

TRENDS AND THEIR IMPACTS ON THE WATERBORNE INDUSTRY TOWARDS 2030

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Maritime Europe Strategy Action

Trends and their Impacts on the Waterborne Industry 2030

Executive Summary

This document provides the consolidated impacts on the waterborne industry foreseen until 2030, based on an analysis of the previously identified trends on population growth, food and water demand and supply, societal expectation related to health, safety, environmental and security, economic and waterborne trade growths, energy demand and supply, climate change and environmental damages and the effects of ICT.

The following key trends and impacts have been identified:

- Continued population growth and urbanization increases demand for focused waterborne services and upgrading of infrastructure
- Food and water demand is increasing with supply becoming challenged which calls for more water transport and aquatic food production.
- Society's increasing expectations to adequate health, safety, security and the impact of industries on the environment will lead to more strict regulations and require the waterborne industries to improve in these areas.
- Developing countries will continue increasing their share in global economic growth which will in turn increase trade in particular among these countries.
- Global growth of population and GDP will increase energy consumption, despite higher energy efficiency of facilities and equipment.
- Waterborne trade growth will be driven by economic growth of developing countries and global growth in demand for food, water and technological products.
- Climate change will lead to more flooding, draughts, extreme weather events and polar melting and will impact all waterborne sectors.
- The fast development in information and communication technologies will increase digitalization in all waterborne sectors and will significantly influence design and operation of assets

Disclaimer:

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Introduction

This document provides market, societal and regulatory trends, with the aim of comparing these with present and expected technology developments and, thus, being able to derive R&D needs to close identified gaps. In this context this document contributes to the refinement of the European maritime transport RDI policies/strategies (Vision 2030, the Strategic Research and Innovation Agenda and the Implementation Plan of the Waterborne Technology Platform).

Foresight – global trends

The following key trends have been observed and are considered to be influential for the future of the waterborne industries:

- The world population is predicted to increase to 8.5 bn in 2030 from 7.3 bn in 2015. At the same time, the share of people living in urban agglomerations is increasing to about 60% in 2030.
- Water demand will grow to 5500 km³ in 2050 from 3500 km³ in 2000. And the rapidly growing water demand from cities, industry and electricity suppliers will challenge water available for irrigation which in turn challenges food production.
- Society's increasing expectations to adequate health, safety, security and the impact of industries on the environment will lead to more strict regulations and require the waterborne industries to improve in these areas.
- While in many OECD countries GDP development is predicted to grow steadily in a lower single digit number, (e.g. Germany approx. 1%-2% p.a.) developing countries will have higher growth rates, e.g. China and India are predicted to at least double their GDP from 2015.
- The world primary energy production grows at 1.5% p.a. from 2012-2035. The region Asia Pacific provides 47% of the increase in global energy production. There will be a similar share of fossil energy consumption between oil, gas and coal, these remaining to be the main energy sources. While energy consumption will grow marginally for OECD countries developing countries will increase their energy consumption by approximately 75%.
- Waterborne trade growth will be driven by economic growth of developing countries and global growth in demand for food, water and technological products.
- It is expected that climate will dramatically change, namely increase of cold temperature and warm temperature extremes, more severe rainfall and flooding, higher frequency of storms and continuous and increasing polar ice melting.
- With massive growth in computational capacity and data storage capabilities, globally accessible networks and cloud infrastructure with increasing bandwidth, availability of smart devices (Internet of Things) and smart and cheap sensors, a significant increase of digitalization in all waterborne sectors is expected.

Foresight - impacts

Population growth

Summary

Continued population growth and urbanization increases demand for focused waterborne services and upgrading of infrastructure

With continued population growth in Africa, Asia and South America during the coming decade and the continuing trend towards urbanization, demand for waterborne services will increase between these growth regions and will in particular need to focus on serving future mega-cities. This also requires an upgrade of the respective infrastructure.

The world population is predicted to increase to 8.5 bn in 2030 from 7.3 bn in 2015. At the same time, the share of people living in urban agglomerations is increasing to about 60% in 2030.

