



# LeadersHIP



## The Sea

# New Opportunities for the Future

**Acknowledgments:**

This report reflects the dedicated work of a 'Coordination Group' established for the revision of the Leader-SHIP strategy. It was composed of all the relevant stakeholder groups of the European maritime industry. This includes representatives of the European Parliament, Member States, European Commission services, maritime technology manufacturers, classification societies, shipping, dredging, the wind energy industry, trade unions, non-governmental organisations and European maritime regions.

**Definition:**

The **European maritime technology industry** encompasses all the enterprises involved in the design, construction, maintenance and repair of all types of ships and other relevant maritime structures, including the complete supply chain of systems, equipment, services and supported by research and educational institutions.

# 2020 LeaderSHIP

**The Sea, New Opportunities for the Future**

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# 1. The LeaderSHIP 2020 Initiative by the European Maritime Technology Industry

## 1.1. LeaderSHIP 2015

In 2002 the European shipbuilding industry developed a vision and a robust strategy for 2015 to ensure its “long term prosperity in a dynamic growth market”. Its vision was based on five key strategic elements:

- Improving leadership in selected maritime market segments;
- Continuing to drive and protect innovation;
- Strengthening customer focus;
- Improving industry structure and implementing a network driven operating model;
- Emphasising production optimisation and shift towards a knowledge based production;

The LeaderSHIP 2015<sup>1</sup> strategy was subsequently developed with the European Commission in close collaboration with the industry. It was successful at becoming a role model for a modern industrial policy.

In the period from 2002 to 2008 the European maritime technology industry recorded substantial growth, and the sector was able to orientate itself as a competitive and innovative world leader in highly-specialised market segments. Enormous progress was made on all five key strategic elements, and they are still as relevant today as 10 years ago.

Throughout the last decade there has been a notable shift in public perception and European policy towards the sector. It has been acknowledged that it is a modern, high-tech and efficient segment of European manufacturing that can drive growth and create new jobs.

## 1.2. Unprecedented Challenges and New Opportunities: the Need for a LeaderSHIP 2020

In 2008 the financial and economic crisis heavily impacted the global markets and consequently the business conditions in Europe. Trade volumes dropped, freight rates collapsed by more than 90%, affecting ordering activities by a similar order of magnitude. Already in its

sixth year, the crisis is continuing to put pressure on the European maritime technology industry through difficult access to finance, a drop in production and low business confidence. Aggressive expansion in Asia has led to the development of unprecedented overcapacities. Today, the market conditions are far more challenging than a decade ago and hence a revised and updated strategy needed to be forged by the European maritime technology industry and European Policy makers.

At the same time, new opportunities are arising, notably in the field of harvesting offshore resources, such as marine renewable energy (off-shore wind and ocean energy).

The revision reflects an integrated approach, seeing stronger involvement of the user industries, trade unions, non-governmental organisations and European, national and regional actors. The main aim is to provide a series of recommendations for the short and medium term to support sustainable growth, high-value jobs and address the societal challenges Europe is currently facing.

## 1.3. Policy Context

European maritime technologies are a crucial component for *Europe 2020* to succeed. The policy's priorities of developing an economy based on knowledge and innovation (*smart growth*) and promoting a resource efficient, greener and more competitive economy (*sustainable growth*) provide a perfect match for the opportunities to be found in the maritime field. This also reflects the guidelines set out in the '*Limassol declaration<sup>2</sup> on a marine and maritime agenda on growth and jobs*'.

The Commission communication '*A Stronger European Industry for Growth and Economic Recovery<sup>3</sup>*' addresses many of the issues included in LeaderSHIP, aiming for a reinforced industrial policy, e.g. access to finance and markets; research, development and innovation; and the importance of human capital, etc.

Given this context a specific approach to industrial policy, including crisis response is essential, acknowledging that not all issues can be addressed by a standard set of tools. It is true that many common challenges that affect business can be addressed with a horizontal approach. However, in the case of the European maritime technology industry there are sector specific challenges which need dedicated focus without forgetting the links in the supply chain and the creation of synergies with related sectors.

<sup>1</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0717:FIN:EN:PDF>

<sup>2</sup> <https://webgate.ec.europa.eu/maritimeforum/content/3060>

<sup>3</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0582:FIN:EN:PDF>

## 2. A Strategic Vision for the Maritime Technology Industry

### 2.1. Strategic Importance

The European coastline is approximately 136,000 km and the oceans and seas are an integral part of the continent's traditional maritime orientation and also a source of new opportunities for the future.

For generations the European seas have inspired exploration and the development of breakthrough innovations in order to harness its potential, and considered a frontier which needed to be overcome. By 2020 Europe should reaffirm the significance of the sea as a frontier offering immense opportunities.

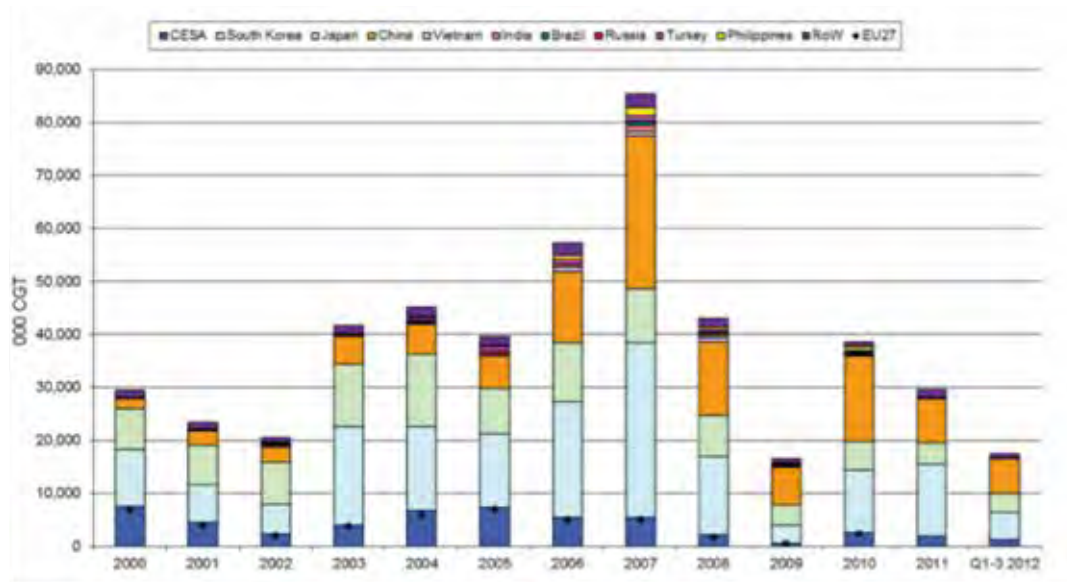
Mankind's use of the sea is broad and includes maritime transport, the enabler of global trade; offshore oil & gas, the back-bone of energy supply in an economy which is still largely based on hydro-carbons; aquaculture

activities, an essential source of protein for a growing world population; maritime tourism; marine renewable energy; coastal protection and land reclamation; off-shore mining; floating structures and factories; and various aspects of maritime and marine research.

Europe can be proud of its outstanding ability to design, manufacture and build the full range of high-tech vessels and maritime structures which meet the most stringent safety and technical requirements, allowing the continent to engage in global trade, exploit resources and when the necessity has arisen, defend its strategic interests. However, with the shift of focus from the West to the East, Europe's maritime capabilities are being challenged on a daily basis.

Shipping and consequently the building of merchant vessels as well as maritime manufacturing have seen cyclical and often volatile market developments. The construction of cargo ships has largely shifted to China, Korea and Japan producing four-fifths of the world's vessels. European production has mainly focused on the production of specialised high-tech ship types.

### New Orders by Main Shipbuilding Areas :



source : SEA Europe elaboration of data from IHS Fairplay, 2013

This graph reflects the volume of global new orders by main shipbuilding areas. If naval shipbuilding is taken into consideration, then the value of the sector could be perceived as being significantly greater<sup>4</sup>.

The global 'added value' of the European maritime technology industry is not truly reflected by statistics based

on tonnage and should be, by no means underestimated. Many businesses have evolved and greatly benefited from the diversification and specialisation of maritime markets. This specialisation has been technology intensive which has allowed Europe to maintain a leading edge in design, innovation and servicing of the most demanding ship types.

<sup>4</sup> The naval shipbuilding industry is not addressed in this report.

## Ships and Maritime Equipment Industry

The ships and maritime equipment industry employs more than 500,000 people and has an average annual turnover of around 72 bln €. Comprising of:

### Shipbuilding and Ship Repair

The European shipbuilding industry and ship repair industry is made up of around 300 yards of which more than 80% can be considered to be 'small to medium' (building ships of 60-150mt). The remaining yards can be defined as 'large'. Around 90% of the orderbook is for export markets.

### Marine Equipment Manufacturing

The European marine equipment manufacturing and industry (propulsion, cargo handling, communication, automation, integrated systems, etc.) is made up of around 7,500 companies, the vast majority of which can be considered to be 'small to medium'. Around 70% of production is for export markets.

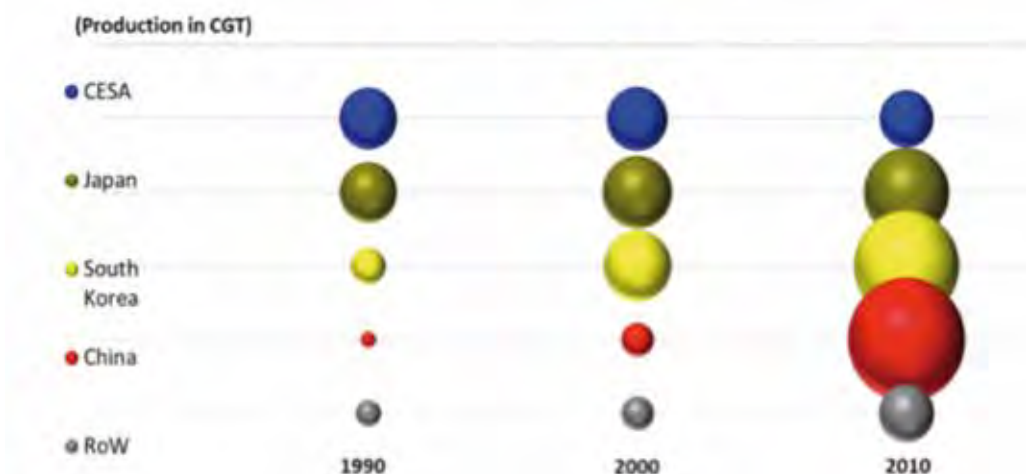
## 2.2. The Industry in 2012

### Reduction of New Orders and Overcapacity

The global maritime technology industry is facing serious challenges. New orders for ships have virtually collapsed from a pre-crisis speculative boom of 85 mln cgt to 16 mln cgt in 2009 and have remained low. The expected average order volume is 30-40 mln cgt annually.

