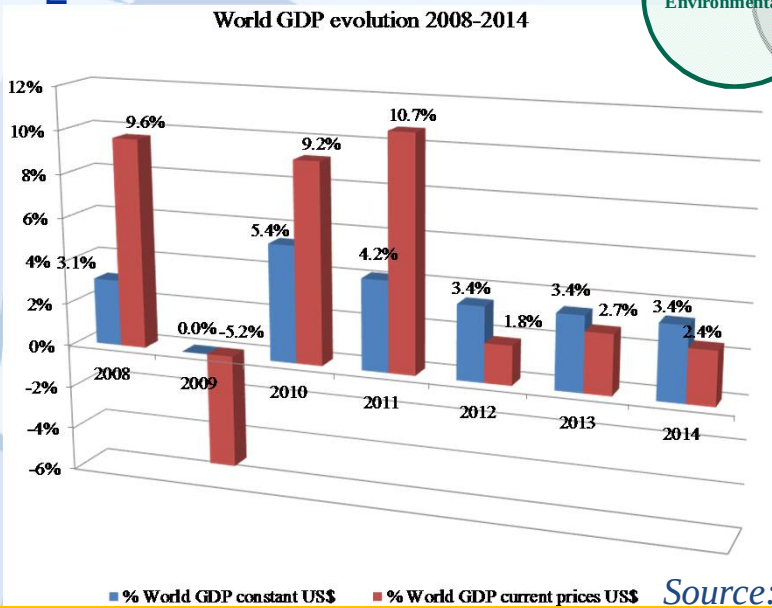
CO_2 emissions

EuDA Fleet CO_2 emissions





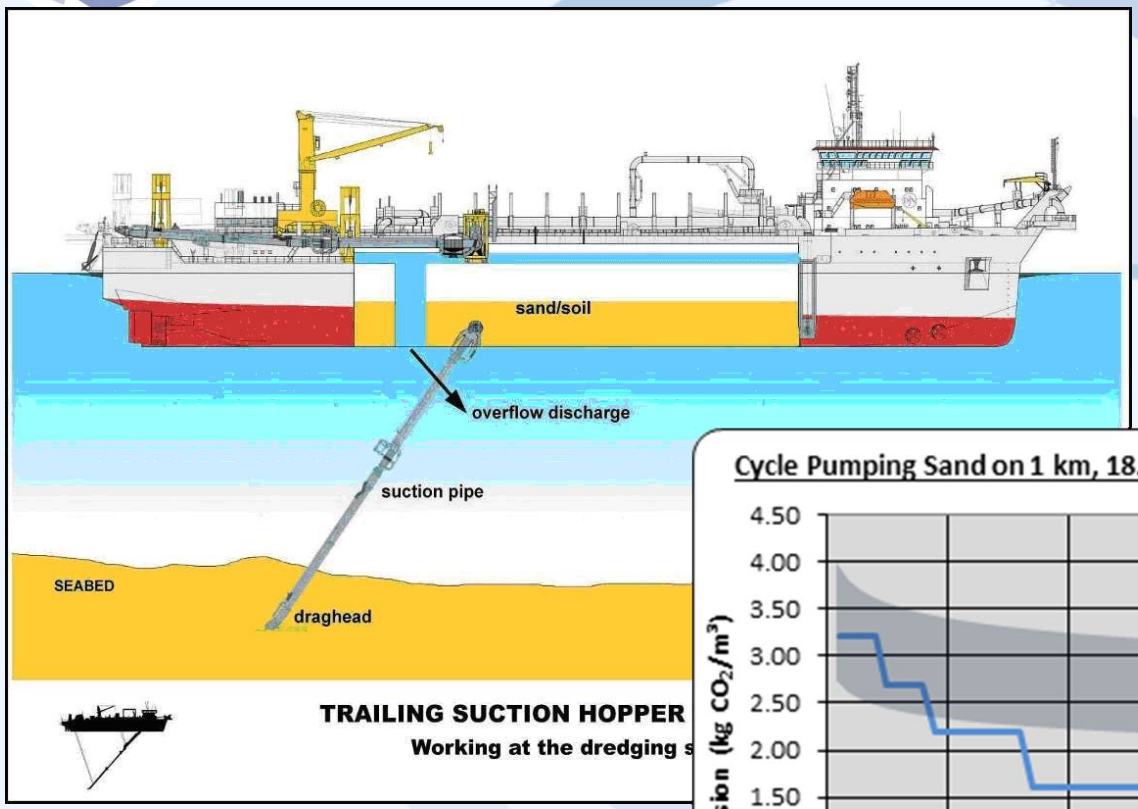
Source: EuDA



Source: IMF

EuDA Sea-Going Fleet		2008	2009	2010	2011	2012	2013	2014
Global Operations								
Installed Power	kW	1,510,000	1,587,000	1,591,462	1,779,152	1,845,002	1,666,135	1,598,624
Fuel Consumption	*ton*	*1,090,000*	*1,016,000*	*998,930*	*1,002,702*	*985,998*	*884,069*	*846,514*
CO_2 Emissions	**ton**	**3,440,000**	**3,211,000**	**3,155,225**	**3,163,003**	**3,108,075**	**2,774,959**	**2,672,869**
European Operations								
Installed Power	kW	420,000	511,000	654,069	636,790	501,981	527,013	530,519
Fuel Consumption	*ton*	*280,000*	*307,000*	*419,853*	*356,809*	*283,388*	*244,423*	*228,823*
CO_2 Emissions	**ton**	**880,000**	**1,088,000**	**1,326,014**	**1,126,267**	**896,361**	**696,476**	**724,198**