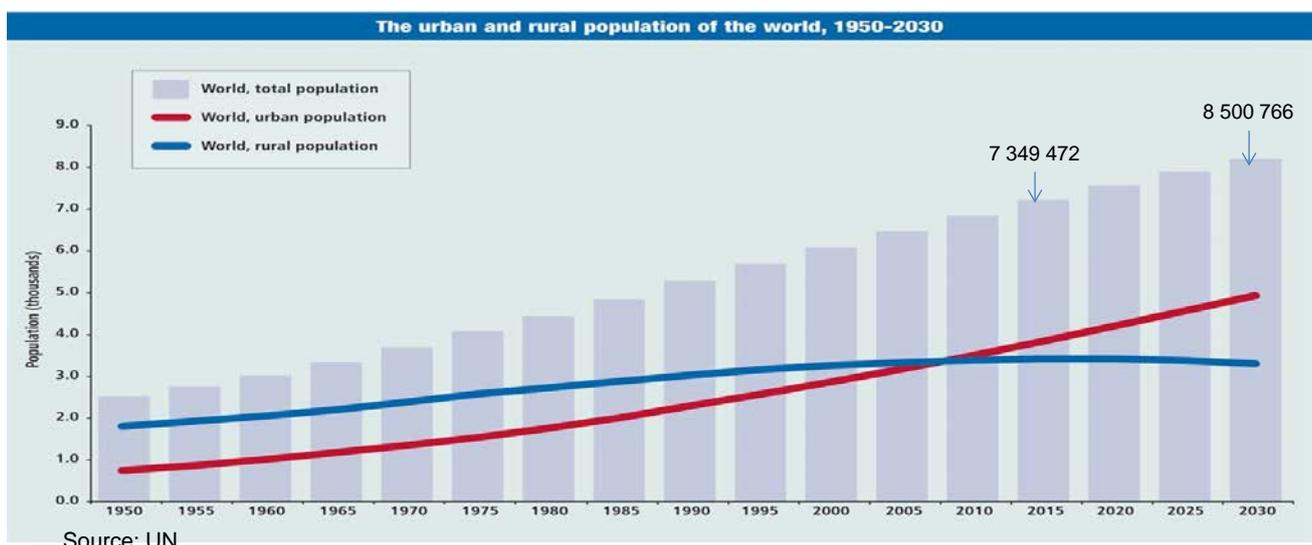


Figure 1: Growth of world population and urbanisation (Source: UN)

Impacts on all waterborne sectors

[Population growth is an underlying mega trend which has an impact on, e.g., food, water and energy demand and supply, trade and climate change. The impact of population growth on the on the waterborne sector is therefore immense. Only the most direct effects of population growth on the waterborne sector are addressed here.]¹

Due to population growth in Africa, Asia and South America during the coming decade, regional and international seaborne trade is predicted to grow as well and shipping activities will grow faster in these regions and infrastructure will need to be upgraded into regional and global trade hubs. And this will be amplified by the rise of a global middle class which drives consumption growth incl. leisure.

With continuing urbanization, growth of services and trade is expected to be focused on relatively few future mega-cities, most of which can be served by seagoing or river going waterborne services. The concentration of people and economic activity will boost demand for transporting people, food, water and production materials. Therefore, ports in proximity to these mega cities need to be upgraded in terms of capacity and efficiency as well as improved in terms of safe operations.

¹ Text in [square brackets] indicates an explanatory note for the reader.

*Game Changer: The rise of the middle class in countries such as India, China and Indonesia may increase political stability and drive democracy and accountability of politicians in these countries. And this would lead to higher social and environmental standards, rise improvement of public services, which in turn increase business. Unfortunately, there are also signs pointing to political instability.*²