At the same time the expanded global shipyard capacity reached new output records year on year peaking in 2012 at around 60 mln cgt. The capacity expansion in shipbuilding has mainly taken place in China, Korea and other emerging markets, however Europe has refrained from taking this approach. The long production cycle in shipbuilding means that the impact of low orders on the supply chain and on employment is only now being felt. This is particularly concerning for Europe.

### Massive Capacities Built Up:

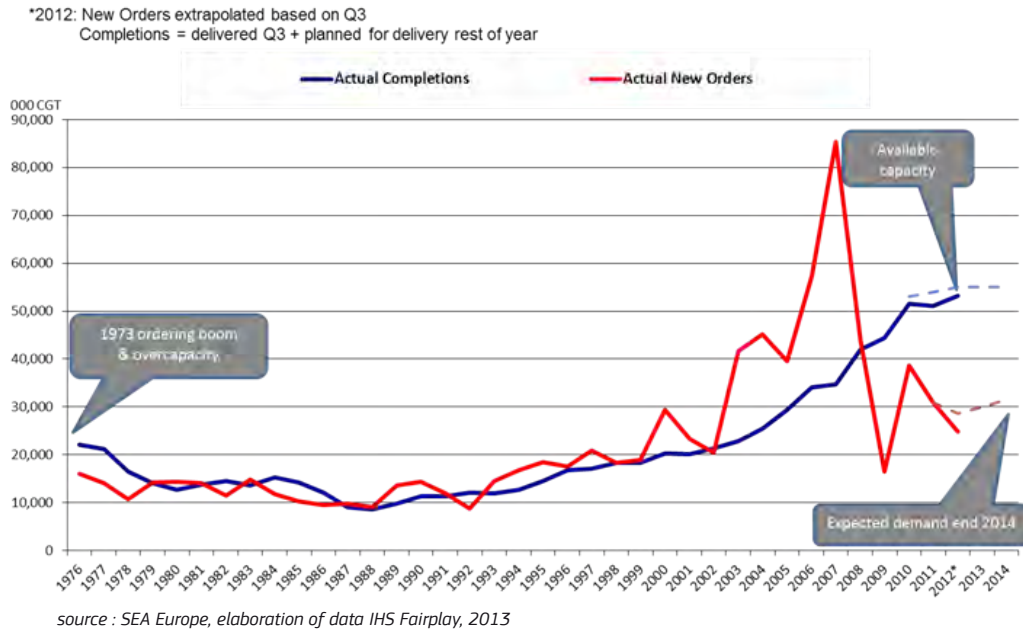


source : CESA Market Monitoring, elaboration of data from Lloyds List Fairplay, 2011

The capacity of the existing fleet is well above the demand due to speculative ordering and reduced growth in trade volumes. At the same time Asian shipyards are still delivering record volumes of cargo vessels resulting in shipping freight rates sharply declining as a consequence

- in some market segments by more than 90%. Lower revenues coupled with high fuel prices and depreciation of assets has seen a sharp decline in the profitability of shipping and hence new ship orders.

## World Shipbuilding Supply and Demand :



The specialised segments of shipbuilding (cruise ships, offshore support vessels, etc.) are not directly affected by overcapacity in the cargo shipping fleet, however, the drought of financing has meant that new orders in these segments have also diminished. The European orderbook has shrunk to 30% of the pre-crisis level at the end of 2012. A major problem is that Asian mass producers of steel intensive vessels are increasingly trying to enter these relatively small niche markets in some cases supported by their governments.

More than 50.000 workplaces have been affected and in several maritime fields, Europe is losing self-sufficiency, highlighting an overall strategic weakness. The relocation of simpler manufacturing processes risks to be followed by the relocation of the more complex systems and their operation.

### Strong Positive Long-Term Trends Remain Intact

Given the current challenging conditions in the industry, there are several trends which have been identified and offer substantial opportunities.

The high expectations of society with regard to the impact of human activity on the environment and safety can be perceived as a driving force for the sector. The substantial increase in the price of oil has led to a dramatic shift in the cost structure in the operation of ships. Regulatory changes addressing climate change, energy efficiency and

air quality will accelerate this trend and should therefore stimulate a gradual 'green' fleet renewal.

Furthermore there is a growing awareness of the vast potential that the sea has to offer which can translate into new growth opportunities. Marine renewable energy and raw materials are prominent examples of this.

Long term global demographic and economic growth will act as a stimulant. Despite the negative situation of the industry today, the economic drivers of the globalisation process remain in existence and the longer term demand for maritime goods and services will see solid growth. It is expected that this will restore balance of supply and demand in the shipping and shipbuilding markets.

### The Way Ahead

Despite long term favourable prospects the present economic situation needs to be taken into account. The fleet/shipbuilding overcapacity, economic recession and chronic lack of financing needs to be dealt with effectively in order to avoid structural damage to competitive companies and the loss of critical mass which safeguards competitiveness once the downward trend reverses.



## 2.3. Strategic Vision for 2020

The industry stakeholders have identified the following characteristics of a strong, sustainable and competitive European maritime industry in 2020:

- **Strategic:** An evolved public perception and the acknowledgement that the maritime technology industry is of strategic importance for the EU and provides quality employment for large global companies, SMEs, in defence and security in Europe;
- **Innovative:** A sector which delivers cost-effective, innovative and technologically advanced products and services through effective use of RDI and high productivity;
- **Competitive:** A successfully restructured sector offering attractive long term employment opportunities for a highly skilled workforce, including younger workers. A workforce in manufacturing, R&D and servicing that is trained and prepared to work with a multitude of technologies;
- **Specialised and Green:** An industry producing specialised products integrating 'green', innovative and safe high-tech technologies, ranging from ships for conventional markets (transport, leisure, oil & gas, etc.) to vessels, structures and systems, devoted to a safe and sustainable exploitation of the oceans and of marine renewable energies;
- **Life Cycle Oriented:** An industry taking care of the environmental footprint of their products from design, through production and operation up to dismantling and recycling;
- **Export Oriented:** A sector exporting a significant share of ships, maritime structures and systems, characterised by high-quality and high performance in specialised market segments;
- **Energy Efficient:** Special emphasis on design, product development and the cost-effective exploitation of technological solutions aimed at energy efficiency and emissions reduction;
- **Global:** A strong European manufacturing base for ships and components sold on the EU and global markets which offer a genuine level playing field to all players in the sector, based on the principles of safety, sustainability and fair competition following balanced trade deals which include sector specific provisions where necessary.

In order to realise this strategic vision, two essential conditions need to be met. Firstly, the private sector and policy actions by authorities at EU, Member State and regional level should complement each other. Secondly, all policy areas having an impact on the maritime technology industry and its customers must be well coordinated among the relevant authorities in charge.

## 3. Fostering Conditions for Business Success

### 3.1. Four Pillars for Action

To achieve the aims of the 'strategic vision' for 2020 an integrated approach is needed. The European maritime stakeholders have narrowed down the areas of policy action to four main themes of focus:

- **Employment and skills**
- **Improving market access and fair market conditions**
- **Access to finance**
- **Research, development and innovation**

In order to bring about the sectoral change needed and create a truly competitive and sustainable industry, policy recommendations under these four main headings shall be explored.

#### 3.1.1. Employment and Skills

The global crisis has a twofold impact on employment and skills in the European maritime technology industry.

On the one hand as a result of the global economic situation the product portfolio of many European producers has been adjusted and shifted. The increased complexity of the products has created additional demand for highly skilled staff. Therefore a large part of the industry is suffering from a pronounced scarcity of skilled personnel and this is a restriction on growth.

Conversely the current economic situation is triggering a phase of consolidation for all the actors involved in the shipbuilding industry. It has been estimated that 9% of world capacity will close in 2013 and a further 11% in 2014 if contracting activity remains weak<sup>5</sup>.

It is expected that the European maritime technology industry will undergo some further restructuring. A strong social dialogue with workers' representatives, public authorities and the other relevant stakeholders, based on mutual trust and shared responsibility is an effective measure by which to seek the best solutions for predicting and managing the restructuring process.

It is proposed that the following areas are further explored to address the threats and challenges to employment and skills:

<sup>5</sup> [http://www.shipfinance.dk/en/Publications/Download/~/\\_media/Shipping-Market-Review/Shipping-Market-Review-October-2012.ashx](http://www.shipfinance.dk/en/Publications/Download/~/_media/Shipping-Market-Review/Shipping-Market-Review-October-2012.ashx)

- *Restructuring* (managing transition and easing the social impact of structural adjustment on employment)

Any such restructuring should be integrated in a long term strategy aiming at ensuring sustainability and competitiveness. Given the fact that employment in the industry has high regional concentrations and that closures and redundancies are last resort options for companies, restructuring operations should be well prepared involving the relevant stakeholders and following best practices in this field<sup>6</sup>. This will maximise the likelihood of a successful restructuring.

- *Image and Career Path*

For several of the 'specialised' maritime market sectors there is a high demand for skilled personnel. By creating the right image and directly appealing to talented young people (including women, who are wholly underrepresented) with a convincing message that the sector has a high-tech future with a long-term positive perspective will enable the industry to rejuvenate itself. In addition measures should be taken to retain qualified personnel in the maritime sector.

It is not all about production jobs, the maritime technology industry also provides opportunities to build careers in financial, management and service sectors. It is able to respond to modern challenges and offer new business and entrepreneurial prospects. These messages have to be effectively communicated.

- *New skills and lifelong learning*

There is a real risk of losing critical mass of skills and technological competences through downsizing and closures. There needs to be better transfer of competences between old and new generations to address the ageing workforce and the lack of 'new blood' in the sector.