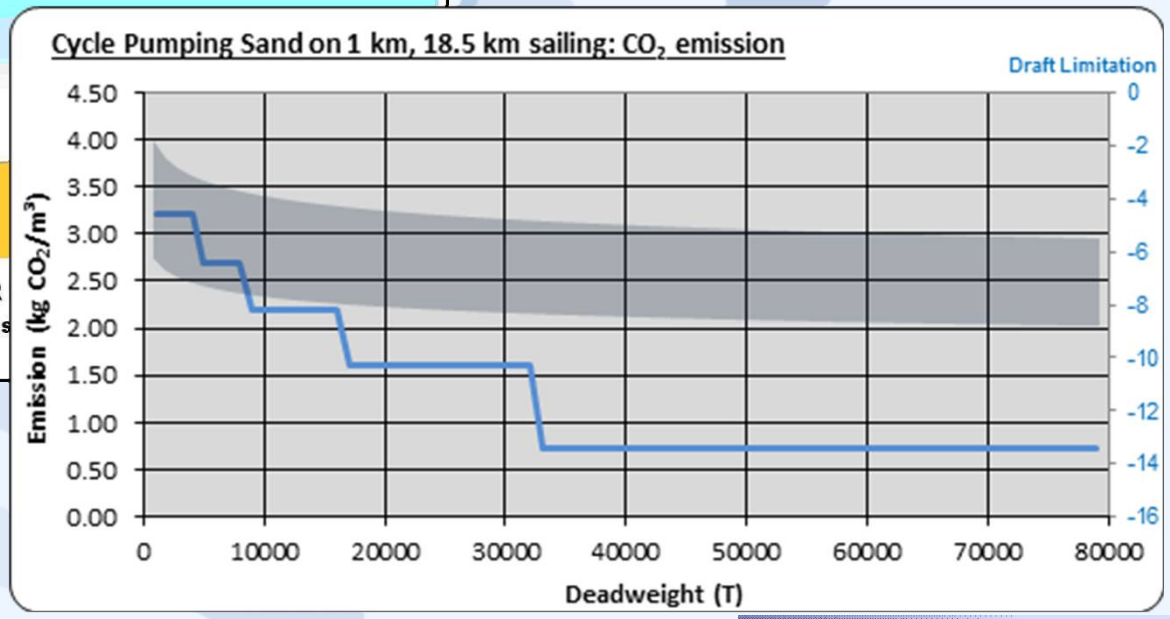
CO_2 emissions
Industry-backed calculations for dredgers



Description of TSHD
(trailing suction hopper dredger)

Basis for Calculation

Graphs of expected Performance
in 'Normalised' Cycles
(+example)



CO_2 emissions
Findings from TSHD's CO_2 performance Analysis

- Dredging operations are **complex**:
  - what is a TSHD's 'Typical' dredging cycle ?
  - dredgers use of energy for working and sailing;
  - optimisation per project (not per ship);
  - smaller vessels can outperform the larger (project conditions);
- **EEDI (as is) not applicable to dredgers**;
- **Early contractor involvement** in the design phase of real dredging projects;
- **Equipment and working methods** selection should be left to the contractor.
- **Dredgers ready to contribute** to CO_2 emissions reduction.

CO_2 emissions
Exclusion from scope MRV Regulation

Result of dialogue with DG CLIMA and with Environment WG of European Council (latest version September 2014):

1. Recital 8

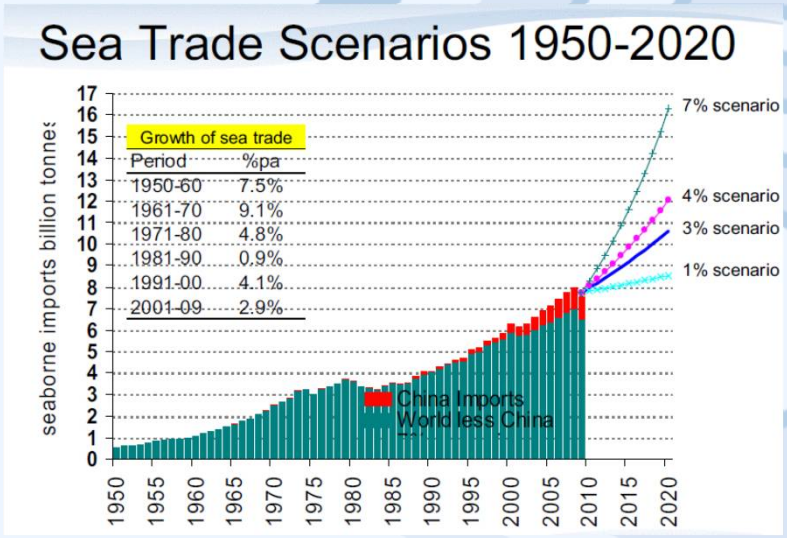
   ⇨ *"[…] However, since this regulation focuses on maritime transport, it should not establish monitoring, reporting and verification requirements for ship movements and activities not serving the purpose of transporting cargo or passengers for commercial purposes, e.g. dredging, ice-breaking, pipe laying or offshore installation activities […]."*