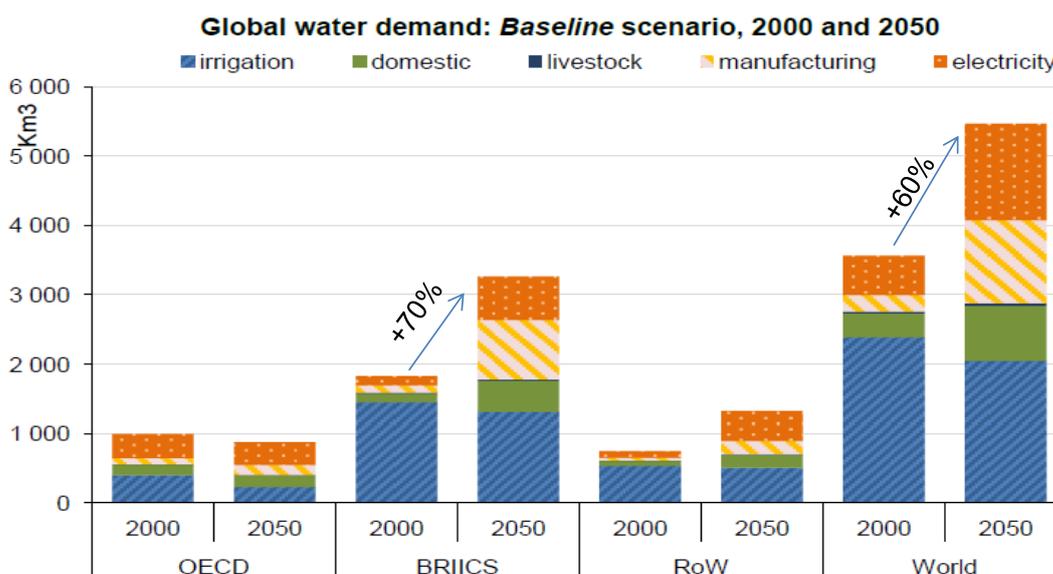
Food and water demand and supply

Summary

Food and water demand is increasing with supply becoming challenged which calls for more water transport and aquatic food production.

Population growth, increasing urbanization and industrialization lead to increased food and water demand and at the same time availability of food and water is reduced, principally because of deteriorating conditions to grow food and access to clean water due to climate change effects. This will lead to an increasing demand for waterborne transport and related infrastructure as well as aquatic food production volumes.

The rush of people to coastal areas and their urbanization will continue, reducing the agricultural capacity while demand for food will rise at least 35% by 2030. While nearly half of the world population will live in areas experiencing severe water stress, demand for water will rise at approx. 40% by 2030. The rapidly growing water demands from cities, industry and electricity suppliers will challenge water available for irrigation which in turn challenges food production.



Note :BRIICS = Brazil, Russia, India, Indonesia, China and South Africa; RoW = rest of the world
Source: *Environmental Outlook Baseline*; output from IMAGE suite of models.

Figure 2: Change in global water demand by region and sector

Impacts on all waterborne sectors

Population growth directly increases scarcity in almost every aspect of life; from food and water, to production materials, to clean air and also to ocean pace. This will lead to an increasing demand for waterborne transport and related infrastructure as well as aquatic food production volumes.

Maritime-specific

Water becomes a more important location factor for people and production. At the regional level, scarcity of water compromises economic growth. This will lead to more concentration of population and economic

² Text in *Italics* indicates a potential game changer coming from highly uncertain development.

activity in location with a more secure water supply, provided by either local production or increased transportation of water.

The distance between the location of food production and where food is needed will increase due to concentration of people in urban agglomerations. This leads to increased transport between production locations and consumers and transport of food and water from areas with a surplus to areas with shortage.

Blue economy-specific

Due to increasing prosperity, urbanization and industrialization leads to changes demand and availability of food and water. The availability is under pressure, because of climate change and sustainability issues. Increased prosperity leads to changes in diet, especially increased consumption of meat and fish.

With the growing demand for food and fresh water aquacultures and desalination will become key drivers. Multi-use offshore platforms will be developed, aiming at reducing costs, by combining different offshore production facilities like wind energy with aquacultures.

Looking at the fishery industry, there is a growing concern for sustainability issues. These include overutilization of fishing grounds and declining fishing populations and the influence of large fishing vessels on the economic viability of local fishers in developing countries. The abundance and distribution of fish populations shifts because of climate change, decreasing fisheries outputs.