A systematic approach at EU level to map the activities versus employment needs in the various regions and Member States addressing current and future skill/training needs would facilitate planning, coordination of skills, intra/inter -sectoral mobility and the implementation of lifelong learning processes. Workers should be encouraged to take advantage of the specialisation of the sector into new markets by 'up-skilling' and acquiring new skills in order to meet evolving skill expectations.

- *Harmonisation of Certificates and Mobility*

Mobility of skilled workers should be facilitated and encouraged within the maritime sector providing for a

flexible and dynamic workforce. More attention should be given to the mutual recognition of degrees of EU graduates and to the skills of workers (in particular from third countries) who possess crucial know-how even if they do not have formal degrees.

Mobility could be facilitated by tailoring educational programmes to address the diversification of the industry and the emerging knowledge requirements. The feasibility of a European maritime engineering degree could be explored. This would meet the needs of today's markets and strengthen the employability of graduates.

### 3.1.2. Improving Market Access and Fair Market Conditions

Promoting a free, fair and open market is one of the founding principles of the European Union. Globally a level playing field, open markets and non-distortion of trade and competition rules are vital for the interests of the EU and more specifically of the European maritime technology industry.

In many countries the maritime industry has often been considered strategic. Although this is also true for the EU<sup>7</sup> the political will to provide active support is mainly recorded outside Europe. Various forms of support have been observed, ranging from subsidies to build up the industry to protectionist measures defending it in times of crisis. Such distortions in fair market conditions threaten the interests of the European maritime technology industry especially if support measures are linked to domestic production or capacities are increased. The sector thrives when global markets are open and when domestic and foreign actors are on an equal footing.

European trade policy should promote proactively free and fair markets to the benefit of the European maritime technology industry. Emphasis has to be placed on pragmatic and well-coordinated action at EU level when the European maritime technology industry is facing unfair trade and market practices.

It is proposed that the following areas are further explored to address the threats to market access and fair market conditions:

- *OECD Working Party on Shipbuilding*

The OECD Working Party on Shipbuilding ("WP6") is the only international forum for governments to discuss shipbuilding matters. Since its inauguration in 1966 many important discussions have taken place in this forum, working towards establishing fair competitive conditions in the global shipbuilding market.

<sup>6</sup> 'Checklist for Restructuring Processes' - [www.ec.europa.eu/social/BlobServlet?docId=2741&langId=en](http://www.ec.europa.eu/social/BlobServlet?docId=2741&langId=en)

<sup>7</sup> [http://ec.europa.eu/enterprise/sectors/maritime/shipbuilding/index\\_en.htm](http://ec.europa.eu/enterprise/sectors/maritime/shipbuilding/index_en.htm)

The OECD shipbuilding agreement achieved in 1992 was an important milestone. Unfortunately it could not enter into force as the USA failed to ratify it.

A renewed effort to negotiate a new agreement was promising particularly as China was part of the Special Negotiation Group established for this purpose. The EU insisted that both market distorting subsidies as well as injurious pricing practise would need to be addressed as was the case in the 1992 agreement. Unfortunately, the renewed negotiations were unable to be concluded successfully and finally abandoned in 2010. There remained a dispute on pricing provisions until the end and the problem of over-capacity was not even addressed due to opposition from Asian members. The OECD continued further analysis and delivered an expert evaluation which concluded that pricing provision would in practise be very difficult to implement. Equally, experience of the WTO shows that anti-subsidy provisions are on the whole rather ineffective.

The role of the OECD Working Party on shipbuilding needs to be redefined. Its two principal ways of addressing market distortions, *i.e.* subsidy and pricing provisions are dysfunctional. New ways to regulate unsustainable market practises need to be considered. These could include monitoring activities, both on government intervention as already undertaken as well as on price developments. Furthermore, ways to address capacity should be explored.

The OECD's Sector Understanding on Export Credits for Ships (SSU) has provided means of reducing differences in state financing instruments. The SSU had a positive impact on the behaviour of governments despite the fact that it is unlikely to provide 'safe haven' protection at the WTO if challenged. With the rise of the non-OECD member China to the largest provider of export credits, multilateral negotiations to overhaul these common rules are absolutely necessary.

- *World Trade Organisation*

In the absence of an International Shipbuilding Agreement the WTO dispute settlement system needs to be used as a last resort for action on subsidies. Although past attempts were not fully successful, the WTO ruled in favour of the EU with regard to illegal export subsidies granted by the Republic of Korea to a number of its shipyards<sup>8</sup>. Parties are often hesitant to launch a procedure because of the risks involved in jeopardising international relations. It is acknowledged that this is a difficult route to go down given the limited success of anti-subsidy procedures. However case law has further evolved in recent years and might offer new ways to address subsidies in shipbuilding.

- *International Labour Organisation*

The ILO is the international organisation responsible for drawing up and overseeing international labour standards. It is the only tripartite United Nations agency that brings together representatives of governments, employers and workers to jointly shape policies and programmes promoting decent work for all. This unique arrangement gives the ILO an edge in incorporating 'real world' knowledge about employment and work.

The WTO has provided a "Consensus on core standards, to be deferred to the ILO: *There is a clear consensus: all WTO member governments are committed to a narrower set of internationally recognized "core" standards — freedom of association, no forced labour, no child labour, and no discrimination at work (including gender discrimination)*"<sup>9</sup>.

- *Public Procurement*

Public values should be taken into consideration when looking at public procurement or when public money is involved especially in the fields of defence, environment, energy, mobility and for labour conditions. According to an EC proposal on public procurement<sup>10</sup> a contracting authority can exclude economic operators from the procedure, if it identifies infringements of obligations established by Union legislation in the field of social, labour or environmental law or of international labour law provisions.

Furthermore the EU is advocating opening the international public procurement markets. Some € 352 bln of EU public procurement is open to bidders from member countries of the WTO agreement on government procurement. However, many third countries are reluctant to open their procurement markets further to international competition and some have adopted protectionist measures in response to the economic crisis.

The European maritime technology sector is disadvantaged by this system with European government shipbuilding contracts heading abroad and European suppliers unable to trade in 'protected' markets. The proposals<sup>11</sup> of the European Commission on public procurement procedures and the inclusion of public values are supported by the sector.

- *Intellectual Property Rights*

New ideas and developments should be safeguarded to ensure that innovative companies remain competitive and see a (fair) return on investment. In principle IPR protection and enforcement regimes are established at international, national and regional levels,

<sup>8</sup> WTO case DS 273

<sup>9</sup> [http://www.wto.org/english/thewto\\_e/whatis\\_e/tif\\_e/bey5\\_e.htm](http://www.wto.org/english/thewto_e/whatis_e/tif_e/bey5_e.htm)

<sup>10</sup> <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011PC0896:EN:NOT>

<sup>11</sup> [http://trade.ec.europa.eu/doclib/docs/2012/march/tradoc\\_149243.pdf](http://trade.ec.europa.eu/doclib/docs/2012/march/tradoc_149243.pdf)

however weaknesses in the systems and their implementation in practice remain. In some cases preference is given to protecting 'national interests' and this can cause distortions in fair treatment of foreign business in the case of IPR.

Furthermore, regulatory requirements in the context of IMO rule development have created new challenges in IP protection. Safety, environmental protection and design transparency are regarded by many parties as overriding, to some extent, the confidentiality of proprietary information. For instance, the ship construction file (SCF) requirement requires shipyards to provide very detailed and broad technical information covering product solutions. The verification of the energy efficiency design index (EEDI) as well as the new IMO regulation on technology transfer and technical cooperation requirements for IMO Member States has created new challenges in this respect.

Given the importance of innovation and technological development within the European maritime technology industry, IPR has to be sufficiently respected and its protection has to be strengthened.

### 3.1.3. Access to Finance

The economic and financial crisis has put an end to the boom in global shipping and shipbuilding markets and affects Europe far more than competitors in Asia. Large over-capacity in many segments of the fleet has led to low freight rates and decreasing ship prices. As a result the maritime technology industry is seeing declining profitability on many new building projects. The protracted duration of the bad market conditions impair the solvency ratio of many enterprises and makes this sector less attractive for external investments compared with other manufacturing industries. This increased risk aversion is hampering the maritime technology industry from entering the financing market and substantially increases the costs of equity and lending.

Funds for new projects are therefore scarce and expensive. State supported export credits have gained importance all over the world, sometimes combined with currency interventions and the use of macro-economic 'crisis response' instruments. However, their availability in Europe is limited due to budgetary constraints of Member States. This leads to increasing market distortions on a global level.

Traditionally European banks have played a dominant role in world ship financing. The crisis has meant that many European banks have reduced their exposure to the

European maritime industry or terminated ship financing altogether. It is expected that this will not change in the near future. In particular European banks have difficulties to finance loans in US Dollars for long maturities even when there is a state export credit insurance in place. Under Basel III export and trade finance is being treated as any other financing structure and therefore the specific characteristics of export loans are not taken into account.

As a consequence, access to finance has become the single most important factor in competing for international shipbuilding contracts. Sometimes contracts are being placed on the availability of finance over the technical competencies of the bidder. This is related to the characteristics of financing a new ship such as the high upfront capital costs of a vessel and long tenors needed. The situation is particularly critical in the first phase of ship construction when large parts of the loan are drawn down but not even the hull is available as collateral.

Furthermore the financial constraints of ship-owners means that opportunities which normally would materialise as a result of say, increasing energy prices and the drive for more efficient ships, are being lost. This is also the case when shipyards seek to engage in new maritime activities such as off-shore wind energy. In many such cases economically and environmentally desirable moves require substantial start up investments which are difficult to raise, in particular for smaller shipbuilding enterprises, where the capital base has been affected by the crisis.

The combination of general economic trends and industry specific business practice demonstrates the need for a coordinated series of recommendations at European, national and regional level which addresses the shortcomings and foster a financial environment which can be used to the benefit of European maritime technology industry as a whole. This in turn will enhance its technological output.

It is proposed that the following areas are further explored to address the threats to access to finance, financing environmental improvements and diversification into new markets:

- *Improving Liquidity in the Market*

The European credit system faces difficult conditions in finding liquidity through its own traditional channels. The situation is particularly difficult in the financing of the construction of new ships, given the exceptionally capital intensive order books and the relatively long periods between contract and delivery – a niche where few banks are available to operate. However, end financing of the ships is not easy either in periods

of scarce availability of long term capital and more demanding solvency requirements.