2. Article 3 aa

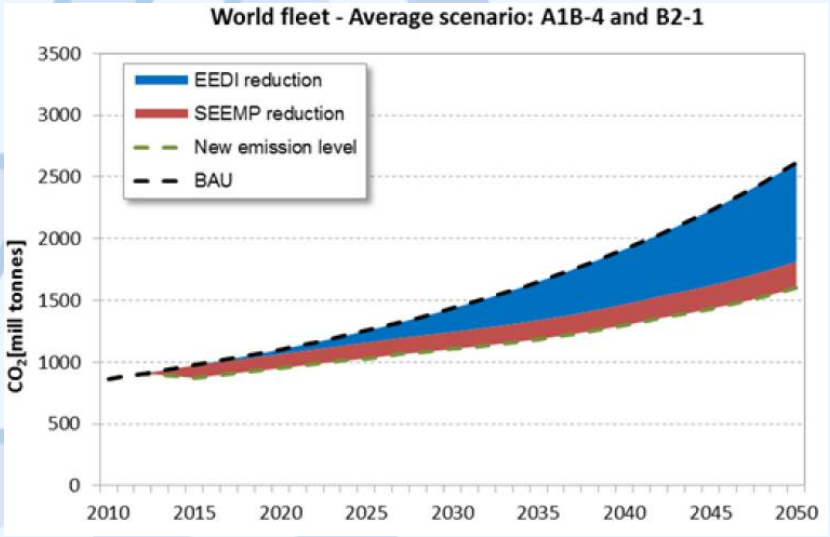
   ⇨ *"(aa) "**voyage**" means any movement of a ship that originates from, or terminates in, a port of call. This shall not include ship movements and activities not serving the purpose of transporting cargo or passengers for commercial purposes;"*

CO_2 emissions
Relative measures vs absolute targets

Relative measures (improved performance and efficiency) cannot achieve the absolute emission targets (Max +2°C) when the global economy and, consequently, demand for waterborne transport are booming.



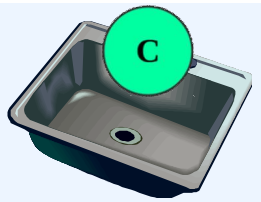
Source: Clarkson Research Services Ltd



Source: IMO

What about Carbon Offsetting ?

Blue Carbon



Blue carbon:

- ✓ oceans & coastal biotopes that are **natural carbon sinks** (mangroves, seagrasses, salt marshes, coral reefs, etc.);
- ✓ captures atmospheric CO_2 through the plants' **photosynthesis**;
- ✓ stores carbon in the long-term through the natural growth processes in the ecosystems' plants and animals (respectively the **gross primary and**

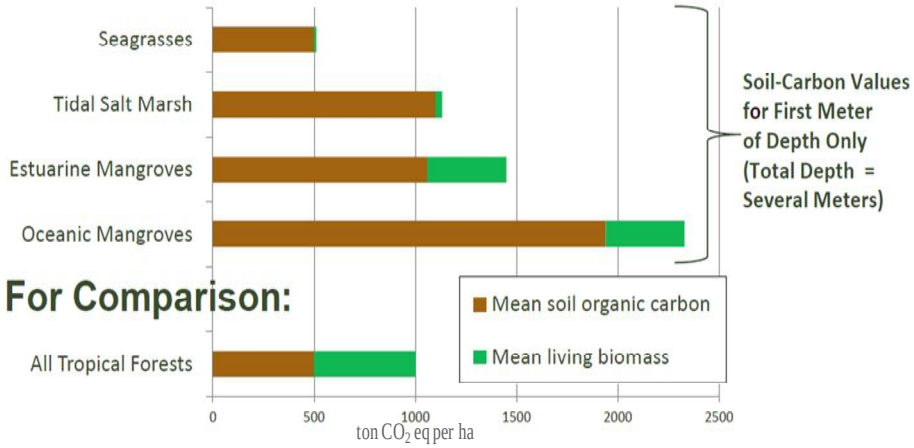
Prerequisites

- ✓ Establishment of **Market Based Measures** (MBM);
- ✓ **Political recognition** (IMO, EU); and
- ✓ direct link to MBM;
- ✓ Functioning MBM market.

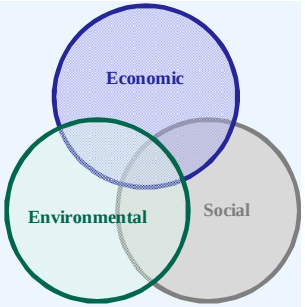
CO_2 emissions reduction:

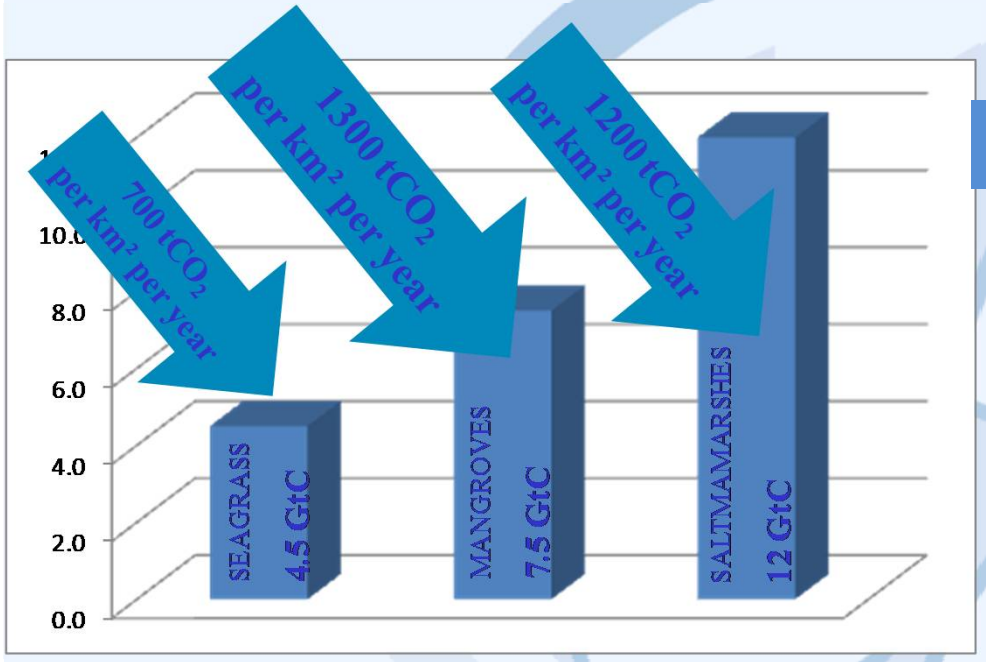
- ✓ emissions reductions cannot be disconnected from **global economy** (and global trade);
- ✓ -40% by 2050 are impossible to achieve if only acting on the **emission sources**;
- ✓ Blue Carbon reduces **CO_2 atmospheric concentrations**
  = offsetting opportunities that can be bought/sold.

