CALAMAR

Expert Paper

Oceans and Climate Change Working Group

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CALAMAR
Cooperation Across the Atlantic for Marine Governance Integration

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The presented recommendations were not arrived at by consensus and do not necessarily reflect the opinions of all authors or their organizations.

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About CALAMAR

The Cooperation Across the Atlantic for Marine Governance Integration (CALAMAR) project aimed to strengthen networks among key maritime stakeholders in the EU and US, and contribute policy recommendations to improve integration of maritime policies and promote transatlantic cooperation. The project convened a dialogue of more than 40 experts from both sides of the Atlantic. The CALAMAR project began in January 2010 and culminated in a final conference in Lisbon, Portugal on April 11-12, 2011 where the Working Groups' conclusions were presented. Two reports were developed to complement the dialogue by providing background information and assessments that: 1) compare EU and US maritime policy, and 2) identify opportunities and challenges for integrated maritime governance. A third report lays out policy recommendations for improved transatlantic cooperation in maritime governance based on the recommendations selected by the working groups throughout their discussions over the course of the CALAMAR project. The following report presents the conclusions of the CALAMAR Oceans and Climate Change Working Group. All project reports are available on the project website at the following link: http://www.calamar-dialogue.org/.

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1 Introduction

Scientific consensus, based on an overwhelming body of evidence, indicates that global climate is changing, that it is caused in large part by human activities, and unless urgent action is taken by all levels of government to both mitigate and adapt to it, that the world will experience increasingly serious and damaging physical, ecologic, human health, and economic effects in the decades ahead. As the countries of the European Union (EU) and the United States (US) move closer to integrated and science-based marine and coastal management to meet the challenges of a climate-changed world, improved science and information platforms, innovative mitigation and adaptation strategies and policy changes will be needed so that management is maximally effective in meeting the needs of future generations.

This is not a challenge unique to the US and Europe. Coastal and ocean areas around the world are at the frontline of climate change. The world's oceans play a central role in climate, akin to the Earth's lungs and circulatory system. Oceans absorb over 80% of the heat added to the climate system and have absorbed nearly 50% of all CO2 added to the atmosphere by burning fossil fuels over the past 250 years. Thirteen of the world's megacities are located along the coast. The EU and the US share histories of dense coastal development around maritime and port cities, and billions of dollars in investment in infrastructure that is now at risk from climate change impacts. With more than half of the human population living in 183 coastal countries, including 44 small island nations, coastal residents around the world are already experiencing the earliest and most pronounced effects of climate change. They will disproportionately bear the brunt of the future impacts from climate change and ocean warming—e.g., sea level rise, increased coastal erosion, extreme weather events and ocean acidification.

The coastal Member States of the EU and the US with its coastal states are in a unique position to further understanding, and develop new approaches to mitigate and adapt to the effects of climate change on oceans, coastal communities and ecosystems. Initiatives on both sides of the Atlantic have focused on three key activities vital to living in a climate-changed world: 1) targeted research on predicted effects of climate change on ecosystem health, delivery of services, and human well-being; 2) marine-based mitigation measures, including reduction of emissions from ships and port facilities, promotion of offshore renewable energies, and investment in protecting and expanding 'blue carbon' repositories such as salt marshes, mangroves, and other wetlands; and 3) means of coping, including adaptation measures that strengthen the resilience of ecosystems to respond to warming waters, rising sea level, and changes in ocean pH, as well as risk reduction, and planning that allows for the movement of humans and migration of ecosystems away from vulnerable areas.

Both the EU countries and the US are undertaking studies and reviewing the adequacy of current policies to address the impacts of climate change on oceans and coasts. In the US, several new interagency efforts for developing climate change adaptation strategies are notable, including the "resiliency and adaptation of coasts/oceans" objective of the National Ocean Council, the first National Fish, Wildlife and Plant Climate Adaptation Strategy (NFWPCAS) led by USFWS and NOAA, the Interagency Climate Change Adaptation Task Force (ICCATF), and the National Climate Assessment. Each of these initiatives uses

science to assess impacts on coastal and marine ecosystems and to guide policy and governance reforms, and the development of adaptation and mitigation strategies.

In February 2010, the European Commission established a specific service to deal with climate change, the Directorate-General for Climate Action (DG CLIMA). DG CLIMA is at the forefront of international efforts to combat climate change, helps the EU to deal with the consequences of climate change and to meet its targets for 2020, as well as develops and implements the EU Emissions Trading System. The EU established an Integrated Maritime Policy (IMP) in 2007 aimed at increasing economic benefit from the seas in an environmentally sustainable manner, which has also the potential to provide a comprehensive framework to integrate and strengthen on-going and planned EU initiatives and efforts on climate change in the coast and the sea. These initiatives include identifying funding options and structures for improving the scientific understanding of climate change risks, impacts, vulnerabilities, and community and ecosystem resilience on the coast and the sea.

Transatlantic cooperation between the EU and the US could greatly enhance the understanding, management, and policy development needed to help coastal communities, states, and nations cope effectively with changing climate impacts on oceans and coasts. Fostering dialogue between the EU and the US will allow faster and more efficient scoping of problems and possible responses and will enhance the ability of all entities to utilize the best possible scientific knowledge, identification of priorities for action, and will enhance our ability to access and utilize the best science, the most effective planning and management tools, and the most efficacious emission reduction measures in order to adopt sensible, implementable, and strategic climate policies.