Measures such as the European Investment Bank (EIB) new transport lending policy have been well received; however, not enough experience has been obtained with the application of the guidelines on concrete project proposals. The expansion of the scope of lending by the EIB should be further explored by the industry to take EIB financing into consideration for projects related to 'green' shipping and retrofitting. Notwithstanding the practice of financing no more than 50% of the project cost this instrument could be seen as the most effective short term source to alleviate the ship financing situation in some cases.

Additional long term financing of the sector needs however to be addressed given the capital intensity and long tenors needed. This could be justified for two reasons:

- The strategy of easing the financing conditions and boosting the credit market for specific industries is coherent with the upcoming focus on sectors within the new direction of EU industrial policy.
- Targeting a specific credit end market would promise a broader impact on refinancing operations, reducing the risk that most of the public economic effort remains on the balance sheets of the financial system without bringing any benefit to the manufacturing world.

In the eventual extension of availability and scope of the *'Europe 2020 Project Bond Initiative'* to enhance the credit standing of private entities that need to raise private funds for projects, the maritime transport sector should be given due consideration.

#### • *Providing Suitable Guarantees*

With the significant time lapse from contract to delivery in the building of a particular vessel or series of vessels, not only is substantial liquidity needed for working capital purposes, but also shipbuilders and/or ship-owners need to issue guarantees to banks to finance such operations (refund guarantees).

In the current economic climate given the difficulties in financing new orders, refund guarantees are a very important tool in protecting the purchaser and the lender's interests. An EU Guarantee Scheme has been extensively examined and discussed over the last decade but no consensus could be reached on whether

such a scheme would be feasible or desirable. However, the current lack of available guarantee capacity from commercial sources due to the deterioration of the banking markets and limited availability of guarantees from public sources in some Member States may give some new impetus to explore market based accessible guarantees.

#### • *Financing Environmental Improvements*

Greening and diversification of the European maritime technology industry have been recognised as 'game-changers' in the short term. Unfortunately, there are many barriers to the financing of environmental improvements for ships. All the investment obstacles discussed above hamper financing of environmental projects as well, whilst other issues specifically affect environment-friendly innovation<sup>12</sup>. Generally, overcapacity, inadequate profitability, and lack of capital in the shipping sector, limit the available resources for investments urgently needed to improve energy efficiency and to implement imminent new regulation for the reduction of emissions<sup>13</sup>. In particular there are specific barriers which need to be explored:

- Lacking or insufficient financial return on investment

Mandatory rules at international level are preferable to support the 'greening' of shipping as they maintain a global level playing field. However, while necessary for environmental reasons, certain 'green' investments lack any positive impact on efficiency gains and are viewed as pure 'add-on' cost by ship-owners. Technology which does have a positive commercial effect for the ship-owner is often not taken into consideration.

- Lack of investment certainty

Mandatory rules should provide sufficient clarity regarding implementation, conditions, etc. On-going discussions on eventual rule changes hamper the necessary investment in technologies.

Uncertainty surrounding the performance of some innovative green technologies is also hampering investments. In some cases there is a lack of convincing performance data and in others the full scope of costs is difficult to assess (e.g. alternative fuel) compounded by the lack of necessary infrastructure to support the technologies in question.

<sup>12</sup> The analysis takes into consideration also the main findings of a study conducted by Maddox Consultants for DG CLIMA on market barriers to cost effective GHG emission reductions in the maritime transport sector. It must be noted that the study's finding related only to existing ships

<sup>13</sup> E.g. ballast water treatment, reduction of SO<sub>2</sub> and NO<sub>x</sub>

- *'Blue' Public Private Partnership*

In addition to improving the regulatory environment and full use of existing instruments for shipping finance a 'Blue' Public Private Partnership (PPP) could be an innovative model for encouraging the financing of environmental improvements.

A "Blue PPP" model consists of a joint venture between a private enterprise and a public entity which engage for a defined period of time into the acquisition of maritime hardware (vessels, systems, infrastructure elements etc.). Such a concept has been successfully used in Japan (JRTT scheme<sup>14</sup>) for many years. The core element in the Japanese model is the availability of a state entity, which has capital and technical competence at its disposal.

In Europe any element of public support needs to be compatible with the rules on State Aid. Therefore, any scheme will need to be clearly and rather narrowly defined in scope and functioning. In principle, a "Blue PPP" could be applied to two different kinds of investments:

- Non-commercial (non-profitable) projects, i.e. projects which require public support (e.g. certain state-run local ferry connections with a public service obligation, basic infrastructure etc.)
- Potentially profitable investments, which the private sector does not or only insufficiently support and carry a significant objective of common EU interest (e.g. energy efficiency, emission reduction, demonstrator of innovative solutions, etc.) which could make them compliant with State Aid rules.

- *Use of Funds from Market Based Measures (MBM)*<sup>15</sup>

MBM to reduce Greenhouse gas (GHG) emissions from ships are discussed at international as well as at European level. They are often considered as an effective measure to complement the implementation of the already adopted energy efficiency design index (EEDI), which addresses new ships and will therefore only gradually impact GHG emissions. Funds generated by eventual MBMs could be used to give an incentive to finance the greening of ships.

### **3.1.4. Research, Development and Innovation (RDI)**

The competitiveness of the European maritime technology industry relies on its capacity for strong research, development and innovation. RDI efforts are

needed to foster not only innovation in products, but also for process and non-technological innovation which are key factors for the competitiveness of the sector.

A ship by definition is the perfect integration environment for new and innovative technologies given the fact that at least 70% of a complex ship's value is made up of marine equipment.

The maritime sector is a complex sector which has its own specificities when it comes to RDI. Ships are tailor-made to the request of a client. The high-tech nature of the industry in Europe dictates that ships are typically one-of-a-kind (prototypes) and by definition, large sophisticated end-products conceived by shipbuilders and marine equipment manufacturers in close cooperation with the ship-owner. It is also confronted by regulatory pressures and has to cope with inevitable uncertainty in this regard. At the concept design phase ships can be designed to specification and the involvement of the maritime technology providers, at this stage, can ensure that innovative solutions can be adopted for specific business requirements. This establishes a crucial European competitive advantage.

It is exactly at this design stage that the maximum implementation of novel technologies can be realised taking into account the whole life-cycle of a ship. Technical solutions often need to be developed to ensure the highest degree of integration and to minimise the technological risk of early uptake for assemblers and the end client.

Given the right conditions and regulatory certainty, RDI within Europe can be fostered to such a degree that the European maritime technology industry can keep its technological lead and remain competitive in a global market, enshrining its high-tech enabling credentials for the future.

It is proposed that the following areas are further explored to further stimulate research, development and innovation within the European maritime technology industry:

- *Exploiting New Market Opportunities*

Today there are many developments within the industry towards new market segments such as off-shore wind; ocean energy (tidal and waves); arctic shipping; off-shore energy exploration; and deep-sea mining. These are specialised markets that should be given the opportunity to be developed and given Europe's strength in harnessing economic potential through advanced engineering, significant growth potential through effective RDI could be realised. New emerging markets such as marine renewable energy also come with challenges that need to be addressed with significant RDI investments.

<sup>14</sup> <http://www.jrtt.go.jp/11English/pdf/AboutJrtt06.pdf>

<sup>15</sup> <http://www.imo.org/ourwork/environment/pollutionprevention/airpollution/pages/market-based-measures.aspx>

It has been further identified that one of the main drivers of research and innovation in the midterm is focussing on the energy efficiency of vessels meeting the upcoming regulatory requirements. Equally, maritime safety remains a key challenge and solutions that make ships and their operation safer can offer new business opportunities with or without regulatory instigation.

- *Stimulating Research, Development and Demonstration*

The 7<sup>th</sup> Framework Programme (FP7) has been successful at stimulating research opportunities through an efficient dialogue between the EC and the industry by means of the Waterborne Technology Platform. Industry identified research priorities have often been translated into the annual research Work Programmes.

The broad spectrum of European goals (Europe 2020, Transport White Paper with its strong focus on emission reduction, etc.) and international regulations are particularly challenging for the maritime technology industry. It has to meet very ambitious environmental and safety targets which require coordinated efforts and massive investment for breakthrough solutions. The new and more ambitious research and innovation framework programme Horizon 2020 will be launched in 2014. The industry believes that a public private partnership (PPP) with clearly defined objectives and a long-term commitment from the industry together with EU, national and regional institutions is an effective tool to meet these demanding targets.

Industry considers that a PPP would ensure the industrial transferability of research results, in terms of cost / benefit or cost / performance, through demonstration projects. An integration layer or meta-demonstrator of the research outcomes could be realised, where all the project results could be integrated as a 'system of systems'. This would be a definitive tool for vessel design and operational assessment and it merits further consideration once the industry has developed the idea in full detail.

More generally investment in innovative technologies and corresponding infrastructure especially related to new or emerging markets (e.g. use of LNG) are often associated with high levels of risk. Independent demonstration of these technologies, infrastructures and processes with the support of Horizon 2020, national and regional funds can mitigate this risk, bridging the gap between research and market-uptake and encouraging diversification. The results derived from demonstration activities can serve as a source of information for political decisions, international rule and legislation development. The European maritime tech-

nology industry should play an active role in future EU RDI projects on marine renewable energy.

- *Stimulating Innovation*

While a strong commitment to the research agenda will be needed in order to meet the overarching objectives of a public private partnership, in the shorter term, the sustained competitiveness of the European industry will rely on the proper stimulation of innovation on the shop-floor.

State aid for innovation aid has proven to be instrumental in this regard. In view of the expiry of the existing Shipbuilding Framework at the end of 2013, the Commission envisages for the shipbuilding industry including the provisions on innovation aid in the Community Framework for State aid for research and development and innovation.

- *Strengthening Relations throughout the Innovation and Supply Chain and Linking Maritime RDI through Instruments of EU Cohesion Policy*

The policy framework proposed by the European Commission for 2014-2020 allows for Structural Funds to be used in different ways, such as for research and innovation, which can also contribute to stimulating diversification of the sector.