Examples



Blue Carbon:
A 'sizeable' offsetting opportunity

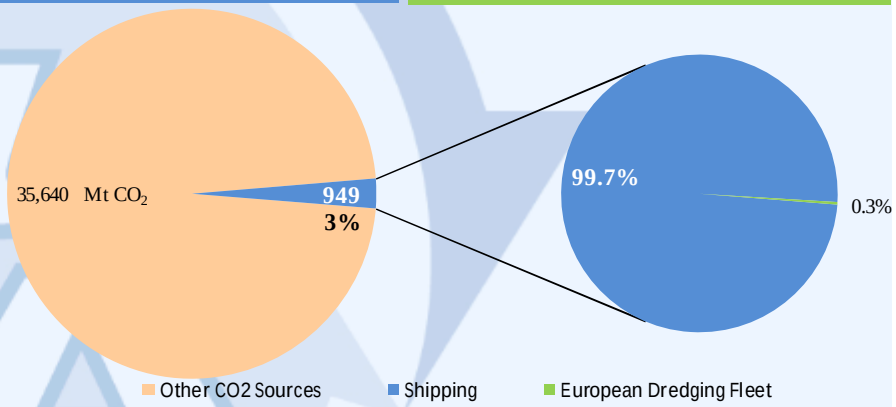




Estimated Blue Carbon Storage vs Blue Carbon uptake

Maritime Sector (2012): 3% of global CO_2 emissions

European Dredging Fleet: **0.3%** of Maritime CO_2 emissions



~ Surface of Luxembourg (2,586 km²)

Estimated Restoration Surfaces

- ✓ 2,700 km² of salt marshes;
- ✓ 2,500 km² of mangrove forests;
- ✓ 4,600 km² of seagrass beds.

Key European Directives regulating Dredging and related activities

European Legislation
Complex Environmental Legislation

The dredgers' situation

Environmental Impact Assessment & Strategic Environmental Assessment

(Directives 85/337/EEC & 2001/42/EC;
Communication COM(2012)628)

EIA & SEA Dir.

- Cornerstones of Europe's authorisation procedure for major Projects/Plans.
- Protecting the Environment by:
  - Assessing Impact on Environment
  - Integrating Environment into designs of Projects/Plans.

Key Issues:

- Inconsistencies, interaction and overlap between EIA-SEA-Habitats directives.
  - How can a common framework be established to clarify, simplify and harmonise the approaches/priorities ?

Birds & Habitat Directives

(Directives 2009/147/EC & 92/43/EEC)

Birds & Habitat Dir.

- Cornerstones of Europe's nature conservation policy.
- Built around two pillars:
  - Natura 2000 network of protected sites;
  - System of species protection.

Key Issues:

- Conflicts between transport and environmental policies/objectives.
  - How can the objectives be combined ?
- Creating delays, uncertainties or blockage of much needed projects.
  - How can the delays and uncertainty be improved ?

Ems Case
Background

NATURA 2000

31/05/1994	17/02/2006	20/02/2008	26/05/2008	09/07/2009	14/01/2010	22/11/2010	19/06/2013
Capital Dredging autorisation (channel deepening for ships with 7.3 m draught)	Lower Ems and Outer Ems included in Natura 2000 sites	Court Case Stadt Papenburg vs Bundesrepublik Deutschland	Reference to European Court of Justice by Verwaltungs-gericht Oldenburg	Opinion of European Court of Justice Advocate General	Judgment of the European Court of Justice (Second Chamber)	Judgment of Verwaltungs-gericht Oldenburg	Lower and Under Ems designated as Natura 2000 sites by Germany.

Ems Case
The main issues

The Concept of a Project

On the definition of project: despite the rulings of the European Court of Justice, *maintenance dredging* should not be considered as a 'plan or project' in the sense of Art. 6(3) of the Habitats Directive.

Capital versus Maintenance Dredging

On Maintenance Dredging: on the one hand, the conclusion of the European Court of Justice that a separate appropriate assessment may be required for maintenance dredging is not consistent with the concept of a project.

On the other hand, maintenance dredging is necessary to maintain the conditions in which the Natura 2000 site was when it was selected.

Ems Case
Pragmatic Approach

Maintenance Dredging

- maintain a certain state of infrastructure ;
- not a project in the sense of Article 6(3) (Habitats Directive);
- distinct projects when
  - changing techniques,
  - conditions or
  - regularity.
- if significant effect, assessment;
- recurring maintenance dredging contribute to navigation and conservation .

Building/Working with Nature

Ems Case Recommendations

European Commission

- define of ‘plan or project’

EU Member States

- in general, maintenance dredging is not a project (Art. 6);
- incorporate in authorisation of capital dredging projects the associated recurrent maintenance dredging campaigns;
- exceptionally distinct ‘maintenance dredging campaigns’;
- recurring maintenance dredging designed and performed to achieving both navigation and Natura 2000 conservation objectives.