Health, safety, environmental and security expectations

Summary

Society's increasing expectations to adequate health, safety, security and the impact of industries on the environment will lead to more strict regulations and require the waterborne industries to improve in these areas.

Civil society, consumers and workers will become less willing to accept negative environmental and social externalities of economic activities in the maritime sector such as, e.g., accidents, water pollution, and unsafe working conditions. The expected increasing scarcity of qualified personnel will also motivate the sector to improve working conditions.

Societal expectations will, therefore, lead to the maritime sector becoming more socially and environmentally responsible by complying with stricter regulations and possibly by adopting voluntary standards. The impact of societal expectations related to health, safety, environmental and security on the maritime sector is rather moderate and will not fundamentally alter the sector's future prospects.

Fuel oil maximum Sulphur content as loaded, bunkered and subsequently used on board were introduced for Sulphur Emission Control Areas (SECA) and outside them with a stepwise increase in the Sulphur content restrictions. Similarly, NOx emission reduction from 2016 require newly built ships to meet the 80% Tier III criteria when operating in a NECA, as shown in the figure below. Increasingly stricter regulation of emissions and widening of respective control areas is expected to continue. Abatement technologies have therefore been under development for the maritime market for several years based on technologies from the energy utility industry and transport sector.

Nitrogen Oxide Requirements - IMO Annex VI

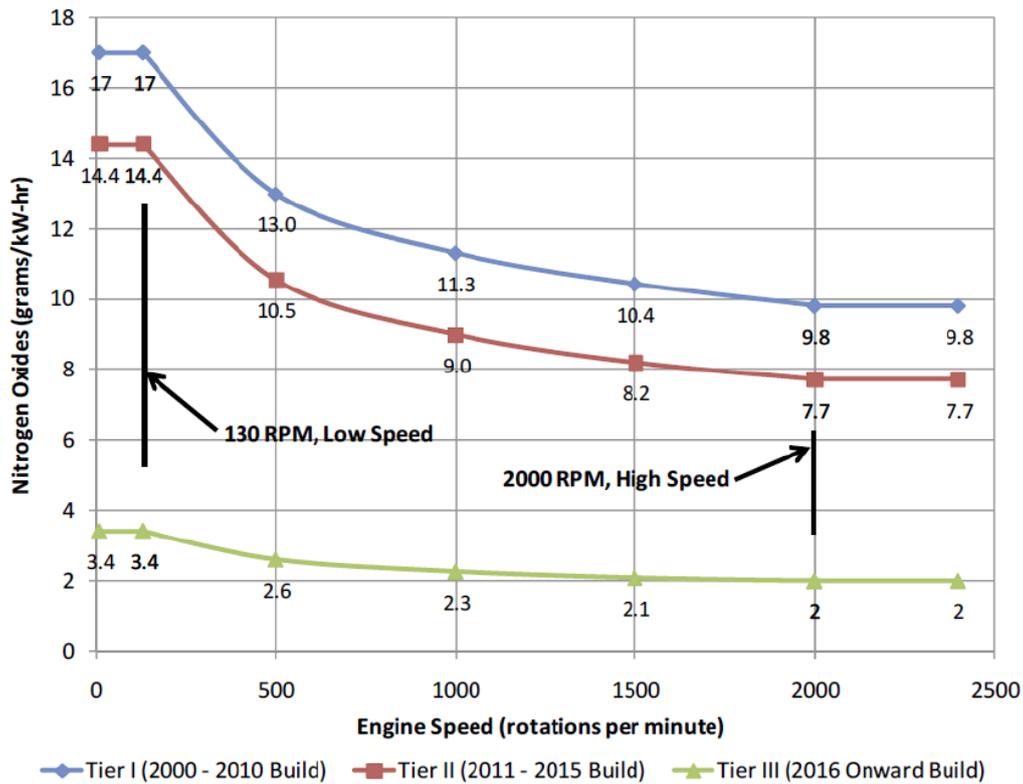


Figure 3: IMO requirements on NOx-emission limits (figure from Danish Environmental Protection Agency, 2012).