European Regions are currently developing their regional innovation strategies for smart specialisation, which will provide a basis for focused measures to create regional innovation environments. These will promote cross-fertilisation with other regional sectors and promote synergies of different EU funds. Structural funds could primarily maintain and foster the knowledge base on which the competitive positioning of the regional maritime technology industry is based. The strategy could include different objectives, in order to complete the available value chain or find synergies between the local infrastructures and competences in other regions:

- Increasing the regional capability for research, innovation and technology transfer, using ERDF to finance and attract private investments on projects (e.g. demonstration, prototyping) and centres of competence in key technologies and applications.
- Encouraging open innovation in clusters to enhance participation of maritime technology SMEs in RDI projects and access to RDI results.

- Enhancing the regional internal linkages among the players (yards, engineering companies, specialized suppliers) and the connections with other regional innovation systems, using structural funds for trans-regional projects that aim to get the necessary critical mass. The objective should be to build a consistent and integrated value chain able to take full advantage of the future innovation in the industry.

The Waterborne Technology Platform demonstrated that it is an effective forum for collecting the R&D needs of the European maritime industry. With the emphasis being placed on innovation within Horizon 2020 the platform has to broaden its scope to close the gap between R&D and Innovation and to increase its collaboration with other relevant technology platforms.

Through an increased focus on synergies with Horizon2020, cohesion policy can be an effective instrument for the promotion of technological and non-technological innovation in the maritime industries.

## 4. Recommendations by the LeaderSHIP 2020 Coordination Group

Having taken these four main areas of focus into consideration the LeaderSHIP 2020 Coordination Group recommends the following measures in order to bring about the sectoral change needed and create a truly competitive and sustainable industry for 2020.

### 4.1. Employment and Skills

The industry with the European Commission should undertake a skills mapping exercise on the basis of a study conducted by the regional clusters and provide input to the available EU programmes and projects aiming at improving the skills and competences.

Anticipation and management of change, systematic consultation and coordination at EU, national and local level should become common practice in order to soften the social impact of adjustment of employment and unemployment.

Member States and Regions should explore with the European Commission how the 'Poles of Excellence' initiative could foster regional networks.

EU programmes should be used effectively for funding individual projects with a focus on lifelong learning.

Existing tools provided by these programmes and initiatives (eg. Shipbuilding Week, European Maritime Day, etc.) should be harnessed and effectively utilised to promote the European maritime technology industry and communicate the image of a high-tech enabling industry. A study should be considered at EU level on the issue and creation of secondary accreditation system in order to give recognition to informal learning.

The ESCO (European Skills, Competencies and Occupations Taxonomy) system describes the most relevant skills, competences and qualifications needed for several thousand occupations and is developed with stakeholders from various public and private organizations. Today there is no subgroup for the maritime sector. The possibility of including this sector should be explored by the EC and the maritime technology stakeholders.





## 4.2. Improving Market Access and Fair Market Conditions

- The role of the OECD Working Party on shipbuilding needs to be redefined with consideration of new ways to regulate unfair and unsustainable market practices. This should include monitoring activities, on both government interventions as already undertaken, and on price developments. Furthermore, ways to reduce capacity and the best ways to overhaul common rules under the SSU should be explored.
- Make full use of all existing trade policy instruments: multilateral, bilateral, etc.
- The European maritime technology industry supports the continuation of work on bilateral and multilateral free trade agreements and the inclusion of sector specific references where relevant.
- In the area of public procurement the following should be taken into consideration by the EC:
  - Design a broad framework and strategy to include ‘public values targets’ in European public tenders as well as higher levels of innovation;
  - Introduce the criteria of the ILO with regard to trade union rights, safety at work, forced labour in the opening of the public tenders, and to appreciate competitiveness not only with economic criteria but also with values that are promoted by Europe;
- Promote a wider acceptance at global level of public values and introduce international reciprocity on public procurement;
- Approve the exclusion from public procurement of those third countries maintaining restrictive procurement measures which lead to a lack of substantial reciprocity in market opening between the EU and the countries concerned.
- The European maritime technology industry supports the EU patent. Measures should be explored for easier or cheaper use.
- The European maritime technology industry, European Commission and Member States should make full use of all existing IPR protection instruments.
- The European maritime technology industry should explore the need for a pan-European monitoring system (or black listing) to deal with counterfeited products and ship design IP infringement cases.

- The industry and the European Commission should work closer together to address issues concerning the protection of intellectual property which may come up in the context of the IMO rule development.

## 4.3. Access to Finance

- EIB funding opportunities and possibilities for broadening its lending activities should be promoted and explored, primarily for projects related to green shipping, offshore renewable energy, and retrofitting. It is proposed that as an immediate action a workshop should be held to further explore these opportunities.
- In the context of eventual EU action on long-term financing, the opportunity of a potential measure for long term ship financing should be explored by the European Commission, the Member States, financial operators and the maritime technology industry.
- All relevant stakeholders should explore the accessibility of market based guarantees.
- The industry, where necessary in cooperation with the European Commission, Member States or Regions should fully explore the possibility of a ‘blue’ PPP in the light of the European industry structure and respecting state aid rules.

## 4.4. Research Development and Innovation

- As soon as possible the European maritime technology industry will develop a comprehensive roadmap, setting ambitious targets providing the justification for a PPP at EU level with the aim of focussing maritime research towards zero emission and energy efficient vessels and towards zero technical accident vessels and emerging market opportunities.
- The PPP should include a ‘META Demonstrator’ verifying the improvements coming from the introduction of single novel appliances on-board, whose industrial transferability has been demonstrated – at the overall/integrated level of the ship or product – and before market implementation.
- The feasibility of a PPP on marine renewable energy could be explored by the relevant stakeholders with the European Commission.
- In view of the expiry of the existing Shipbuilding Framework at the end of 2013, the European Commission envisages for the shipbuilding industry including

the provisions on innovation aid in the Community Framework for State aid for research and development and innovation.

- Member States and coastal regions should investigate the possibility of allocating structural funds for the diversification of the maritime technology industry into new market sectors. This should accompany the change the sector is currently undergoing, especially in the context of regional strategies for smart specialisation.





# 2020 LeaderSHIP

*The cover page photos are the courtesy of:*

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PROGRAMMES AND FUNDS RELEVANT FOR EMPLOYMENT AND SKILLS DIRECTLY  
MANAGED BY THE EUROPEAN COMMISSION

LIFE LONG LEARNING- PROGRAMME 2007-2013	<p>Eligibility: The Lifelong Learning Programme applies to all types and levels of education and vocational education and training and it is accessible to all the entities listed in Article 4 of the Decision.</p> <p>Subprogrammes: -Comenius, Grundtvig: In- service training -Comenius: Assistantships -Comenius, Erasmus, Leonardo da Vinci, Grundtvig: Multilateral projects, networks and accompanying measures -Comenius, Leonardo da Vinci, Grundtvig: Partnerships; Comenius: Comenius Regio partnerships; Grundtvig: Workshops -Grundtvig: Assistantships, senior volunteering projects -Transversal programme: Key activity 1 — Study visits -Transversal programme: all other activities</p> <p>Targets: Leonardo da Vinci should increase placements in enterprises to 80 000 a year by the end of the programme; Grundtvig should support the mobility of 7 000 individuals involved in adult education a year by 2013.</p> <p><u>CALL FOR PROPOSAL 2013 - EAC/S07/12 - Published on 03/08/2012 - LIFELONG LEARNING PROGRAMME</u></p> <p>Budget and duration of projects: The total budget of the call is EUR 1 276 million</p> <p>Duration and deadlines of projects: The level of grants awarded as well as the duration of projects vary depending on factors such as the type of project and the number of countries involved. Deadlines of the call: between January and October 2013</p> <p><a href="#">LINK</a></p> <p>Commission proposal for Erasmus for All 2014-2020 brings together all the current EU and international schemes for education, training, youth and sport, replacing seven existing programmes with one.</p> <p>The new programme will focus on EU added value and systemic impact, with support for three types of action: learning opportunities for individuals, both within the EU and beyond; institutional cooperation between educational institutions, youth organisations, businesses, local and regional authorities and NGOs; and support for reforms in Member States to <u>modernise education and training systems and promote innovation, entrepreneurship and employability. Two-thirds of the funding would be spent on mobility grants to enhance knowledge and skills.</u></p> <p>New elements will be the creation of 400 'knowledge alliances' and 'sector skills alliances'. <u>Knowledge alliances</u> are large-scale partnerships between higher education institutions and businesses to promote creativity, innovation and entrepreneurship by offering new learning opportunities and qualifications. <u>Sector skills alliances</u> are partnerships between education and training providers and businesses to promote employability by forming new sector-specific curricula and innovative forms of vocational teaching and training.</p> <p>link: <a href="http://ec.europa.eu/education/erasmus-for-all/">http://ec.europa.eu/education/erasmus-for-all/</a></p>
PROGRESS 2007-2013	<p>The PROGRESS programme is a financial instrument supporting the development and coordination of EU policy in the following five areas: Employment, Social inclusion and social protection, Working conditions, Anti-discrimination and Gender equality</p> <p>Objectives PROGRESS's ultimate objective is to help achieve the goals of the Europe 2020 Strategy. 3 intermediate objectives – milestones towards this goal: -Effective application of EU rules on worker protection and equality -Shared understanding and ownership of EU objectives -Effective partnerships 5 immediate objectives – met throughout the process: Effective information sharing and learning</p>

**PROGRAMME  
FOR SOCIAL  
CHANGE AND  
INNOVATION  
2014-2020**

Evidence-based EU policies and legislation  
Integration of cross-cutting issues and consistency  
Greater capacity of national and EU networks  
High-quality and participatory policy debate

The European Union Programme for Social Change and Innovation is based on three existing instruments:  
– the PROGRESS Programme: fostering co-operation between Member States in the employment and social affairs field  
– EURES: Free movement of workers, contributes to economic development and social cohesion in the Union.  
– the European Progress Microfinance Facility for employment and social inclusion: there is a clear need to strengthen institutional capacity-building (especially of non-banking microfinance institutions) in order to cover start-up costs and funding for lending to high-risk target groups.

The strengthened policy framework under the new Europe 2020 strategy implies an even stronger need for evidence-based policy-making so that Union policies and legislation are responsive to the socio-economic challenges. The EU Programme for Social Change and Innovation aims to increase coherence of EU action in the employment and social areas by bringing together and building on the implementation of the Progress Programme, EURES and the European Progress Microfinance facility.