We recognize several specific areas ripe for Transatlantic cooperation between the US and the EU on the issue of climate change and oceans/coasts: 1) advancing climate change and ocean science information; 2) improving and prioritizing mitigation strategies for reducing emissions and slowing the rate of climate change; and 3) encouraging dialogues and exchange of information about strategies for adapting to climate change.

Significant climate and oceans relevant research is being undertaken on both side of the Atlantic including drivers and rates of change, impacts of changes (temperature and corollary changes in ocean circulation, sea level, ocean acidification, effects on fisheries productivity, occurrence of water-borne disease and harmful algal blooms, among others), and modeling and scenario development. Ocean observing systems have been a very effective tool in advancing our knowledge in these areas. Another crucial aspect of research includes assessing costs and benefits of investments in climate science and policy alternatives, including costs of scientific research, adaptation, and mitigation.

While the contributions of the various sectors to GHG emissions are now relatively well understood and are the subject of international discussion, there has been much less scrutiny and study of the risks that coastal communities, maritime industries, and ecosystems face from climate change impacts and what actions should be taken to mitigate or adapt to those risks. There is much to be gained by expanding Transatlantic dialogue and cooperation on ocean-based topics including mitigation actions such as alternative energy development, emissions reductions in maritime industries, and cost effective adaptation approaches.

Since climate change and accelerating rates of change appear inevitable, coastal nations will have to devote significant energy and resources to adaptation. Improved information on climate adaption will build on the US and EU studies that assess relative vulnerability and resilience of different coastal regions and habitats to climate change impacts. Other studies, as well as management measures that emerge from this science, are aimed at maximizing the natural resilience of ecosystems and the ability of coastal communities to adapt to changing temperature, coastal and oceanographic conditions. Adaptation studies also include projections and scenarios that model movements of species, identification of constraints or bottlenecks that inhibit adaption to sea level rise, prioritization of measures to allow natural adaptation to an ever-changing ocean and coast, recommendations on appropriate engineering and design for infrastructure, and the possible translocation of human communities at risk.

For all three areas of endeavor—science, mitigation, and adaptation—much more progress can be made by shared scoping of problems and challenges, information exchange and access to shared or compatible databases, and sharing of lessons learned on the most effective mitigation and adaptation strategies. In the sections that follow, we identify common challenges and recommend specific ways that EU/US cooperation can more quickly and efficiently overcome those challenges.

There is growing consensus in those communities, regions, states, and nations that have developed Climate Action Plans that responding to climate change is not only the right thing to do, it is the only smart and economically beneficial thing to do. Most of the measures that are recommended for action would be prudent even if climate change were not an issue. They will save both the residents and the government money, energy and fuel costs, create healthier, safer, more livable and sustainable communities, and will provide protection and insurance or buffer from any potential future changes.

2 Foci for Transatlantic Information Exchange and Collaborative Activities

2.1 Science and Information Platforms - Improve and Enhance EU/US Climate Dialogue

2.1.1 Encourage and support EU and US dialogue and environmental information and data sharing on climate change adaptation in coastal areas, seas, and oceans

Coastal populations on both sides of the Atlantic will face significant challenges in developing effective adaptation approaches to climate change to ensure the sustainability of coastal communities and the health of marine and coastal ecosystems. Both the EU and the US are developing vulnerability and risk assessments as well as adaptation measures in order to improve the capacity of coastal populations to understand, prepare for, and respond to the impacts of climate change. There is much to be gained from the sharing of information and best practices on these approaches in a EU/US Transatlantic Dialogue on Coastal Adaptation. The practice of sharing information and best practices will help develop and strengthen the tools and policy approaches needed to respond to climate change in a timely and effective manner.

Both the EU and US play leading roles in the international community, providing guidance and support through their aid agencies and other authorities to help coastal states and

communities around the world adapt to climate change. This is especially important for developing countries and small island nations. The sharing of best practices and lessons learned from these international assistance programs would promote more coordinated approaches between the EU and US, and other contributing countries, in delivering aid and other support to affected coastal communities throughout the world.

The EU and the US are actively planning for adaptation to climate change, including guidance for actions that may be taken by Member States and localities in the EU and by states and local communities in the US. The European Commission prepared a White Paper on Adaptation in April 2009, Adapting to Climate change: Towards a European Framework for Action, that established a framework for action focused on: 1) building a knowledge base; 2) taking climate change impacts into consideration in key EU policies; 3) financing; and 4) supporting wider international efforts on adaptation. In the process of its implementation, an EU comprehensive and global Strategy on Climate Change Adaptation is expected to be delivered by 2013 and a Clearing House Mechanism on Adaptation is expected to be operative by 2012. The White Paper also foresees the preparation of EU Guidelines on adaptation in coastal and marine areas.