All waterborne sectors

Considering that Society’s tolerance for social and environmental externalities will decrease and stricter regulations will follow, the waterborne sector will have to implement more measures to prevent accidents, reduce air emissions and water pollution as well as improve working conditions and security.

Maritime-specific

Regulations are in place and more under discussion to limit emissions from international shipping in the near future. New safety and security regulations are also continuously released for application to international shipping, with less public notice, however. Health standards will remain national or even local implementations.

Initiatives and standards will increasingly take into account the whole life-cycle of a ship, from raw materials used in shipbuilding to final dismantling.

Growing public expectations related to environmental protection will result in more non-governmental and industry-led initiatives with new and additional voluntary standards.

Blue economy-specific

The increasing expectation of society to the necessity of a sustainable use of the fishing resource will result in a slowdown and eventually stop of overfishing the seas and in a restoration of the fish stocks. The trend for higher population density in coastal areas in combination with Society’s increased environmental awareness will require developing coastal areas in a more sustainable manner.

Infrastructure-specific

Increasing ship sizes will require fairway and port infrastructures to be further expanded and developed to ensure safe ship transport and maneuvering. Waterborne infrastructures will also have to account for first (semi) autonomous ships operations.

Economic growth

Summary

Developing countries will continue increasing their share in global economic growth, which will in turn increase trade in particular among these countries.

Future economic growth will be increasingly driven by innovation instead of population growth. The middle class in the developing countries will increase and will drive consumption of technological products which will increase the need for raw materials and manufacturing and will also increase waterborne transport of manufactured goods. As Africa will gradually replace Asia as the region with the highest growth rate, waterborne trades to and from Africa will increase.

While in many OECD countries GDP development is predicted to grow steadily in a lower single digit number (e.g. Germany approx. 1%-2% p.a.), developing countries will have higher growth rates, e.g. China and India are predicted to at least double their GDP from 2015.

All waterborne sectors

[Economic growth is usually measured as the percentage growth rate of real gross domestic product or the real GDP (Statistics of the Growth of the Global Gross Domestic Product (GDP))³

The progressive economic development of countries in Asia and Africa will drive the growth in the demand of bulks, oil and gas for their industrial development, will increase the output of manufactured products to the world market and also increase their populations' demands for consumption. Transport of goods to and from these countries and exploitation of natural resources in their economic zones will increase.

Maritime-specific

The increasing volume and the improving competitiveness of products produced in African and Asian countries will increase manufactured goods seaborne transport between these countries and the developed world.

Blue economy-specific

The increased demand of the increasing Middle Classes for "high tech" products and the scarcity of onshore mineral resources will lead to an increased exploitation of raw materials offshore, requiring seabed mining and related technologies to be developed for safe and environmental friendly exploitation of the ocean space.

Infrastructure-specific

Increasing trade from and to developing African and Asian countries will require upgrading existing and building new port facilities.

³ Text in [square brackets] indicates an explanatory note for the reader.

Energy demand and supply growth

Summary

Global growth of population and GDP will increase energy consumption, despite higher energy efficiency of facilities and equipment.

Worldwide in 2030, the majority of the required energy will still be produced from fossil sources. There will be a nearly equal share between coal, oil and gas. Largest growth rate, however, will be seen for alternative energy sources.

Based on an increase of oil price in the long-term, the trend for exploration of fossil energy sources will continue to offshore locations rather than onshore and to deeper waters and also harsher environments. Also, more complex energy sources such as tar sands or methane hydrates will be exploited.

Energy production on offshore wind farms will significantly increase and also other water-based energy production devices using wave and tidal current energy will have a larger market.

The world primary energy production grows at 1.5% p.a. from 2012-2035. The region Asia Pacific provides 47% of the increase in global energy production. There will be a similar share of fossil energy consumption between oil, gas and coal, these remaining to be the main energy sources. While energy consumption will grow marginally for OECD countries developing countries will increase their energy consumption by approximately 75%.