Ems Case
Connecting EU legislations and policies

Capital Dredging is a project subject to **Environmental Impact Assessment**.
In general, maintenance dredging is not a project.
Authorisation of capital dredging projects should also cover the associated recurrent maintenance dredging campaigns.

Maintenance dredging can and should be designed and performed to achieving both **navigation** and **Natura 2000** conservation objectives.

Water & Marine Strategy Framework Directives

(Directives 2000/60/EC & 2008/56/EC)

Water & Mar. Strategy Framework Dir.

Water & Marine Strategy Framework Directives

(Directives 2000/60/EC & 2008/56/EC)

Water & Mar. Strategy Framework Dir.

- Cornerstones of Europe's water policy.
- Built around the following concepts:
  - River basin management (cross-border);
  - Good Ecological Status (water quality);
  - Good Environmental Status (including human activities).

Key Objectives:

- Protection of all waters (surface, ground) & marine environment across Europe;
- "combined approach" of emission limit values and quality standards;
- ~6 years cycles: 2014 (monitoring programme); 2015 (programme of measures) & 2020 (GES achieved) !

Water & Marine Strategy Framework Directives (continued)

Water & Mar. Strategy Framework Dir.

Key Issues:

- Measures, Monitoring and adaptive Management
  - How to select & implement these instruments ?
- Shipping activities
  - How to integrate these activities ?
  - How to further develop them (Transport Strategy 2018) ?
- Sediments
  - How to deal with contaminated/uncontaminated sediments ?

Weser Case
(Water Framework Directive)

Legal Action to stop planned dredging

- ☞ complaint about the potential deterioration of the water quality associated with the proposed dredging of the Weser.

Water Framework Directive

- ☞ 'deterioration' of Good Ecological Status;
- ☞ How to interpret temporary and localised impacts (e.g. from dredging activities)?

European Court of Justice Judgement (01/07/2015)

- ☞ follows the current provisions of the Water Framework Directive (WFD);
- ☞ applying the '**one out, all out**' principle;
- ☞ clarifies the definition of '**deterioration of the status**' in the water quality classes: High, Good, Moderate, Poor and Bad (not within a class unless Bad)

Weser Case
Connecting EU legislations and policies

Authorisation under the **Environmental Impact Assessment** covers extensive analysis the project's impacts and verifies its compatibility with all environmental EU legislation, including the **Water Framework Directive**.

Nothing new ?
There is no 'deterioration of the status' within the water quality classes: High, Good, Moderate and Poor, except for the lowest water quality class Bad (as the deterioration cannot result in a reduction of class anymore).

Quid for environmental dredging aiming at eliminating pollutants and improving soil and water quality in the long term ?

Waste Framework Directive

(Directive 2008/98/EC)

Waste Framework Dir.

Waste Framework Directive

(revised Directive 2008/98/EC)

Waste Framework Dir.

- Cornerstone of Europe's waste policy.
- Built around the following concepts:
  - Definition of waste;
  - Waste hierarchy (waste vs non-waste);
  - Waste Management.

Key Principles:

- Prevention;
- Recycling and Re-use;
- Recovery (Energy);
- Final Disposal of Waste and Monitoring.

Waste Framework Directive

(revised Directive 2008/98/EC)

Waste Framework Dir.

Definition of Waste (**EU - WFD**):

⇨ *"Any substance or object which the holder discards or intends or is required to discard."*;

☞ Room for (different) interpretations !

Definition of Waste (**OECD**):

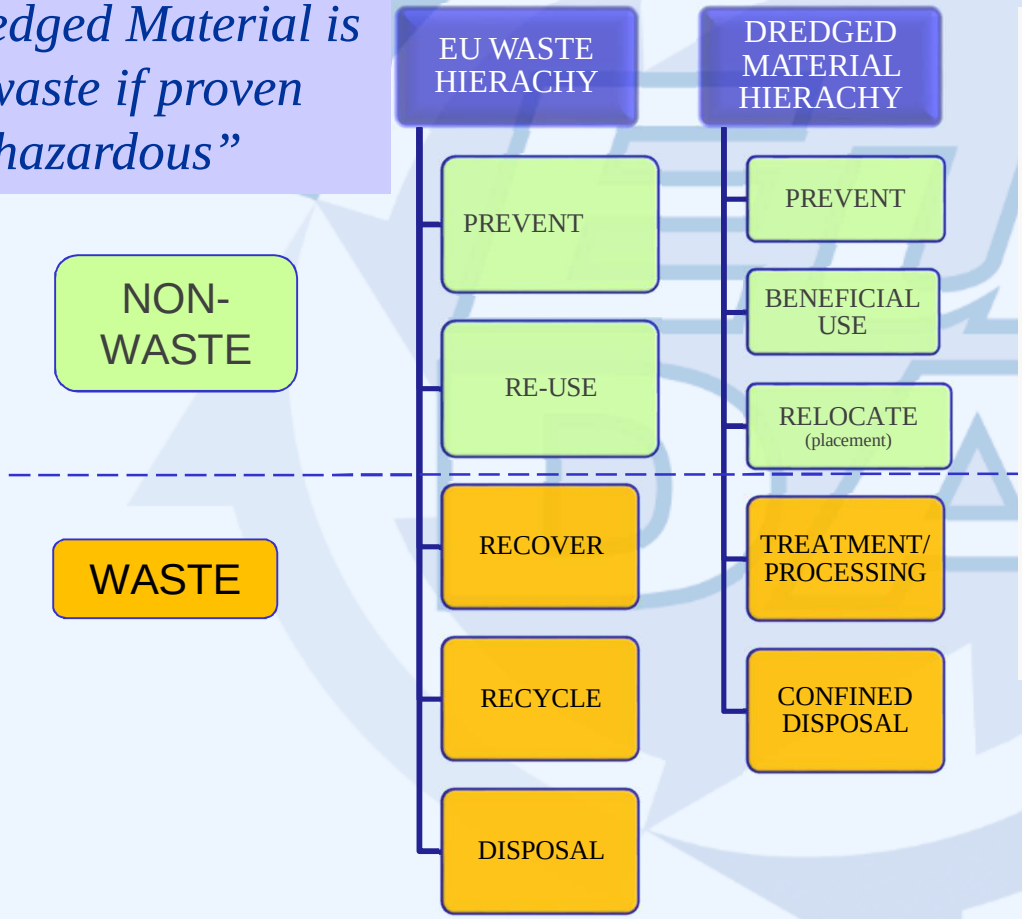
⇨ *"Waste refers to materials that are not prime products for which the generator has no further use (in terms of his own purposes of production, transformation or consumption) and of which he wants to dispose."*;