In the US, the Interagency Climate Change Adaptation Task Force released a progress report in October 2010, giving guidance on how federal agency policies and programs can better prepare the country to respond to the impacts of climate change. The Task Force calls for an expanded and strengthened understanding of, preparation for and responding to climate change by the nation through federal measures. Major recommendations of the report include: 1) insuring accessibility of scientific information; 2) adaptation as a standard part of agency planning; 3) coordination of federal efforts to respond to climate change impacts that cross-cut jurisdictions and missions; 4) development of a US strategy to support international adaptation; and 5) building strong partnerships to support local, state, and tribal decision makers.

In all of these efforts, there is emphasis on guidance and tools for determining suitable approaches to adaptation (e.g., defense or retreat), measurement of the impacts of climate change on both ecosystems and economies, the role of ecosystem-based adaptation management to build resilience to climate change, the adoption of integrated approaches, and the prioritization of the most vulnerable communities and resources. Typical tools include the use of scenarios, vulnerability and risk assessments, models, as well as visual tools to help show the vulnerability of specific areas to the potential impacts of climate change.

Important needs identified in all of these efforts are capacity building for national and local decision makers, as well as public outreach efforts to prepare coastal communities and marine and coastal industries for the inevitable changes that will take place. A Transatlantic Policy Dialogue on Coastal Adaptation in Coastal Areas and in Oceans/Seas could provide a continuing mechanism for information exchange between leaders in the US and EU on adaptation practices, including emerging tools and best practices. It could also lead to cooperation between the EU and US though joint venues to develop tools and educational resources for building the capacity of coastal communities and maritime industries to adapt to climate change impacts, as well as a possible exchange program for state or local officials to promote learning about innovative approaches other coastal communities use to address similar challenges related to planning for and adapting to climate change.

Recommendation

Organize a Transatlantic Policy Dialogue on Climate Adaptation in Coastal Areas and in Oceans/Seas to bring together the experiences of the two regions, focusing on emerging best practices and fostering new collaboration among US and European local, regional, and national leaders on both sides of the Atlantic by the end of 2012.

The Transatlantic Policy Dialogue could be initiated through a partnership between a US federal agency, such as NOAA, and the European Commission. From the US, other participants could include US federal agencies working on adaptation, state government leaders from states with innovative adaptation strategies, US city leaders active in adaptation measures, and appropriate representatives from the US Conference of Mayors. From the EU, other participants could include representatives from other EU institutions such as the Committee of the Regions, Member state government leaders working on progressive adaptation efforts, and the Conference of Peripheral Maritime Regions on behalf of European coastal regions, and Covenant of the Mayors. Representatives from the scientific community and private industries (e.g. insurance, maritime transportation, commercial fishing) should also be included.

2.2 Develop and fund a Transatlantic oceans and climate change platform for improving exchange of information and best practices

Establishing efficient and effective ways to categorize, analyze, transmit, and exchange information about climate change has been identified as a critical need by both the US and EU To support decision-making and public information, the establishment of a European Adaptation Clearinghouse is also now under development. This web-based tool will act as a one-stop-shop for gathering relevant climate change data and will offer guidance on how to build an adaptation strategy, providing an extensive library of research, links and best practices to help come up with and assess adaptation options. The US National Ocean Policy has also established the development of Coastal Ocean Mapping and Planning Portal as a priority, and federal agencies such as NOAA and the EPA are establishing web-based information clearinghouses. There has been recent acceleration in the establishment of specialized portals for accessing and exchanging environmental data and information related to climate change. Recognizing this, the greatest opportunity to bolster the exchange of information and data would be to develop a virtual Transatlantic Platform on Coastal Oceans and Climate Change.

The Transatlantic Platform on Coastal Oceans and Climate Change could connect to all the specialized portals that serve geospatial data as well as the related case studies, decision support tools, training, and information needed to turn these sources into useful information needed by professionals concerned with climate change mitigation and adaptation and their impacts on coastal communities and economic sectors. This collaborative platform could be used by all levels of government as well as by the private and non-profit sectors. Site content could be provided and maintained by many organizations, but all would need to meet the site's quality and applicability standards, which could be established by a steering committee in compliance with current international standards. This distributed system would allow data and information owners to retain their assets while making them available to various other systems through data and information sharing standards.

Some suggestions of what could constitute priority components for the Transatlantic Platform on Coastal Oceans and Climate Change:

a) Information on Climate Change Impacts on Ecosystem Services

Exchange of information and tools that improve integration of ecosystem services considerations (both provisioning and functionality)—including economic valuation, mapping, and decision support tools—into climate policies and management/adaptation strategies.

b) Best Practices in Climate Adaptation

Sharing of best practices and case studies of responding or adapting to climate change impacts—particularly sea level rise on both gray infrastructure (ports, roads, sewers, coastal development) and green infrastructure (natural habitats and ecosystems)—will provide managers and decision makers the broadest, most comprehensive background for developing or adopting climate change adaptation strategies. This will help integrate climate change information into the planning and management of coastal and maritime uses (ports and maritime transport, tourism operators, energy suppliers, public works, community development, etc.). Sharing best practices and case studies should also include tools and models used for observing, assessing, and predicting climate change impacts and the vulnerability of coastal areas, including mapping of vulnerable coastal areas at appropriate scales.

c) Exchange of Knowledge on Resiliency

Exchange of knowledge on resiliency of coastal ecosystems and human communities related to climate change. This should include sharing of tools and mechanisms for assessing a community's resilience to climate impacts, such as indicators and resiliency indexes, to help inform future planning and management activities.

d) Tools and Best Practices for Scenario Building

Exchange of information, tools, and best practices on scenario building in order to provide better information to decision makers on evaluating trade-offs and making informed choices. This should include tools and case studies for designing and employing scenarios reflecting both environmental and socioeconomic factors.