All waterborne sectors

[The trend for increasing exploration of fossil energies in deeper waters and harsher environments requires an oil price level of 80-100 \$/barrel for such enterprises to be profitable. While currently the oil price level has declined significantly it is expected that in the mediate term it will rise above a profitable level again.]

Concerns about the environmental impact of the current energy system in combination with an expected long-term increase in oil prices, increasing concerns about the geopolitical situation in major energy producing countries in combination with the EU target to increase energy autarchy and in particular, by 2030, to have a 27% share of renewable energies in the energy mix, will result in an increasing diversity of energy sources in all waterborne sectors.

With the aim of reducing greenhouse gas emissions in the EU and globally, the production, consumption and transport of “clean” fuels such LNG, methanol, hydrogen, bio fuels will increase significantly.

The trend for exploration of energy sources in deeper waters and harsher environment will require development of ships and production platforms capable of operating in these areas in the most safe, efficient and environmental friendly way and relevant infrastructure development for supporting, monitoring and maintaining the assets.

Maritime-specific

With the global aim at reducing greenhouse gas emissions environmental metrics such as SEEMP, EEDI will be further developed and become stricter and the number of ECAs will further increase. This will require ships to become for environmental friendly and energy efficient. Hybrid propulsion systems, using alternative energy sources, hydrogen in fuel cells and “cleaner” fuels in combustion engines will address this trend.

The volatility in oil and gas prices will lead to the need of “future-proof” vessels, which have built-in a design flexibility to allow for easy retrofitting and adjustments of propulsion plants in accordance with market conditions and regulatory requirements.

A high oil price level and the pressure on emission control will result in an increased transport of natural gas and other “clean” fuels around the world. With the U.S. shale gas revolution LNG exports will increase from the U.S. to Asia Pacific and other markets, where gas prices are much higher than in the U.S. Current gas tanker sizes will increase due to economy of scale effects and the enlargement of the Panama Canal allowing VLGC (very large gas carriers) to cross. The increasing tanker size will need new tank technologies to be developed.

Blue economy-specific

The pressure to reduce fossil energy sources from the energy mix will increase the production of renewable energy significantly. Offshore wind farms and floating energy devices for wave, tidal current and ocean thermal energy conversion (OTEC) plants will significantly increase in number and size.

The significant increase of offshore wind energy production, the need for wind energy buffers and the trend for “clean” fuels for ships and other transport devices will result in developments to transfer wind energy on platforms into other sources like hydrogen. Platforms will need to have gas storage and transfer-to-ship facilities as well as bunker facilities for ships using hydrogen as fuel.

Increasing awareness of environmental impact of offshore production facilities will require that the industry follows higher environmental and safety standards.

Infrastructure-specific

With the increase in production and consumption of alternative fuels like LNG and hydrogen the infrastructure in ports need to be developed covering storage facilities for further distribution with ships and other transportation means, charge and discharge facilities for tankers, bunker facilities for ships using such fuels for propulsion. This will be required for ports in the coastal areas, for inland waterways, but also for offshore platforms which generate “clean” fuels from wind energy.

With the aim of reducing greenhouse gas emissions and generate own power supplies cleaner and cheaper ports will make more use of renewable energy sources on their own premises.

Based on the expectations that economy of scale effects will be further used for especially gas carriers and container vessels, relevant port infrastructures will need to be improved/developed for such ship sizes.

Based on the current difficult market situation it is expected that the number of ships to be scrapped will increase at least in short-term. In combination with an increased pressure on ship owners to use scrapping facilities with adequate environmental friendly production standards there is opportunity for more European yards to develop scrapping services and provide the relevant infrastructure.

Waterborne trade growth

Summary

Waterborne trade growth will be driven by economic growth of developing countries and global growth in demand for food, water and technological products.

The low transport cost of shipping compared to other means of transport is the reason that about 90% of global goods transport is done by ships. Improvement in port infrastructure and logistic chains and the new generation of energy efficient vessels will benefit seaborne trade and keep the leadership in international freight transport.