The Programme will seek to achieve the following general objectives:

- Strengthen ownership of the Union objectives in the employment, social and working conditions fields;
  - Support the development of adequate, accessible and efficient social protection systems and labour markets and facilitate policy reform, by promoting good governance, mutual learning and social innovation;
- Modernise Union law in line with the Smart Regulation principles and ensure that Union law on matters relating to working conditions is effectively applied;
- Promote workers' geographical mobility and boost employment opportunities by developing Union labour markets that are open and accessible to all;
  - Promote employment and social inclusion by increasing the availability and accessibility of microfinance for vulnerable groups and micro-enterprises and by increasing access to finance for social enterprises.

CALL FOR PROPOSAL VP/2012/008 Published on 07/06/2012 - Supporting a partnership for enhancing Europe's Capacity to tackle demographic and societal change

Budget: 500.000 €

Deadline: 11/09/2012

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#### EUROPEAN GLOBALISATION ADJUSTMENT FUND

European globalization adjustment fund funds up to € 500 million each year workers to find new jobs and develop new skills when they have lost their jobs as a result of:

- changing global trade patterns, e.g. when a large company shuts down or a factory is moved to outside the EU or
- global financial and economic crisis – EGF funding has been available for this since 1 May 2009 and is due to end on 30 December 2011. However, the Commission has proposed extending this provision until 31 December 2013 (when the whole EGF Regulation must be reviewed).

By financing measures such as:

- job-search assistance
- careers advice
- tailor-made training and re-training
- mentoring
- promoting entrepreneurship.

By providing one-off, time-limited individual support, such as:

- job-search allowances
- mobility allowances
- allowances for participating in lifelong learning and training activities.

The EGF will not fund social protection measures such as pensions or unemployment benefits. These are the responsibility

of EU national governments.

Individual workers made redundant can benefit from schemes set up by national governments to help them. EGF funding cannot be used to keep enterprises in business or to help them with modernisation or structural adjustment.

Link: <http://ec.europa.eu/social/main.jsp?catId=326&langId=en>

## Relevant Market Segments for R&amp;D&amp;I

Market Groups	Topics	EX/MT/LT	Market Description and Challenges	Challenges of Innovation
Offshore oil and gas	Specialized vessels: AHTS	Ex	<ul style="list-style-type: none"> <li>AHTS fleet aging, capacity demand increasing, notably for ships with higher power and high specs aimed at HSE, such as DP3.</li> <li>Markets promising as long as oil prices stay high. Operationally, North Sea market to remain stable and slowly starts decreasing, deep water markets in Africa, Americas, Asia, Arctic, to increase significantly.</li> </ul>	<ul style="list-style-type: none"> <li>Extra Flexibility</li> <li>Fuel efficiency</li> </ul>
	Support vessels and crew boats	Ex	<ul style="list-style-type: none"> <li>Smaller size vessels, note building up of (over?)capacity in especially PSV fleet.</li> <li>Markets highly competitive, speculative orders and building exist</li> <li>Several hundred crew and support boats mainly electric or hybrid, locally built with possible EU equipment</li> <li>Design is able to be reused for the offshore wind industry</li> </ul>	<ul style="list-style-type: none"> <li>Stringent safety requirements</li> <li>Higher comfort onboard</li> </ul>
	Floating structures and FPSO	Ex	<ul style="list-style-type: none"> <li>Mostly an Asian affair in terms of shipbuilding (also conversions).</li> <li>Often (multi) billion dollar projects.</li> <li>Design engineering is an EU strength</li> <li>Technology can be scaled upwards for innovation</li> <li>Some (large) European owners, e.g. Shell, BG, BP, SBM Offshore, Exmar, others are Petrobras, MODEC, CNOOC.</li> <li>(Drilling) equipment mostly supplied by European and American parties.</li> </ul>	<ul style="list-style-type: none"> <li>Techniques and procedures for effective maintenance during operation</li> <li>Increased service depth and drilling capacities.</li> </ul>
	Oil or gas shuttle tankers	Ex	<ul style="list-style-type: none"> <li>These types of ship are built in the Far East</li> </ul>	<ul style="list-style-type: none"> <li>Cargo transfer equipment</li> </ul>
	Oil spill recovery system or vessel	MT	<ul style="list-style-type: none"> <li>Post Macondo incident this is of increasing importance to have at site.</li> <li>Further innovations and increased efficiency badly needed, no leading technology has yet emerged.</li> </ul>	<ul style="list-style-type: none"> <li>Working in realistic sea states</li> <li>Multipurpose capacity</li> </ul>
	Polar conditions adaptation	MT	<ul style="list-style-type: none"> <li>Northern-European (notably Scandinavian) and Russian shipbuilders and owners have leading ice class experience, but modern markets work so that ice breaking ships can be built anywhere – often on the basis of European designs.</li> <li>Polar code under development at IMO deserves EU attention.</li> <li>The need for finding and exploiting new sources of raw materials leads to the</li> </ul>	<ul style="list-style-type: none"> <li>DP in ice-going conditions</li> <li>New requirements under the Polar Code</li> </ul>



Market Groups	Topics	EX/MT/LT	Market Description and Challenges	Challenges of Innovation
			exploitation of resources in difficult places	
	Operation in very deep water	LT	<ul style="list-style-type: none"> <li>Oil and mining activities need to be exploited in very deep water.</li> <li>The equipment needs to be powerful and free of maintenance. A complete industry for install, repair, protect and safe the installation and the environment has to be developed.</li> <li>Europe has a strong experience in this field with a large potentiality</li> </ul>	<ul style="list-style-type: none"> <li>New materials for deep sea autonomous systems</li> <li>New ROV to be developed with increased control precision and more power capability.</li> <li>Development of totally new autonomous underwater systems providing multi-role functions</li> </ul>
	Offshore Drilling Technology	LT	The need for finding and exploiting new sources of raw materials leads to the exploitation of resources in difficult places	<ul style="list-style-type: none"> <li>New drilling systems for deep sea locations.</li> <li>New class of offshore vessels</li> </ul>
	Arctic Vessels	MT	<ul style="list-style-type: none"> <li>Search for new fields of valuable raw materials</li> <li>HFO restrictions</li> <li>Additional safety / environmental requirements arising from the polar code including for non-ice class ships operating in polar waters</li> </ul>	<ul style="list-style-type: none"> <li>New hull forms</li> <li>Development of ice resistant technologies</li> <li>New safety and rescue appliances for arctic conditions</li> </ul>
	Foundations or cable laying systems	MT	<ul style="list-style-type: none"> <li>Experienced (western) offshore and dredging companies are tech leaders, but technology maturing in Asia. Building of these vessels anywhere.</li> </ul>	<ul style="list-style-type: none"> <li>Deep water systems</li> <li>Larger diameter</li> </ul>
<b>Offshore wind energy</b>	Installation Vessels	MT	<ul style="list-style-type: none"> <li>So far a small market dominated by European innovations but increasingly threatened by Asian competition when it comes to shipbuilding. OFWC under discussion at IMO, clear European interests.</li> <li>Increasingly specialised vessels. Jack up designs still to dominate</li> <li>Some evidence of strategic investment by developers to secure vessels</li> <li>Supply chain strong up to 2015. Through the latter half of the decade, pressure might return if we do not have new investments.</li> <li>Some units are under construction, others are just entering into service. Performance will be monitored on the basis for further investment decision.</li> </ul>	<ul style="list-style-type: none"> <li>More efficient manner of working offshore: larger decks, efficient component handling systems</li> <li>Development of deep water technologies which make use of floating vessels for staying beyond the operational limits of jack-up vessels.</li> <li>Streamlining of installation process</li> <li>Large crane capacities</li> <li>Capacity of handling different</li> </ul>

Market Groups	Topics	EX/MT/LT	Market Description and Challenges	Challenges of Innovation
	Foundations	MT	<ul style="list-style-type: none"> <li>Major opportunities for domestic manufacturing due to low technical barriers for entry, for example by using shipyards or tower manufacturers</li> <li>High elasticity of supply, lowering bottleneck risk. They present an attractive diversification opportunity for substantial existing marine oil and gas production capacity in Europe.</li> <li>Move into deeper water: increased market share from space-frame structures as well as novel fixed and floating structures further into the future.</li> <li>New deep foundation concepts will help unlock the Atlantic and Mediterranean potential</li> <li>40 GW offshore installed by 2020 and 150 GW by 2030 – meaning between <b>25,000 and 30.000 turbines to be installed</b> with similar number of substructures to manufacture and install by 2030.</li> </ul>	<p>foundation types</p> <ul style="list-style-type: none"> <li>Capacity of handling different foundation types</li> <li>More lift capacity</li> <li>Underwater noise reduction</li> <li>Facilities for full scale testing and pilot installations.</li> </ul>
	Service, maintenance vessels	MT	<ul style="list-style-type: none"> <li>Smaller size vessels, focus on HSE. Many smaller players involved in shipbuilding, building to customer specs (but also educating the customer with respect to sea behavior).</li> <li>Off-shore wind farm support vessels under discussion at IMO, clear European interests. EC directive needs to be adapted.</li> <li>Smaller size vessels. Not many players building this type yet.</li> </ul>	<ul style="list-style-type: none"> <li>Adaption of safety regulations</li> <li>Regulatory certainty, IMO, etc.</li> <li>Innovations needed, focusing at HSE and costs.</li> <li>Working in higher sea states</li> <li>Year round access</li> <li>Shallow water installations could perhaps do without ships, serviced by divers or (semi) autonomous vehicles / robots.</li> </ul>
	Underwater remote control system or autonomous vehicles	MT	<ul style="list-style-type: none"> <li>Current, tides and thermal devices have the equipment between sea surface and sea bed. The mooring equipment, the connecting cable between devices, and so on, could need autonomous vehicles with new systems for mounting, dismounting and maintenance operations.</li> <li>For tidal power generation a high percentage of the global potential is located within the EU.</li> <li>New requirement from rules and regulation to be developed. EU objectives of renewable energy policy (80-95% emissions reduction in 2050).</li> </ul>	<ul style="list-style-type: none"> <li>Innovations needed for new equipment and associated control system.</li> <li>Impact on marine life</li> </ul>