These are fundamental issues to the challenge of climate change—issues that can provide immediate value to conservation managers and scientists as well as the potential for humanizing, de-mystifying, and personalizing climate change in terms that are understood by and resonate with decision makers and the general public. A robust platform that connects many portals covering climate change and ocean policy data, that uses understandable metrics like monetary value, community readiness, and the direct benefits of ecosystem services, would allow us to address core issues while helping educate and inform stakeholders that may otherwise remain disengaged. In this way, we can advance the climate adaptation "community of practice" through use of current and evolving technologies. As information is exchanged, the use of common categories and protocols will ensure that information is useful across disciplines and readily understood by decision makers and other audiences.

Recommendation

Develop a Transatlantic Platform to support sharing of information and broad dissemination of best practices, scenario building, ecosystem services, and adaptation responses and resiliency by the end of 2012.

Discussions of the possible configuration of such a portal could be initiated by CALAMAR with input from entities such as the US National Oceanic and Atmospheric Administration, the European Commission and its bodies such as the European Environment Agency. This portal should be supported and funded by all participating jurisdictions, agencies, and programs.

2.3 Improve and encourage funding, collaboration, and use of Global Ocean Observing Systems (GOOS) for climate-related applications and decisions

Climate change monitoring and adaptation require scientific understanding based on reliable observations and monitoring mechanisms. The Global Ocean Observing System (GOOS) will enhance the capacity to model and adapt to climate change and variability. Better understanding of the climate and its impacts on the ocean system will contribute to improved climate-related applications and decisions.

Sustained and fully integrated observations must be maintained into the future to evaluate how the climate is changing so that informed decisions can be made on prevention, mitigation, and adaptation strategies. These observations are crucial to support the additional research needed to refine understanding of the climate system and its changes, to initialize predictions on decadal time scales, and to develop the models used to make these predictions as well as longer-term scenario-based projections. Observations are also needed to assess social and economic vulnerabilities and to develop the actions needed across a broad range of societal sectors.

When taking into consideration the main findings from the Global Climate Observing System (GCOS) Progress Report 2004-2008, the following policies and activities demonstrate the need for a fully developed GOOS:

a) The increasing visibility of climate variability and change has reinforced world-wide awareness of the importance of an effective Global Climate Observing System;

b) Developed countries have improved many of their climate observation capabilities, but national reports suggest little progress in ensuring long-term continuity for key observing systems;

c) Substantial progress in implementing the IP-04 ocean domain actions has been made: the ice-free upper 1500 meters of the ocean are being observed systematically for temperature and salinity for the first time in history. Commitments to continuity of a number of critical ocean satellite sensors have been made.

d) Space agencies have improved both mission continuity and observational capability, and are increasingly meeting the identified needs for data processing, product generation, and access;

e) The GOOS has progressed significantly over the last five years, but still falls short of meeting all the climate information needs of the UNFCCC (UN Framework Convention on Climate Change), and broader user communities.

A fully implemented GOOS will provide observations of the essential climate variables needed to make significant progress in the generation of global climate products and derived information; it will also provide support for the research, modeling, analysis, and capacity-building activities required by the UNFCCC. While much international effort has occurred with regard to space-based observations, it is increasingly important that greater emphasis be placed on the utilization and coordination of in situ ocean based assets, as they will provide the scale and resolution most needed for near-term decisions.

Recommendation

Commit to: (a) designating and supporting national and regional agencies, including national and regional research organizations with responsibilities for implementing an ocean observing system; (b) establishing effective partnerships between their ocean research and operational communities towards implementation; and (c) engaging in timely, free and unrestricted data exchange.

The EU and US should support the acceleration of the implementation of the Global Climate Observing System (GCOS) and strengthening the climate-related functions and activities: The WMO Global Observing System (GOS) and Global Atmosphere Watch (GAW), the IOC-led Global Ocean Observing System (GOOS), the FAO-led Global Terrestrial Observing System (GTOS), and the global hydrological networks and all relevant satellite systems. US-EU actions that secure the provision of key data for climate studies and forecasting from satellite systems will be needed, as is seeking greater support and emphasis on climate variables, and the integration of the EU Global Marine Environmental Security (GMES) and the US Integrated Ocean Observing System (IOOS) to provide the local to regional scale observations. Facilitating ocean data sharing and use by stimulating global cooperation on operational oceanography, especially in developing countries, is essential to a successful GOOS.

The EU and US would benefit from supporting a global carbon observation and analysis system that addresses the three components of the carbon cycle (atmosphere, land, and ocean) and provides high-quality regional information on CO2 and CH4 concentrations and emission variations. Combining observations, analysis and the development of tools for carbon tracking and carbon storage is critical and should build upon 2004 internationally-accepted strategies and the work of the WMO Global Atmospheric Watch to implement the atmospheric component of those strategies. Both the EU and US can provide leadership to coordinate and strengthen existing capacity building networks within Earth observation communities, and adopt a composite and integrated system for observing the essential climate variables, as required by the United Nations Framework Convention on Climate Change.