All waterborne sectors

Worldwide the throughput in sea ports could quadruple by 2030. The drivers for infrastructure investments are port congestion, insufficient intermodal connection and increasing vessel size. Autonomous and novel multi-use offshore platforms will host new industrial activities at sea, developed in coherence with shore based facilities, but also properly integrated into the maritime trade sea routes.

With an increased trend to use alternative fuels e.g. LNG, methanol, ethanol, DME, biodiesel and biogas, the trade of these fuels around the world will increase. Especially the trade of LNG from the U.S. shale gas production facilities to Asia Pacific region will significantly increase due to the high gas price in Asia Pacific and the enlargement of the Panama Canal allowing very large gas carriers to cross.

Climate change and environmental damages

Summary

Climate change will lead to more flooding, draughts, extreme weather events and polar melting and will impact all waterborne sectors.

It is expected that climate will dramatically change, namely increase of cold temperature and warm temperature extremes, more severe rainfall and flooding, higher frequency of storms and continuous and increasing polar ice melting.

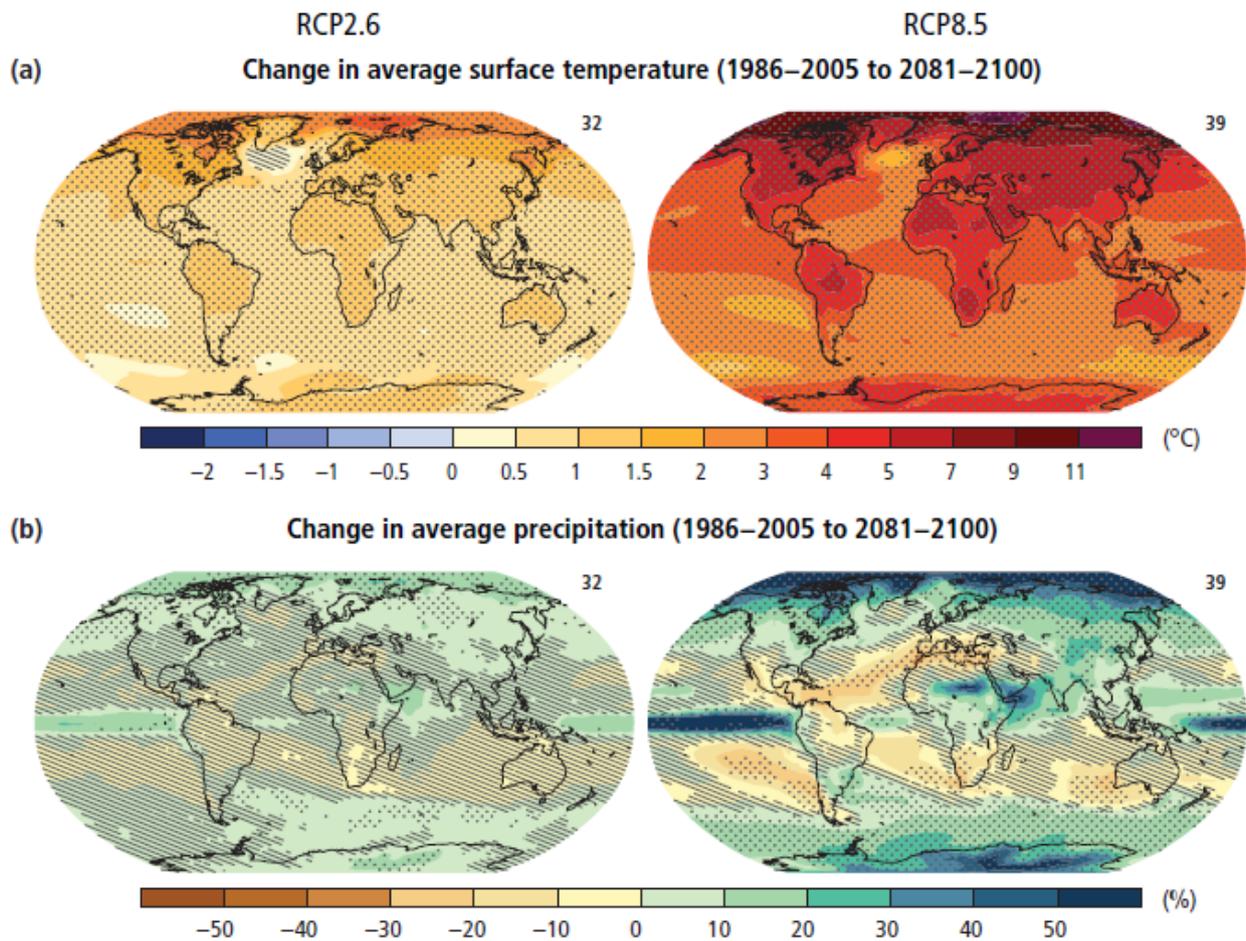


Figure 4: Change in average surface temperature (a) and change in average precipitation (b) based on multi-model mean projections for 2081–2100 relative to 1986–2005 under the RCP2.6 (left) and RCP8.5 (right) scenarios. The number of models used to calculate the multi-model mean is indicated in the upper right corner of each panel. Stippling (i.e., dots) shows regions where the projected change is large compared to natural internal variability and where at least 90% of models agree on the sign of change. Hatching (i.e., diagonal lines) shows regions where the projected change is less than one standard deviation of the natural internal variability. (IPCC, 2014)

All waterborne sectors

The impacts of climate change are regionally different. Investments are needed to make transport infrastructures, but also assets like aqua farms, oil and gas platforms, etc. more robust against the expected more severe weather conditions.

Maritime-specific

For shipping, the increased intensity and frequency of oceanic storms will increase weather routing, which could lead redirecting of ships along longer but less storm-prone routes. Ferries and fishing vessels are expected to experience more events in which operation will not be possible. Continuous and increasing polar ice melting will result in the utilization of accessible new sea routes, especially the Northwest Passage, along the northern coast of North America and the Northeast Passage, along the northern coast of Russia. The exploitation of expected significant oil and gas resources in arctic areas will be seen.

Blue economy-specific