Revised Waste Framework Directive

Waste Hierarchy

Waste Framework Dir.

"Dredged Material is not waste if proven non hazardous"



- New Approach including out-of-waste strategies (before and during the waste cycle)
- unevenly implemented
- 'North/South' divide
- Problem for transnational projects with contaminated sediments:

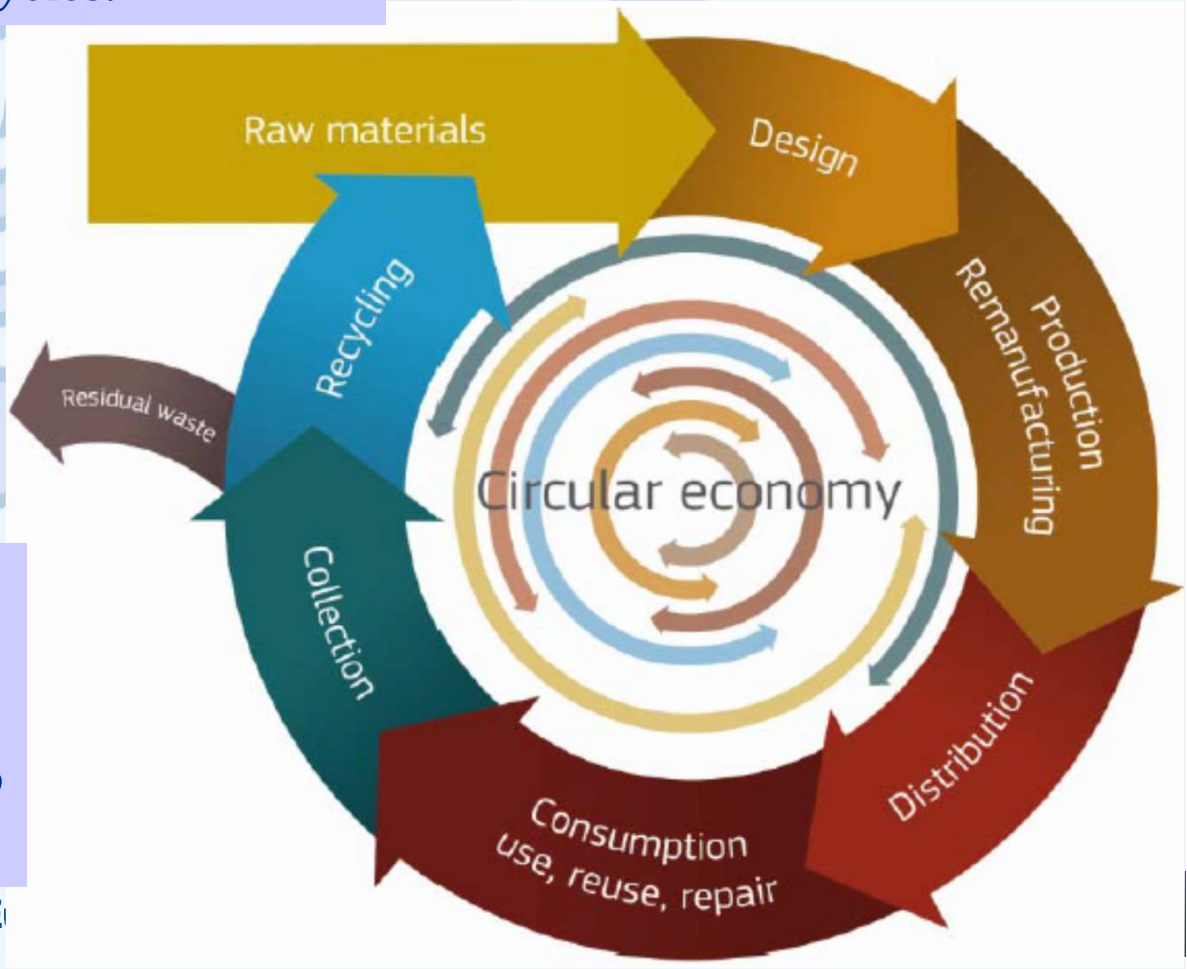
⇨ Iffezheim Barrage (France-Germany)

Circular Economy

(COM(2014) 398)

Waste Framework Dir.

"Keep as much of the valuable materials from leaking out of our economies' cycles."



"The Circular Economy approach aims at extracting most of the added value from waste, considered as a resource to put to beneficial use."