3 Mitigation Strategies and Initiatives

3.1 Promote new and emerging ocean renewable energy sources and collaboration on emerging best practices

It is widely recognized that the ocean has a vast, largely untapped potential for renewable energy, including wind, wave, tidal, and solar. Ninety percent of the world's wind energy

occurs over the ocean. The EU has been an international leader in the development of offshore wind energy, and it is an emerging priority of the US, particularly in the Northwest Atlantic. Only a fraction of the theoretically available marine-based renewable energy is currently technically available or cost-effective. To maximize potential benefits from renewable energy resources, it will be important to increase understanding of energy potential, address approval processes and identify priority ocean areas. Competing uses for ocean space, particularly in coastal ocean areas, can significantly reduce the potential for successful siting and sustainable operation of marine renewable energy facilities. Currently, complex regulatory and approval processes and uncertainty regarding project financing can result in substantial delay of renewable energy facilities. In order for widespread offshore renewable energy facilities to be viable and supported by the public, it will be necessary to assure proper environmental controls and management and to minimize negative environmental impacts such as habitat alterations, noise, seabed and shoreline disturbances.

Implementation of coastal and marine spatial planning (CMSP) to inform options and adaptive management of the ocean can provide a responsible path forward. The complexity and lengthy processes involved in implementing a responsible CMSP framework should not deter progress in CMSP efforts. The economic and environmental risks and benefits of offshore renewable energy all need to be incorporated into planning, decision making, and climate change mitigation and adaptation processes.

Offshore alternative energy resources are being developed worldwide. Challenges and lessons from different oceans and environments need to be shared. The Implementing Agreement for a Co-operative Programme on Ocean Energy Systems (IEA-OES) was established by the International Energy Agency in 2001, with the EU joining in 2003 and the US joining in 2005. Similarly, the International Electrotechnical Commission (IEC) Technical Committees 88 and 114 are establishing international standards for offshore renewable energy with demonstrated international cooperative efforts. The EU and US can leverage the work of the IEA-OES, IEC, and CALAMAR by establishing alternative energy policies that incorporate and encourage cooperation among different ocean user sectors including shipping, fisheries, and telecommunications. The urgent need to mitigate global effects of climate change underscores the need for collective action in creating review standards and permitting schemes by the end of 2012 that efficiently and effectively supports the responsible commercialization of offshore renewable energy technologies.

Recommendation

Support government, business and nongovernmental organizations in enhancing development of ocean-based renewable energy and efficient review and permitting schemes, identifying scientific and information gaps, and advancing research and development of new technologies for extraction of renewable energy from the ocean.

Identifying and applying adaptive management and best information available regarding potential impacts on the marine environment, accelerating efforts and improving methodologies to identify priority areas through coastal and marine spatial planning, designing conflict resolution frameworks for siting and development, and undertaking further environmental studies and global sharing of results as needed, will help catalyze the path to more sustainable energy options. This will in part require the development and promotion of efficient regulatory frameworks to overcome development obstacles, minimize impacts, and support investments.

3.2 Encourage government agencies and stakeholders to place information and data on alternative energy funded by public resources into the public domain

Public funding is being used on both sides of the Atlantic for environmental and technical studies related to alternative renewable energy, yet data obtained from these studies are not always placed in the public domain. Competitive issues are often cited as rationale for such behaviour. Building the body of knowledge that will help define the responsible commercialization of offshore renewable energy is critical to supporting common EU/US goals of producing carbon-free, sustainable energy in an environmentally responsible manner.

Recommendation

Require all environmental and technical data related to offshore renewable energy research supported by public funds be placed in the public domain.

All funding jurisdictions should institute policies by the end of 2012 that require data generated through public funding mechanisms regarding our oceans be placed into the public domain using robust information technologies, such as the proposed Transatlantic Platform on Coastal Oceans and Climate Change (see 2.2).

3.3 Encourage public/private collaboration between the US and EU to reduce emissions of maritime industries

Driven by national and international initiatives on the reduction of greenhouse gases and the work of the International Maritime Organization (IMO) to regulate vessel emissions, most individual port and maritime efforts to date have focused on mitigation of CO2 and other harmful emissions from transportation and port operations. According to a 2010 report, maritime transport accounts for as much as 5% of “global man-made carbon dioxide emissions.” Approximately 40 percent of the ships in the world fleet account for 80 percent of these emissions. Without action, this contribution is expected to increase in the future due to projected growth in world trade and the demand for seaborne transport. There is relatively dense traffic on the North Atlantic between the USA and Europe, and the potential for emission mitigation measures, and collaboration of E.U and U.S. ports, as well as with Asia and other growing markets is critical for the success of future mitigation strategy.