Market Groups	Topics	EX/MT/LT	Market Description and Challenges	Challenges of Innovation
<b>Energies from the Sea</b> <b>(Waves, current, tides, thermal)</b>	Extraction, transport and logistics	MT	<ul style="list-style-type: none"> <li>Some pioneers (relying heavily on innovative shipbuilders and ship owners) and some experienced offshore / dredging companies eyeing this market, but so far industry in infancy.</li> <li>Promising, but environmental concerns and technological challenges key issues.</li> </ul>	<ul style="list-style-type: none"> <li>New underwater or floating devices for energy conversion and its transport to shore installations.</li> <li>Reliability</li> <li>Proof of concept</li> </ul>
	Situ exploration technologies and systems	MT	<ul style="list-style-type: none"> <li>Some pioneers (relying heavily on innovative shipbuilders and ship owners) and some experienced offshore / dredging companies eyeing this market, but so far industry in infancy.</li> <li>Promising, but environmental concerns and technological challenges key issues</li> </ul>	<ul style="list-style-type: none"> <li>Proof of concept</li> </ul>
	New Prototypes designed and built by shipyards	MT	<ul style="list-style-type: none"> <li>Concerning currents and tidal devices, there are some current devices from 10kW to 100kW in testing</li> <li>Drivers of this market would be to meet the objectives of renewable energy policy in Europe</li> <li>New requirements from rules and regulations to be developed.</li> <li>Impact of legislation on different phases. Offshore renewable energy development.</li> </ul>	<ul style="list-style-type: none"> <li>Development of devices for marine renewable energies.</li> <li>Maintenance during the devices life cycle.</li> </ul>
<b>Methane-hydrates</b>	Specialized open oceans platforms,	LT	<ul style="list-style-type: none"> <li>Methane hydrates are the largest resource of hydrocarbons in the crust of the planet</li> <li>There is currently no process devised to economically harvest this vast resource</li> </ul>	<ul style="list-style-type: none"> <li>Avoiding methane emissions</li> <li>A cost-effective method to extract natural gas from solid hydrates</li> </ul>
<b>Ocean mining</b>	Situ exploration technologies and systems	LT	<ul style="list-style-type: none"> <li>Large vessels for exploration and exploitation of mining with new technologies for the exploration and exploitation of raw materials</li> <li>(Future) access to rare earths/ minerals, fossils, etc. increasingly of national importance, also for EU – in that sense a critical field of R&amp;D.</li> <li>New requirements from rules and regulations to be developed.</li> </ul>	<ul style="list-style-type: none"> <li>New systems for subsea process.</li> <li>New ships and systems for operation in deep water.</li> <li>Controlled work ensuring minimal impact on the sea bed.</li> </ul>
	Low cost mariculture plants, systems and service	Ex	<ul style="list-style-type: none"> <li>Value of production equal to that of fisheries, stagnation due to space limits and low innovation levels.</li> <li>The demand for quality and sustainable fish consumption.</li> <li>New EU aquaculture strategy (including funding under the future EMFF).</li> </ul>	<ul style="list-style-type: none"> <li>Improved concept that can be offered to an international market, creating new business opportunities.</li> </ul>

Market Groups	Topics	EX/MT/LT	Market Description and Challenges	Challenges of Innovation
<b>Aquaculture + Fisheries</b>	vessels		<ul style="list-style-type: none"> <li>• Growing demand for fish combined with declining catches of wild fish</li> <li>• Sustainable fisheries market.</li> </ul>	<ul style="list-style-type: none"> <li>• Ships for the transport of live fish.</li> <li>• Innovative equipment to improve product quality, floating offshore aquaculture tanks.</li> </ul>
	Productive, sustainable and safe fishing vessels	Ex	<ul style="list-style-type: none"> <li>• Fishing quota policy make overcapacity in many ship types evident.</li> <li>• Current fleet in many cases overpowered and using fishing techniques in need of revision with an eye on environmental aspects.</li> <li>• Financing of new builds / new equipment a bottleneck for ship owners fishing on common species which are not (so) profitable.</li> <li>• Central EU (financial) institutions could help here.</li> <li>• The continuous increase on demand for fish consumption and declining catches</li> <li>• High fuel prices – transition to more sustainable fishing</li> </ul>	<ul style="list-style-type: none"> <li>• Substantial improvement of fishing vessels needed, to be more selective, energy efficient and safe.</li> <li>• Ships and systems needed to support sustainable fisheries.</li> <li>• Development of factory ships needed to maintain a high level of product quality</li> </ul>
	Specialized factories and support vessels	Ex	<ul style="list-style-type: none"> <li>• EU countries amongst largest owners of large factory vessels, Asian competition growing. Fleets are active across the globe, in principle abundant fleet capacity, fishing (quota) licenses vital for fishing companies.</li> <li>• No major fleet expansions foreseen for European fishers, fleet growth centered on Asia and S-Americas.</li> </ul>	<ul style="list-style-type: none"> <li>• Role for EU institutions could be to monitor world fleet development and initiate and support rationalizations and ‘greening’ of fleets</li> </ul>
	Algae Cultivation	LT	<ul style="list-style-type: none"> <li>• Cultivation of algae as a mineral and fuel.</li> <li>• Already research being undertaken in Europe.</li> </ul>	<ul style="list-style-type: none"> <li>• Ensuring minimal environmental impact</li> <li>• Efficient refineries and cultivation methods.</li> </ul>

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Cargo Vessels	Cargo for Inland, Short Sea and Ocean going  (from small cargo to post-panamax ships)	Ex	<ul style="list-style-type: none"> <li>• Many cargo ship types increasingly larger in size, ULCC and post-panamax most striking examples.</li> <li>• This development puts smaller size vessels under some pressure, as transshipment starts to take place using larger vessels or as cargo is being shifted to rail or road.</li> <li>• Within Europe (and N-America), ECA's put pressure on owners to 'green their act', but due to low margins many ship owners do not have funds for fleet renewal.</li> <li>• Road transport sector leading over maritime in terms of development of cleaner engines (also as truck fleet replacement much shorter time cycle than ships), shipping needs to innovate to stay at forefront in terms of footprint / emissions per ton-kilometer.</li> <li>• The size of ships in short routes are changing due to the cascade effect created but the ULCC</li> <li>• Market strongly impaired by current crisis</li> </ul>	<ul style="list-style-type: none"> <li>• Much technology in Europe available, but funding (uptake) an issue</li> <li>• Emphasis on regulations (emissions, bwt, etc.)</li> <li>• Towards zero incident shipping</li> </ul>
	LNG Tankers /  Short Sea Shuttle Tanker	Ex	<ul style="list-style-type: none"> <li>• Large size LNG tanker market dominated by Korea, China upcoming.</li> <li>• After a couple of years in which ordering virtually disappeared (building up of ship overcapacity as a result of speculative ordering), recently (especially post-Fukushima and with development of shale gas) larger size vessels more in demand.</li> <li>• For European companies, the small size LNG tanker market can be a viable niche, especially as the LNG supply chain in Europe / N-America is being established.</li> <li>• Gas containment technology used to be a western dominated market, but Korea has its own system and also would like to buy France's GTT.</li> <li>• Preservation of LNG knowledge base (newbuild and repair) vital for Europe.</li> </ul>	<ul style="list-style-type: none"> <li>• Emphasis on Sox and NOx regulations</li> </ul>
	Chemical tankers	Ex	<ul style="list-style-type: none"> <li>• Small / medium size chemical tankers for short sea shipping.</li> </ul>	
	Ro Pax  Large Ferries	Ex  Ex	<ul style="list-style-type: none"> <li>• Stable market with only a dozen ships ordered and delivered each year,</li> <li>• More stringent safety and emissions standards needed to overhaul the large ferry market.</li> </ul>	<ul style="list-style-type: none"> <li>• Improved design safety</li> <li>• Harmonization of safety rules</li> </ul>

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<b>Passenger vessels</b>				globally <ul style="list-style-type: none"> <li>• Increase accessibility of passenger vessels for disabled travelers</li> <li>• Increase ship sizes and passenger capacity // assessment of risks.</li> <li>• Fulfillment of stricter regulations (e.g. environment, safety, ...) through cost competitive technologies</li> </ul>
	Cruise liners	Ex	<ul style="list-style-type: none"> <li>• Markets so far dominated by European shipbuilders (Germany, France, Italy, Finland). Deliveries historically and projected to be around 8-10 ships per year.</li> <li>• Korea's STX owns big yards in France and Finland, but orders lacking. Both Japanese and Chinese will build cruise vessels the next couple of years, Japan will build two ships for German owner AIDA and China a couple for national cruise companies.</li> <li>• China also has a cruise ship on the cards for an Australian customer (Titanic rebuild for Clive Palmer).</li> <li>• Cruise ship companies, facing saturation in US and some EU markets (notably UK), focus growth strategies predominantly on Asian markets, ships might need adaptation to (cultural) preferences of these new customers.</li> </ul>	<ul style="list-style-type: none"> <li>• Innovative technologies could be better integrated onboard these vessels by including the suppliers in the design process of such vessels.</li> <li>• Fulfillment of stricter regulations (e.g. environment, safety, ...) through cost competitive technologies</li> <li>• cost efficiency of innovative solutions for improved product competitiveness Increase of energy efficiency to compensate higher fuel oil prices</li> </ul>
	Super-yachts (Inland and Seagoing)	Ex	<ul style="list-style-type: none"> <li>• Fleet approx. 4,400 vessels (&gt;25m), Russian, European, Middle Eastern, Australian and American owners dominate.</li> <li>• Deliveries per year approx. 400. Super yacht market caters to the world's high net worth individuals, spending on new yachts since crisis much reduced but leading quality builders AND cost fighters do continue to receive orders.</li> <li>• Operationally, cost control and (part) standardization vital for yards.</li> <li>• Consolidation in terms of ownership of shipyards, with European yards bought out by Middle-East or Asian companies.</li> <li>• Growth must come more and more from new client markets such as Asia (notably China) or South-America. Ultimately, localising the yachts to specific</li> </ul>	<ul style="list-style-type: none"> <li>• Fulfillment of stricter regulations (e.g. environment, safety, ...) through cost competitive technologies</li> <li>• Miniaturization of innovative technology solutions</li> <li>• Security of vessel and passengers during navigation</li> <li>• Standardization of luxury solutions Increase of energy efficiency to</li> </ul>