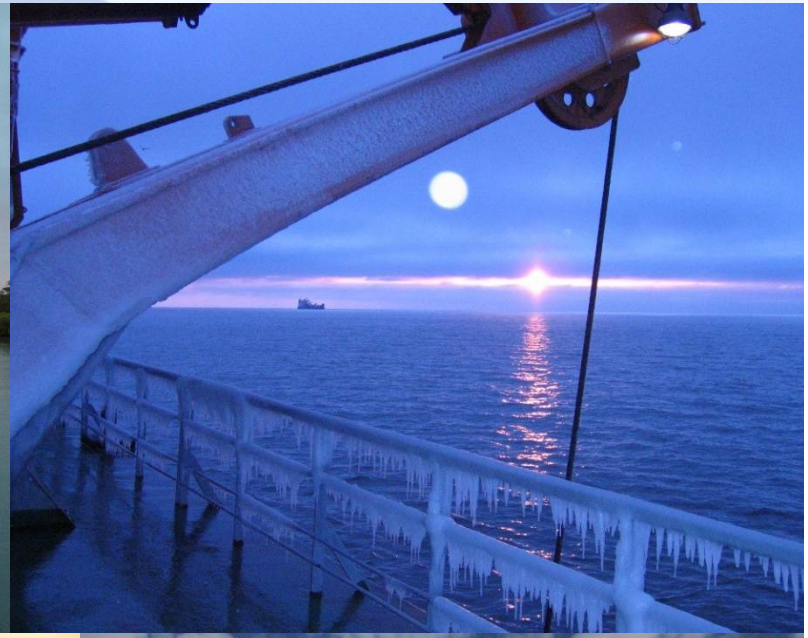
Waste Framework Directive

Waste Framework Dir.

Key Issues:

- **Dredged Material is not waste unless proven otherwise !**
- Different Waste definitions/approaches between international legislations.
  Different interpretations/implementations by Member States.
  - ☞Can a generic European approach be developed ?
  - ☞How to define ‘hazardous/non-hazardous’ dredged material ?
  - ☞How to clarify the use of Waste vs Water Framework Directive ?

The Way Forward



The Way Forward

Solutions in Cooperation & Integration

⇨At policy level (European & National):

- cooperation between **policy makers**
  (Environment and Transport: e.g. Environmental Guidelines for Estuaries & Coastal areas and Environmental Guidelines for Rivers);
- cooperation with **stakeholders**;
- **adaptive management** and **adaptive monitoring**;
- **integration of various environmental assessments** (common framework).

⇨For implementation (across all political levels):

- **clarification** and **simplification**;
- **harmonisation** of legislation transposition and interpretation (common understanding)

The Way Forward

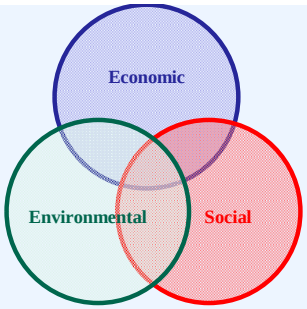
Solutions in Cooperation & Integration

⇨At project level:

- take '**nature**' into account at the design phase and
- engage the **stakeholders** at an early stage and keep communication simple (de-jargonise).

"To improve certainty and keep delays under control for large infrastructure projects"

The Way Forward
Paradigm Shift for Business

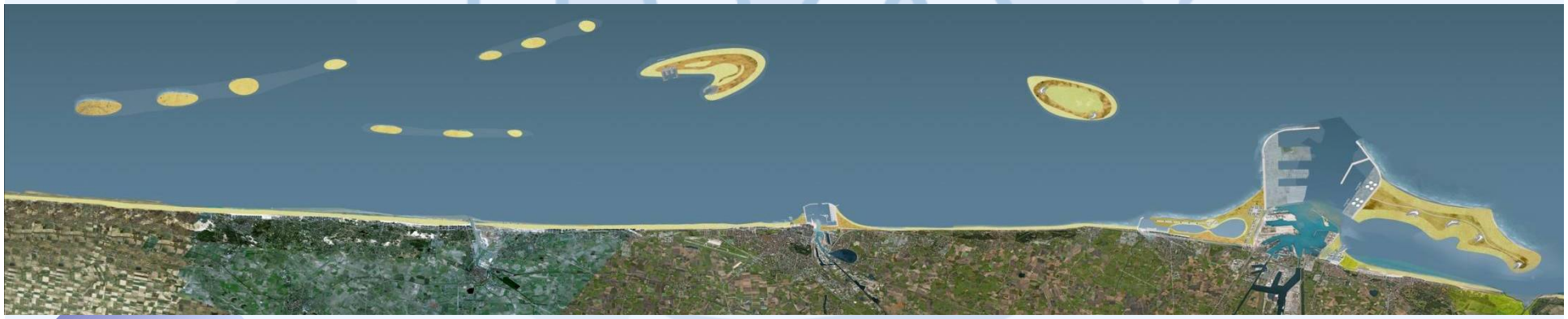


⇨ From defensive approach, minimising environmental impact,

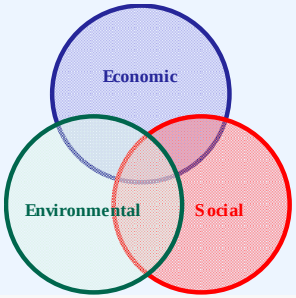
"Environment = Constraint"