Ports in both the US and EU are beginning to take progressive steps to reduce ship and port emissions. Some ports, like the Port of Rotterdam, have developed comprehensive climate adaptation and mitigation plans. In addition to planning, ports are beginning to take action to provide incentives for emissions reductions. As an example, starting in January 2011, the ports of Amsterdam, Rotterdam, Antwerp, Bremen, and Hamburg began rewarding clean ocean-going vessels with discounts on their port dues. The rewards are offered to vessels that score well on the Environmental Ship Index (ESI), an index that shows the environmental performance of ships in terms of the emission of air pollutants (NOx and SOx) and CO2. The ESI is a certificate that is awarded by the World Port Climate Initiative, a collective of 55 prominent ports which work actively to reduce air pollution and the emission of CO2 in particular under the auspices of the International Association of Ports and Harbors (IAPH). Ports and other nautical service providers throughout the world can use the ESI to reward ships and, in this way, encourage sustainable behaviour in the shipping industry.

Recommendation

Expand US and EU dialogue at the governmental level and among port and maritime interests groups to develop and promote technical and market-based measures to reduce ship and port emissions that can be implemented by the ship owners and ports in the US and EU on their fleets, and do not require IMO consensus and conventions or regulation.

Developing and supporting a network of port cities in the US and EU that identify best practices, and strengthen the incentive system for shipping and other port users will facilitate emissions reductions, as will efforts to increase maritime supply chain efficiencies and improve in-port handling, including availability of alternative energy sources and other efficiency strategies. Building consensus in IMO and with non-governmental organizations regarding mitigation actions is also an important way to facilitate emissions reductions in maritime industries.

4 Adaptation Strategies

4.1 Engage insurance, reinsurance and financial sectors on adaptation strategies

In addition to continuing changes in sea level, climate change threatens to increase the severity and frequency of coastal storms and extreme weather events. The impacts will be particularly acute in densely developed and low-lying coastal areas, including critical port and transportation facilities. An assessment by the Wharton School's Risk Center indentified an increase in global economic loss from natural disasters from over $50 billion in the 1950's to almost $800 billion in the 1990s. Incorporating the estimate of one foot of sea level rise by 2030 from the 2007 report of the IPCC, Lloyds of London and Risk Management Solutions predict that flood losses along the tropical Atlantic coastlines alone would increase 80 percent.

It is increasingly clear that coastal communities must take adaptation actions to reduce such risks and the associated economic impacts. The U.S. National Institute of Building Sciences (NIBS) has demonstrated that every dollar spent on mitigation saves society about four dollars of recovery costs. The projected impacts of a changing climate on port and airport facilities, roads, transit lines, sewage treatment plants and pumping stations, drinking water supplies, and other critical infrastructure will further escalate the current risk estimates. It is important that the knowledge, tools, and approaches be developed to reduce risks, and also that policies that quantify additional risks from climate change are adopted to enable planners, underwriters, and others to formulate and implement mitigation and adaptation strategies.

In the US, the CERES and the Heinz Center for Science, Economics and the Environment issued a set of recommendations—Resilient Coasts: A Blueprint for Action—that set out a framework for private sector engagement and government action to enhance coastal community resilience in the face of intensifying hazards and increased risks from a changing climate. The framework principles are outlined generally and have been adapted in the recommendations set out below. Although directed primarily at US policy-makers, the principles provide a starting point for increased collaboration between the EU and US in developing community resilience and a stabilized and reliable coastal insurance market.

Sharing of the methodologies and predictive tools used by the insurance companies on both sides of the Atlantic might help them to improve their operations in order to ensure they have a constructive role in relation to adaptation to climate change.

Recommendation

Develop flexible adaptation plans and funding mechanisms, including ecosystem-based approaches, identifying actions necessary to maintain viable private property and casualty insurance markets for coastal communities, and integrate climate change into due diligence for investment and lending.

Establishing a EU-US public-private sector dialogue to identify and fill gaps in scientific understanding and develop tools for incorporating climate change impacts into risk assessments and risk adaptation decisions will help to promote better engagement of the insurance industry in climate change adaptation strategies. Using risk-based land use planning, design, development and redevelopment, adaptable infrastructure, and building code standards can all help to meet future climate risks.

4.2 Encourage approaches that allow adaptation of the built environment to sea level rise and changing storm conditions

Coastal inundation and flooding are direct consequences of climate change and continued sea level rise. While global sea level rise over the past century averaged about 1.8 mm/yr, regional differences are common due to either uplift or subsidence of the land surface, or changes in ocean circulation. Historic sea level rise rates along most of the European coastline are in the range of 0-3 mm/yr. Sea level is falling relative to the shoreline in Scandinavia, however, at rates up to 9 mm/yr due to isostatic rebound of areas depressed by glacial loading during the last Ice Age. From Maine to Florida, historic sea level rise ranges from 0–6mm/yr.

Beginning in 1993, documenting global sea level rise has been improved and refined through the use of satellite altimetry, which reveals a rate of about 3.2 mm/yr, almost double the rate of the last century. The range of estimates based on projected global temperature increases indicates global sea level may rise 26-43cm by 2050 and 100-140cm by 2100. Recent research looking more carefully at the “meltwater component” provides an updated sea level rise scenario of 1.5-2.0 m by 2100. When combined with expected increases in wave heights and greater seasonal precipitation, these conditions will lead to increased cliff, bluff, dune and beach erosion. Given the extent and investment in coastal development and infrastructure along both sides of the Atlantic Ocean, coastal states and nations face serious problems in the near future. Coastal recreation and tourism, infrastructure, as well as industrial, commercial and residential development will all be at an increasing risk in the decades ahead.