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			cultural tastes and cleaning up the ship's environmental performance (lightweight materials, lower fuel consumption, etc.) may become key issues for the future.	compensate higher fuel oil prices
	Leisure crafts above 24m	Ex	See above	
<b>Complex Special</b>	Dredgers, Workboats, Tugs, Research vessels, Offshore service Vessels, Cable and Pipe-laying systems...	Ex	<ul style="list-style-type: none"> <li>• With projected continuous growth in world trade, global communications and industrial infrastructure, the market for these vessels offers considerable potential for new demand.</li> <li>• Replacement demand also ensured, as ships in all fleets mentioned (except for offshore service vessels) are, on average, generally of a high age.</li> <li>• New ships often required to be versatile (combining various functions), comfortable for crew, standardized (saving costs).</li> </ul>	<ul style="list-style-type: none"> <li>• Research vessels and scientific systems capable of operating safely and effectively unrestricted worldwide and in heavy weather conditions</li> </ul>
<b>Retrofitting / Ship Repair</b>	Yards/Equipment	MT	<ul style="list-style-type: none"> <li>• Low complexity repairs shifted much to low wage areas, western yards increasingly rely on complex conversions / retrofits.</li> <li>• Retrofit markets could become very valuable, as new equipment required by IMO and other regulators (e.g. BWTS, scrubbers) will in the next decade need to be retrofitted to many ships.</li> <li>• Increasing international competition, ongoing consolidation.</li> <li>• More environmental friendly process for retrofitting and ship repair activities.</li> </ul>	<ul style="list-style-type: none"> <li>• Skills set of workers will need refocusing on these areas.</li> <li>• Developing eco-innovative tools and processes with a neutral environmental impact</li> <li>• To consider the environmental impact throughout the ship's life cycle // Coordination holistic retrofit solutions (e.g. BWT, Scrubber, LNG SCR)</li> </ul>
<b>Equipment</b>	Scrubbing or gas emission treatment	Ex	<ul style="list-style-type: none"> <li>• Given the EU legislation an EU market for this technology is already in existence</li> <li>• Technology is also already there and requires market uptake by ship-owners</li> </ul>	<ul style="list-style-type: none"> <li>• Incentives for ship-owners to retrofit vessels with scrubbers and to see a real return on investment.</li> </ul>

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			to install the products onto vessels	<ul style="list-style-type: none"> <li>• Integration of after treatment with vessel (mechanically but also related to control strategy)</li> <li>• Size and cost of equipment</li> </ul>
	Electric ship concept adaptation	MT	<ul style="list-style-type: none"> <li>• Innovation in this field concerns the electric rotating machinery (motors or generators) and the associated electric converters. The acceptance of electric concepts will create a real green and environmentally friendly vessel</li> <li>• The main market drivers are the overall size and weight reduction of the total electric chain, the increase of the overall efficiency increase combined with acceptable acquisition costs.</li> <li>• The alternative to a green and environmentally friendly ship design to complement efficient power generation supplied by LNG</li> <li>• Possible integration on board of medium size vessels.</li> </ul>	<ul style="list-style-type: none"> <li>• Application of the super-conductivity or permanent magnets technology.</li> <li>• Development of intelligent and modular electronic converters.</li> <li>• Novel power architectures according to the ship types and its sailing profile</li> <li>• Development of hybrid solutions</li> </ul>
	Engines adapted to various fuels	Ex	<ul style="list-style-type: none"> <li>• Will probably continue to equip all the vessels for supplying the essential part of the energy onboard. This equipment needs to be adapted to the various fuels which could be available in the near future. (LNG, Biofuel, etc.)</li> <li>• Market drivers could be fuel efficiency standards</li> <li>• Gas emission regulations (NOx)</li> <li>• Future GHG emission regulations</li> <li>• Potential future PM/BC emission limits.</li> <li>• Fuel flexibility</li> <li>• Methane emission reduction</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced emission and energy consumption</li> <li>• More integral design so the overall system works better</li> <li>• Smart solutions for optimum use during service life</li> <li>• Increased efficiency by optimum energy management and awareness</li> <li>• Sensors and new computing tools as well as continuous emissions monitoring equipment in combination with good system integration for a better overall performance.</li> </ul>
	LNG Fuel Adaptation	MT	<ul style="list-style-type: none"> <li>• LNG-driven vessels is likely to be a potential market for both retro-fit and new building</li> <li>• Test cases will be mainly operating in ECAs or influenced by local markets.</li> <li>• Availability of LNG infrastructure (bunker, etc.) and pricing will be a decisive driver.</li> <li>• Potential NOx and Sox regulations</li> </ul>	<ul style="list-style-type: none"> <li>• Design challenge to match LNG concept with minimum impact on vessel operations</li> <li>• Development of LNG bunkering infrastructure.</li> </ul>



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	Energy Storage	Ex	<ul style="list-style-type: none"> <li>The key factor for the success of the mixture of various energy production devices on ships (the so called HYBRID systems) rely on effective storage capabilities</li> <li>Reduced cost of equipment and storage efficiency will be a driver to boost this market.</li> </ul>	<ul style="list-style-type: none"> <li>Ensuring minimal energy leakage from storage devices.</li> <li>Price of stored energy per cycle (degradation of storage device per cycle!)</li> <li>Safety (lots of stored energy, high power levels in and out of storage. In case of batteries: combination of Li-based chemistries and water / high temperature etc.)</li> </ul>
	Alternative Propulsion	LT	<ul style="list-style-type: none"> <li>Fuel Cells</li> </ul>	<ul style="list-style-type: none"> <li>Provide maritime fuel cells solutions (Power, dimensions, weight, integration)</li> </ul>
	Propellers	Ex	<ul style="list-style-type: none"> <li>Large number of equipment suppliers worldwide distributed</li> <li>Focus on the propulsion's efficiency</li> <li>Different systems available: blades, PODs, thrusters, etc...</li> </ul>	<ul style="list-style-type: none"> <li>Optimization of the configuration of propulsion's systems achieving higher efficiency rates</li> </ul>
	HVAC	Ex	<ul style="list-style-type: none"> <li>Large number of equipment suppliers worldwide distributed</li> <li>Chillers and compressors as main technical component to be further developed for competitiveness</li> </ul>	<ul style="list-style-type: none"> <li>Definition of correct operational profile</li> <li>Optimization of thermal balance (load and production)</li> <li>Reduction on any possible thermal dissipation</li> </ul>
	Auxiliaries	Ex	<ul style="list-style-type: none"> <li>Large number of equipment suppliers worldwide distributed</li> <li>Technical auxiliaries services</li> </ul>	<ul style="list-style-type: none"> <li>Black / Gray / technical Water treatments</li> <li>Other purification treatments</li> </ul>
	Lightning	Ex	<ul style="list-style-type: none"> <li>Large number of equipment suppliers worldwide distributed</li> <li>Main lightning systems, emergency lightning, public area lightning</li> </ul>	<ul style="list-style-type: none"> <li>Energy saving lighting systems</li> <li>High efficiency lighting systems</li> </ul>
	Entertainment	Ex	<ul style="list-style-type: none"> <li>Large number of equipment suppliers worldwide distributed</li> <li>Fast pace evolving market with introduction of new technologies</li> </ul>	<ul style="list-style-type: none"> <li>Technology transfer from ground to ship environment with particular reference to marine conditions</li> <li>Energy saving / high efficiency entertainment systems</li> </ul>

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				<ul style="list-style-type: none"> <li>Vibration control and insulation</li> </ul>
<b>Security</b>	Patrol Vessels	Ex	<ul style="list-style-type: none"> <li>Development of greener coast guard vessels</li> <li>Vessels capable of modular mission packages covering illegal traffic control, disaster relief to oil spill recovery.</li> <li>Vessels which can easily be adapted by the requirements of the client</li> </ul>	<ul style="list-style-type: none"> <li>Able to incorporate modular mission package for supporting diverse roles with an optimized efficiency of the energy consumption and minimum emissions</li> </ul>
	Integration of Unmanned vehicles	MT	<ul style="list-style-type: none"> <li>Unmanned vehicles (surface/air) are being developed for over the horizon detection and/or self-protection.</li> <li>The integration of such vehicles on civilian ships could be used for detecting fisheries or other type of resources as a substitute of incorporating manned helicopters.</li> </ul>	<ul style="list-style-type: none"> <li>Containerization of the offered solution integrating the control / communication systems and the unmanned vehicle for being easily deployed on different vessels.</li> <li>Deployment and recovery systems of the unmanned vehicle in the mother ship.</li> </ul>
	Passive safety concept	MT	<ul style="list-style-type: none"> <li>It's essential to prepare the maritime industry to take in consideration the consequences of the accidents occurred during sailing and to pre-equip the ships for cancelling or limiting these consequences in term of human safety and environmental impacts.</li> </ul>	<ul style="list-style-type: none"> <li>Invention of new ship equipment for saving the ship integrity or limiting the pollution risk in case of accident.</li> <li>Invention of new systems assuring the crew and passengers safety in case of accidents</li> </ul>
	Anti-Piracy Integrated Systems	MT	<ul style="list-style-type: none"> <li>Development of an integrated system composed by sensors (mainly EO / IR) and non-lethal weapons that can be installed on civilian vessel as a measure of protection against piracy attacks.</li> <li>Protection needs for vessels operating in danger areas.</li> </ul>	<ul style="list-style-type: none"> <li>Adaptation of more complex self-protecting systems used onboard naval vessels for a civilian application.</li> </ul>
<b>Design and Production Process</b>	New materials and construction processes	MT	<ul style="list-style-type: none"> <li>Greener and more efficient processes and materials.</li> <li>Reduced pollution limits of processes. Environmental regulations (local, regional, EU, national, etc).</li> <li>Potential future PM/BC emissions limits.</li> </ul>	<ul style="list-style-type: none"> <li>Eco-innovative processes.</li> </ul>

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Efficiency	Engineering processes	Ex	<ul style="list-style-type: none"> <li>IT systems for calculation, simulation, modeling and optimization</li> </ul>	<ul style="list-style-type: none"> <li>Integration between IT systems and production processes</li> <li>Production Engineering</li> </ul>