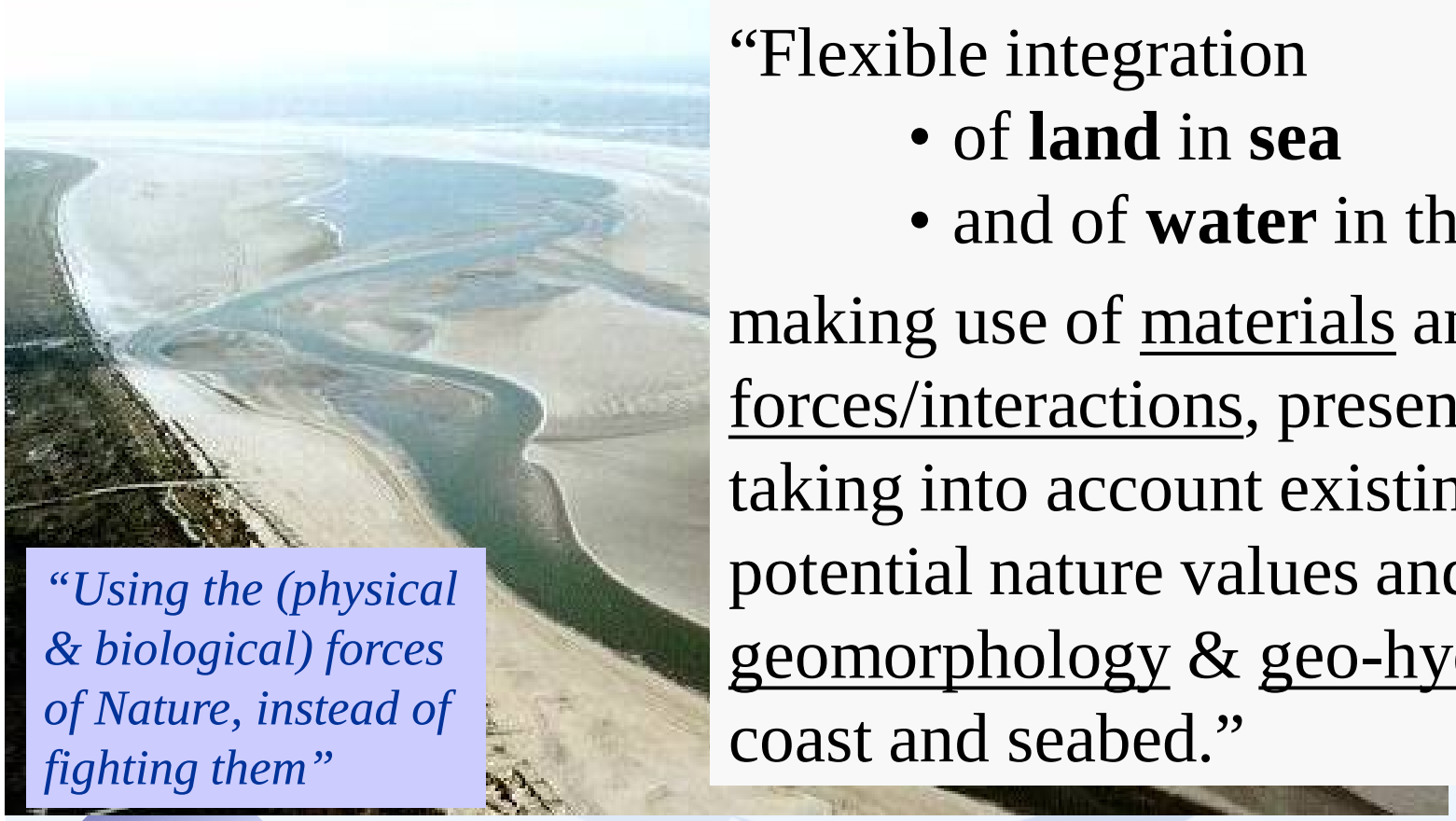
⇨ To constructive approach, optimising full (socio-)economic and environmental potential.

"Environment = Opportunity"



The Way Forward
Concept of Building with Nature





"Using the (physical & biological) forces of Nature, instead of fighting them"

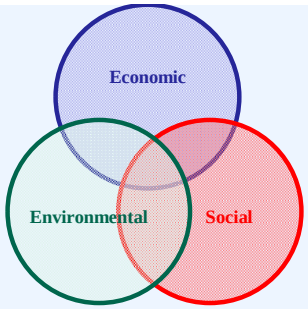
"Flexible integration

- of **land** in **sea**
- and of **water** in the **new land**

making use of <u>materials</u> and <u>forces/interactions</u>, present in nature, taking into account existing and potential nature values and the <u>bio-geomorphology</u> & <u>geo-hydrology</u> of coast and seabed."

(developed over last 30 years by Ronald Waterman)

The Way Forward
Philosophy of Building with Nature



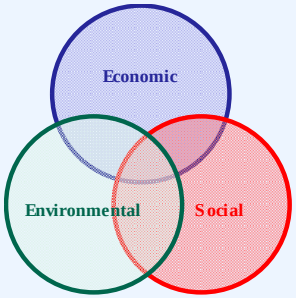
Principles:

- ⇨ Long Term Vision and Investment Perspective
- ⇨ No Regret: Preserve Ecosystem, Preserve Investment
- ⇨ Guarantee of Safety
- ⇨ Partnership with Nature

Consider the project's added value to:

Safety ? | Nature ? | Attractiveness ? | Sustainability ? | Society ? Economy ?

New Sustainable Approach
Implementing Building with Nature



Building with Nature

is a partnership with Nature, integrating both physical and biological aspects of Nature in a project's design, EcoDynamic Design or Geo-Engineering, and implementation so that the project integrates more harmoniously and more harmlessly into Nature and when possible to Nature's benefits.

"Where Nature and Man build together for their mutual benefit."

Conclusions

Conclusions

- ⇨ Dredging is not a problem
  … it is part of the solution !
- ⇨ Building our Future can and should be done together with Nature !

Building with Nature provides a frame to building sustainable, resilient and integrated waterborne infrastructure.

Thank you !

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  www.european-dredging.eu