Climate change will produce significant changes in sea level and also the frequency and severity of storms, which will have impacts on port infrastructure, operations, and maritime commence. Ports and maritime commerce are critical to the domestic and international trade and transportation networks of the US and EU. US ports handle 78 percent of all foreign trade by weight and 44 percent by value. Given the concentration of people, infrastructure, and other assets in and around ports and their importance to global trade, failure to develop effective adaptation strategies will have widespread economic and potential security

implications. The EU and US Atlantic ports share a history of intensive coastal development around maritime and port cities, and billions of dollars in investment in infrastructure to support commerce that is at risk from climate change impacts. It is clear that EU and US ports need to consider now whether there is a need to evaluate current infrastructure and modify design standards for new infrastructure to accommodate changing conditions such as the extent of storm surge, the navigability of channels, bridge clearance, and dredging needs.

There are two categories of coastal development that will be affected by future climate change and associated sea level rise and for which adaptation strategies need to be developed. The first involves existing development, including infrastructure, located in potentially vulnerable areas. Adaptation strategies to address climate change impacts include relocation incentives from high-risk areas, government purchase of vulnerable property, planned retreat (gradually moving back buildings and other structures), seawalls and levees to protect critical facilities, and rebuilding restrictions for those structures located in vulnerable areas that have been damaged during severe climatic events.

The second category involves strategies for new or proposed development. The range of adaptation approaches includes: the encouragement of smart growth and clustered development in low-risk areas, mandatory setbacks to restrict development within a certain distance or elevation of vulnerable areas, required warning notices to buyers and developers of the potential impacts of future climate change and sea level rise, and the use of expendable or movable structures in high-risk areas.

In both cases, the long-history of coastal development in Europe can inform the US about successful and unsuccessful approaches for dealing with these issues. We all share Atlantic coastlines and will be affected by the same climate change effects. Shared experiences and best practices on either side of the Atlantic can provide mutual benefits and we need information and data platforms for exchanging lessons learned and successful response strategies. Engagement of surveyors, engineers, geoscientists, and coastal planners in dialogues around marine management in the era of rapid climate change could facilitate the emergence of practical and creative solutions to the dilemmas posed by changing coastlines and marine ecosystems.

Recommendation

Engage surveyors, engineers, geoscientists, and coastal planners to facilitate the development of practical and creative solutions to the dilemmas posed by changing coastlines and marine ecosystems.

Expanding collaboration and dialogue between the US and European maritime trade associations and other maritime clusters on experiences, best practices, and strategies for adapting to climate change, including collaborations between ports and municipal and regional authorities to identify specific information and research gaps and undertake studies, will allow better-coordinated planning practices and responses.

Collaboration with national and international bodies will allow development of regional and locally relevant climate change and climate change impact projections relevant to assessing risk and informing planning at port and other water dependent facilities. Incorporating climate change into national coastal flood and extreme event risk management approaches, urban

development strategies, post-disaster redevelopment and port planning will greatly enhance climate change adaptation.

4.3 Encourage and support ecosystem-based adaptation strategies and approaches that allow nature to accommodate change

Wetlands are among the most productive and diverse ecosystems on Earth. Whether estuaries, salt marshes, lagoons or tidal flats, most occur in coastal areas. Development on both sides of the Atlantic has led to the disappearance of large areas of wetlands and a reduction or loss of the services they provide, including spawning grounds and nurseries for economically valuable fish and shellfish, stop over points for migrating waterfowl, water filtration and pollutant removal, coastal protection, and carbon sequestration. Wetlands also buffer coastal regions from flooding by absorbing excess water and energy, thus can help protect shorelines from erosion. Over half of the wetlands in the US have vanished in the face of development, particularly in coastal regions. Rising ocean levels will gradually submerge many low-lying portions of coastal wetlands unless sediment accumulation and vegetation growth can keep up with rising water levels. In many natural or undeveloped areas these wetlands can migrate inland with sea level rise. However, where development and infrastructure have been placed along the edges of estuaries, lagoons or marshes, these wetlands cannot migrate and they will gradually be submerged with a loss of the amenities they provide.

Emerging strategies to protect, utilize, and preserve coastal habitats and ecosystems in the face of climate change include setting aside additional buffer zones to allow for wetland migration, creation of new wetlands to replace lost areas, removing levees or other barriers to wetland migration, and discouraging or prohibiting additional development where it would restrict inland migration. Best practices and success stories need to be shared across the Atlantic so learning curves can be shortened and approaches for preserving or restoring these productive ecosystems improved globally.

Recommendation

Utilize planning tools in the EU and the US to accelerate the development of coastal and marine spatial plans that would effectively increase the resilience of the most ecologically critical and productive ecosystems and would also highlight the management priorities that most need to be addressed.

Launching a Task Force or initiative between the US and EU that investigates the transferability of resilience findings from coral reef systems to other marine and coastal ecosystems present in the US and in Europe could be conducive to better being able to harness scientific information on resilience for climate change adaption. In addition, findings of the MESMA (Management Evaluation of Spatially Managed Areas – a newly launched EU initiative) could provide guidance on the optimal use of CMSP to allow natural ecosystems to adapt to changing conditions. The US and EU, and in fact the rest of the world, would benefit from analyzing lessons learned from sectoral adaptive management (e.g. fisheries management and marine protected area management), to develop general guidance on adaptive management in an integrated, MSP context.