Based on a higher public awareness towards energy efficient and environmental friendly operations environmental regulations related to environmental impacts from offshore production facilities like (carbon) emissions and water usage are expected.

With the expectation of increasing exploitation of oil and gas resources in deeper waters and harsher environments, of increasing number and size of wind and aqua farms in combination with the expected increase in more severe weather conditions the blue growth industry will face more regulatory pressure for safe and environmental friendly operations.

Infrastructure-specific

With the increase of more severe weather conditions coastal infrastructure, such as ships fairways, dikes, but also wind and aqua farms, oil and gas platforms will be subject to more stress and damages and need to be designed and/or improved in order to withstand these more severe conditions. The increasing possibility due to polar ice melting to navigate in the arctic region will need to build up and/or improve existing infrastructure for safe shipping and/or exploitation of resources.

Information and Communication Technologies (ICT)

Summary

The fast development in information and communication technologies will increase digitalization in all waterborne sectors and will significantly influence design and operation of assets.

With massive growth in computational capacity and data storage capabilities, globally accessible networks and cloud infrastructure with increasing bandwidth, availability of smart devices (Internet of Things) and smart and cheap sensors, a significant increase of digitalization in all waterborne sectors is expected.

All waterborne sectors

The increasing ICT capabilities will lead to a higher interconnectivity of systems, which are more software dependent and contain of smart devices. Higher automation of systems and the availability of smart sensors will provide the opportunity to operate assets remote controlled, semi or fully autonomous. Complexity of systems will further increase and challenges the way they are tested and maintained throughout their entire life-cycle.

With the availability of globally accessible and more powerful data networks and cloud infrastructure interconnectivity between sea and shore will increase significantly, meaning that sea-based operations will become more supported and controlled by land-based operation centers.

The increasing interconnectivity between technical systems, the opportunities to have autonomous operations offshore, or to support and control offshore operations from shore, requires to secure systems and operations against cyber-attacks, but also against expected more severe weather conditions due to global warming.

The growing digitalization in all waterborne sectors will result in using electronically data as substitute for current legal paper documentation. It will also require solutions related to data ownership, data access, intellectual property right issues.

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