5 Conclusion

The EU and US have much to learn from each other on the science of oceans and climate change and much to gain from working together on climate change mitigation and adaptation measures. We share a common ocean and have coastlines that have been intensively developed with large ocean-dependent economies. Yet global climate is changing, and both sides of the Atlantic will experience increasingly serious and damaging physical, economic, ecologic, and human health effects in the years ahead. It is in our common interest to bring together our best minds, practices, and initiatives to learn from each other's advances and experiences, as well as our successes and our failures.

There are three areas where collaboration and information access and exchange will provide immediate benefits across the Atlantic:

1. advancing the acquisition and sharing of climate change and ocean science information,

2. improving and prioritizing mitigation strategies for reducing greenhouse gas emissions and slowing the rate of climate change, and

3. exchanging information on strategies and best practices for adapting to climate change in coastal areas.

Significant activity is under way in the EU Member States and in the US to monitor climate change and project future impacts in coastal regions. Many different sources of information exist on both sides of the Atlantic, but there remains much be learned as new data continues to be acquired, processed, and interpreted. We need to expand our collective ability to acquire and utilize oceans and climate information. A dialogue between the EU and US on oceans and climate change should be encouraged and supported. The best opportunity for encouraging and supporting the exchange of information and data is to develop an easily accessible and robust Transatlantic Platform on Coastal Oceans and Climate Change. As information is accessed and exchanged, the use of common language and protocols will ensure that the information is useful across disciplines and easily understood and utilized by decision makers and the public.

Mitigating climate changes needs to become a high priority immediately on both sides of the Atlantic as the cost of failure to respond will likely be catastrophic. While the contributions of various sectors to greenhouse gas emissions are relatively well understood, there has been much less study of the risks that coastal communities, maritime industries, and coastal ecosystems face from the impacts of continuing climate change. The more mitigation measures we can initiate now, the less adaptation and suffering that will be required in the future. The oceans have a vast and almost untapped potential for renewable energy, yet efforts to date to utilize those in the US have been minimal. The EU has been an international leader in the development of offshore wind energy and we need to maximize future potential for this and other renewable sources (wave, tidal, solar) by advancing the most efficient and effective technologies, addressing project approval processes, and identifying priority coastal areas for energy siting. Information and data that have been developed on renewable energy and funded by public resources need to be placed in the public domain to make future efforts more efficient and effective. Shipping and maritime industries are significant sources of greenhouse gas emissions. EU and US dialogue should

be expanded to develop and promote all measures that will reduce ship and port emissions and lead to more energy efficient operations.

Even adopting the most ambitious emission reduction strategies will not immediately halt the climate change that is presently underway. The greenhouse gases that have already been released and that will be released before we gain control over our fossil fuel based economy will persist in the atmosphere and continue to affect our global climate for many decades into the future. The adaptation of coastal areas to climate change with all of its associated impacts will require significant energy and resources. Sea level rise and an increase in the severity and frequency of coastal storms and extreme weather events will impact low-lying coastal communities, including port and transportation facilities, infrastructure, and near shore habitats and ecosystems. The enormous EU and US investments in intensive development and infrastructure around maritime and port cities on both sides of the Atlantic make a strong economic argument for understanding the risks these areas face and developing appropriate adaptation plans. Establishing a US-EU dialogue and encouraging collaboration on impact projections, shared experiences, best emerging practices, and lessons learned can help facilitate practical and creative solutions to the dilemmas posed by changing coastal conditions.

Coastal ecosystems are also at risk to the impacts of climate change. Whether estuaries, salt marshes, lagoons, or tidal flats, marine wetlands are among the most productive, diverse and economically valuable ecosystems on Earth. The benefits provided by these habitats have been significantly reduced by coastal development along the Atlantic shorelines in both the US and EU. We need to share our best practices, successes and most effective emerging strategies for protecting and preserving these coastal habitats and ecosystems in the face of sea level rise, including creating new wetlands to replace lost areas, setting aside buffer zones, and removing barriers to allow for future wetland migration.

The EU and US share the Atlantic Ocean—its power to transport, its power to support life, its power to impact and destroy, and its power to change our planet and our lives. While some uncertainties over exactly how climate change will reverberate across the Atlantic remain, the uncertainties should not result in paralysis or lack of action. Planning for climate change is fundamentally a risk management strategy, an insurance policy against an uncertain future. Managing these risks involves using the best available science to understand the likelihood of climate impacts and their associated consequences, and then selecting and implementing the most effective response options. There is growing consensus in the communities, regions, states, and nations with developed Climate Action Plans that responding to climate change is not only the right thing to do, it is the only smart thing to do. We can hope for the best but should be preparing for the worst. Most of the measures that are recommended for action would be prudent even if climate change were not an issue. They will save both the public and the government money, energy and fuel costs, create healthier, safer, more livable and sustainable communities, states, and nations, and will provide insurance or buffer from any potential future changes.